


## EVIDENCE REVIEW

# Mental health effects prevalence in children and adolescents during the COVID-19 pandemic: A systematic review

Júlia Meller Dias de Oliveira DDS, MSc<sup>1,2</sup> | Luciana Butini DDS, PhD<sup>1,3</sup> |  
 Patrícia Pauletto DDS, MSc<sup>1,2</sup> | Karyn Munyk Lehmkuhl MLS<sup>1,4</sup> |  
 Cristine Miron Stefani DDS, PhD<sup>1,5</sup> | Michele Bolan DDS, PhD<sup>2</sup> |  
 Eliete Guerra DDS, PhD<sup>5</sup> | Bruce Dick MD, PhD<sup>6</sup> | Graziela De Luca Canto DDS, PhD<sup>1,2</sup> |  
 Carla Massignan DDS, PhD<sup>1,5</sup> 

<sup>1</sup>Brazilian Centre for Evidence-Based Research (COBE), Florianópolis, Brazil

<sup>2</sup>Department of Dentistry, Federal University of Santa Catarina (UFSC), Florianópolis, Brazil

<sup>3</sup>Division of Pediatric Dentistry, Faculdade São Leopoldo Mandic, São Paulo, Brazil

<sup>4</sup>University Library, Federal University of Santa Catarina (UFSC), Florianópolis, Brazil

<sup>5</sup>Department of Dentistry, Health Sciences Faculty, University of Brasília (UnB), Brasília, Brazil

<sup>6</sup>Department of Anesthesiology and Pain Medicine, University of Alberta, Edmonton, Alberta, Canada

## Correspondence

Carla Massignan, Department of Dentistry, University of Brasília, Campus Universitário Darcy Ribeiro, Brasília-DF, CEP 70910-900, Brazil.  
 Email: carla.massignan@unb.br

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## Abstract

**Background:** The COVID-19 pandemic health crisis has changed household and school routines leaving children and adolescents without important anchors in life. This, in turn, can influence their mental health, changing their behavioral and psychological conditions.

**Aims:** To systematically review the literature to answer the question: “What is the worldwide prevalence of mental health effects in children and adolescents during the COVID-19 pandemic?”.

**Methods:** Embase, Epistemonikos database, LILACS, PsycINFO, PubMed, Scopus, Web of Science, and World Health Organization Global literature on coronavirus disease were searched. Grey literature was searched on Google Scholar, Grey Literature Report, and Preprint server MedRxiv. Observational studies assessing the prevalence of mental health effects in children and adolescents during the COVID-19 pandemic were included. Four authors independently collected the information and assessed the risk of bias of the included studies.

**Results:** From a total of 11,925 identified studies, 2873 remained after the removal of the duplicated records. Nineteen studies remained after the final selection process. The proportion of emotional symptoms and behavior changes varied from 5.7% to 68.5%; anxiety 17.6% to 43.7%, depression 6.3% to 71.5%, and stress 7% to 25%. Other outcomes such as the prevalence of post-traumatic stress disorder (85.5%) and suicidal ideation (29.7% to 31.3%) were also evaluated.

**Linking Evidence to Action:** Overall findings showed that the proportion of children and adolescents presenting mental health effects during the COVID-19 pandemic showed a wide variation in different countries. However, there was a trend toward mental health issues. Therefore, policymakers, healthcare planners, youth mental health services, teachers, parents, and researchers need to be prepared to deal with this demand.

## KEYWORDS

adolescents, Children, COVID-19, mental health, prevalence, systematic review

## INTRODUCTION

COVID-19 is a severe acute respiratory syndrome, caused by a type of coronavirus (SARS-CoV-2), identified in late 2019 in China (World Health Organization, 2020). Along with all the essential activities that have been restricted, educational institutions such as schools and daycare centers have also been disrupted. One year into the COVID-19 pandemic, over 800 million students still face significant disruptions to their education, ranging from full school closures to reduced or part-time academic schedules (31 and 48 countries, respectively; UNESCO, 2020). School routines have been considered important coping mechanisms for young people with mental health issues. When schools are closed, they lose an anchor in life and their symptoms can relapse (Lee, 2020).

Although recent studies have shown that COVID-19 infection tends to have milder symptoms in children and adolescents (Nature, 2020), the most recent data shows an increase of infection in children and more hospitalizations (Delahoy et al., 2021). Social distancing measures have been taken to prevent educational institutions from becoming a vehicle for the dissemination of this novel coronavirus. The effect of this restriction on children and adolescents' mental health has increased with the prolongation of social isolation, consequently triggering or exacerbating episodes of anxiety, panic, and depression (Jiao et al., 2020; Loades et al., 2020).

Some studies have also confirmed that changes in emotional and psychological factors can weaken or compromise the immune system (Han & Lee, 2018; Hoven et al., 2005; Jiao et al., 2020; Laor et al., 1997; Park et al., 2020; Plourde et al., 2017). However, although there are an increasing number of studies on this subject, the prevalence of these mental health effects is not clear for younger populations.

The importance of the results for researchers in this area is very high. It has the potential to guide the pre-existing policies as well as the orientation of new policies to face and combat mental health problems and their consequences. A recent paper recommended that mental health professionals should establish evidence-based guidelines and easy operational strategies to cope with COVID-19 pandemic-related mental health problems in children (Liu et al., 2020).

## Objective

The aim of this study is to answer the research question, "What is the worldwide prevalence of mental health effects in children and adolescents during the COVID-19 pandemic?" The methodology was based on the acronym PECOS, in which participants (P) were healthy children and adolescents up to 18 years old, with no restrictions on gender or ethnicity; Exposure (E) was the COVID-19 pandemic; Control (C) was not applicable; Outcomes (O) were the prevalence of mental health effects during the COVID-19 pandemic; and the type of Studies (S) included were studies with prevalence data for this population, as observational studies (cross-sectional and cohort).

## METHODS

The protocol was registered at the Prospective Register of Systematic Reviews (PROSPERO) under number CRD42020183878.

This systematic review was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Checklist (PRISMA; Page et al., 2021) and Synthesis Without Meta-analysis (SWiM) reporting items (Campbell et al., 2020) which has been developed to guide clear reporting in reviews in which alternative synthesis methods to meta-analysis of effect estimates are used.

### Search strategy and eligibility

The search strategy was performed with the assistance of an experienced librarian on October 23, 2020 and updated up to February 1, 2021 in the following databases: Embase, Epistemonikos database, LILACS, PsycINFO, PubMed, Scopus, Web of Science, and World Health Organization Global literature on coronavirus disease. In addition, the grey literature was searched on Google Scholar, Grey Literature Report, and Preprint server MedRxiv. No filters regarding the language and date of publication restrictions were used (Table S1). A manual search was carried out in the reference list of the included articles and experts were contacted to indicate possible nonincluded articles.

To be included, the study had to present prevalence of possible mental health effects in children and adolescents during COVID-19 pandemic, during the period of social distancing and quarantine or during the period of daily activities resuming. Emotional symptoms, anxiety, depression, stress, post-traumatic stress disorder (PTSD), and suicidal ideation in children and adolescents were considered. Uncooperative behavior, sadness, worry, helplessness, fear, worry about being infected with coronavirus, worry about death, irritability, and acute stress were also evaluated. In addition, any kind of measurement was accepted, such as questionnaires or diagnoses based on health professional assessments.

Exclusion criteria comprised: (1) Studies conducted in adolescents aged >18 years, without specification of the range age, without separated data about mental health effects in children <18 years old without previous diagnosis of mental health effects; (2) Studies that did not provide quantitative data regarding the prevalence of mental health effects; (3) Studies that presented only secondary data about prevalence of mental health effects; (4) Reviews (literature or rapid reviews), letters, books, conference abstracts, case report, opinion article, technical articles, posters and guidelines; and (5) Studies with duplicated data from another included study.

An electronic manager (EndNote version 9) was used to organize the references. Four reviewers selected the articles independently in two phases after a pilot training test. In phase 1, the titles and abstracts were read, and eligibility criteria applied using online software (Rayyan, Qatar Computing Research Institute). In phase-2, the reviewers read the full-texts, also applying the eligibility criteria. Any divergences were solved by consensus and with the help of a fifth reviewer if there was still incompatibility.

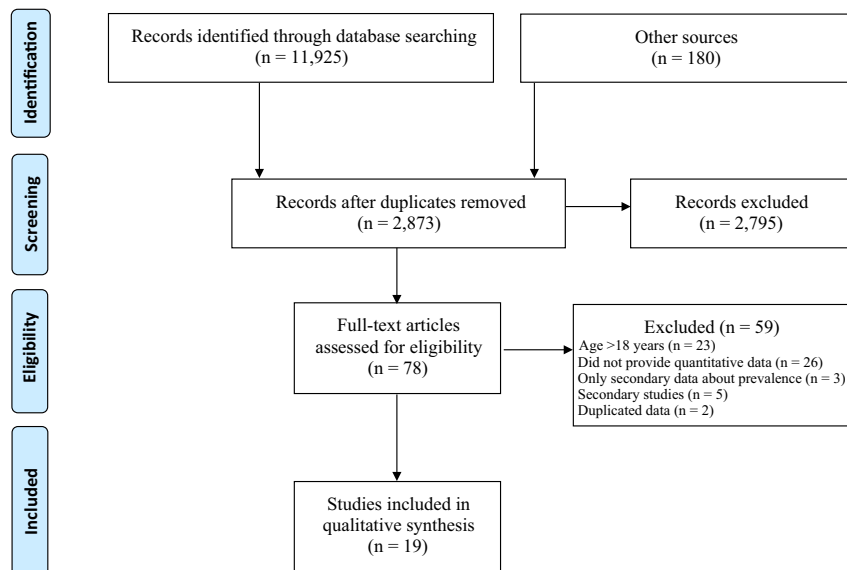


FIGURE 1 Flow diagram of literature search and selection criteria<sup>1</sup>

## Data abstraction

The same four reviewers extracted pertinent data from the selected studies, independently in a pilot-tested form. If data were missing from the article, three contact attempts by electronic mail were tried in a 15-day period to obtain relevant unpublished information.

Next, the extracted data were crosschecked, and their accuracy confirmed in a consensus meeting. In case of disagreement, conflicts were resolved with a final decision by the fifth reviewer.

The included articles were grouped based on the type of outcome. In addition, the included studies were also grouped based on the studies' design and methodological quality.

## Quality assessment

The methodological quality of the included studies was assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data (Munn et al., 2015). Independently, four reviewers evaluated the included studies and all reviewers prior to critical appraisal assessments agreed upon all decisions about the scoring system.

## Summary measures and reporting bias assessment

Children and adolescents' emotional, behavioral, and psychological health disorders were considered as the main outcome and the analysis was not restricted by any method for measurement or diagnosis. The extracted data were synthesized in a descriptive manner. Additionally, the quantitative analysis of results was performed based on the primary outcome of prevalence rate of different types of emotional, behavioral, and psychological factors, measured by

<sup>1</sup>Adapted from Prisma.

means of relative or absolute frequencies and their 95% confidence intervals.

Heterogeneity within studies was assessed based on population characteristics, methodological characteristics, and outcome characteristics. Based on preliminary searches, it was expected to find high heterogeneity among included studies, so meta-analysis was considered inappropriate. Therefore, the synthesis of results was also descriptive. Since funnel plots were not feasible, the reported outcomes in the methods and results sections were compared to identify potential reporting bias.

## RESULTS

From a total of 11,925 studies identified by the searches of the eight databases, after deduplication, 2873 remained. In the first selection phase, 2794 studies were excluded after title and abstract reading, leaving 78 studies selected to the second phase. After full-text reading, 19 studies were finally included for analysis (Figure 1). Further information about the 59 excluded studies is available in Table S2.

## Study characteristics

There were 17 cross-sectional and two cohort studies selected (only cross-sectional data were used to analyze the prevalence data; Gassman-Pines et al., 2020; Zhang et al., 2020) from nine different countries, mostly China. Almost all of them used Internet and social media to access the target population, given the ease with which participants can be contacted during pandemic circumstances. Both parents and children or adolescents answered proxy or self-reported questionnaires. Overall, it was found that more than 35,543 children and adolescents were evaluated given that not all included studies reported sample size.

The included studies used different validated instruments to measure mental health effects in children and adolescents. Some studies also evaluated fear (Shorer & Leibovich, 2020), PTSD during the pandemic (Hou et al., 2020), and suicidal ideation (Hou et al., 2020; Zhang et al., 2020). Additionally, some nonvalidated questionnaires were also used in one study to measure uncooperative behavior, sadness, and worry (Gassman-Pines et al., 2020). The instrument to evaluate worry, helplessness, and fear was not reported in one study (Saurabh & Ranjan, 2020). Detailed results of individual studies are described in Table S3.

## Quality assessment

Among all included studies, no study achieved a complete positive methodological quality tool evaluation in all domains from the Joanna Briggs criteria (Table 1). The domain that presented the highest rate of negative ( $n = 10$ ) or uncertain ( $n = 8$ ) judgments was the domain regarding the sampling process, since only one study (Liu et al., 2021) presented a process that did not result in a convenience sample or sampling via the Internet. Further, the domains regarding the description of participants and sample size resulted in seven studies with unfavorable judgments, with seven and five negative judgments, respectively, together with two uncertain judgments. In addition to these, a negative judgment was given in the appropriate sample domain for the study by Yeasmin et al. (2020). The rest of the nonpositive judgments were related to judgments of uncertainties in the appropriate sample domains ( $n = 3$ ; Sakka et al., 2020; Shorer & Leibovich, 2020; Vallejo-Slocker et al., 2020). Finally, negative judgments occurred in the domains of valid methods used for the identification of the condition ( $n = 2$ ; Gassman-Pines et al., 2020; Saurabh & Ranjan, 2020) and in the domain of adequate response rate and its appropriate management ( $n = 4$ ; Liu et al., 2021; Sakka et al., 2020; Shorer & Leibovich, 2020; Vallejo-Slocker et al., 2020).

## Synthesis of results

Examination of emotional symptoms and behavior findings found that one American study with children aged 2–7 years disclosed that a minority of them presented with uncooperative behavior (11.5%) and sadness or worry (5.7%; Gassman-Pines et al., 2020). A Chinese survey found similar results where, overall, less than 13.9% of children presented with difficulties such as emotional symptoms, behavioral problems, hyperactivity-inattention, peer problems, or behavior problems (Liu et al., 2020). These findings were in contrast with a Spanish study of children and adolescents under the care of the government where 74% presented fear related to the COVID-19 pandemic (Vallejo-Slocker et al., 2020), and an Indian study where 61.9% presented with fear, 66.1% felt helplessness, and 68.5% were worried (Saurabh & Ranjan, 2020). On the other hand, a web-based Spanish survey found increased emotional problems in 27.4% of children aged 3–12 years (Romero et al., 2020).

A total of 12 studies reported anxiety, including two Chinese national online surveys (Zheng et al., 2020; Zhou, Zhang et al., 2020). The prevalence of anxiety varied from 17.6% (Dong et al., 2020) to 43.7% (Zhou, Zhang et al., 2020).

Ten studies reported depression rates. These rates were found to have a high variability between 6.3% from a sample of two Chinese schools, one rural and one urban with children aged 7 to 14 years (Zheng et al., 2020); and 71.5% from a rural Chinese high school with adolescents aged below 16 years (Hou et al., 2020).

Lower stress prevalence was identified in Chinese children and adolescents (7%; Dong et al., 2020) in contrast with 25% in Israeli children (Shorer & Leibovich, 2020). However, differences in age ranges (6–18 years *versus* 2–8 years) and questionnaire responders (parents *versus* self-reported) should be highlighted.

PTSD during the pandemic was evaluated in one study, showing a high prevalence of 85.5% in under-16-year-old participants in a rural Chinese area (Hou et al., 2020). Moreover, suicidal ideation was assessed in two studies with similar a prevalence of 31.3% (Hou et al., 2020) and 29.7% (Zhang et al., 2020) in samples of Chinese adolescents.

Reporting bias was not detected in the included studies, based on the methods and results evaluations noted above.

## DISCUSSION

The worldwide prevalence of depressive symptoms (Ellis et al., 2020; Zheng et al., 2020) and anxiety (Dong et al., 2020; Hou et al., 2020) varied greatly between countries and regions. Some included studies evaluated both depression and anxiety among children and adolescents and the prevalence rates also varied considerably (Chen et al., 2020; Zhou, Yuan et al., 2020). Explanations for the variability in these findings may be due to extensive variations in the sample sizes, definitions of mental health, tools used to collect data, and the large age-range variations in the included studies. It appears that, according to age group, mental health effects manifestations may differ. We also found considerable variation related to characteristics of the settings, sampling strategy, and sex. Included studies took place with school-based and Internet-based populations. Further, parents and children or adolescents answered the questionnaires in various studies, and girls seemed to be more affected by the mental effects during the pandemic.

Our findings also showed other prevalent mental effects of quarantine, such as worry, helplessness, fear (Saurabh & Ranjan, 2020), nervousness, agitation, and aggressiveness (Shorer & Leibovich, 2020). In addition, some included studies reported negative impacts for child psychological well-being (Gassman-Pines et al., 2020) and behavioral problems which included emotional symptoms, conduct problems, hyperactivity-inattention, peer problems, and a decrease in prosocial behaviors (Liu et al., 2020).

We further assessed how various potentially relevant factors were associated with the prevalence of the mental health effects that were evaluated. Duan et al. (2020) found that seven significant

TABLE 1 Risk of bias assessed by Joanna Briggs Institute critical appraisal checklist for studies reporting prevalence data

	1. Was the sample frame appropriate to address the target population?	2. Were study participants sampled in an appropriate way?	3. Was the sample size adequate?	4. Were the study subjects and the setting described in detail?
Garcia de Avila et al., 2020	Y	N	N	Y
Chen et al., 2020	Y	U	Y	N
Dong et al., 2020	Y	N	Y	Y
Duan et al., 2020	Y	N	Y	N
Ellis et al., 2020	Y	N	Y	Y
Gassman-Pines et al., 2020	Y	N	U	N
Hou et al., 2020	Y	U	Y	N
Liu et al., 2020	Y	Y	Y	N
Qi et al., 2020	Y	N	Y	Y
Romero et al., 2020	Y	N	Y	Y
Sakka et al., 2020	U	N	N	N
Saurabh & Ranjan, 2020	Y	N	N	Y
Shorer & Leibovich, 2020	U	U	N	Y
Vallejo-Slocker et al., 2020	U	U	U	Y
Yeasmin et al., 2020	N	N	N	Y
Zhang et al., 2020	Y	U	Y	N
Zheng et al., 2020	Y	U	Y	Y
Zhou, Yuan et al., 2020	Y	U	Y	Y
Zhou, Zhang et al., 2020	Y	U	Y	Y

Note: Y = Yes, N = No, U = Unclear.

factors were associated with higher levels of anxiety, including female gender, residence in urban regions, and emotion-focused coping styles. Nine factors associated with higher levels of depression including smartphone addiction, Internet addiction, and being a resident in Hubei province. Moreover, two additional factors were found to be associated with decreased levels of depressive symptoms: (1) hours spent on the Internet per day before the epidemic and (2) tendency to apply a problem-focused coping style. A study carried out in Brazil observed that social distancing without parents, number of people living together in home, and education level of guardians represented variables associated with higher anxiety scores in children (Garcia de Avila et al., 2020). Regarding the influence of socioeconomic variables, Qi et al. (2020) concluded that there was a higher prevalence of mental health problems among adolescents with medium and low levels of social support in China during the outbreak of COVID-19.

Another interesting finding was that COVID-19 stress was related to increased loneliness and depressive symptoms, especially for adolescents who spend more time on social media. Furthermore, beyond COVID-19 stress, more time connecting to friends virtually during the pandemic was related to higher depressive symptoms. Family time and schoolwork were related to less depressive symptoms (Ellis et al., 2020).

Some studies verified that children's depressive symptoms and anxiety were influenced by gender. Vallejo-Slocker et al. (2020) found that girls scored higher than boys in emotional problems.

Female students suffered greater psychological distress, as well as higher levels of stress, anxiety, and depressive symptoms, during the COVID-19 outbreak in comparison with males (Zhou, Zhang et al., 2020). Duan et al. (2020) also reported that total scores of Child Anxiety (SCAS) for females were significantly higher than those of males. Moreover, being female and having poor academic records were associated with severe depressive symptoms and anxiety, suicidal ideation, and suicidal attempts (Hou et al., 2020). A possible explanation is that females may be more vulnerable to stressful life events. However, a recent study carried out in adults did not find clear gender differences in psychological stress associated with COVID-19 (Cai, 2020). Regarding the influence of age, no association was detected with respect to anxiety across different age groups (Chen et al., 2020). Unfortunately, few studies compared the prevalence rates in different age groups, thus a subgroup analysis was not possible.

By understanding the trend in youth mental health problems during the pandemic, a more effective management for the planning of interventions can be reached. Nowadays, there are programs that aim to address mental health problems in youth that seek for more accessible, affordable, and evidence-based solutions. An example is The Creating Opportunities for Personal Empowerment (COPE; Melnyk, 2020). It is a cost-effective program that uses the key concepts of Cognitive Behavioral Therapy, and it can be implemented by both mental health providers and nonpsychiatric mental health-care professionals, like pediatric and family nurse practitioners,

5. Was the data analysis conducted with sufficient coverage of the identified sample?	6. Were valid methods used for the identification of the condition?	7. Was the condition measured in a standard, reliable way for all participants?	8. Was there appropriate statistical analysis?	9. Was the response rate adequate, and if not, was the low response rate managed appropriately?
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	U	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	U
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	U
Y	U	Y	Y	Y
Y	Y	Y	Y	U
Y	Y	Y	Y	U
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y
Y	Y	Y	Y	Y

pediatricians, family practice physicians, and teachers in primary care and school-based settings (Melnik, 2020). E-health interventions for anxiety and depression in children and adolescents have already been employed and may also be an alternative to address the mental health problems in children and adolescents (Thabrew et al., 2018).

The present systematic review has several strengths. We searched to find the maximum number of eligible studies to minimize bias and to obtain homogeneity by applying appropriate eligibility criteria. Additionally, most of the included studies adopted a representative sample and presented a low risk of bias.

The biggest limitation of this study was that no baseline data were available, which makes it impossible to disentangle the baseline levels of the variables considered from the change associated with the recent circumstances with the COVID-19 pandemic. In a cohort study, Zhang et al. (2020) investigated psychological symptoms, nonsuicidal self-injury, and suicidal ideation, plans, and attempts among a cohort of children and adolescents before the outbreak started retrospectively (wave 1, early November 2019) and two weeks after school reopening (wave 2, mid-May 2020) in an area of China with low risk of COVID-19. The results demonstrated that the prevalence of emotional and psychological conditions outcomes among students in wave 2 increased significantly from levels at wave 1. However, no similar increases in anxiety symptoms were found between the 2 waves. Another prospective cohort concluded that both parents' and children's well-being in the post-crisis period was

strongly associated with the number of crisis-related hardships that the family experienced (Gassman-Pines et al., 2020).

It is very important to highlight that participant age range varied considerably between studies. Moreover, studies' sample inclusion criteria did not follow rigorous methods or standards. As expected, due to pandemic restrictions, data were collected using online questionnaires, social media, and emails in most studies. As well, another methodological aspect may have influenced our findings. The use of valid measurements and tools, different questionnaires, and self-rating scales for children across studies may have caused conflicting and inconsistent results. We must consider the heterogeneity of the included studies and of the populations of children that were studied. Meta-analysis was not performed due to these methodological heterogeneities. A quantitative analysis combining heterogeneous studies could introduce bias in the results. Finally, most included studies were from China, which may affect the generalizability of results globally.

### Implications for practice and future research

There was great variability in the worldwide prevalence data for the emotional, behavioral, and psychological health disorders in children and adolescents during the COVID-19 pandemic. Overall, findings showed that the proportion of children presenting with psychological problems during the pandemic was high and it is likely that the pandemic is worsening the mental health of youth. Many children

and adolescents are suffering emotionally at present during this pandemic.

Future studies should use validated measures and try to compare the mental health effects prevalence in youth during and post pandemic periods.

## LINKING EVIDENCE TO ACTION

- Evaluating the prevalence of emotional, behavioral, and psychological conditions in children and adolescents during the COVID-19 pandemic is relevant and provides evidence for policymakers, healthcare planners, youth mental health services, teachers, parents, and researchers.
- The present data might help policymakers, healthcare planners, youth mental health services, teachers, parents, and researchers to be prepared to deal with mental health effects of the pandemic in youth. Programs for children's mental health should be implemented. Furthermore, in addition to screening routinely for these problems, interventions for prevention and treatment should be encouraged.
- Adequate management of the potentially relevant factors that may be associated with the prevalence of mental health effects can also help to mitigate the problem. Alternatives to hours spent on the Internet such as secure outdoor activities should be encouraged.

## CONCLUSION

The proportion of children presenting with mental health problems during the pandemic varied widely. However, the results demonstrated an overall trend in declining mental health for youth, likely due to the pandemic.

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## CONFLICT OF INTEREST

None of the authors have any conflicts of interest to declare.

## ORCID

Carla Massigan  <https://orcid.org/0000-0001-8033-055X>

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Additional supporting information may be found in the online version of the article at the publisher's website.

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