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CLINICAL PSYCHOLOGY | REVIEW ARTICLE

Covid-19 and mental health of children and adolescents: A systematic review

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Abstract: The outbreak of the COVID-19 pandemic had imposed considerable risk on public health, and had generated unprecedented levels of panic. There are increasing concerns over the possible negative impact of COVID-19 on the mental health of children/adolescents. This review was conducted to describe the impact of COVID-19 on the mental health of children and adolescents. An electronic search was conducted in PubMed, CINAHL, MEDLINE, and the WHO Global Health database on COVID-19. The 2020 updated Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guideline and an adapted Joanna Briggs aetiology review methodology were followed in conducting this review. A total of 21 studies from 8 different countries located on 4 continents (Asia, Europe, North America & South America), reporting on sample size of 56,368 met the inclusion criteria. Using the JBI critical appraisal tool for studies reporting on prevalence data, the quality of most of the studies was assessed to be moderate. Prevalence of depression, anxiety and stress was estimated to range from 7.2% to 78%; of anxiety, from 15% to 78%, depression, from 7.2% to 43.7% and stress, at 17.3%. Correlates for COVID −19 related mental health outcomes were identified as female gender and social isolation among others. The COVID-19 pandemic has negatively affected the mental health of children and adolescents. It is recommended that governments and health agencies prioritize mental health, especially for children and adolescents to prevent long-term effects on them.

Subjects: Health Psychology; Mental Health Research; Psychological Disorders

Keywords: Mental health; children; adolescents; COVID-19; Pandemic; Review

1. Background

The outbreak of Coronavirus Disease 2019 (COVID-19) pandemic has imposed considerable risk on public health, human safety, and wellbeing and had generated an unprecedented level of panic. COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and having been first detected as a human infection in Wuhan China, in November 2019, the disease had spread across the globe leading to extensive global health burden and socio-economic catastrophe (Gebru et al., 2021; Verschuur et al., 2021).

On 11 March 2020, the World Health Organization (WHO) declared COVID-19 as a pandemic considering its fast rate of spread within a short period and rate of death. In an attempt by governments to control the spread of the disease, varieties of drastic measures were imposed, including total/partial lockdown, travel ban/border closures, closure of schools, isolation, and quarantine protocols. These measures resulted in restrictions in the movement of people and an

abrupt change in everyday lifestyles, separation from friends, loved ones, and families. These sudden changes had the potential to impact negatively on mental health and emotional wellbeing (Phiri et al., 2021). Evidence from past outbreaks of SARS epidemics showed that people who recovered develop mental health disorders (Cheng et al., 2004; Cheng & Wong, 2005; Chua et al., 2004) and specifically Post-Traumatic Stress Disorder (PTSD (Wu et al., 2005) and a similar trend is emerging with COVID-19 pandemic (Phiri et al., 2021)—but the emphasis has largely been directed at the adult population.

Mental health problems have been widely reported in the general population during this pandemic across countries (Hossain et al., 2020; Newby et al., 2020; Xiong et al., 2020). Most of these reports have focused on adults, including healthcare workers (Batra et al., 2020; Muller et al., 2020; Newby et al., 2020). However children and adolescents deserve a high level of attention because of their vulnerability to mental health problems especially during emergencies and disasters (Danese et al., 2020; Paus et al., 2008). Apart from that, there is also high tendency to misinterpret mental health problems in children, resulting in low detection, diagnosis and general underreporting. In the wake of COVID −19, the vulnerability of children to mental health problems is heightened by a subtle neglect as children are considered to have a lesser risk of suffering from severe COVID-19 disease and death (Shekerdemian et al., 2020). However, they could be hard hit by the COVID-19 pandemic and its associated measures such as school closures, lack of outdoor activity, and abnormal feeding and sleeping habits which are likely to disturb children's normal routines, and lead to boredom, discomfort, impatience, irritability, and a variety of neuropsychiatric symptoms and risky behaviours (Ghosh et al., 2020; Meherali et al., 2021)

According to the United Nations Educational, Scientific, and Cultural Organisation (UNESCO), about half of the world's students population (862 million children) were affected by the closure of schools (UNESCO, 2020) and this would have a negative effect on the mental health of children and adolescents (Ghosh et al., 2020; G. G. Wang et al., 2020). As an educational intervention during the pandemic, most schools in many countries resorted to online learning to promote continuity in the education system with varying degree of satisfaction among students (Moy & Ng, 2021; Thapa et al., 2021). The online learning could also be perceived as a source of stress especially to first time users and students in locations with poor internet, logistic access, and inadequate technical support among other factors (Fawaz & Samaha, 2021; Hasan & Bao, 2020).

An earlier systematic review conducted by Nearchou et al. (2020) in June 2020 concluded that the COVID-19 pandemic may have a negative effect on the mental health of children and adolescents. The study further reported that emotional reactions to COVID −19 such as stress, fear, worry and concern predicted mental health outcomes in young people. However, the findings had little or no focus on children. Some of the studies included in the review focused greatly on adult population. Some of the studies included were also appraised to be of low quality. The reviewers, therefore, recommended the need for researchers to improve the quality of future studies to generate more robust evidence to guide policy and intervention.

1.1. Aim of the review

The main aim of this review was to determine the impact of the COVID-19 pandemic on the mental health of children and adolescents and to identify the risk or protective factors for mental health in children and adolescents.

1.2. Objectives of the review

The specific objectives of this review include:

(1) Describe the impact of COVID-19 on the mental health of children and adolescents during the COVID-19 pandemic

(2) Identify risk factors for mental health impact on children and adolescents during COVID-19

(3) Determine the protective factors for mental health impact on children and adolescents during COVID-19

1.3. Review question

The main systematic review question which was asked to guide the review methodology was: "Does the COVID-19 pandemic impact negatively on the mental health of children and adolescents?"

2. Materials and methods

This review aimed to synthesize relevant primary studies to describe the effect of COVID-19 pandemic/lockdown measures on the mental health of children and adolescents by using a systematic review methodology.

2.1. Formulating the review question

Formulating a concise review question for the appropriate type of review to be conducted is a critical step for a successful systematic review. There are several formats available for framing review questions. For instance, the PICO (population, intervention comparison, and outcome) format is widely used for effectiveness reviews (Booth & Cleyle, 2006; Fineout-Overholt & Johnston, 2005; Munn et al., 2018). This review aimed at describing the impact of the COVID-19 pandemic or lockdown measure on the mental health of children and adolescents. To frame the question for this review, the PEO format (Moola et al., 2015) was identified as appropriate and was used. The PEO format is used for aetiology and/risk reviews (Moola et al., 2015). Since the type of research question guides selection of methodology, the Joanna Briggs Institute methodology for conducting aetiology review was adapted and used for this review (Moola et al., 2015) while the 2020 updated Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA; Page et al., 2021) was adapted for reporting. The PEO format stands for population (type of participant), exposure (independent variable) and outcome (dependent variable). The main facets of the question are summarized in Table 1.

An initial scoping search was conducted in Google Scholar and Cochrane Library using the main terms of the topic in Table 1. This was done to ascertain whether there is an existing systematic review that has addressed the review question adequately to avoid unintentional duplication. Another reason for carrying out an initial scoping search of the selected databases was to gain a fair idea of the range or depth of existing literature available.

In order to build a comprehensive search strategy for the database, facet analysis was carried out to identify synonyms for each of the main terms in the question—see, in Table 1. The following terms were identified under the population component: children, adolescents, teenagers. For the exposure component, the following terms were identified: COVID-19, COVID19, lockdown, quarantine, isolation, lock-down, and sars-cov-2. The terms under the outcome component included: mental health, stress, post-traumatic stress disorder, suicide, depression, and anxiety. All these terms were used to construct a comprehensive search strategy to be used for database search—see, Table 2.

2.2. Inclusion and exclusion criteria

Articles were included in the review only if they met the following criteria: if the study is COVID-19 related, conducted on humans and, published in English between 1 December 2020 and

Table 1. Review question in PEO format

P- population	E- exposure	O-outcome
Adolescents/Children	COVID-19	mental health state

Table 2. Search strategy using Boolean Operators (OR & AND)

P—Population	**Children* OR adolescent OR teenager AND**
E—Exposure	COVID-19 OR COVID 19 OR lockdown OR lock-down OR quarantine OR AND
O—Outcome	Mental health OR anxiety OR depression OR stress

Table 3. Inclusion & exclusion criteria

Inclusion criteria	**Exclusion criteria**
Human studies Peer reviewed Published in English Published between 1 December 2020 and 10 June 2021 Participants ≤18 years COVID-19 related	Participants >18 years Not published in English Not reported on age Data format not binary Qualitative design

10 June 2021. Also, the outcome measure must have been recorded quantitatively and in a binary data format (n/N) or in the percentage of the proportion of participants who experienced an event, where applicable. The outcome measure must be a mental health-related outcome and for this review, the primary outcomes of interest were depression, anxiety, and stress. The secondary outcome includes post-traumatic stress disorder (PTSD) and suicidal behaviour and risk/mitigating factors for mental health impact due to COVID-19 pandemic. In addition, the study must be conducted on children or adolescents or both with ages not more than 18 years. Studies were not included if they were not published in English, were qualitative studies, animal studies, not COVID-19 related or if participants were older than 18 years—see, Table 3.

2.3. The electronic database search

Four major databases were selected for the electronic search. These databases included: PubMed, CINAHL Complete, MEDLINE with full text, and the World Health Organization (WHO) COVID-19 Global literature on coronavirus disease. The WHO Global literature on coronavirus disease is a database dedicated to global COVID-19 research. The three reviewers (SSO, MA & AOY) conducted the final electronic search independently in the selected databases on 10 June 2021 using the search strategy designed.

2.4. Conducting the electronic search

To retrieve as many relevant published articles and to minimize selection bias, the main terms were searched as Medical Subject Heading (MeSH) Term and as a free text or under "All Fields". If the synonym of the main term is also a MeSH term, then it is also searched under MeSH and also under "All Fields". During the database search, the main term and its synonyms were combined using the Boolean operator "OR". The Boolean operator "AND" was used to combine the searches across the PEO components—see, Table 2 details of the search strategy using the Boolean operators.

The PubMed platform was searched using this search strategy as follows: (covid-19 OR covid 19 OR sars-cov-2 OR quarantine OR lockdown OR lock-down) AND (mental health OR depression OR anxiety OR stress OR suicide OR posttraumatic stress disorder OR post-traumatic stress disorder) AND (children OR teenager OR adolescents). The following filters applied to the search result: English Language, Journal articles, publications from 1 December 2020, to 10 June 2021, Human studies, and Child: birth to 18 years. On the WHO platform, items were specifically searched under Main Subject and under "Title, abstract and subject". The search was limited to articles published in the English language.

Disagreements arising at the third stage were discussed thoroughly and an agreement was reached before a decision was taken to either include the article or not. No study author was contacted for clarification on data and therefore, any article that did not have adequate information for example, on the age of participants or an unclear outcome measure were excluded from the review. All studies that met the inclusion criteria were selected for inclusion and data extraction. The selection process through which articles were selected has been summarized in Figure 1 using the updated Preferred Reporting Items for Systematic Reviews and Meta-Analysis (The PRISMA 2020 statement) flow chart (Page et al., 2021).

2.5. Selection of studies

The three reviewers manually scrutinized all the records independently and selected studies that met the inclusion criteria for final inclusion in the review. The reviewers (SSO, MA & AOY) first read the titles of each article and made a selection based on a judgment of relevance. The second stage of selection involved reading the abstracts of all the studies selected at the first stage. The final stage of selection was based on reading the full text of all articles selected at the second stage. This stage was carefully done to remove duplicates.s

2.6. Data extraction from included studies

Data from each primary study included in the review were extracted using a data extraction format designed by the reviewers. All 3 reviewers (SSO, MA & AOY) extracted data on the author and year of publication, the country where the study was conducted, participants, the age range of participants, and sample size (Table 4).

Another data set extracted from the studies was data on the primary outcome (in the form; number of participants who experienced an outcome of interest divided by sample size, n/N). The primary outcomes of interest for the review are Depression, Anxiety, Stress, Post-Traumatic Stress Disorder (PTSD), and suicide ideation. Data was also collected on protective factors for mental health as well as risk factors.

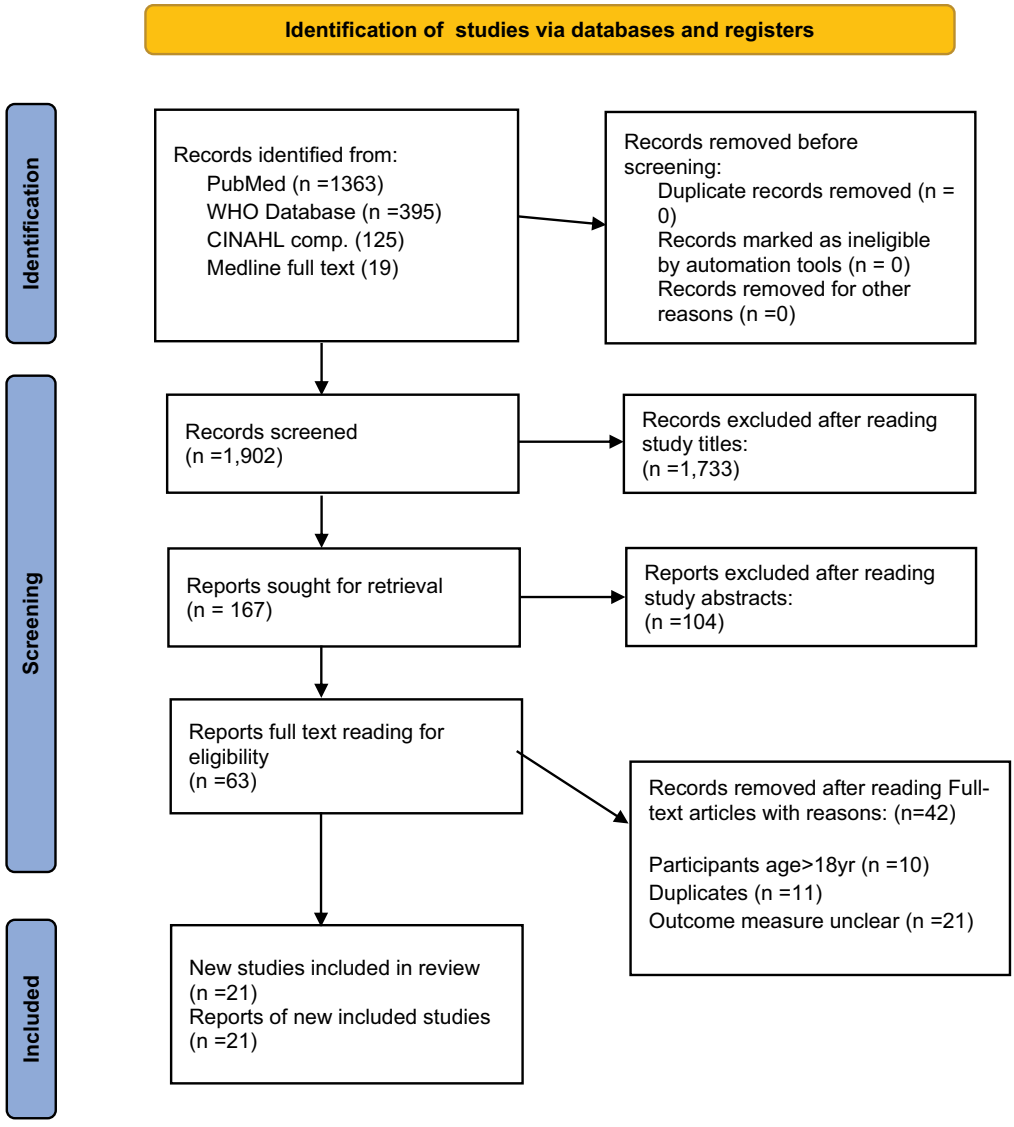
2.7. Quality appraisal

The JBI critical appraisal tool for studies reporting on prevalence data was used to appraise the 21 studies which met the inclusion criteria for the study since all the studies provided prevalence data on mental health outcomes. The appraisal specifically focused on nine areas; the sampling frame and sampling technique, adequacy of sample size, description of study setting and subjects, coverage of identified sample, valid methods used to identify mental health indicators, standard tools used for measurements of mental health indicators, statistical analysis and adequacy of response rate (Munn et al., 2015). The total number of "yes" for items that are applicable to each study were averaged to determine if the study was of low, moderate or high quality.

3. Results/Findings

A total of 21 articles (33.3%) were deemed to have met the inclusion criteria and were finally selected for inclusion in the review. Table 5 contains a summary information on the 42 studies excluded and the reasons for exclusion. A general overview of the 21 articles selected is provided in Table 4. The 21 studies are from 8 different countries located in 4 continents (Asia, Europe, North America & South America. Most of the studies were conducted in China which had 13 articles in total, followed by Italy which had 2 search papers. The rest of the countries are the Netherlands, Brazil, Turkey, United States of America (USA), India, and Spain—all of which had 1 research article each. All the 21 studies have recruited a total of 56,368 participants (children and adolescents) below 18 years. All these children and adolescents have experienced the COVID-19 pandemic, or, lockdown measures or isolation or school closure, and had to stay home over a while. The findings relating to the various outcome measures are summarized in Table 6 and discussed below.

Figure 1. Updated PRISMA2020 flow diagram showing the study selection process.



3.1. Prevalence of depressive symptoms

There were sixteen (16) studies reported data on the prevalence of depression. From the extracted data, the prevalence of depression symptoms ranges from 7.2% to 43.7%. The total number of participants from the 16 studies is 50,196 children and adolescents. Data extracted from these studies suggest that COVID-19 pandemic had a substantial impact on the mental health of the children and adolescents at the various places of study. Out of the 50,196 participants (children and adolescents), 14,139 participants experienced depressive symptoms, which represents a pooled prevalence estimate of 28.2%. Thus, almost a third of the participants had depression.

3.2. Prevalence of anxiety symptoms

Data on the proportion of participants who experienced anxiety was measured in 17 studies which include. The sample size in all these studies put together amounts to 36,396 and out of which 10,048 (27.6%) reported symptoms of anxiety. Thus, approximately one-third of these participants reported experiencing anxiety. The prevalence of anxiety symptoms ranges from 15% to 78%.

Table 4. Excluded papers and reasons for exclusion

Participants age >18 years	Duplicates	Unclear outcome data
X. X. Chen et al. (2021)	L. Zhang et al. (2020a)	J. Zhang et al., (2020)
Yeasmin et al. (2020)	Raviv et al. (2021a)	Oosterhoff et al. (2020)
Hawke et al. (2020)	Garcia de Avila et al. (2020a)	X. Zhang et al.,(2020)
Hermosillo-de-la-Torre et al. (2021)	Dyer et al. (2021)	Raviv et al. (2021b)
S.-J. Zhou et al. (2020)	S.-J. Zhou et al. (2020a)	Saurabh and Ranjan (2020)
Khan et al. (2020)	Ademhan Tural et al. (2020a)	Nuñez et al. (2021)
Liu et al. (2021)	McKune et al. (2021a)	Okely et al. (2021)
Dyer et al. (2021)	Pisano et al. (2021)	Melegari et al. (2021)
Mohler-Kuo et al. (2021)	SaSama et al. (2021)	Kang et al. (2020)
		Ezpeleta et al. (2020)
	Yeasmin et al. (2020)	Zreik et al. (2021)
		Jackson et al. (2021)
		Qin et al. (2021)
		Cusinato et al. (2020)
		(Ademhan Tural et al., 2020b)
		(Di Riso et al., 2021)
		(Durcan et al., 2021)
		(Magson et al., 2021)
		(Paiva et al., 2021)
		(Pınar Senkalfa et al., 2020)
		(Rogers et al., 2021)

3.3. Stress in children and adolescents

Only two of the studies (Tang et al., 2021; Zhang et al., 2020) had presented measurements on stress among the study participants. The total sample size for the two studies is 5,367 and out of this sample, 930 representing 17.3% reported stress.

3.4. Prevalence of post-traumatic stress disorder (PTSD)

In all, there were three studies (Ma et al., 2021; Shek et al., 2021; C. Zhang et al., 2020) that provided data on Post-Traumatic Stress Disorder (PTSD) with a combined sample size of 6,674 out of which 877 participants experienced PTSD, representing 13.1%.

3.5. Prevalence of suicide attempt, ideation, or plan

Information on suicide was provided in only one of the studies (Zhang et al., 2020) which involved a sample size of 1,241 participants, out of which 50.7% (629) had engaged in various suicidal behaviours such as suicidal ideation: 29.7% (369/1241); suicidal plan: 14.6% (181/1241); and suicidal attempts: 6.4% (79/1241).

3.6. Risk and Protective factors of mental health problems

The prevailing risk factors for poor mental health outcomes (depression, anxiety, stress, PTSD, and suicide) related to COVID-19 were identified by 19 of the studies. Two studies did not report any significant risk factors (L. Zhang et al., 2020; Segre et al., 2021). Female gender was identified to be associated with high levels of COVID −19 related mental health outcomes by seven (7) studies with a total sample size of 22,587. Adolescence (older adolescent) was identified by 5 studies, 4 from China and 1 from Spain (Pizarro-Ruiz & Ordóñez-Camblor, 2021) while social isolation was also reported in various forms in 5 studies. The forms included staying without parents, (Garcia de Avila

Table 5. Characteristics of studies included in the review

Code.	Study reference	Country	Study design	Population	Age range	Sample size (N)
2.	Abawi et al., (2020)	Netherlands	Mixed-methods	Obese Children	10.5(mean)	75
3.	S. Chen et al., (2020)	China	Cross-sectional	Adolescents	Grade 7-12	7772
5.	Duan et al., (2020)	China	Cross-sectional	Children/ adolescents	7-18	3613
7.	Garcia de Avila et al., (2020)	Brazil	Cross-sectional	Children	6 – 12	289
8.	Kılınçel et al., (2021)	Turkey	Cross-sectional	Adolescents	12 – 18	745
9.	Ma et al., (2021)	China	Cross-sectional	Children/ Adolescents	7 – 15	668
10.	McKune et al.,(2021)	USA	Cross-sectional	Children	K-12 schools	280
14.	Pisano et al., (2021)	Italy	Cross-sectional	Adolescents	14 – 19	326
16.	Sama et al., (2021)	India	Cross-sectional (WB)	Children	School/KG-going child	310
17.	Segre et al., (2021)	Italy	Cross-sectional	Children/ Adolescents	6 – 14	82
18.	Shek et al., (2021)	China	Longitudinal	Adolescents	13.15(mean)	4981
19.	Tang et al., (2021)	China	Cross-sectional	Children/ Adolescents	6 – 17	4391
20.	Wang et al., (2021)	China	Cross-sectional	Children/ Adolescent	15.6(mean)	6435
21.	L. Zhang et al.,(2020)	China	Longitudinal – Cohort	Children/ Adolescent	9.3-15/9	1241
22.	C. Zhang et al., (2020)	China	Cross-sectional	Teenagers	13.93	1025
23.	S.-J. Zhou et al.,(2020)	China	Cross-sectional	Adolescents	12 – 18	8079
24.	J. Zhou et al., (2020)	China	Cross-sectional	Female adolescents	11 – 18	4805
29.	Pizarro-Ruiz & Ordóñez-Camblor, (2021)	Spain	Cross-sectional	Children/ Adolescents	8 – 18	590
33.	F. Chen et al., (2020)	China	Cross-sectional	Children/ Adolescents	6 – 15	1036
36.	Li et al., (2021)	China	Cross-sectional	Adolescents	12 – 18	7890
40.	Xie et al., (2020)	China	Cross-sectional	Children	Grade 2-6	1784

et al., 2020b), staying without companion on weekdays (F. F. Chen et al., 2020a), adolescents going through strict quarantine for 8–10 hours (Pizarro-Ruiz & Ordóñez-Camblor, 2021), long term home restrictions with less face-to-face communications and less pleasure. Other risk factors included residing in boarding house, living in areas of high infections (Xie et al., 2020; J. Zhou et al., 2020), fear of contracting COVID- 19, (Abawi et al., 2020; Xie et al., 2020), family member infected with

COVID −19, identified in 2 studies from China and Turkey (S. Chen et al., 2020; Kılınçel et al., 2021) and exposure to TV news or information about COVID-19 identified in 2 studies, (Kılınçel et al., 2021; Li et al., 2021).

Moreover, family loss of income, rural dwelling or home location, and poor socioeconomic status were identified in 4 studies, while previous psychopathology was identified by 2 studies in Spain and Italy (Kılınçel et al., 2021; Pisano et al., 2021). Parental educational level or qualification (S. Chen et al., 2020; SaSama et al., 2021), poor parent-child relationship (J. Wang et al., 2021), poor sleep (Li et al., 2021; J. Zhou et al., 2020), insufficiency of food and perceived discrimination (Li et al., 2021b), Smart phone use and internet addiction (Duan et al., 2020) were also identifiesd as correlates. However, there was conflicting reports on school level as a correlate for covid 19—related mental health outcomes. While lower grade level students had high prevalence of anxiety and depression in Wuhan—China (S. Chen et al., 2020), and anxiety and OCD-related behaviours in USA (McKune et al., 2021), on the contrary, high school students had higher prevalence of anxiety and stress than junior school students in C. X. Zhang et al.'s (2020) study in Guangdong—China. Factors such as PositiveYouth development PYD (Shek et al. (2021), positive coping and resilience (C. Zhang et al., 2020), optimism (Xie et al., 2020), and exercise/physical activity (F. S. Chen et al., 2020; Li et al., 2021) were identified as protective or mitigating against COVID-19 related mental health outcomes.

4. Discussion

A systematic review conducted during the early days of the pandemic suggests that the pandemic was affecting children and adolescents' mental health (Nearchou et al., 2020b). However, there were not many robust primary studies at the time of that study. This review was conducted to synthesize and describe the mental health impact of COVID-19 on children and adolescents from primary studies. The primary outcome measures of interest included the anxiety, depression, and stress. Secondary outcomes were Post-Traumatic Stress Disorder (PTSD) and suicidal behaviour. The review further examined the mitigating factors as well as risk factors of COVID-19 and mental health of children and adolescents. The overall evidence gathered points to the fact that COVID-19 has negatively affected the mental health of a sizeable proportion of children and adolescents.

5. Prevalence and correlates of depression, anxiety and stress

In this review, the prevalence rates of depression, anxiety, and stress from the individual studies ranged from 7.2% to 43.7%, 15% to 78%, and 15.2% to 26.1% respectively. In an earlier review, it was found that the range of prevalence of depression was from 22.6% to 43.7% and that of anxiety from 18.9% to 37.4% (Nearchou et al., 2020b). Similarly, a meta-analysis reported the pooled prevalence of depression, anxiety and stress among college students as 31.2%, 39.4%, and 26.0% respectively (Batra et al., 2021). Comparatively, the levels of depression and anxiety have marginally reduced, and this could be due to the time difference that has allowed for better adjustment to the COVID-19 situation, although the studies included in the previous study were rated as low to moderate in methodological quality.

The current review investigated the risk and mitigating factors for the prevalence of the mental health outcomes of interest. These correlates have been classified into personal/individual factors (such as age, school grade, gender, and being in a boarding house, previous psychopathology), family factors (such as income, educational status of parent, employment, parent-child interaction, infected family member), community factors (such as rural dwelling, high infection area, access to friends), and media (smart phone use, internet browsing, extensive exposure to television news on COVID-19).

Age and gender are significant individual determinants of mental health generally. In the present review, about six (6) studies reported that the adolescent cohort experienced a higher risk of depression and anxiety compared to younger children. This finding agrees with Paus et al., that adolescents are vulnerable to mental disorders, especially depression (Paus et al., 2008b). This is because adolescence is a critical time for acquiring and sustaining important emotional and

Table 6. Data extracted from the studies on outcome measures

Code. Reference	Brief description	Sample size	Study Measures	Prevalence of mental health problems	Correlates of mental health problems	Score	Quality appraisal
2. Abawi et al. (2020)	This study was carried out to describe COVID-19 related anxiety among children and adolescents with severe obesity	Sample size: N = 75 Sampling strategy described	Paediatric quality of life inventory	The proportion of participants who experienced anxiety: 24/75 (32%). Thus, 32% of participants experienced anxiety.	Fear of contracting COVID-19 and fear of infecting family members	3	Low
3. S. Chen et al. (2020)	The researchers compared levels of anxiety and depression of adolescents from Wuhan (the city of origin of COVID-19) with adolescents of other cities (Beijing & Hangzhou)	Total sample size (N = 7772) Sampling strategy adequately described.	1. Patient Health Questionnaire (PHQ-9) for depression 2. Generalized Anxiety Disorder −7 (GAD-7) for anxiety. All instruments are standardized	Anxiety: 26.9 (2091/7772) Depression: 42.9% (3334/7772)	Female gender, lower grade level, family member infected with COVID-19	7	High
5. Duan et al. (2020)	This study investigated anxiety and depression among Chinese children and adolescents and also identify the influencing factors.	Sample size: N = 3613	Spence Child Anxiety Scale (SCAS) for anxiety The Child Depression Inventory (CDI)	Depression: 22.28% (805/3613) .	Smart phone use and internet addiction. .	6	Moderate
7. Garcia de Avila et al., (2020)	This study assessed anxiety in Brazilian children using Children's Anxiety Scale (CAS) and the Numerical Rating Scale	Sample size: N = 289	The Child Anxiety Questionnaire (CAQ) and Numerical Rating Scale (NRS),	Anxiety: 19.4% (56/289; CAQ) to 21.8% (63/289; NRS).	*Female gender *Working parents *socially isolated without parents.	6	Moderate
8. Kılınçel et al. (2021)	This study aimed to determine how home quarantine affected adolescents and the factors affecting the result.	Sample size: N = 745	State of Anxiety Inventory	Anxiety: 37.4% (279/745). Worry: 64%	*Exposure to TV news about the COVID-19 pandemic *Past psychiatric referral *Having COVID-19 positive person in the family	5	Moderate

(*Continued*)

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Table 6. (*Continued*)

Code. Reference	Brief description	Sample size	Study Measures	Prevalence of mental health problems	Correlates of mental health problems	Score	Quality appraisal
9. Ma et al. (2021)	This study evaluated the impact of the COVID-19 pandemic on education and mental health of Chinese children aged 7–15	Sample size: N = 668	1 Impact of Event Scale-Revised (IES-R) for PTSD. 2 Short Mood and Feeling Questionnaire(SMFQ) —for depression	Depression: 7.2% (48/668) PTSD): 20.7% (138/668)	*Resident in boarding house	7	High
10. McKune et al., (2021)	This study was conducted to describe the psychosocial health of children and adolescents during the COVID-19 pandemic and lockdown.	Sample size: N = 280	Questionnaire	Anxiety: 34.6% (97/280 Depression: 35.4% (99/280) OCD symptoms: 32.1% (90/280)	*Loss of household income *Female gender *Lower school level	6	Moderate
14. Pisano et al. (2021)	The study was conducted to determine anxiety and depression in adolescents	Sample size: N = 326	1 State-Trait Anxiety Inventory (STAI) 2 Mood and Feelings Questionnaire—short form (MFQ-SF) 3 Strength and Difficulty Questionnaire (SDQ)	Severe Anxiety: 47.5% (153/326) **Depression symptoms**: 14.1% (46/326)	* Female gender *Previous psychopathology	6	Moderate
16. SaSama et al. (2021)	The study was conducted in 4 districts of Punjab in India to assess the impact of lockdown on mental status of children.	Sample size: N = 310.	Web-basedquestionnaire	Anxiety: 21.3% (66/310) Depression: 21.0% (65/310) Irritation: 72.6% Anger: 66.1%	*Economic status of family *Educational levels of mother * Area of their house and type of residential facilities available *Number of children in the family	3	Low

(*Continued*)

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Table 6. (*Continued*)

Code. Reference	Brief description	Sample size	Study Measures	Prevalence of mental health problems	Correlates of mental health problems	Score	Quality appraisal
17. Segre et al. (2021)	The study aimed at investigating psychological distress (anxiety and mood swing) and changes in routines.	Sample size:: N = 82	Anxiety Clinical Scale	Anxiety: 78% (64/82) Terrified: 75.6%. Constantly afraid and in fear of the dark:30.5%. Increased irritability and intolerance to rules:53.3% Mood problems: 43.9% (36/82)	None significant detected	3	Low
618. Shek et al. (2021)	The study examined the effect of COVID-19 pandemic on Chinese adolescents in terms of the prevalence of post-traumatic stress disorder (PTSD) symptoms and also to determine the moderating effect of positive youth development on PTSD.	Sample size: N = 4981	Chinese Positive Youth Development Scale (CPYDS)—for (positive Youth Development (PYD) Children's Revised Impact of Event Scale (CRIES-13)—for PTSD	Severe PTSD: 10.4% (517/4981).	Fear of being at risk of COVID-19 infection PositiveYouth development PYD)	6	Moderate
19. Tang et al. (2021)	The study was carried out to mainly ascertain the impact of COVID-19 pandemic on mental health dimensions such as stress, depression, and anxiety among children and adolescents in China.	Sample size: N = 4342	Depression Anxiety Stress Scale (The Chinese Version—DASS 21)	Depression: 19.7% (857/4342) Anxiety: 24.9% (1080/4342) Stress: 15.2% (659/4342)	* Adolescence is associated with a higher prevalence of depression, anxiety and stress.	6	Moderate

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Table 6. (*Continued*)

Code. Reference	Brief description	Sample size	Study Measures	Prevalence of mental health problems	Correlates of mental health problems	Score	Quality appraisal
20. J. Wang et al. (2021)	This study was conducted on adolescents in China to ascertain depression, difficulty in studying at home as well as factors associated with the development of depression among study participants.	Sample size: N = 6435	Child Depression Inventory (CDI)	Depression 17.1% (1140/6435)	* Poor parent-child relationship.	6	Moderate
21. L. Zhang et al., (2020)	This study was part of a longitudinal cohort in China study that was started before the COVID-19 pandemic. During the pandemic, the participants were followed up to ascertain if they were experiencing psychological impacts as a result of the COVID-19 pandemic.	Sample size: N = 1241	long version of the child self report Mood and Feelings Questionnaire (MFQ) MacArthur Health & Behavior Questionnaire (HBQ) Non-suicidal self-injury (NSSI) Questionnaire "middle school questionnaire" of the 2013 Youth Risk Behaviour Surveillance System in the USA	Depression: 24.7% (309/1241) Anxiety: 197/1241 (15%) Suicidal ideation: 29.7% (369/1241) Suicidal plan: 14.6% (181/1241) Suicidal attempts: 6.4% (79/1241)	None reported	6	Moderate
22. C. Zhang et al., (2020)	The researchers explored the psychological impact of COVID-19 on junior school and senior high school teenagers in China. They assessed depression, anxiety, and stress symptoms. They also explored mitigating factors for these psychological effects of the COVID-19 pandemic.	Sample size: N = 1025	1 Depression Anxiety Stress Scale (DASS—21) 2 Brief Resilience Scale 3 Coping Style Questionnaire 4 Impact of Event Scale-Revised	Depression: 226/1025 (22.0%) Anxiety: 276/1025 (26.9) Stress: 271/1025 (26.1%) Post Traumatic Stress Disorder (PTSD). 21.70%	*High school students Positive coping Resilience	6	Moderate

(*Continued*)

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Table 6. (*Continued*)

Code. Reference	Brief description	Sample size	Study Measures	Prevalence of mental health problems	Correlates of mental health problems	Score	Quality appraisal
23. S.-J. Zhou et al., (2020)	The study was conducted to explore depression and anxiety symptoms among adolescents during the COVID-19 pandemic.	Sample size: N = 8079	1 Generalized Anxiety Disorder scale (GAD-7) —for anxiety 2 Patient Health Questionnaire (PHQ-9) for depression	Anxiety symptoms: 3020/8079 (37.4%) Depression: 3533/8079 (43.7%).	1 Adolescence 2 Rural dweling 3 Female gender 4 Higher student grades	8	High
24. J. Zhou et al., (2020)	The researchers aimed at describing depression among Chinese adolescent females and also to identify determinants of depression.	Sample size: N = 4805,	Centre for Epidemiological Studies Depression Scale (CES-D),	Depression; 39.5% (1899/4805)	Risk factor: 1 Female adolescent 2 Living in an infectious area 3 Age 15–18 associated 4 sleep <6 hr 5 Exercise < 30 min	6	Moderate
29. Pizarro-Ruiz and Ordóñez-Camblor (2021)	The study was conducted to determine the effect of 8 to 10 days of lockdown/ confinement on the mental health of children and adolescents.	Sample size: N = 590	Assessment System for Children and Adolescents (SENA)	Anxiety: 16% (95/590) Depression: 11.0% (65/590).	Adolescent going through strict quarantine for 8 to 10 hours *Being a teenager/ adolescence	6	Moderate
33. (F. F. Chen et al., 2020a)	The study was conducted in China to determine the prevalence of anxiety and depression among children and teenagers between the ages of 6 to 15 years.	Sample size: N = 1036	1 Depression Self Rating Scale 2 Screen for Child Anxiety Related Disorders (SCARED	Depression: 11.8% (122/1036) Anxiety: 18.9% (196/1036)	1 Female adolescence 2 Parent educational level 3 older adolescent 4 without companion on weekdays *Exercise	6	Moderate

(*Continued*)

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Table 6. (*Continued*)

Code. Reference	Brief description	Sample size	Study Measures	Prevalence of mental health problems	Correlates of mental health problems	Score	Quality appraisal
36. (Li et al., 2021b)	The study investigated the prevalence of depression and anxiety among adolescents in Wuhan in China between the ages of 12 and 18 years.	Sample size: N = 7890	Hospital Anxiety And Depression Scale (HADS)	Depression: 1941/7890 (24.6%) Anxiety: 1708/7890 (21.6).	1 Long-term home restriction 2 Going outside of the home, 3 Insufficiency of food, 4 Perceived discrimination, poor sleep quality, *less face-to-face communication, less pleasure from interests/hobbies Browsing information about COVID-19 **Mitigating factors** 1 Physical activity	6	Moderate
40. (Xie et al., 2020)	The researchers recruited children and adolescents in primary schools in China to determine prevalence of anxiety and depression related to COVID-19 pandemic, school closure and lockdown.	Sample size: N = 1784.	1 Children's Depression Inventory–Short Form (CDI-S) 2 Screen for Child Anxiety Related Emotional Disorders,	Depression: 403/1784 (22.6%) Anxiety: 337/1784 (18.9%)	*Living in places with high infection rate *Worried about COVID-19 Optimism	6	Moderate

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social habits for mental health. Therefore, the sudden and drastic changes in social life patterns as a result of the school closures and other restrictions associated with the pandemic may have been overwhelming for adolescents to adjust to or cope with (Gazmararian et al., 2021), resulting in the signs and symptoms of depression experienced by many. This current review also reported that older adolescents, adolescents in high school or higher school grades were particularly at higher risk of depression, anxiety, and stress. Similarly, student status was associated with greater levels of depression symptoms and PTSD symptoms, according to a systematic review (Xiong et al., 2020). On the contrary, two studies reported lower school and grade level as risk factors for depression and anxiety (S. F. Chen et al., 2020a; McKune, Acosta, Diaz, Brittain, Joyce-Beaulieu, et al., 2021). This may be because young children and adolescents do not fully understand the disease and therefore are less worried.

Also, female adolescents had a significantly higher risk of developing depression and anxiety compared to their male counterparts, according to data obtained from ten (10) studies. This finding is supported by a cross-country study and a meta-analysis which report that due to the intricacies of gender differences, females generally experience worse mental health than boys, with varying directions and degrees of the gender gap (Batra et al., 2021; Campbell et al., 2021). The implication of this piece of evidence concerning age and gender is that mental health interventions should pay special attention to the emotional and psychological wellbeing of adolescents, especially female adolescents, so they can be protected from developing psychological symptoms.

Notwithstanding, children and adolescents who had previous psychopathology or past psychiatric referral were at higher risk of depression and anxiety during the pandemic, as reported by two studies (Kılınçel et al., 2021; Pisano et al., 2021) in this review. This can be attributed to an exacerbation of symptoms (Lin et al., 2021) as a result of reduced access to health care services due to lockdowns and fear of contracting the COVID-19 virus. On the contrary, Bobo et al.'s (2020) primary survey in France using both closed and open-ended questions found that for children and adolescents with ADHA there was more psychological stability or better wellness, reduction in school-related anxiety, adaptable modifications to the children's routines, and higher self-esteem. Also, parents' awareness of the importance of inattention and ADHD symptoms in their children's learning challenges appears to have increased as a result of the lockdown situation (Bobo et al., 2020). This means that the impact of COVID-19 and its associated lockdown could have both positive and negative effects on the mental health outcomes of children and adolescents.

Furthermore, family-related factors such as loss of household income and the educational level of the mother are another risk factor for children and adolescents to develop depression and anxiety, according to the data (McKune et al., 2021; SaSama et al., 2021). As primary caregivers, educational status of mothers can have significant influence on the care given to children especially during the pandemic. Other risk factors that have been extracted from the studies and which appear to be linked to loss of household income include insufficient food and the poor parent-child relationship (Li et al., 2021). The COVID-19 pandemic has led to numerous job losses, and this may have resulted in economic hardships and the inability of such parents to provide basic needs for their families. Therefore, insufficient food has been detected as a risk factor for chronic mental health problems among children (Li et al., 2021a; Paslakis et al., 2021). Also, a parent who has lost his/her livelihood through the pandemic may be unable to maintain a healthy mindset, or psychological wellbeing (Griffiths et al., 2021; Posel et al., 2021) and that could impact negatively on the parent-child relationship, and this will expose the child to the risk of mental illhealth as observed in the primary studies. This is because poor parent-child relationships do not promote open communication. Additionally, because of school closures and restrictions on movement, many children spend several hours at home alone while their parents are working, especially on weekdays (F. S. Chen et al., 2020b). These culminate in boredom leading to depression and anxiety.

The review also discovered that a higher risk of depression and anxiety were significantly associated with having a family member who is infected with COVID-19 (Kılınçel et al., 2021), and fear of contracting COVID-19 (Abawi et al., 2020; Shek et al., 2021). Thus, depression, anxiety, and stress were prevalent in children who were living in fear of contracting COVID-19. This finding is also supported by another review (Xiong et al., 2020). As members of the family children are equally concerned about all members of the family and therefore it is expected for them to be worried. Apart from that, the children maybe aware that due to their close contact they will be required to undergo screening and quarantine for days which may separate them from their loved ones leading to fear.

In addition to the personal and family-related factors, community-related factors were also identified to influence the risk of depression and anxiety among children and adolescents during the pandemic. Notable among them is living in a rural dwelling or living in an area with an increased number of infections known as hotspots, as reported by four (4) studies (SaSama et al., 2021a; Xie et al., 2020a; J. Zhou et al., 2020a; S.-J. Zhou et al., 2020b). Rural settlements are usually characterized by unfavourable disparities in vital resources which may be necessary for proper adjustment and coping with the pandemic. For example, most schools switched to online learning during the periods of school closure. This required access to a computer and the internet, which may be lacking in rural areas. Children and adolescents within these areas are left behind in such online learning experiences, which can have dire psychological effects such as feelings of being discriminated against, self pity, and anger. Similarly, anxiety and depression were found to be lower in metropolitan areas and higher in rural areas and higher psychological symptoms were recorded among children in highly infectious areas (Marques de Miranda et al., 2020).

Our review also revealed that face-to-face communication with friends was limited as were opportunities to engage in hobbies and other physical activities as a result of home restrictions and strict quarantine, and this also presented increased risk factors for depression and anxiety (F. S. Chen et al., 2020; Li et al., 2021). Adolescents generally prefer to associate with their peers even more than family as they get to socialise and engage in extracurricular activities which help in their total upbringing. Also, regular physical activity and exercise have been identified in this review as protective or mitigating factors against depression and anxiety during the pandemics and this is supported by Maugeri et al. (2020). Therefore, parents, teachers, religious and community youth organisation should device innovative strategies or programmes that offer young people opportunity to communicate, share ideas, learn and engage with their peers.

In this review, media-related concerns such as extended smart phone use, internet addiction, browsing about COVID-19 information and frequent exposure to television news on the COVID-19 also posed a risks for depression, anxiety, and stress among children and adolescents. Therefore, parents and guardians/caregivers need to take active steps against excessive exposure of children to television news on the happenings of COVID-19 pandemic. While television is a great source of information, some information may not be appropriate for the consumption of children and adolescents. Contrary to this finding, Gazmararian et al. (2021) reported that about 51% of adolescents in Georgia used social media to help them cope with the anxiety, fear and stress of the pandemic. Prior to the lockdowns, children and adolescents used internet mostly for entertainment on social media but had to re-direct the use of the internet to online learning. This was met with some challenges that contributed to stress and anxiety among children and adolescent. While the transition to remote online learning as a result of the COVID-19 may yield positive perceptions from students, there are some problem areas that need attention to maximize the benefit for students on different curricula (Kaurani et al., 2021). Furthermore, evidence suggest that e-learning perceptions influence student's psychological distress (Hasan & Bao, 2020). However, Moy and Ng (2021) studied university students in Malaysia and did not find perception towards e-learning to be associated with stress, anxiety, or depression.

This review also identified some factors that mitigate or are protective against depression and these include: regular physical exercise/activity, being optimistic, positive coping, and resilience. However, physical activity is observed to be greatly reduced during lockdowns and online learning (Chu & Li, 2022; Maugeri et al., 2020).

6. Prevalence and correlates post-traumatic stress disorder (PTSD) and suicidal behaviours

The overall prevalence rate of Post-Traumatic Stress Disorder (PTSD) in the review was 13.1%. from three (3) studies (C. Zhang et al., 2020; Ma et al., 2021; Shek et al., 2021). Similarly, Batra et al. (2021) reported a total prevalence of 29.8% for PTSD among college students in a meta-analysis. With regards to risk factors, adolescents had a higher risk of developing PTSD than young children. Also, the fear of contracting COVID-19 infection and being in boarding houses were the other risk factors for PTSD. Boarding houses may be likened to institutionalised care which has been identified to negatively affect the psychological, emotional and social development of children and adolescents (Desmond et al., 2020). Hence, in the event of a pandemic, the preferred place the child may be the home, with all their loved ones present, which creates a sense of security even in adversity. On the other hand, positive youth development (PYD) was found to be the mitigating factor against the development of PTSD. PYD programmes offer opportunities for young people to learn about, respect, and explore diversity, as well as to build the interpersonal skills necessary to traverse differences in a productive and civil manner (Arnold, 2020). Such programmes should be initiated and promoted across countries to empower the youth to overcome the negative effects of the pandemic.

Also, data on suicidal behaviour was obtained from only one of the studies (Zhang et al., 2020), which reported a 50.7% prevalence of suicidal behaviour in various forms. Presence of suicidal ideas, suicidal plan, and suicidal attempts were 29.7%, 14.6%, and 6.4% respectively. This is a longitudinal study that had data on the participants on suicide recorded before the pandemic and during the pandemic, the researchers followed up on the participants to collect the second data. And, the data gathered suggest a significant increase in suicidal behaviours during the pandemic compared to data before the pandemic. A higher prevalence of suicidal ideations were also recently reported in a meta-analysis by Batra et al. (2021). This suggests that COVID-19 had a huge negative impact on the mental health of children and adolescents in terms of suicide requiring active measures to restore and improve their mental health status. However, more research studies are needed to get more robust evidence.

7. Strengths and weaknesses of this review

One of the strengths of this review is that it contains data from many studies, compared to earlier reviews. Also, the methodological quality of the studies included in this review is generally of moderate quality. The majority of the studies recruited adequate sample sizes and collected data using standardized measuring instruments. Also, three reviewers scrutinized and worked in collaboration to select papers for inclusion and on data extraction to avoid selection or data extraction biases. Furthermore, the reviewers followed strictly, the predetermined inclusion criteria and selected only articles that met the inclusion criteria.

Regardless, this review has weaknesses and so the results should be interpreted with these limitations in mind. Firstly, the reviewers selected and searched only 4 databases. And, even though these four databases are major databases, it is possible that other databases not searched could contain other relevant articles. In addition, only articles published in English were included. All these are considered limitations as they threaten the completeness of evidence included in this review against what may actually exist.

8. Recommendations and conclusion

In summary, the evidence gathered showed that the COVID-19 pandemic impacted negatively the mental health of children and adolescents. On primary outcomes, the prevalence of depression

was 28.2% and ranges from 7.2% to 43.7%. The prevalence of anxiety was 27.1% and ranges from 15% to 78%. On stress, the prevalence was 17.1% and it ranges from 15.2% to 26.1%. Post-Traumatic Stress Disorder (PTSD) was prevalent in 13.1% of the participants while suicidal behaviour was recorded in 50.7%. It was also revealed that adolescents had more of the psychological impact compared to children and female adolescents were at higher risk of experiencing anxiety, depression, and stress.

The findings generated in this review point to the fact that the COVID-19 pandemic impacted negatively the mental health of children and adolescents. It is therefore recommended that a special mental health interventions be designed to pay attention to adolescents especially females to protect their psychological and emotional wellbeing. Majority of the studies accessed were cross-sectional studies. And, it is not yet known how these mental health experiences of the children and the adolescents are going to affect them in the future. In this regard, it is recommended that future research should consider undertaking longitudinal designs that will follow the participants for an extended period to determine if there will be residual effects in their adulthood. Policy-wise, government and state agencies responsible for mental health policy should consider prioritizing mental health for children and adolescents with specific attention directed at mitigating the effects of the COVID-19 pandemic. It is also worth noting that among all the studies that were included in the review, none came from the African continent. It is recommended that African researchers take this task up and generate context-specific evidence to guide mental health care, especially in children and adolescents.

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