



REVIEW ARTICLE

Anxiety symptoms and disorders during the COVID-19 pandemic in children and adolescents: Systematic review and meta-analysis



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Abstract

Background and Objectives: The COVID-19 pandemic and its associated factors have been shown to affect anxiety levels of young people. We meta-analytically assessed the prevalence of anxiety symptoms and anxiety disorders in children and adolescents during the pandemic, and the predictors and moderating factors influencing anxiety.

Methods: Multiple databases and registers were searched in this PRISMA and MOOSE-compliant systematic review and meta-analysis (PROSPERO:CRD42021266695) until 27/06/2021. We included individual studies evaluating the prevalence and characteristics of anxiety symptoms or anxiety disorders in children and adolescents (mean age ≤ 18 years), during the COVID-19 pandemic. Data extraction and quality assessment were carried out by independent authors. Random-effects meta-analyses of the prevalence of anxiety symptoms and anxiety disorders were conducted using Comprehensive Meta-Analysis (CMA) V3.

Results: 74 articles (total participant sample=478,882) were included (mean age=13.4 years, 52.3% female). The pooled rate of children and adolescents fulfilling diagnostic criteria for anxiety disorders was 13.0% (95%CI=4.9–30.1); the pooled prevalence of anxiety symptoms was 26.5% (95%CI=20.3–33.9). Anxiety symptoms were significantly more prevalent in females than males ($B = 0.103$, $p < .001$), significantly higher during the second wave of COVID-19, following July 2020, than during the first wave, prior to June 2020, ($Q = 8.136$, $p = .017$), and during school closure ($Q = 8.100$, $p = .014$). Quality of included studies was overall moderate.

Conclusions: There is a high prevalence of anxiety symptoms in children and adolescents during the COVID-19 pandemic, especially amongst females. This study identifies vulnerable groups, risk, and protective factors, which is crucial to developing clinical practice to prevent further mental health deterioration in young people.

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Introduction

COVID-19 was declared a global pandemic on the 11th of March 2020 by the World Health Organization (WHO).¹ As of the 13th of April 2023, a total of 762,739,900 COVID-19 cases have been confirmed worldwide, with 6,896,778 deaths.² The COVID-19 pandemic is having detrimental effects on public mental health,³ with a significant impact on mental health outcomes in children and adolescents,⁴⁻⁶ especially older adolescents, girls, and young people with neurodiversities and/or chronic physical conditions.⁷ Anxiety disorders and anxiety symptoms account for the most prevalent psychiatric problems in those aged 6 to 18 years old, with a worldwide prevalence of 6.5%.⁸ Anxiety symptoms seem to have exacerbated in the general population during the COVID-19 pandemic.³

A previous meta-analysis assessed the prevalence of anxiety amongst medical students during COVID-19,⁹ which was shown to significantly increase compared to pre-pandemic levels. Meta-analyses on the prevalence of anxiety amongst the general population³ and college students¹⁰ have also been conducted, showing female sex as the most significant risk factor. A narrative review and a systematic review on the psychological impact of COVID-19 thus far have shown a

high prevalence of anxiety, amongst children⁴ and adolescents,⁵ respectively; but no meta-analyses were conducted. A recent meta-analysis of 29 studies assessed the prevalence of anxiety symptoms and depressive symptoms in children and adolescents, finding a 20.5% prevalence of clinically elevated anxiety, highlighting increased anxiety levels, and evaluated three moderating factors: age, sex, and pandemic data collection time point.⁶ Further to this, a recent meta-analysis of children and adolescents from Turkey and China found a 26% prevalence of anxiety, with adolescents and females reporting a higher prevalence of anxiety than children and males.¹¹

This systematic review and meta-analysis evaluates and comprehensively characterizes anxiety symptoms and anxiety disorders in children and adolescents during the COVID-19 pandemic, evaluating a broad range of moderating factors. This review aims to meta-analyse the prevalence of anxiety symptoms and the proportion of anxiety disorder emergence present amongst children and adolescents during the COVID-19 pandemic. This systematic review also aims to provide comprehensive evidence about the influence of predictors and moderating factors on the anxiety symptoms within children and adolescents.

Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (eTable 1 & eTable 2) and Meta-analyses Of Observational Studies in Epidemiology (MOOSE) guidelines¹² (eTable 3). We pre-registered the study protocol in PROSPERO (CRD42021266695).

Search strategy and selection criteria

A systematic search was conducted on PubMed and Web of Science database (Clarivate Analytics), incorporating the Web of Science Core Collection, BIOSIS Citation Index, KCI-Korean Journal Database, MEDLINE, Russian Science Citation Index, and SciELO Citation Index as well as Cochrane Central Register of Reviews, and Ovid/PsycINFO databases from inception until the 1st of April 2021 was conducted and then updated on the 27th of June 2021. The following search terms were applied and adapted accordingly: ("COV" OR "coronavirus" OR "Orthocoronavirinae" OR "SARS-CoV-2" OR "2019 nCoV" OR "2019nCoV" OR "2019 novel coronavirus" OR "COVID-19" OR "new coronavirus" OR "novel coronavirus" OR "SARS CoV-2" OR "Wuhan coronavirus" OR "COVID 19" OR "2019-nCoV") AND ("teen" OR "child*" OR "adolesc*" OR "kid" OR "student" OR "pediatric" OR "juven*") AND ("anxiet*" OR "anxious" OR "hypervigilance" OR "social anxiety" OR "panic" OR "GAD" OR "generalized anxiety disorder").

To identify relevant grey, non-published, literature, we looked at medRxiv, psyArXiv, and bioRxiv pre-print databases. A manual search of the references of the included primary studies and reviews related to this topic was conducted. Articles identified were screened as abstracts by two independent researchers (UP, IC; MSc level researchers, supervised by a senior academic researcher). After excluding those that clearly did not meet our inclusion criteria, the full texts of the remaining articles were then assessed for eligibility and decisions were made regarding their final inclusion in the review.

The inclusion criteria were as follows: 1) individual studies with original data, including grey literature, 2) conducted in children and adolescents with a mean age of <18y, in line with previous studies,¹³ 3) assessing exposure to COVID-19, 4) reporting the percentage of anxiety and/or depression symptoms/disorder in this population, 5) in English. The exclusion criteria were as follows: 1) conference proceedings, case reports, narrative reviews, or qualitative studies, 2) studies including adults with a mean age >19-years-old, 3) studies in which children and adolescents were not exposed to COVID-19, 4) studies focusing on physical health outcomes or mental health outcomes other than anxiety.

Data extraction

Data extraction was led by the main researcher (UP) and also independently extracted by members of the research team who extracted data in pairs and attained consensus via group discussion (HAG, KP, BK; MD/Doctorate level researchers, supervised by a senior academic researcher). Any discrepancies arising were resolved through consensus, consulting another senior academic researcher (GSP) if an agreement was not attained. The variables extracted included: first author, year of publication, country(ies), wave of COVID-19 during study duration, whether there was school closure,

the percent attending school, whether there was a lockdown (as operationalised in each study - such as, home confinement, school closure, quarantine etc.), months since March 2020 - when COVID-19 was declared a global pandemic, study design (cross-sectional, longitudinal), sample size, sex (% females), age (mean±SD, range), tools to assess anxiety symptoms (see eTable 4), mental health outcome (anxiety measurement instrument used, threshold of the anxiety measurement instrument used), quality appraisal (see below) and key findings.

Strategy for data synthesis

A meta-analysis for the prevalence of anxiety symptoms was conducted as our primary outcome. A secondary analysis was conducted on the prevalence of anxiety disorders according to DSM/ICD criteria. Random effects model meta-analyses were conducted pooling the percentage (95%CI) expressing the rate of the symptoms/disorders. We also tested using sub-analyses the prevalence of anxiety symptoms by continent (Europe, Asia, North America, South America), wave of the pandemic (first wave – up to June 2020 –, second/subsequent waves – from July 2020), school closure (yes, no) lockdown status (yes, no), design (cross sectional, longitudinal).

Hedges' g was used to estimate parameters and effect size in the meta-analysis. Publication biases were assessed with the metafunnel function visually by examining the funnel plot and quantitatively by the Egger's test.¹⁴ The trim and fill method was used to correct the estimates in the case of publication biases. The presence of significant heterogeneity amongst study point estimates was assessed using Q statistics. The proportion of the total variability due to true heterogeneity was evaluated with the I^2 index. We conducted meta-regressions including age, sex, sample size, percent attending schools and longitudinal progression (i.e., time passed from March 2020) as moderating factors. The meta-analyses were conducted using Comprehensive Meta-Analysis (CMA) V3.¹⁵

Results of the systematic review were synthesised narratively and summarised in tables. Results were stratified by clinical at-risk populations and risk factors, followed by protective factors.

Quality appraisal

For study appraisal, this systematic review used the Newcastle-Ottawa Scale (NOS). We used the appropriate version of the NOS according to the design of the studies (cross-sectional studies (see appendix) or cohort studies¹⁶). The quality assessment process was led by the main researcher, and also independently assessed by other co-authors (HAG, KP, BK). Any disagreements that arose were discussed with the corresponding author and resolved.

Results

Search results

Our electronic search identified 16,082 publications; a further 6 publications were identified via backward searching of key papers. 1043 and 166 publications went through

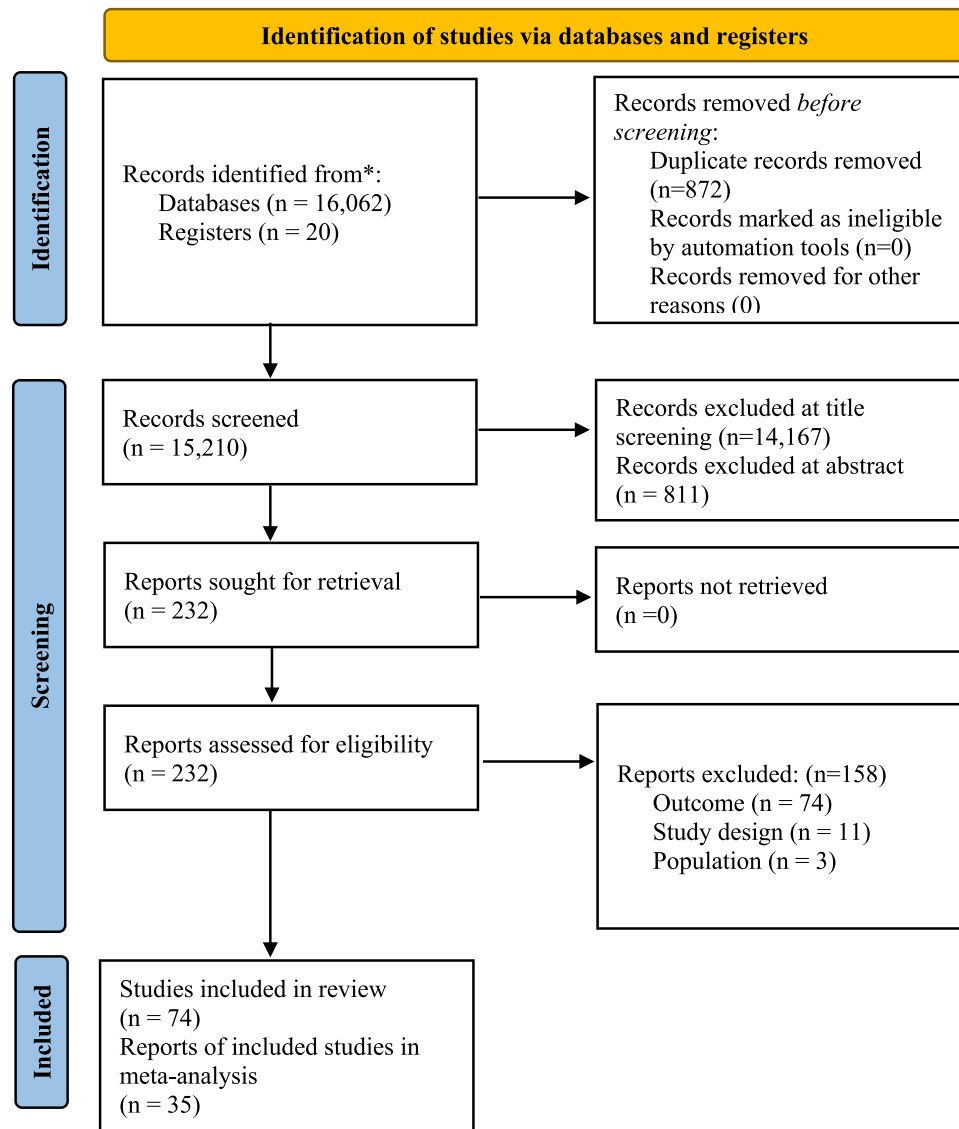


Fig. 1 PRISMA 2020 flowchart.

abstract screening and full-text screening, respectively; 92 publications were excluded (see eTable 7), and 74 publications, including one study from pre-print databases,¹⁷ met the criteria for inclusion. After accounting for overlap in study outcomes, 35 samples reported meta-analyzable results for anxiety. Results of the search follow in the PRISMA 2020 flow diagram (Fig. 1).

Study characteristics

Sample sizes ranged from 45 to 373,216 participants (total sample size (n)=478,882), of which 52.3% were female. Participants had a mean age of 13.4 years (range: 0–22). Most publications were cross-sectional studies (number of studies (k = 63, n = 85.1%), the rest were longitudinal studies or clinical trials (k = 11, n = 14.9%). The included studies were conducted in Asia (k = 42, n = 56.8%), Europe (k = 21, n = 28.4%), North America (k = 9, n = 12.2%), South America (k = 1, n = 1.4%), and Australia (k = 1, n = 1.4%). (Summary of study characteristics and key findings can be found in eTable 8).

Quality assessment

The quality of the included studies was 6.3 ± 1.6 (range: 2–9), which is considered moderate quality. Cross-sectional studies scored an average of 6.4 ± 1.6 (range: 2–9) out of 9.0 stars longitudinal studies scored an average of 5.8 ± 0.9 (range: 5–8) out of 8.0 stars (see eTable 8 & eResults).

Meta-analysis

A meta-analysis of 35 studies showed a pooled percentage of anxiety symptoms during the COVID-19 pandemic of 26.5% (95%CI=20.3–33.9) (Fig. 2 & Table 1). The prevalence ranged from 1.8%¹⁸ to 62.7%.¹⁹ 13.0% (95%CI=4.9–30.1) of children and adolescents had DSM/ICD anxiety disorders (k = 4). Anxiety levels worsened from baseline to follow-up (hedges' g = 0.493, 95%CI=0.430–0.556) (k = 3) in the longitudinal studies (mean follow up=95.3 days) (eTable 5).

In the sub-analysis (see eTable 5), we found that anxiety symptoms were more prevalent in North America (35.9%,

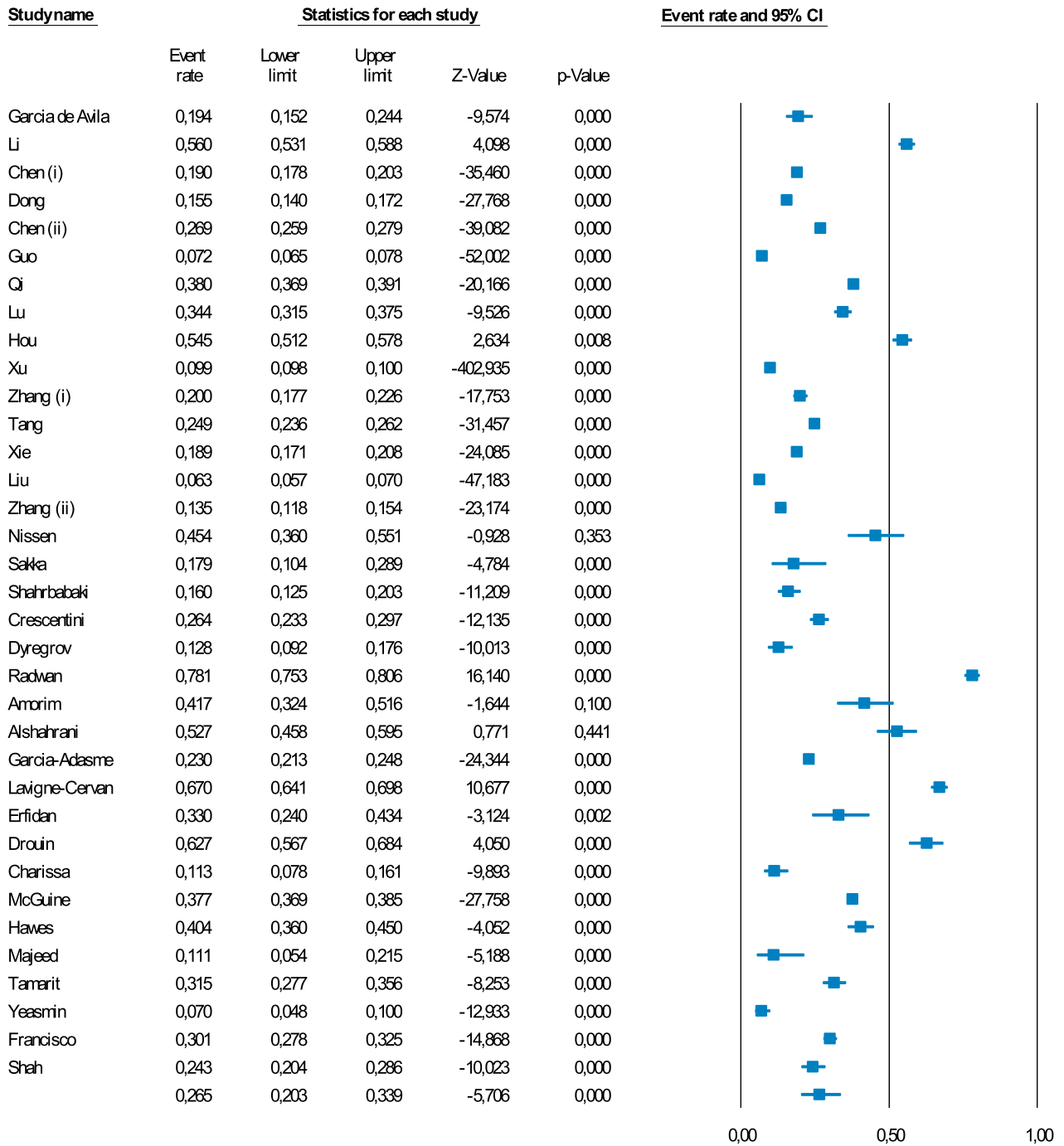


Fig. 2 Prevalence of anxiety symptoms: Forest plot.

95%CI=24.1–38.9, $k = 4$, $n = 11.4%$) and Europe (31.5%, 95%CI=21.4–34.3, $k = 9$, $n = 25.7%$) than in Asia (23.5%, 95%CI=16.7.4–32.1, $k = 21$, $n = 60.0%$) and South America

(19.4%, 95%CI=15.2–24.4, $k = 1$, $n = 2.9%$) ($Q = 9.231$, $p=.026$) (Fig. 3). We also found that there were more anxiety symptoms during the second wave, following July 2020 (41.1%, 95%CI=8.1–84.7, $k = 3$, $n = 8.6%$), than during the first wave, from December 2019 to June 2020 (25.3%, 95%CI=19.2–32.6, $k = 32$, $n = 91.4%$) ($Q = 8.136$, $p=.017$) (Fig. 4). We finally found that there were more anxiety symptoms in children whose school had closed (17.8%, 95%CI=11.9–25.8, $k = 10$, $n = 31.3%$) than those whose school had not closed (32.5%, 95%CI=26.9–38.7, $k = 22$, $n = 68.8%$) ($Q = 8.100$, $p=.014$). We did not find differences between studies conducted during lockdown period ($k = 22$)

Table 1 Test for heterogeneity.

	Test for heterogeneity		
	Q	I ²	P
Anxiety Symptoms	22,336.379	99.848	0.000

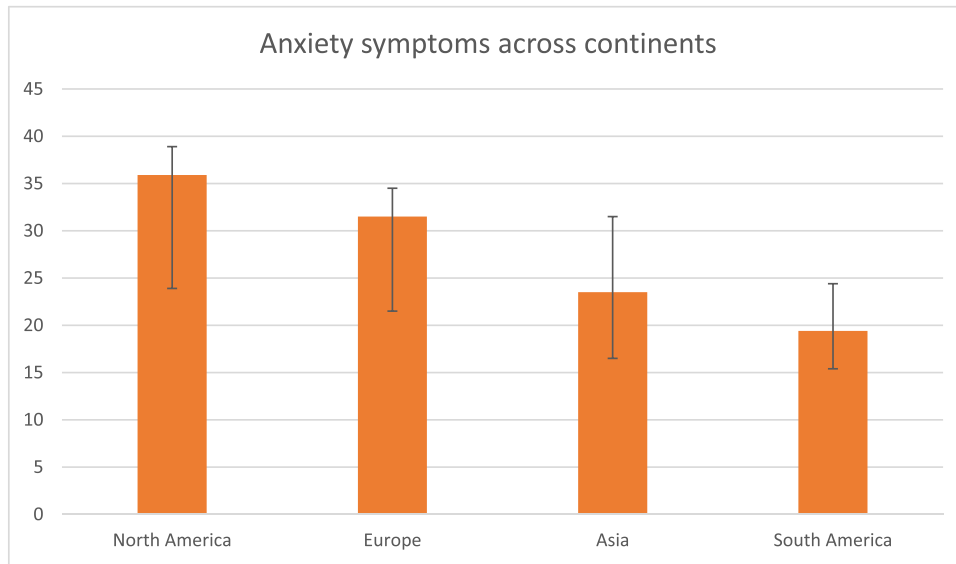


Fig. 3 Prevalence of anxiety symptoms across continents.

and those in which this was not specified ($k = 12$) ($p=.576$) or between cross-sectional ($k = 32$) and longitudinal studies ($k = 3$) ($p=.551$).

Meta-regressions between the outcome of anxiety and other predictors

Increased number of months since March 2020 ($B = 0.150$, $p<.001$) and increased % of females ($B = 0.103$, $p<.001$) were associated with a higher prevalence of anxiety symptoms (see eTable 6). Meta-regressions for age, % attending school, and sample size did not result statistical significance (all $p>0.05$) (eTable 6).

Publication bias (small study effect) assessment

Some asymmetry was found within the funnel plot (Fig. 5) and Egger’s test quantitatively suggested publication bias

($t\text{-value}=3.695$; $p=.00079$). However, trim and fill value did not adjust the results and the plot did not indicate small-effect bias (Fig. 5). Thus, publication bias was not found.

Narrative synthesis

The following clinical populations reported an increased risk of anxiety symptoms: Autism Spectrum Disorder (ASD) ($p<.001$),²⁰ hearing difficulties ($p=.003$),²¹ haematology-oncology disease ($p=.01$),²² neurological disorders ($p<.05$),²³ multiple sclerosis ($p<.001$),²⁴ and those who had previously sought out psychiatric help (OR=4.4, 95%CI=2.5–25.3).²⁵

Risk factors for exacerbation of anxiety symptoms evaluated during COVID-19 included family relationships, media use, and level of COVID-19 fear (see eTable 4). Regarding family, parental anxiety symptoms (95%CI=1.0–4.6),^{26,27} parent behaviour, including their employment status, sports

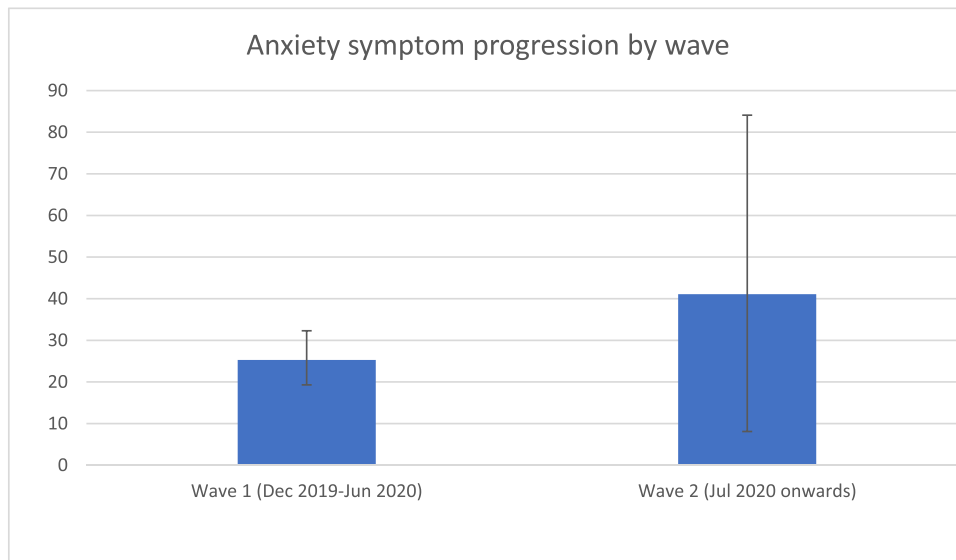


Fig. 4 Progression of anxiety symptoms from wave 1 to wave 2 of the COVID-19 pandemic.

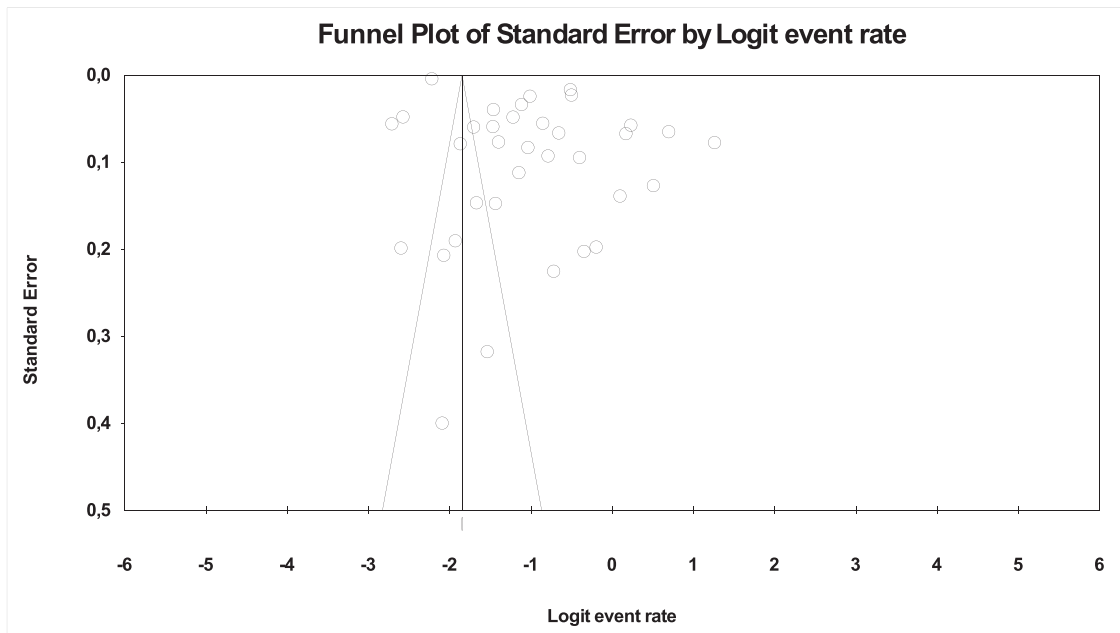


Fig. 5 Funnel plot of anxiety symptoms.

practiced, and compulsions ($p < .001$),^{28,29} being away from parents (OR=1.3, 95%CI=1.1–1.6),^{30,31} number of people at home (OR=1.3, 95%CI=1.0–1.6),³⁰ having siblings ($p < .001$),³² and arguments with parents (OR=2.5, 95%CI=1.8–3.6)³³ have been associated with exacerbation of anxiety symptoms. Similarly, a family member testing positive for COVID-19 (OR=3.8, 95%CI=1.8–13.6)²⁵ was found to be a risk factor for

anxiety symptoms. Furthermore, exposure to COVID-19 related media was associated with more severe anxiety symptoms (OR=1.5, 95%CI=1.0–2.3).^{18,25,34,35} COVID-19 related fear was also a common risk factor for anxiety symptom exacerbation (OR=1.3, 95%CI=1.0–1.5)^{30-32,36-41} (see Fig. 6).

School concerns were associated with panic disorder ($p < .001$), social anxiety ($p < .05$), and generalised anxiety

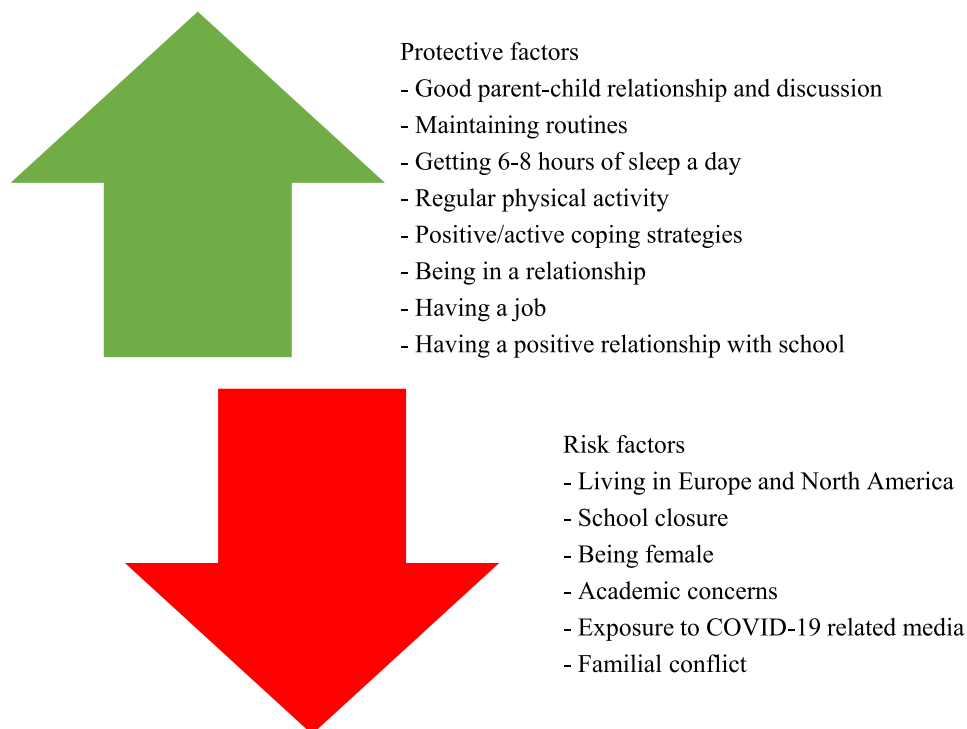


Fig. 6 Risk and protective factors for anxiety symptoms in children and adolescents.

Risk and protective factors have been identified from the subgroup-analysis and meta-regression conducted in this study, and from the narrative synthesis.

($p < .001$).³⁹ Specifically, being a senior in high school as opposed to younger ages (OR=1.3, 95%CI=1.2–1.4),^{31,42–44} poor academic records (OR=1.4, 95%CI=1.0–1.9),⁴⁵ and inattention during online studying (OR=1.3, 95%CI=1.0–1.8) were associated with exacerbation of the symptoms of anxiety. Longitudinal research has shown that pre-pandemic symptoms of anxiety were the strongest indicator of anxiety symptoms during the pandemic ($p < .001$).⁴⁶

Personal protective factors included positive coping (OR=0.946, $p < .001$),⁴⁷ such as regular moderate-high level physical activity ($p < .05$),^{36,37,40,42,45,48,49} sleeping 6–8 h a day ($p < .001$),^{40,42} maintaining routines ($p = .045$),²⁰ balanced videogame usage ($p < .05$),⁵⁰ maintaining hobbies such as gaming,⁴⁹ and active and humorous coping⁵¹ which were associated with lower anxiety levels. School-related protective factors for anxiety symptoms included teacher's social support,⁵² hoping to go back to school (OR=0.6, $p < .001$), and missing teachers (OR=0.5, $p < .001$) or classmates (OR=0.6, $p < .001$).³³ Furthermore, protective factors related to the home were: good parent-child relationships ($p < .001$),³² being accompanied at home on a workday ($p < .001$),³⁶ living with parents ($p = .009$),³¹ and parent-child discussion (OR=0.7, 95%CI=0.6–0.8).⁴⁴ In addition, being in a romantic relationship (OR=0.4, 95%CI=0.2–0.9)⁵³ and being employed ($p = .005$)⁵⁴ were associated with lower anxiety levels (see eTable 4).

Discussion

This systematic review and meta-analysis provides a large and comprehensive review on the presentation of anxiety symptoms and disorders in children and adolescents. The pooled estimated prevalence of anxiety disorders during the COVID-19 pandemic was 13.0%, and that of anxiety symptoms was 26.5%. This meta-analysis found the prevalence of anxiety disorders during the COVID-19 pandemic to be twice as high as the worldwide prevalence of anxiety disorders before the COVID-19 pandemic.⁸ Meta-regressions found anxiety symptoms to be significantly more frequent in females. Furthermore, our results suggest that children and adolescents' anxiety symptoms significantly increased since the onset of the pandemic, in March 2020. Anxiety symptoms were more prevalent in the second wave of COVID-19 than the first wave of COVID-19, more prevalent in young people whose school had closed, and more prevalent in North America and Europe than in Asia and South America. Previous meta-analyses of the COVID-19 period have found the prevalence of anxiety symptoms to be between 28.0%⁹–31.0%¹⁰ in college students, which is comparable, if not higher, to the figures that this meta-analysis found, suggesting that the increase in anxiety symptoms extends from childhood and adolescence to early adulthood.⁵⁵ The 26.5% prevalence of anxiety symptoms found in this meta-analysis was higher than that found in a previous meta-analysis (20.5%),⁶ suggesting that anxiety symptoms kept increasing, up to 29.3%, during the research period from the start of the pandemic in December 2019 until June 2021.

Resilience is our ability to adapt well to adversity and is shaped by individual, familial, and systemic factors.^{56,57} Typically, young people show high levels of resilience.⁵⁸ However, resilience in young people may have a limit, with

anxiety symptoms increasing from wave 1 to wave 2 of COVID-19. The first wave of the pandemic may have been associated with the fear of the unknown as the developing COVID-19 situation is unpredictable and novel^{59,60}; furthermore, young people may have been exposed to consistently increasing morbidity and infection rates² alongside anxiety-provoking media.¹⁸ With repeated activation of acute stress mechanisms, subsequent waves may be associated with chronic stress,⁶¹ post-traumatic stress^{62,63} and hypochondriasis.⁵⁹ Children seem to cope better with shorter lockdowns⁶⁴ and face more mental health difficulties with longer lockdowns,^{65,66} showing further that resilience in children may have a limit. Furthermore, the mental health difficulties seen with longer lockdowns emphasise that they are only appropriate in emergency cases, due to the negative impacts of social restrictions and their associated stressors. Consequently, children and adolescents should have access to resilience-based interventions,^{67,68} including the provision of academic skills at the individual level, support for family cohesion, and supportive teacher interactions.⁶⁹ Further longitudinal research is required on the impact of the COVID-19 pandemic on anxiety in young people to assess if further waves do lead to chronic stress or if young people habituate⁷⁰ to the unprecedented global situation which may become their new normal.⁷¹

School closures resulted in more anxiety symptoms in children and adolescents. One potential hypothesis is that this could be due to parental burnout and limited support from teachers during remote learning,⁵² alongside difficulty accessing school-based psychological services.⁷² Children and adolescents from low socioeconomic backgrounds experienced more financial stressors,⁷³ and health risks during the COVID-19 pandemic.^{74–76} One in seven children were unable to access the internet at home, the rate of which is two times higher in low-income communities⁷⁷; which may exacerbate social comparison.⁷⁸ The compounded social and economic difficulties may complexify the transition to remote learning.⁷⁹ While school closures are effective in controlling COVID-19, the psychological harm for young people could be profound,⁸⁰ as children face disruptions in school routines.⁷² Families with low socioeconomic status should be supported with financial safety nets, with schools ensuring all students have access to resources required to get online, to ensure equity. Furthermore, school closures, which are needed for protection, occur during periods of high transmissibility, and may result in more anxiety in young people due to the underlying emphasis on high infection rates. Schools should aim to not overwork students and be mindful of the mental health difficulties vulnerable students are facing.

Our meta-regression analysis showed female sex to be associated with higher levels of anxiety symptoms^{28–31,33,35–37,42–45,49,50,53,54,81–86} and chances of developing anxiety disorders⁸⁷ during the COVID pandemic. This seems to be more pronounced during adolescence, coinciding with puberty and a shift in hormones⁸⁸; females in general are more prone to experiencing anxiety than males.⁸⁹ Females reportedly face more interpersonal stressors,⁹⁰ including family, peer, and intimate relationships,⁹¹ and were more likely than males to experience increases in interpersonal violence during lockdowns.⁹² Females also ruminate more,⁹³ which may adversely impact their mental health and could be targeted

for early intervention support. Age was not found to be a predictor for anxiety symptoms or disorders in our meta-regression analyses.

Further specific vulnerable groups identified by this systematic review include children and adolescents with neurodevelopmental disorders or Special Educational Needs or Difficulties (SEND),^{20,23,25} haematological or oncological diseases,²² neurological disorders^{23,24} or hearing difficulties,²¹ amongst others. Vulnerable young people have lost both specialised educators⁵² and a structured learning environment due to the pandemic.⁷⁷ Children with SEND may experience a delay in the developmental progress of essential skills resulting from a suspension of social groups and therapy sessions.⁹⁴ Those with chronic illnesses are reported to have higher levels of anxiety during pandemics.^{95,96} Physical health conditions may affect one's immune system and result in more COVID-19 related anxiety due to the higher risk of vulnerability-based complications during COVID-19.⁹⁷ Furthermore, as those with chronic physical health conditions already face more disability and non-disability challenges,⁹⁸ they may experience diminished resilience when facing the additional stressor of COVID-19. Young people with disabilities may also face difficulties in accessing the routine medical care they rely on as healthcare systems are at risk of being overwhelmed by COVID-19, leading to an increase in anxiety.⁹⁹ Services should attempt to check-in with those known to be medically vulnerable to mediate negative mental health effects because of the chronic and acute difficulties they face.

Children with behavioural problems, pre-existing mental health difficulties, and children who already had a poor relationship with their parents prior to the pandemic are especially vulnerable to an exacerbation of conflicts at home¹⁰⁰ which may result in exacerbation of anxiety symptoms.^{33,46,101} Home is not a safe space for all children⁹⁹ and schools being shut means children are less able to access safeguarding networks that would be available to them if schools were open.¹⁰² Furthermore, studies included in this systematic review found parental stress and anxiety to be risk factors for anxiety symptomatology within children and adolescents.^{26,27,103} Parents experiencing parental burnout during COVID-19 are more likely to engage in child abuse and neglect,¹⁰⁴ posing a short-and-long-term risk for children.^{105,106} Some parents, for instance, healthcare workers, may be under particular pressure which may result in an exacerbation of anxiety symptoms in children.^{30,38,107} This is related to long working hours, highly emotive work, and increased potential exposure to COVID-19.^{108,109}

This systematic review found that pre-pandemic anxiety symptoms were predictive of anxiety symptoms severity during the pandemic.⁴⁶ Having previously accessed psychiatric help is a risk factor for the exacerbation of anxiety symptoms.²⁵ Those known to have previous psychiatric disorders should receive early intervention to help them to cope with expected difficulties and prevent further mental health consequences. Telemental health services have shown to be effective⁷² and should be adapted to reach vulnerable groups in an extended scope.

This meta-analysis found young people from western continents, including Europe and North America, to report more anxiety symptoms than young people from Asia and South America. Young people from Asia face a range of more

severe adverse risks before COVID-19.¹¹⁰ Children and adolescents from high-risk backgrounds are found to show more resilience.¹¹¹ Furthermore, young people from cities are reported to face more mental health difficulties than those from rural areas.¹¹² There is a lower prevalence of people who use the internet or own a smartphone in Africa, Asia, and South America, in comparison to people from Canada, Australia, or the Netherlands.¹¹³ Excessive exposure to COVID-19 related media^{18,25,34,35} is a risk factor for anxiety symptom exacerbation. Previous research has supported this by showing increased smartphone usage is associated with anxiety levels¹¹⁴ which is more prevalent in western continents. Limiting exposure to media may result in decreased anxiety levels.¹¹⁵ Another hypothesis would be that fear relating to COVID-19 is a risk factor for anxiety symptoms.^{30-32,36-41,101,116} Since the start of the pandemic, western Europe and North America have had higher rates of COVID-19 community infections, with a higher death rate per million inhabitants, compared to eastern continents and eastern Europe.¹¹⁷ Low-income countries have an estimated infection-fatality rate of 0.23% compared to 1.15% in high-income countries.¹¹⁸ The rate of COVID-19 in the community is associated with more COVID-19 fear and anxiety³⁶ and a lower rate of community COVID-19 cases in low-income countries could explain why there are lower subsequent levels of anxiety. In addition, children from western countries may be more open to report anxiety and communicate their feelings compared to children from eastern countries; this may come from the cultural model of individualism in western cultures more easily allowing individuals to express internal personal characteristics and emotions.¹¹⁹ Furthermore, research has found stressful life events to be perceived as less stressful than breaking cultural taboos¹²⁰; therefore, there are cultural differences in what is perceived as stressful or anxiety inducing.

More government support is needed to promote recovery. Some studies report disasters to require global and governmental efforts to maintain and restore resilience within society.^{121,122} This should involve both a rise in funding and the provision of more trained staff to Child and Adolescent Mental Health Services (CAMHS). As COVID-19 is exacerbating young people's mental health and resulting in the emergence of anxiety, the demand on CAMHS, an already stretched service, will grow.⁷⁴ To prevent further adversity to young people's mental health, we need to provide an adaptable, multi-disciplinary support system⁷⁴ to protect children and adolescents' mental health. Furthermore, governmental guidance surrounding disaster regulations and plans should be readily available and easy to understand to maintain resilience in the community.¹²³⁻¹²⁵

The COVID-19 pandemic has resulted in a shift in mental health care for young people.¹²⁶ To ensure continuity of care, mental health services have adopted a telehealth support format.¹²⁷ Remote interventions have shown good effectivity in anxiety treatment.¹²⁸ Research has found minimal therapist contact therapies to be efficacious for a range of anxiety diagnoses,¹²⁹ showing that face-to-face contact may not be essential for therapeutic efficacy.¹²⁹ Telehealth interventions are cost-effective¹³⁰ and reduce barriers to care by improving access.¹³¹ Telehealth-based psychotherapy has a range of uses within paediatric care¹³² however, can be limited by one's psychological resistance

to novel treatment methods, cultural background, alongside their technology literacy.¹³³ Most reviews looking at the efficacy of remote psychotherapy interventions for anxiety occurred pre-COVID-19. More research including randomised control trials and meta-analyses are needed to evaluate the effectiveness of remote psychotherapy during COVID-19 for children and adolescents so that the best care can be provided.

Limitations

The findings of this review should be interpreted in the context of various limitations. First, 52.7% of included studies either did not provide clear outcome data or were too heterogeneous or not rigorous enough to be meta-analysed (e. g., the thresholds of the instruments were not in line with validation data). Only four studies provided meta-analysable data regarding anxiety disorders. Second, 87.9% of included studies were from the first wave of COVID-19. More studies on the 2nd and 3rd wave of COVID-19 are needed to evaluate the long-term impact that COVID-19 has on the mental health of young people. Third, 86.5% of included studies were cross-sectional, which limits causal inference. Future longitudinal research should follow those presenting anxiety symptoms during the pandemic to assess if the symptoms presented reduce, continue, or develop into anxiety disorders either as the pandemic continues or post-COVID-19.

Conclusion

This meta-analysis found a high prevalence of anxiety symptoms and the emergence of anxiety disorders in children and adolescents during the COVID-19 pandemic. Specific vulnerable groups include young people in North America and Europe, and females. Identifying those at risk is the first step in developing more appropriate community-based preventative clinical interventions.

Conflict of interest

Dr Salazar de Pablo has received personal fees from Janssen Cilag and Lundbeck. Dr Catalan has received personal fees from Janssen Cilag and Lundbeck. Prof. Cortese declares honoraria and reimbursement for travel and accommodation expenses for lectures from the following non-profit associations: Association for Child and Adolescent Central Health (ACAMH), the Canadian AADHD Alliance Resource (CADDRA), the British Association of Psychopharmacology (BAP), and from Healthcare Convention for educational activity on ADHD.

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Data availability statement

Data is available upon reasonable request. Requests for data access should be sent to the corresponding author.

Ethical considerations

No ethical approval was required for this review.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.ejpsy.2023.06.003](https://doi.org/10.1016/j.ejpsy.2023.06.003).

References

1. World Health Organization. WHO Director-General's Opening Remarks at the Media Briefing on COVID-19-11 March 2020. In: Geneva, Switzerland.
2. World Health Organization. Weekly epidemiological update on COVID-19 - 13 April 2023. 2022.
3. Salari N, Hosseini-Far A, Jalali R, Vaisi-Raygani A, Rasoulpoor S, Mohammadi M, et al. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Global Health*. 2020;16(1):1–11. <https://doi.org/10.1186/s12992-020-00589-w>.
4. de Miranda DM, da Silva Athanasio B, de Sena Oliveira AC, Silva ACS. How is COVID-19 pandemic impacting mental health of children and adolescents? *Int J Disaster Risk Reduct*. 2020;101845. <https://doi.org/10.1016/j.ijdr.2020.101845>.
5. Jones EA, Mitra AK, Bhuiyan AR. Impact of COVID-19 on mental health in adolescents: a systematic review. *Int J Environ Res Public Health*. 2021;18(5):2470. <https://doi.org/10.3390/ijerph18052470>.
6. Racine N, McArthur BA, Cooke JE, Eirich R, Zhu J, Madigan S. Global prevalence of depressive and anxiety symptoms in children and adolescents during COVID-19: a meta-analysis. *JAMA Pediatr*. 2021. <https://doi.org/10.1001/jamapediatrics.2021.2482>.
7. Samji H, Wu J, Ladak A, Vossen C, Stewart E, Dove N, et al. Mental health impacts of the COVID-19 pandemic on children and youth—a systematic review. *Child Adolesc Ment Health*. 2022;27(2):173–89.
8. Polanczyk GV, Salum GA, Sugaya LS, Caye A, Rohde LA. Annual research review: a meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *J Child Psychol Psychiatry*. 2015;56(3):345–65. <https://doi.org/10.1111/jcpp.12381>.
9. Lasheras I, Gracia-García P, Lipnicki DM, Bueno-Notivol J, López-Antón R, De La Cámara C, et al. Prevalence of anxiety in medical students during the COVID-19 pandemic: a rapid systematic review with meta-analysis. *Int J Environ Res Public Health*. 2020;17(18):6603. <https://doi.org/10.3390/ijerph17186603>.

10. Chang J-J, Ji Y, Li Y-H, Pan H-F, Su P-Y. Prevalence of anxiety symptom and depressive symptom among college students during COVID-19 pandemic: a meta-analysis. *J Affect Disord.* 2021. <https://doi.org/10.1016/j.jad.2021.05.109>.
11. Ma L, Mazidi M, Li K, Li Y, Chen S, Kirwan R, et al. Prevalence of mental health problems among children and adolescents during the COVID-19 pandemic: a systematic review and meta-analysis. *J Affect Disord.* 2021;293:78–89.
12. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ.* 2021;372. <https://doi.org/10.1136/s13643-021-01626-4>.
13. Catalán Alcántara A, Salazar de Pablo G, Vaquerizo Serrano J, Mosillo P, Baldwin H, Fernández Rivas A, et al. Annual research review: prevention of psychosis in adolescents-systematic review and meta-analysis of advances in detection. *Prognosis Interv.* 2021.
14. Egger M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ.* 1997;315(7109):629–34. <https://doi.org/10.1136/bmj.315.7109.629>.
15. M. Borenstein. Software for publication bias. Publication bias in meta-analysis: prevention, assessment and adjustments. 2005:193–220. <https://doi.org/10.1002/0470870168>.
16. Modesti PA, Reboldi G, Cappuccio FP, Agyemang C, Remuzzi G, Rapi S, et al. Panethnic differences in blood pressure in Europe: a systematic review and meta-analysis. *PLoS One.* 2016;11(1). <https://doi.org/10.1371/journal.pone.0147601>. e0147601.
17. Cenk M, Yegit CY, Ergenekon A, Aksoy AT, Bilicen G, Gokdemir Y, et al. Effect of COVID-19 Pandemic on Anxiety Levels of Children with Cystic Fibrosis and Healthy Children. *Authorea Preprints*; 2020.
18. Yue J, Zang X, Le Y, An Y. Anxiety, depression and PTSD among children and their parent during 2019 novel coronavirus disease (COVID-19) outbreak in China. *Curr Psychol.* 2020: 1–8. <https://doi.org/10.1007/s12144-020-01191-4>.
19. Drouin M, McDaniel BT, Pater J, Tosco T. How parents and their children used social media and technology at the beginning of the COVID-19 pandemic and associations with anxiety. *Cyberpsychol Behav Soc Netw.* 2020;23(11):727–36. <https://doi.org/10.1089/cyber.2020.0284>.
20. Amorim R, Catarino S, Miragaia P, Ferreras C, Viana V, Guardiano M. The impact of COVID-19 on children with autism spectrum disorder. *Rev Neurol.* 2020;71(8):285–91. <https://doi.org/10.33588/rn.7108.2020381>.
21. Ariapooran S, Khezeli M. Symptoms of anxiety disorders in Iranian adolescents with hearing loss during the COVID-19 pandemic. *BMC Psychiatry.* 2021;21(1):114. <https://doi.org/10.1186/s12888-021-03118-0>.
22. Cakiroglu S, Yeltekin C, Fisgin T, Oner OB, Aksoy BA, Bozkurt C. Are the anxiety levels of pediatric hematology-oncology patients different from healthy peers during the COVID-19 outbreak? *J Pediatr Hematol Oncol.* 2021;43(5). <https://doi.org/10.1097/MPH.0000000000001924>. e608-e12.
23. Conti E, Sgandurra G, De Nicola G, Biagioni T, Boldrini S, Bonaventura E, et al. Behavioural and emotional changes during COVID-19 lockdown in an Italian paediatric population with neurologic and psychiatric disorders. *Brain Sci.* 2020;10(12). <https://doi.org/10.3390/brainsci10120918>.
24. Dilek TD, Boybay Z, Kologlu N, Tin O, Guler S, Saltik S. The impact of SARS-CoV2 on the anxiety levels of subjects and on the anxiety and depression levels of their parents. *Mult Scler Relat Disord.* 2021;47:102595. <https://doi.org/10.1016/j.msard.2020.102595>.
25. Kilincel S, Kilincel O, Muratdagi G, Aydin A, Usta MB. Factors affecting the anxiety levels of adolescents in home-quarantine during COVID-19 pandemic in Turkey. *Asia Pac Psychiatry.* 2021;13(2). <https://doi.org/10.1111/appy.12406>. e12406.
26. Ademhan Tural D, Emiralioğlu N, Tural Hesapcioglu S, Karahan S, Ozsezen B, Sunman B, et al. Psychiatric and general health effects of COVID-19 pandemic on children with chronic lung disease and parents' coping styles. *Pediatr Pulmonol.* 2020;55(12):3579–86. <https://doi.org/10.1002/ppul.25082>.
27. Cheah CSL, Wang C, Ren H, Zong X, Cho HS, Xue X. COVID-19 racism and mental health in Chinese American families. *Pediatrics.* 2020;146(5). <https://doi.org/10.1542/peds.2020-021816>.
28. Akgul G, Atalan Ergin D. Adolescents' and parents' anxiety during COVID-19: is there a role of cyberchondriasis and emotion regulation through the internet? *Curr Psychol.* 2021: 1–10. <https://doi.org/10.1007/s12144-020-01229-7>.
29. Crescentini C, Feruglio S, Matiz A, Paschetto A, Vidal E, Cogo P, et al. Stuck outside and inside: an exploratory study on the effects of the COVID-19 outbreak on Italian parents and children's internalizing symptoms. *Front Psychol.* 2020;11:586074. <https://doi.org/10.3389/fpsyg.2020.586074>.
30. Garcia de Avila MA, Hamamoto Filho PT, Jacob F, Alcantara LRS, Berghammer M, Jenholt Nolbris M, et al. Children's anxiety and factors related to the COVID-19 pandemic: an exploratory study using the children's anxiety questionnaire and the numerical rating scale. *Int J Environ Res Public Health.* 2020;17(16). <https://doi.org/10.3390/ijerph17165757>.
31. Qi M, Zhou SJ, Guo ZC, Zhang LG, Min HJ, Li XM, et al. The effect of social support on mental health in Chinese adolescents during the outbreak of COVID-19. *J Adolesc Health.* 2020;67(4):514–8. <https://doi.org/10.1016/j.jadohealth.2020.07.001>.
32. Cao Y, Huang L, Si T, Wang NQ, Qu M, Zhang XY. The role of only-child status in the psychological impact of COVID-19 on mental health of Chinese adolescents. *J Affect Disord.* 2021;282:316–21. <https://doi.org/10.1016/j.jad.2020.12.113>.
33. Liu Y, Yue S, Hu X, Zhu J, Wu Z, Wang J, et al. Associations between feelings/behaviors during COVID-19 pandemic lockdown and depression/anxiety after lockdown in a sample of Chinese children and adolescents. *J Affect Disord.* 2021;284:98–103. <https://doi.org/10.1016/j.jad.2021.02.001>.
34. Mangolian Shahrabaki P, Dehghan M, Maazallahi M, Asadi N. Fear and anxiety in girls aged 7 to 11 years old and related factors during the coronavirus pandemic. *Clin Child Psychol Psychiatry.* 2021. <https://doi.org/10.1177/13591045211013873>. 13591045211013873.
35. Radwan E, Radwan A, Radwan W. The role of social media in spreading panic among primary and secondary school students during the COVID-19 pandemic: an online questionnaire study from the Gaza Strip, Palestine. *Heliyon.* 2020;6(12):e05807. <https://doi.org/10.1016/j.heliyon.2020.e05807>.
36. Chen F, Zheng D, Liu J, Gong Y, Guan Z, Lou D. Depression and anxiety among adolescents during COVID-19: a cross-sectional study. *Brain Behav Immun.* 2020;88:36–8. <https://doi.org/10.1016/j.bbi.2020.05.061>.
37. Chi X, Liang K, Chen ST, Huang Q, Huang L, Yu Q, et al. Mental health problems among Chinese adolescents during the COVID-19: the importance of nutrition and physical activity. *Int J Clin Health Psychol.* 2021;21(3):100218. <https://doi.org/10.1016/j.ijchp.2020.100218>.
38. Garcia-Adasme SI, Cardenas-Rebollo JM, Jimenez-Perianes A, Lalinde M, Jimeno S, Ventura PS, et al. Pediatric home confinement due to COVID-19: somatic and anxiety spectrum consequences. *J Clin Nurs.* 2021. <https://doi.org/10.1111/jocn.15829>.
39. Hawes MT, Szenczy AK, Klein DN, Hajcak G, Nelson BD. Increases in depression and anxiety symptoms in adolescents and young adults during the COVID-19 pandemic. *Psychol Med.* 2021: 1–9. <https://doi.org/10.1017/S0033291720005358>.
40. Lu C, Chi X, Liang K, Chen ST, Huang L, Guo T, et al. Moving more and sitting less as healthy lifestyle behaviors are protective factors for insomnia, depression, and anxiety among

- adolescents during the COVID-19 pandemic. *Psychol Res Behav Manag.* 2020;13:1223–33. <https://doi.org/10.2147/PRBM.S284103>.
41. Sakka S, Nikopoulou V, Bonti E, Tatsiopoulou P, Karamouzi P, Giakoulidou A, et al. Assessing test anxiety and resilience among Greek adolescents during COVID-19 pandemic. *J Mind Med Sci.* 2020: 173–8. <https://doi.org/10.22543/7674.72.P173178>.
 42. Chen X, Qi H, Liu R, Feng Y, Li W, Xiang M, et al. Depression, anxiety and associated factors among Chinese adolescents during the COVID-19 outbreak: a comparison of two cross-sectional studies. *Transl Psychiatry.* 2021;11(1):148. <https://doi.org/10.1038/s41398-021-01271-4>.
 43. Liu R, Chen X, Qi H, Feng Y, Xiao L, Yuan XF, et al. The proportion and associated factors of anxiety in Chinese adolescents with depression during the COVID-19 outbreak. *J Affect Disord.* 2021;284:114–9. <https://doi.org/10.1016/j.jad.2021.02.020>.
 44. Tang S, Xiang M, Cheung T, Xiang YT. Mental health and its correlates among children and adolescents during COVID-19 school closure: the importance of parent-child discussion. *J Affect Disord.* 2021;279:353–60. <https://doi.org/10.1016/j.jad.2020.10.016>.
 45. Hou TY, Mao XF, Dong W, Cai WP, Deng GH. Prevalence of and factors associated with mental health problems and suicidality among senior high school students in rural China during the COVID-19 outbreak. *Asian J Psychiatr.* 2020;54:102305. <https://doi.org/10.1016/j.ajp.2020.102305>.
 46. Rogers AA, Ha T, Ockey S. Adolescents' perceived socio-emotional impact of COVID-19 and implications for mental health: results from a U.S.-based mixed-methods study. *J Adolesc Health.* 2021;68(1):43–52. <https://doi.org/10.1016/j.jadohealth.2020.09.039>.
 47. Zhang C, Ye M, Fu Y, Yang M, Luo F, Yuan J, et al. The psychological impact of the COVID-19 pandemic on teenagers in China. *J Adolesc Health.* 2020;67(6):747–55. <https://doi.org/10.1016/j.jadohealth.2020.08.026>.
 48. Alves JM, Yunker AG, DeFendis A, Xiang AH, Page KA. Prenatal exposure to gestational diabetes is associated with anxiety and physical inactivity in children during COVID-19. *Clin Obes.* 2021;11(1):e12422. <https://doi.org/10.1111/cob.12422>.
 49. Dyregrov A, Fjærestad A, Gjestad R, Thimm J. Young people's risk perception and experience in connection with COVID-19. *J Loss Trauma.* 2020: 1–14. <https://doi.org/10.1080/15325024.2020.1853974>.
 50. De Pasquale C, Chiappedi M, Sciacca F, Martinelli V, Hichy Z. Online videogames use and anxiety in children during the COVID-19 pandemic. *Children.* 2021;8(3). <https://doi.org/10.3390/children8030205>.
 51. Cauberghe V, Van Wesenbeeck I, De Jans S, Hudders L, Ponnet K. How adolescents use social media to cope with feelings of loneliness and anxiety during COVID-19 lockdown. *Cyberpsychol Behav Soc Netw.* 2021;24(4):250–7. <https://doi.org/10.1089/cyber.2020.0478>.
 52. Camacho A, Correia N, Zaccoletti S, Daniel JR. Anxiety and social support as predictors of student academic motivation during the COVID-19. *Front Psychol.* 2021;12:644338. <https://doi.org/10.3389/fpsyg.2021.644338>.
 53. Tamarit A, de la Barrera U, Mónaco E, Schoeps K, Castilla IM. Psychological impact of COVID-19 pandemic in Spanish adolescents: risk and protective factors of emotional symptoms. *Revista de psicología clínica con niños y adolescentes.* 2020;7(3):73–80. <https://doi.org/10.21134/rpcna.2020.mon.2037>.
 54. AlAZzam M, Abuhammad S, Abdalrahim A, Hamdan-Mansour AM. Predictors of depression and anxiety among senior high school students during COVID-19 pandemic: the context of home quarantine and online education. *J Sch Nurs.* 2021;1059840520988548. <https://doi.org/10.1177/1059840520988548>.
 55. Wittchen H-U, Hoyer J. Generalized anxiety disorder: nature and course. *J Clin Psychiatry.* 2001;62:15–21.
 56. Masten AS. Ordinary magic: resilience processes in development. *Am Psychol.* 2001;56(3):227.
 57. Benzie K, Mychasiuk R. Fostering family resiliency: a review of the key protective factors. *Child Fam Soc Work.* 2009;14(1):103–14. <https://doi.org/10.1111/j.1365-2206.2008.00586.x>.
 58. Petty K. Ten ways to foster resilience in young children—teaching kids to “bounce back”. *Dimensions Early Childhood.* 2014;42(3):35–9.
 59. Coelho CM, Suttiwan P, Arato N, Zsido AN. On the nature of fear and anxiety triggered by COVID-19. *Front Psychol.* 2020;11:3109. <https://doi.org/10.3389/fpsyg.2020.581314>.
 60. Banerjee D. The COVID-19 outbreak: crucial role the psychiatrists can play. *Asian J Psychiatr.* 2020;50:102014. <https://doi.org/10.1016/j.ajp.2020.102014>.
 61. Burtscher J, Burtscher M, Millet GP. (Indoor) isolation, stress and physical inactivity: vicious circles accelerated by Covid-19? *Scand J Med Sci Sports.* 2020. <https://doi.org/10.1111/sms.13706>.
 62. Chang MC, Park D. Incidence of Post-Traumatic Stress Disorder After Coronavirus Disease. *Healthcare.* 8. Multidisciplinary Digital Publishing Institute; 2020 373.
 63. Liang L, Gao T, Ren H, Cao R, Qin Z, Hu Y, et al. <? covid19? >Post-traumatic stress disorder and psychological distress in Chinese youths following the COVID-19 emergency. *J Health Psychol.* 2020;25(9):1164–75. <https://doi.org/10.1177/1359105320937057>.
 64. Abawi O, Welling MS, van den Eynde E, van Rossum EFC, Halberstadt J, van den Akker ELT, et al. COVID-19 related anxiety in children and adolescents with severe obesity: a mixed-methods study. *Clin Obes.* 2020;10(6). <https://doi.org/10.1111/cob.12412>. e12412.
 65. Panchal U, Salazar de Pablo G, Franco M, Moreno C, Parellada M, Arango C, et al. The impact of COVID-19 lockdown on child and adolescent mental health: systematic review. *Eur Child Adolesc Psychiatry.* 2021. <https://doi.org/10.1007/s00787-021-01856-w>.
 66. P. Waite, S. Pearcey, A. Shum, J. Raw, P. Patalay, C. Creswell. How did the mental health of children and adolescents change during early lockdown during the COVID-19 pandemic in the UK? 2020. <https://doi.org/10.1111/jcv2.12009>.
 67. Luthar SS, Cicchetti D. The construct of resilience: implications for interventions and social policies. *Dev Psychopathol.* 2000;12(4):857–85. <https://doi.org/10.1017/S0954579400004156>.
 68. Noam GG, Hermann CA. Where education and mental health meet: developmental prevention and early intervention in schools. *Dev Psychopathol.* 2002;14(4):861–75. <https://doi.org/10.1017/S0954579402004108>.
 69. Zolkoski SM, Bullock LM. Resilience in children and youth: a review. *Child Youth Serv Rev.* 2012;34(12):2295–303. <https://doi.org/10.1016/j.childyouth.2012.08.009>.
 70. Grissom N, Bhatnagar S. Habituation to repeated stress: get used to it. *Neurobiol Learn Mem.* 2009;92(2):215–24.
 71. Corpuz JCG. Adapting to the culture of ‘new normal’: an emerging response to COVID-19. *J Public Health.* 2021;43(2). e344-e5.
 72. Golberstein E, Wen H, Miller BF. Coronavirus disease 2019 and effects of school closure for children and their families—reply. *JAMA Pediatr.* 2021;175(2):211–2.
 73. Solantaus T, Leinonen J, Punamäki R-L. Children's mental health in times of economic recession: replication and extension of the family economic stress model in Finland. *Dev Psychol.* 2004;40(3):412. <https://doi.org/10.1037/0012-1649.40.3.412>.
 74. Levine DT, Morton J, O'Reilly M. Child safety, protection, and safeguarding in the time of COVID-19 in Great Britain: proposing

- a conceptual framework. *Child Abuse Negl.* 2020;110:104668. <https://doi.org/10.1016/j.chiabu.2020.104668>.
75. Xiang M, Yamamoto S, Mizoue T. Depressive symptoms in students during school closure due to COVID-19 in Shanghai. *Psychiatry Clin Neurosci.* 2020. <https://doi.org/10.1111/pcn.13161>.
 76. Perrin PC, McCabe OL, Everly GS, Links JM. Preparing for an influenza pandemic: mental health considerations. *Prehosp Disaster Med.* 2009;24(3):223–30. <https://doi.org/10.1017/S1049023x00006853>.
 77. Masonbrink AR, Hurley E. Advocating for children during the COVID-19 school closures. *Pediatrics.* 2020;146(3). <https://doi.org/10.1542/peds.2020-1440>.
 78. Armitage R, Nellums LB. Considering inequalities in the school closure response to COVID-19. *Lancet Global Health.* 2020;8(5):e644. [https://doi.org/10.1016/S2214-109X\(20\)30116-9](https://doi.org/10.1016/S2214-109X(20)30116-9).
 79. Kerres M. Against all odds: education in Germany coping with Covid-19. *Postdigit Sci Educ.* 2020;2(3):690–4. <https://doi.org/10.1007/s42438-020-00130-7>.
 80. Orben A, Tomova L, Blakemore S-J. The effects of social deprivation on adolescent development and mental health. *Lancet Child Adolesc Health.* 2020;4(8):634–40. [https://doi.org/10.1016/S2352-4642\(20\)30186-3](https://doi.org/10.1016/S2352-4642(20)30186-3).
 81. Duan L, Shao X, Wang Y, Huang Y, Miao J, Yang X, et al. An investigation of mental health status of children and adolescents in china during the outbreak of COVID-19. *J Affect Disord.* 2020;275:112–8. <https://doi.org/10.1016/j.jad.2020.06.029>.
 82. Francisco R, Pedro M, Delvecchio E, Espada JP, Morales A, Mazzeschi C, et al. Psychological symptoms and behavioral changes in children and adolescents during the early phase of COVID-19 quarantine in three European countries. *Front Psychiatry.* 2020;11:1329. <https://doi.org/10.3389/fpsy.2020.570164>.
 83. Lavigne-Cervan R, Costa-Lopez B, Juarez-Ruiz de Mier R, Real-Fernandez M, Sanchez-Munoz de Leon M, Navarro-Soria I. Consequences of COVID-19 confinement on anxiety, sleep and executive functions of children and adolescents in Spain. *Front Psychol.* 2021;12:565516. <https://doi.org/10.3389/fpsyg.2021.565516>.
 84. McGuine TA, Biese KM, Petrovska L, Hetzel SJ, Reardon C, Klierthermes S, et al. Mental health, physical activity, and quality of life of US adolescent athletes during COVID-19-related school closures and sport cancellations: a study of 13 000 athletes. *J Athl Train.* 2020. <https://doi.org/10.4085/1062-6050-0478.20>.
 85. Smirni P, Lavanco G, Smirni D. Anxiety in older adolescents at the time of COVID-19. *J Clin Med.* 2020;9(10). <https://doi.org/10.3390/jcm9103064>.
 86. Xie X, Xue Q, Zhou Y, Zhu K, Liu Q, Zhang J, et al. Mental health status among children in home confinement during the coronavirus disease 2019 outbreak in Hubei Province, China. *JAMA Pediatr.* 2020;174(9):898–900. <https://doi.org/10.1001/jamapediatrics.2020.1619>.
 87. Riecher-Rössler A. Sex and gender differences in mental disorders. *Lancet Psychiatry.* 2017;4(1):8–9. [https://doi.org/10.1016/S2215-0366\(16\)30348-0](https://doi.org/10.1016/S2215-0366(16)30348-0).
 88. Li SH, Graham BM. Why are women so vulnerable to anxiety, trauma-related and stress-related disorders? The potential role of sex hormones. *Lancet Psychiatry.* 2017;4(1):73–82. [https://doi.org/10.1016/S2215-0366\(16\)30358-3](https://doi.org/10.1016/S2215-0366(16)30358-3).
 89. Lewinsohn PM, Gotlib IH, Lewinsohn M, Seeley JR, Allen NB. Gender differences in anxiety disorders and anxiety symptoms in adolescents. *J Abnorm Psychol.* 1998;107(1):109.
 90. Shih JH, Eberhart NK, Hammen CL, Brennan PA. Differential exposure and reactivity to interpersonal stress predict sex differences in adolescent depression. *J Clin Child Adolesc Psychol.* 2006;35(1):103–15. https://doi.org/10.1207/s15374424jccp3501_9.
 91. Rudolph KD. Gender differences in emotional responses to interpersonal stress during adolescence. *J Adolesc Health.* 2002;30(4):3–13.
 92. Bourgault S, Peterman A, O'Donnell M. *Violence Against Women and Children During COVID-19—One Year on and 100 Papers in.* Washington DC: Center for Global Development; 2021.
 93. S. Nolen-Hoeksema, L.M. Hilt. Gender differences in depression. 2009.
 94. Lee J. Mental health effects of school closures during COVID-19. *Lancet Child Adolesc Health.* 2020;4(6):421. [https://doi.org/10.1016/S2352-4642\(20\)30109-7](https://doi.org/10.1016/S2352-4642(20)30109-7).
 95. Karacin C, Bilgetekin I, Basal FB, Oksuzoglu OB. How does COVID-19 fear and anxiety affect chemotherapy adherence in patients with cancer. *Future Oncol.* 2020;16(29):2283–93. <https://doi.org/10.2217/fon-2020-0592>.
 96. Özdin S, Özdin Ş Bayrak. Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: the importance of gender. *Int J Soc Psychiatry.* 2020;66(5):504–11. <https://doi.org/10.1177/0020764020927051>.
 97. Al-Rahimi JS, Nass NM, Hassoubah SA, Wazqar DY, Alamoudi SA. Levels and predictors of fear and health anxiety during the current outbreak of COVID-19 in immunocompromised and chronic disease patients in Saudi Arabia: a cross-sectional correlational study. *PLoS One.* 2021;16(4). <https://doi.org/10.1371/journal.pone.0250554>.
 98. Breitzkreuz R, Wunderli L, Savage A, McConnell D. Rethinking resilience in families of children with disabilities: a socioecological approach. *Community Work Fam.* 2014;17(3):346–65. <https://doi.org/10.1080/13668803.2014.893228>.
 99. Gabrielli J, Lund E. Acute-on-chronic stress in the time of COVID-19: assessment considerations for vulnerable youth populations. *Pediatr Res.* 2020;88(6):829–31. <https://doi.org/10.1038/s41390-020-1039-7>.
 100. Wu Q, Xu Y. Parenting stress and risk of child maltreatment during the COVID-19 pandemic: a family stress theory-informed perspective. *Dev Child Welfare.* 2020;2(3):180–96. <https://doi.org/10.1177/2516103220967937>.
 101. Magson NR, Freeman JYA, Rapee RM, Richardson CE, Oar EL, Fardouly J. Risk and protective factors for prospective changes in adolescent mental health during the COVID-19 pandemic. *J Youth Adolesc.* 2021;50(1):44–57. <https://doi.org/10.1007/s10964-020-01332-9>.
 102. Martinkevich P, Larsen LL, Græsholt-Knudsen T, Hesthaven G, Hellfritzsch MB, Petersen KK, et al. Physical child abuse demands increased awareness during health and socioeconomic crises like COVID-19: a review and education material. *Acta Orthop.* 2020;91(5):527–33. <https://doi.org/10.1080/17453674.2020.1782012>.
 103. Orgiles M, Espada JP, Delvecchio E, Francisco R, Mazzeschi C, Pedro M, et al. Anxiety and depressive symptoms in children and adolescents during COVID-19 pandemic: a transcultural approach. *Psicothema.* 2021;33(1):125–30. <https://doi.org/10.7334/psicothema2020.287>.
 104. Hoffman JA, Miller EA. Addressing the consequences of school closure due to COVID-19 on children's physical and mental well-being. *World Med Health Policy.* 2020;12(3):300–10. <https://doi.org/10.1002/wmh3.365>.
 105. Griffith AK. Parental burnout and child maltreatment during the COVID-19 pandemic. *J Fam Violence.* 2020: 1–7. <https://doi.org/10.1007/s10896-020-00172-2>.
 106. Curtis T, Miller BC, Berry EH. Changes in reports and incidence of child abuse following natural disasters. *Child Abuse Negl.* 2000;24(9):1151–62. [https://doi.org/10.1016/S0145-2134\(00\)00176-9](https://doi.org/10.1016/S0145-2134(00)00176-9).
 107. Almis H, Han Almis B, Bucak IH. Mental health of children of health workers during the COVID-19 pandemic: a cross-sectional study. *Clin Child Psychol Psychiatry.* 2021. <https://doi.org/10.1177/13591045211016527>. 13591045211016527.

108. Moazzami B, Razavi-Khorasani N, Moghadam AD, Farokhi E, Rezaei N. COVID-19 and telemedicine: immediate action required for maintaining healthcare providers well-being. *J Clin Virol.* 2020;126:104345. <https://doi.org/10.1016/j.jcv.2020.104345>.
109. Vieta E, Pérez V, Arango C. Psychiatry in the aftermath of COVID-19. *Rev Psiquiatr Salud Ment.* 2020;13(2):105. <https://doi.org/10.1016/j.rpsmen.2020.04.004>.
110. Titterton M, Smart H. Risk, resilience and vulnerability in children and adolescents in relation to long-term conditions: the example of Eastern Europe and Central Asia. *J Nurs Healthc Chronic Illn.* 2010;2(2):153–63. <https://doi.org/10.1111/j.1752-9824.2010.01055.x>.
111. Werner EE, Smith RS. *Journeys from Childhood to Midlife: Risk, Resilience, and Recovery.* Cornell University Press; 2001.
112. Böbel TS, Hackl SB, Langgartner D, Jarczok MN, Rohleder N, Rook GA, et al. Less immune activation following social stress in rural vs. urban participants raised with regular or no animal contact, respectively. *Proc Natl Acad Sci.* 2018;115(20):5259–64. <https://doi.org/10.1073/pnas.1719866115>.
113. S.K. Schumacher, Nicholas. 8 charts on internet use around the world as countries grapple with COVID-19; 2020 [accessed 31/08/2021 2021].
114. Lee KE, Kim S-H, Ha T-Y, Yoo Y-M, Han J-J, Jung J-H, et al. Dependency on smartphone use and its association with anxiety in Korea. *Public Health Rep.* 2016;131(3):411–9. <https://doi.org/10.1177/003335491613100307>.
115. Lee Smith LJ, Trott M, Yakkundi A, Butler L, Barnett Y, Armstrong NC, et al. The association between screen time and mental health during COVID-19: a cross sectional study. *Psychiatry Res.* 2020;292:113333.
116. Ellis WE, Dumas TM, Forbes LM. Physically isolated but socially connected: psychological adjustment and stress among adolescents during the initial COVID-19 crisis. *Canadian J Behav Sci /Revue canadienne des sciences du comportement.* 2020;52(3):177–87. <https://doi.org/10.1037/cbs0000215>.
117. Walker S, Smith H. *Why has Eastern Europe Suffered Less from Coronavirus than the West?*, 5. *The Guardian*; 2020.
118. N. Brazeau, R. Verity, S. Jenks, H. Fu, C. Whittaker, P. Winskill, et al. Report 34: COVID-19 infection fatality ratio: estimates from seroprevalence. 2020. <https://doi.org/10.25561/83545>.
119. Wilson SL, Raval VV, Salvina J, Raval PH, Panchal IN. Emotional expression and control in school-age children in India and the United States. *Merrill Palmer Q.* 2012(1982):50–76.
120. Aldwin CM. *Culture, coping and resilience to stress.* Centre for Bhutan Studies; 2004.
121. Lifton RJ. *The Protean Self: Human Resilience in an Age of Fragmentation.* University of Chicago Press; 1999.
122. Greene RR, Greene DG. Resilience in the face of disasters: bridging micro-and macro-perspectives. *J Hum Behav Soc Environ.* 2009;19(8):1010–24. <https://doi.org/10.1080/10911350903126957>.
123. Maguire B, Cartwright S. *Assessing a Community's Capacity to Manage change: a Resilience Approach to Social Assessment.* Bureau of Rural Sciences Canberra; 2008.
124. McAslan A. (A35) Building National and Community Resilience. *Prehosp Disaster Med.* 2011;26(S1). <https://doi.org/10.1017/S1049023x11000483>. s10-s1.
125. Price-Robertson R, Knight K. *Natural disasters and community resilience.* *Child Fam Community Aust Pap.* 2012;3:2–13.
126. Guessoum SB, Lachal J, Radjack R, Carretier E, Minassian S, Benoit L, et al. Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. *Psychiatry Res.* 2020;291:113264. <https://doi.org/10.1016/j.psychres.2020.113264>.
127. Revet A, Hebebrand J, Anagnostopoulos D, Kehoe LA, Klauser P. ESCAP CovCAP survey of heads of academic departments to assess the perceived initial (April/May 2020) impact of the COVID-19 pandemic on child and adolescent psychiatry services. *Eur Child Adolesc Psychiatry.* 2021: 1–10. <https://doi.org/10.1007/s00787-020-01699-x>.
128. Lamb T, Pachana NA, Dissanayaka N. Update of recent literature on remotely delivered psychotherapy interventions for anxiety and depression. *Telemedicine and e-Health.* 2019;25(8):671–7. <https://doi.org/10.1089/tmj.2018.0079>.
129. Newman MG, Erickson T, Przeworski A, Dzus E. Self-help and minimal-contact therapies for anxiety disorders: is human contact necessary for therapeutic efficacy? *J Clin Psychol.* 2003;59(3):251–74. <https://doi.org/10.1002/jclp.10128>.
130. Thase ME, McCrone P, Barrett MS, Eells TD, Wisniewski SR, Balasubramani G, et al. Improving cost-effectiveness and access to cognitive behavior therapy for depression: providing remote-ready, computer-assisted psychotherapy in times of crisis and beyond. *Psychother Psychosom.* 2020;89(5):307–13. <https://doi.org/10.1159/000508143>.
131. Brenes GA, Danhauer SC, Lyles MF, Hogan PE, Miller ME. Telephone-delivered cognitive behavioral therapy and telephone-delivered nondirective supportive therapy for rural older adults with generalized anxiety disorder: a randomized clinical trial. *JAMA Psychiatry.* 2015;72(10):1012–20. <https://doi.org/10.1001/jamapsychiatry.2015.1154>.
132. Racine N, Hartwick C, Collin-Vézina D, Madigan S. Telemental health for child trauma treatment during and post-COVID-19: limitations and considerations. *Child Abuse Negl.* 2020;110:104698. <https://doi.org/10.1016/j.chiabu.2020.104698>.
133. Kinoshita S, Cortright K, Crawford A, Mizuno Y, Yoshida K, Hilty D, et al. Changes in telepsychiatry regulations during the COVID-19 pandemic: 17 countries and regions' approaches to an evolving healthcare landscape. *Psychol Med.* 2020: 1–8. <https://doi.org/10.1017/S0033291720004584>.