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Anxiety and depressive symptomatology among children and adolescents exposed to the COVID-19 pandemic – A systematic review

Anksioznost i simptomi depresije među decom i adolescentima u pandemiji COVID-19 – sistematski pregled

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Abstract

Background/Aim. Children and adolescents are sensitive groups for the development of mental disorders during the crisis. The aim of this systematic review was to assess the impact of the COVID-19 pandemic on anxiety and depressive symptomatology in the population of children and adolescents. **Methods.** The investigation was based on a systematic review followed by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol, including Ovid MEDLINE, Embase, Global Health, and APA Psyc Info databases, to identify relevant studies reporting anxiety and depressive symptoms among children and adolescents during the COVID-19 pandemic. A total of 27 articles were included. **Results.** Anxiety symptoms increased from 28.3% before the pandemic to 49.5% during confinement [General Anxiety Disorder (GAD)-7 ≥ 11)] (McNemar test, $p < 0.0001$). More depressive symptomatology was found, as well as weight and sleep disturbances which are the characteristics of children and adolescents' mental health. Additionally, female teenagers were experiencing grater declines in mood disorders than male teenagers during the COVID-19 crisis. On the one hand, different positive correlations between anxiety and other variables, were found, such as clinical depressive symptoms and anxiety (3/14), smartphone and internet addiction (2/14), lower levels of family income (2/14), perceived threats (2/14), higher grades at school (2/14), and loneliness (1/14). On the other hand, positive correlations were reported between depression and children and adolescents that were socially disconnected (3/17). Finally, mothers with higher level of education and income were associated with higher level of happiness (2/17). **Conclusion.** COVID-19 has a strong impact on the mental health of children and adolescents regarding depression and anxiety symptoms. Prevention programs focused on coping strategies should be conducted in elementary schools, middle schools, and high schools. Mental health should become a priority matter for governments, and the current pandemic could be an opportunity to highlight the importance of mental well-being and to invest in the betterment of clinical trainings, treatments and mental health research.

Key words:
adolescent; anxiety; child; covid-19; depression.

Apstrakt

Uvod/Cilj. Deca i adolescenti su osetljiva grupa za razvoj psihičkih poremećaja tokom krize. Cilj ovog sistematskog pregleda literature bio je da se proceni uticaj pandemije COVID-19 na razvoj simptoma anksioznosti i depresije u populaciji dece i omladine. **Metode.** Sistematski pregled literature je urađen pomoću PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) protokola, uključujući *Ovid MEDLINE, Embase, Global Health i APA Psyc Info* baze podataka, u cilju identifikovanja relevantnih istraživanja o simptomima anskioznosti i depresije kod dece i adolescenata u toku pandemije COVID-19. Pregledano je 27 radova. **Rezultati.** Simptomi anksioznosti su se povećali sa 28,3% pre pandemije na 49,5% tokom „zatvaranja" usled pandemije [*General Anxiety Disorder* (GAD)-7 ≥ 11)] (*McNemar* test $p < 0{,}0001$). Ustanovljen je i skok u simptomima depresije, kao i u telesnoj masi i poremećajima spavanju, koji karakterišu smetnje u mentalnom zdravlju dece i adolescenata. Poremećaj raspoloženja (pad) je bio veći kod tinejdžera ženskog, u odnosu na tinejdžere muškog pola. Pokazane su pozitivne korelacije između anksioznosti i drugih varijabli: kliničkih depresivnih simptoma i anksioznost (3/14), zavisnosti od pametnih telefona i interneta (2/14), nižeg porodičnog prihoda (2/14), percipirane opasnosti (2/14), viših razreda u školi (2/14), i

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usamljenosti (1/14). Pokazane su i pozitivne korelacije između depresije i socijalne isključenosti dece i adolescenata (3/17). Konačno, pokazana je povezanost između majki sa višim nivoima obrazovanja i prihoda i osećanja sreće (2/17). **Zaključak.** Pandemija COVID-19 ima snažan uticaj na mentalno zdravlje dece i adolescenata odnosno pojavu simptoma depresiije i anksioznosti. Zbog toga bi u osnovnim, srednjim i višim školama trebalo sprovoditi programe prevencije, sa fokusom na razvoj strategija prevladavanja. Mentalno zdravlje bi trebalo da postane prioritetna tema vlada zemalja, a trenutna pandemija mogućnost da se istakne važnost brige o mentalnom blagostanju i ulaganja u poboljšanje kliničkih treninga, tretmana i istraživanja u oblasti mentalnog zdravlja.

Ključne reči:
adolescenti; anksioznost; deca; covid-19; depresija.

Introduction

According to the World Health Organization (2020), childhood and adolescence are critical developmental stages, when social and emotional skills are shaped. Thus, the environment is crucial for children and adolescents' well-being, and early negative experiences could be a risk factor for developing emotional disorders like depression and anxiety [1].

The Coronavirus Disease 2019 (COVID-19) pandemic is the hardest global crisis we have faced in the past 75 years. Since its emergence in Asia, the virus has spread to every continent, causing death to over 1.6 million people worldwide [2]. Throughout the outbreak, people have lost relatives, social connections, jobs, and income [3]. In addition, some governments implemented strict socializing measures to control (or try to reduce) the spread of the virus, including isolation, 15-day quarantines, remote schooling, and national lockdowns. Fear about the virus's impact, uncertainty about the future, and social distancing are considered among the factors that explain sharpened anxiety and depressive symptoms among children and adolescents.

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), depressive symptomatology's most common features are sadness, emptiness, or irritable moods, followed by somatic or cognitive changes. More specific symptoms include irritable mood, diminished interest in normal activities, insomnia or hypersomnia, significant weight loss or weight gain, diminished ability to concentrate or think, and recurrent thoughts involving death. On the other hand, the most common feature of the anxiety symptomatology DSM-5 is excessive fear and anxiety related to behavioral disturbances. Excessive worrying, difficulty controlling the worry, restlessness or feeling keyed up or on edge, being easily fatigued, irritability, sleep disturbances, muscle tension, and difficulty concentrating or mind going blank are the main symptoms of anxiety.

Studies that have examined the direct link between viral diseases and affective disorders symptomatology have found correlations with diseases such as influenza (H1N1), varicella-zoster, and herpes simplex virus [4]. Moreover, previous systematic reviews and meta-analyses have evaluated anxiety and depression in health workers and adults during SARS/MERS/COVID-19 [5] . Nevertheless, none has examined the impact of the pandemic on children and adolescents. Therefore, the aim of this systematic review was to assess the impact of the COVID-19 pandemic on anxiety and depressive symptomatology in this population.

Methods

A literature systematic review was carried out with the aim of selecting relevant studies from January to October 2020, using four databases. Ovid MEDLINE, Embase, Global Health, and APA PsycInfo that were examined thoroughly up to November 25th, 2020 using the combination of the following search terms: (child* OR "kid" OR "student" OR "infant") OR (adolesc* OR "teen" OR "young people" OR "Middle school students" OR "High School students" OR "College Students" OR "University Students" OR "Undergraduates students") AND (covid* OR "covid19" OR "coronavirus" OR "covid-19 pandemic") AND ("depress*" OR "major depression" OR "mood disorders*" OR "affective disorders" OR "MDD" OR "anxi*" OR "Agoraphobia" OR "GAD" OR "General Anxiety Disorder", OR "Separation Anxiety Disorder", OR "Social Anxiety Disorder", OR "Social Phobia", OR "School Phobia", OR "Panic Disorder" OR "Panic Attack" OR "Obsessive Compulsive disorder" OR "OCD"). These key terms were chosen to find the most relevant studies regarding the COVID-19 impact in emotional disorder symptomatology among children and adolescents. Upon finalizing duplication at Ovid, the studies found were downloaded into Endnote (X9) and its abstracts were reviewed, as well as screened with the inclusion and exclusion criteria. Subsequently, the remaining studies (full text) were read and assessed for eligibility using Rayyan platform. Finally, a manual review was followed to obtain references and additional articles.

Inclusion criteria

Information was extracted and summarized from the remaining studies, and one author was contacted and asked for a full text paper. Our inclusion criteria consist of: a) individual studies; b) studies conducted in children and adolescents; c) studies conducted during the COVID-19 pandemic; d) studies evaluating depressive or anxiety symptomatology, comprised of statistical data and established instruments, tools, or scales; e) reviews focused only on studies published in English.

Data extraction

One researcher extracted data from every study that was included. A summary of selected variables included: first author, year of publication, countries, population, sample size, age range, sex (% female), instruments, and primary outcome (Figure 1).

Quality assessment

The overall results of the meta-analysis depend indeed also on a rigorous evaluation of the studies' quality. Among all the possible tools for this complex evaluation, the Newcastle Ottawa Scale (NOS) is one of the most used worldwide, above all, for observational studies [6]. The NOS is a validated instrument and has a long history of reliability commonly used in medicine in the field of psychiatry, in both observational and interventional studies' meta-analyses.

Each study was assessed for risk of bias with the Newcastle-Ottawa Quality Assessment Scale adapted from the NOS for cohort studies to cross-sectional studies developed by the collaboration between the University of Newcastle Australia and Canada [7].

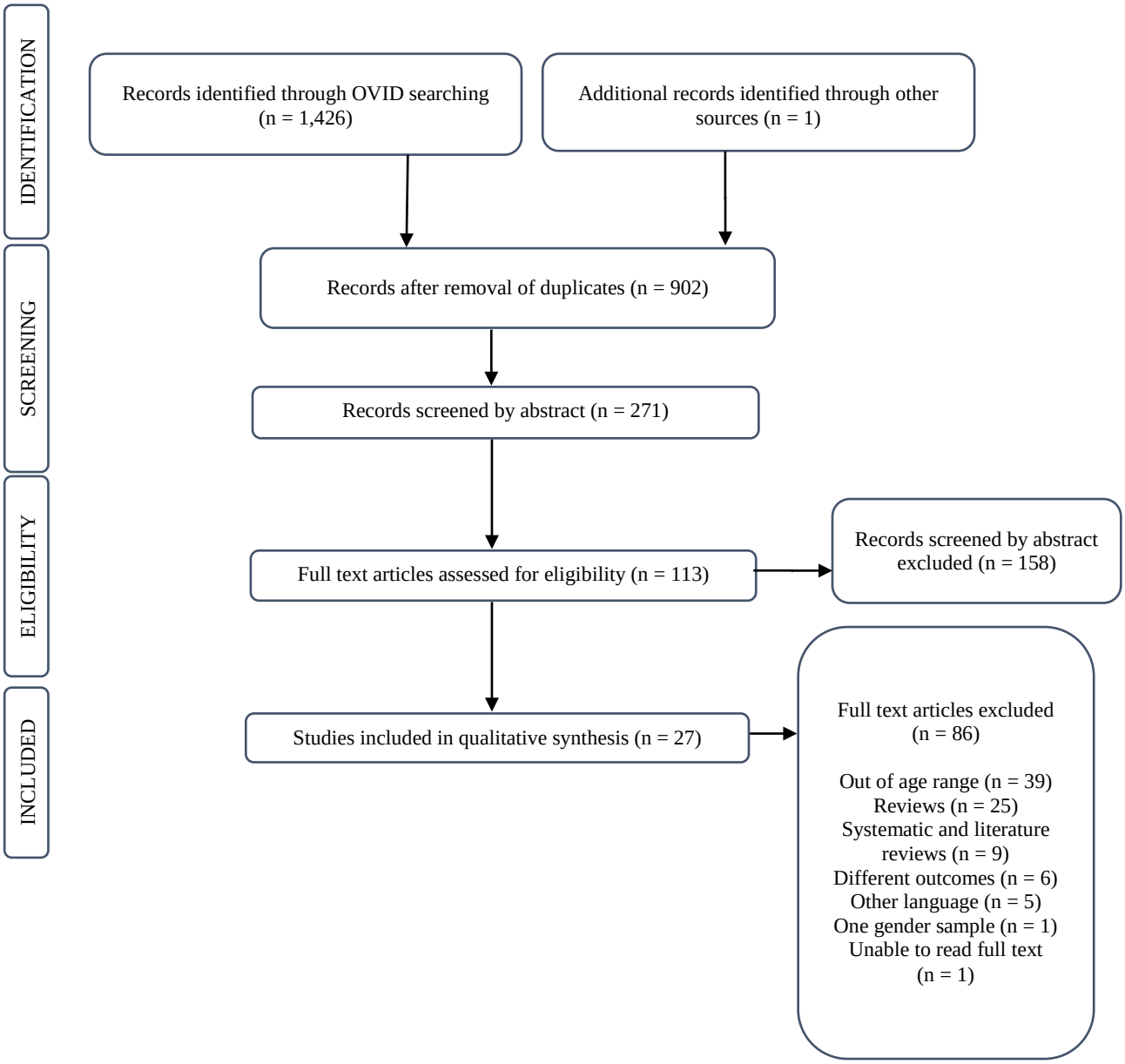

Fig. 1 – PRISMA flow diagram for systematic review.

The NOS assesses the quality of nonrandomized studies with a star system in order to have a proper understanding of each study. The maximum score is 10 points (10 stars) (Table 1) [8–34].

Table 1

Quality assessment with Newcastle-Ottawa Scale adapted for cross-sectional studies

Study	Score
Abawi et al. [8]	7 – Good study
Adıbelli et al. [9]	7 – Good study
Asanov et al. [10]	8 – Good study
Chen et al. [11]	7 – Good study
Garcia de Avila et al. [12]	7 – Good study
Duan et al. [13]	7 – Good study
Fazeli et al. [14]	8 – Good study
Giannopoulou et al. [15]	8 – Good study
Guo et al. [16]	8 – Good study
Hou et al. [17]	6 – Satisfactory study
Kılınçel et al. [18]	6 – Satisfactory study
Li et al. [19]	7 – Good study
McGuine et al. [20]	6 – Satisfactory study
Metwally et al. [21]	7 – Good study
Oosterhoff et al. [22]	8 – Good study
Qi et al. [23]	7 – Good study
Seçer et al. [24]	7 – Good study
Smirni et al. [25]	8 – Good study
Tang et al. [26]	8 – Good study
Xie et al. [27]	8 – Good study
Zhang et al. [28]	6 – Satisfactory study
Ellis et al. [29]	7 – Good study
Magson et al. [30]	7 – Good study
Ougrin et al. [31]	8 – Good study
Alves et al. [32]	7 – Good study
Rogers et al. [33]	7 – Good study
Dilek et al. [34]	6 – Satisfactory study

Results

The initial search identified 1,426 records; upon duplication, it was reduced to 902 and screened by date since the COVID-19 global pandemic in early 2020; studies published in 2019 were excluded. After the first screening, 271 articles were reviewed by their abstracts, and 158 records were omitted for failing to meet the inclusion criteria; for instance, studies that did not include the desired population age range (n = 39), reviews without a quantitative method (n = 25), systematic and literature reviews (n = 9), studies with different outcomes (n = 6), studies written in another language (n = 5), and one gender sample (n = 1).

Synthesis includes 27 observational studies with 21 cross-sectional studies, 4 longitudinal cohorts, 1 case-control, and 1 mixed-method study. Twenty different countries were represented: Asia (20%), Europe (50%), America (20%), Africa (5%), and Oceania (5%). The overall population is 52,797 children and adolescents from 6 to 19 years old (out of which 54.12% were females) (Table 2).

The desired outcome (anxiety and depressive symptomatology) was measured by each study with different instruments and a combination of clinical interviews and assessments. The main characteristics of the studies, including the most common instrument for anxiety – the 7-item Generalized Anxiety Disorder (GAD)-7 Scale [15, 17, 19] and for depression, The Pediatric Quality of Life Inventory 4.0 (PedsQL) [8, 14, 20], are shown in Table 2 [8–34].

Results for anxiety symptomatology

Ten out of 27 studies looked only for anxiety symptoms and 14 looked for anxiety and depressive symptomatology (Table 2). Fourteen found that anxiety levels were significantly higher among children and adolescents during the pandemic compared with previously published norms. For example, the proportion of the sample who screened positive for anxiety (GAD-7 $\geq$ 11) increased from 28.3%, before the pandemic, to 49.5% during confinement (McNemar test, $p < 0.0001$); those scoring within the severe anxiety range (GAD-7 $\geq$ 17) increased from 3.8% to 20.5% (McNemar test $p < 0.0001$). The comorbidity, defined as a positive screen for depression and anxiety, increased from 24% to 45% (McNemar-Bowker, test $p < 0.0001$) [15]. Some studies also looked at different positive correlations between anxiety and other variables, like clinical depressive symptoms and anxiety [15, 21, 25–28, 33], smartphone and internet addiction [13, 18], lower levels of family income [12, 30], perceived threats [13, 16, 17], higher grades at school [11, 17], loneliness [29], poor academic records [34], TV as the main source of communication [29], social stigma [19, 22], friends or family conflict [34], and emotion-focused coping style [24].

Table 2

Main characteristics of the studies included (data extraction)

Study	Country	Study design	Sample size (n)	Age range (years)	Sex (% female)	Instruments	Primary outcome
Abawi et al. [8]	Netherlands	Cross-sectional	75	7–15	52	PedsQL Questionnaire, Phone Interview (20–30 min)	anxiety symptomatology
Adıbelli et al. [9]	Turkey	Cross-sectional	597	7–13	55	Generic Health-related, Quality of Life, Questionnaire for Children	depressive symptomatology
Alves et al. [32]	USA	Observational	64	9–15	63	State-Trait Anxiety Inventory for Children (STAIC), Positive and Negative Affect Schedule for Children (PANAS-C)	anxiety symptomatology
Asanov et al. [10]	Ecuador	Cross-sectional	1320	14–18	53	5-item MHI-5 index of Veit and Ware (1983)	depressive symptomatology
Chen et al. [11]	China	Cross-sectional	1036	0–19	49	Depression Self-Rating Scale for Children, Screen for Child Anxiety Related Disorders	anxiety symptomatology
Garcia de Avila et al. [12]	Brazil	Cross-sectional	289	6–12	54	The Children's Anxiety Questionnaire (CAQ) and the Numerical Rating Scale (NRS)	anxiety symptomatology
Dilek et al. [34]	Turkey	Case control	30	8–18	64	The State-Trait Anxiety Inventory (STAI), Hospital Anxiety and Depression Scale (HAD)	anxiety and depressive symptomatology
Duan et al. [13]	China	Cross-sectional	3613	7–18	50	Spence Child Anxiety Scale, Child Depression Inventory and Coping style Scale	anxiety and depressive symptomatology
Ellis et al. [29]	Canada	Longitudinal cohort	1054	14–18	74	COVID-19 Stress Questions, Brief Symptom Inventory (BSI), UCLA Loneliness Scale, Godin Leisure-Time Exercise Questionnaire	depressive symptomatology
Fazeli et al. [14]	Iran	Cross-sectional	1512	13–18	44	Depression, Anxiety, and Stress Scale-21 (DASS-21), Insomnia Severity Index(ISI), Internet Gaming Disorder Scale-Short Form (IGDS9-SF), Pediatric Quality of Life Inventory 4.0 Short Form (PedsQLTM 4.0 SF15)	anxiety symptomatology
Giannopoulou et al. [15]	Greece	Cross-sectional	442	16–18	68	Anxiety was measured using the 7-item Generalized Anxiety Disorder Scale (GAD-7)	anxiety and depressive symptomatology
Guo et al. [16]	China	Cross-sectional	6196	11–18	52	Post-traumatic stress symptoms (PTSS) were assessed with the self-report PTSD Checklist for DSM-5 (PCL-5), Anxiety was assessed by the Zung self-rated anxiety scale (SAS)	anxiety symptomatology
Hou et al. [17]	China	Cross-sectional	335	16	39	The 9-item Patient Health Questionnaire (PHQ-9), the 7-item Generalized Anxiety Disorder Scale (GAD-7), and the Impact of Events Scale - Revised (IES-R)	anxiety and depressive symptomatology
Kılınçel et al. [18]	Turkey	Cross-sectional	745	12–18	70	State Anxiety Inventory (STAI-S), Trait Anxiety Scale (STAI-T): UCLA loneliness scale	anxiety symptomatology
Li et al. [19]	China	Cross-sectional	1172	8–18	58	Social Cognition and Behaviour Investigation of COVID-19, Children's Revised Impact of Event Scale (CRIES-8), Generalized Anxiety Disorder scale (GAD-2) adapted from the Perceived Threat of the Middle East Respiratory Syndrome (MERS) scale	anxiety symptomatology

Table 2 (continued)

Study	Country	Study design	Sample size (n)	Age range (years)	Sex (% female)	Instruments	Primary outcome
Magson et al. [30]	Australia	Longitudinal cohort	248	13-16	51	The Generalized Anxiety subscale (e.g., "I worry about things") of the Spence Children's Anxiety Scale (SCAS-C), The Short Mood and Feelings Questionnaire – Child Version (SMFQ-C; Angold et al. 1995),The Student's Life Satisfaction Scale (SLSS; Huebner 1994),COVID-19 related stress	anxiety and depressive symptomatology
McGuine et al. [20]	USA	Cross-sectional	13002	9–19	53	General Anxiety Disorder-7 Item (GAD-7),Patient Health 16 Questionnaire-9 Item (PHQ-9), The Pediatric Functional Activity Brief Scale (PFABS) and the Pediatric Quality of Life Inventory 4.0 (PedsQL)	anxiety and depressive symptomatology
Metwally et al. [21]	Egypt	Cross-sectional	2040	8-12	51	Designed Questionnaire, Children completed self-report rating scale, Child psychiatrists interview with the DSM-IV panic symptoms	anxiety symptomatology
Oosterhoff et al. [22]	USA	Cross-sectional	683	13–18	75	8-item Patient-Reported Outcomes Measurement Information System Anxiety Scale	anxiety and depressive symptomatology
Ougrin et al. [31]	England, Scotland, Ireland, Austria, Italy, Hungary, Serbia, Turkey, Oman and the United Arab Emirates	Cohort	1795	NA–18	88	Hospital interview for self-harm	anxiety and depressive symptomatology
Qi et al. [23]	China	Cross-sectional	7202	14–18	NA	Patient Health Questionnaire-9, Chinese version of the 7-item Generalized Anxiety Disorder scale, Social Support Rate Scale	anxiety and depressive symptomatology
Rogers et al. [33]	USA	Mixed methods	609	14–17	NA	Open-ended questions, six-question Children's Depression Inventory−Short (CDI-S), generalized anxiety	anxiety and depressive symptomatology
Seçer et al. [24]	Turkey	Cross-sectional	598	14–18	61	Questionnaire is a self-reported seven-point Likert-type measurement tool adapted to the Turkish culture	anxiety and depressive symptomatology
Smirni et al. [25]	Italy	Cross-sectional	148	17–19	57	Self-Rating Anxiety Scale (SAS) Italian Emotion Awareness Questionnaire (EAQ) for children and adolescents	anxiety symptomatology
Tang et al. [26]	China	Cross-sectional	4391	1–12 (grade)	49	Depression, anxiety, and stress scale (DASS-21)	anxiety and depressive symptomatology
Xie et al. [27]	China	Cross-sectional	2330	6–12 (grade)	44	Children's Depression Inventory–Short Form (CDI-S) and the Screen for Child Anxiety Related Emotional Disorders, respectively	anxiety and depressive symptomatology
Zhang et al. [28]	China	Cohort	1271	4–8 (grade)	NA	Study questionnaire (with ethical approval)	anxiety and depressive symptomatology

NA – not available.

Six studies reported that females have consistently higher (32.2%) prevalence rates of anxiety disorders symptomology, although we can also see an increase in males (23.9%) using GAD-7 anxiety scale [17]. The data showed that being a female was a risk factor for anxiety symptomatology during the pandemic outbreak. Post-traumatic stress disorder (PTSD) symptomatology was also common at this sample with three studies outlining high rates.

Social distancing was also mentioned and studied statistically as a potential source of anxiety and depressive symptoms in three studies. Anxiety levels of children who "stayed at home" were more than five standard deviations [32] higher than before the pandemic [10]. Vulnerable groups with obesity and multiple sclerosis had a high percentage of anxiety symptoms [34].

Finally, one study found modest differences in anxiety with 0.2 to 0.6 standard deviations [30].

An overview of studies, including the findings of anxiety or depression in young examinees, is shown in Table 3 [8, 11, 12, 14, 16, 18, 19, 21, 25, 32] and Table 4 [9, 10, 13, 15, 17, 20, 22–24, 26–31, 33, 34].

Table 3

Results and main findings

Study	Main findings anxiety outcome	Main findings depression outcome
Abawi et al. [8]	Anxiety symptoms were reported for 24 out of 75 (32%) children.	NA
Alves et al. [32]	Anxiety levels of children who "stayed at home" were higher than in pediatric populations prior to the pandemic.	NA
Chen et al. [11]	Female adolescents presented a higher risk of presenting mood disorders. Nevertheless, there was no association with different ages or anxiety.	Older adolescents in the sample were more depressed than the younger ones. The data indicated that adolescents without companionship during the week were more likely to be depressed.
Garcia de Avila et al. [12]	Higher levels of anxiety were found among children with a prevalence of 19.4% (using the CAQ) and 21.8% (using the NRS).	NA
Fazeli et al. [14]	Anxiety is correlated with depression.	Quality of life in the pandemic is also affected by internet gaming disorder. Findings showed that variables such as internet gaming, insomnia, anxiety, depression, and stress had positive correlations, with small to large effects.
Guo et al. [16]	Exposure to COVID-19 predicted higher levels of PTSD and anxiety (0.06–0.15) (standardized betas).	NA
Kılınçel et al. [18]	Positive correlations were found between loneliness and anxiety (r:0.175, P:.001), (r:0.194, P:.000).	NA
Li et al. [19]	Children and adolescents are considered a vulnerable group that might experience anxiety and PTSD symptoms. The stigma around socializing and the perception of a threat could represent risk factors related to PTSD and GAD in the coronavirus pandemic.	NA
Metwally et al. [21]	Phobia, expressed through stress, avoiding people and panic, was the most prevalent disorder among young children.	NA
Smirni et al. [25]	Over half of the individuals reached a high anxiety score. Items regarding sleep, anxiety, panic, and negative expectation of the future reached high average scores.	NA

NA – not available.

Table 4

Results and main findings

Study	Main findings anxiety outcome	Main findings depression outcome
Adıbelli et al. [9]	Not available.	41.5% of children gained weight, 34.2% of children increased their sleeping time, and 69.3% stated that their internet use increased as a result of the COVID-19 lockdown.
Asanov et al. [10]	Not available.	16% of this sample scored for major depression disorder, while 68% reported being happy.
Dilek et al. [34]	Adolescents with multiple sclerosis (MS) diagnosis presented more anxiety than the control group (healthy group). Results show that 100% of MS children present anxiety symptoms, whereas this ratio was 34% for the control group.	During COVID-19, 43.3% of patients gained weight, and 73% had less exposure to sunlight.
Duan et al. [13]	91.06% of children and adolescents reported higher levels of social phobia, generalized anxiety, panic disorder, physical injury, and separation anxiety. These levels also correlated with depression symptoms, smartphone and internet use.	Depressive symptomatology among children and adolescents (22.28%) was higher than in prior studies (13.2%)
Ellis et al. [29]	Not available.	Social media frequency use increased during the COVID-19 pandemic while 28% of the respondents showed depression symptoms.
Giannopoulou et al. [15]	The number of samples who screened positive for anxiety was higher (49.5%) (GAD-7 $\geq$ 11) in the home confinement than before the COVID-19 pandemic (28.3%) (GAD-7 $\geq$ 11). The proportion of those with severe anxiety rose from 3.8% to 20.5% (GAD-7 $\geq$ 17) (McNemar test $p < 0.0001$).	The proportion of all respondents indicating positive screen for depression increased from 48.5% before coronavirus to 63.8% for the time of social distancing (McNemar test $p < 0.0001$) and of those, scoring within the severe depressive symptomatology (PHQ-9 $\geq$ 20), increased from 10% to 27% ($p < 0.001$).
Hou et al. [17]	54.5% presented anxiety symptoms, and 85.5% presented PTSD symptomatology.	The results indicated that 71.5% presented some depression symptoms.
Magson et al. [30]	While significant decrements in mental health were demonstrated, the size of these effects is modest with 0.2 to 0.6 standard deviations.	Feeling lonely without social connections during the pandemic was correlated with higher levels of depression symptoms and low life satisfaction.
McGuine et al. [20]	Data reveals that athlete adolescents from lower-income families experienced high levels of depression and anxiety while physical activity and quality of life drops.	The prevalence of depression symptoms was higher in team sports (74.1%) and lowest in individual sports (64.9%).
Oosterhoff et al. [22]	Several reasons and motivations for social distance have different impacts on mental and social health. Young people who were persistent in social distancing in order to stay safe reported less burdensomeness and greater anxiety. On the contrary, adolescents who were doing social distancing to avoid social judgement felt more anxious than depressed.	Depression symptoms were found in the youth that was following social distancing due to peer recommendation, while adolescents who preferred to stay home presented lower depressive symptoms.
Ougrin et al. [31]	The proportion of youth with an emotional disorder increased from 58% in 2019 to 66% emotional disorder in 2020. The proportion of youth presenting with self-harm tendencies increased from 50% in 2019 to 57% in 2020, and out of the clinical diagnoses that present self-harm, emotional disorders (anxiety).	The proportion of children and adolescents self-harming with suicide intent was 49% in 2019 and 55% in 2020 across all areas. However, this apparent increase in 2020 did not reach the threshold required for significance ($p = 0.057$).
Qi et al. [23]	The prevalence of anxiety symptoms is 38%. The rate is high even though the pre-pandemic prevalence is unknown.	Prevalence of depressive symptoms is higher than anxiety symptoms by 44%.

Table 4 (continued)

Study	Main findings anxiety outcome	Main findings depression outcome
Rogers et al. [33]	Adolescents reported distinctly challenging poor social interaction during the outbreak, the ability to get out of the house was the second hardest thing to cope with, followed by the lack of privacy and family conflict.	Although the quantitative results revealed a low prevalence of mental health problems, paired samples t-test showed an increase in depression and feelings of loneliness.
Seçer et al. [24]	The fear of getting infected with the virus is a risk factor for anxiety symptoms in adolescents.	The negative emotional reactivity caused by the fright of virus infection predicted depression symptoms in adolescents. Depression and anxiety are predictors of OCD.
Tang et al. [26]	Anxiety symptoms were the most prevalent, especially in middle school pupils who had more pressure on academic performance. The prevalence of anxiety was 24.9%.	Depression symptoms were found in 19.7% of the sample, which was similar to other findings.
Xie et al. [27]	The anxiety prevalence of the sample was 18%. On the other hand, most children worried about being infected with the COVID-19 virus.	22% of the sample reported depressive symptoms and low optimism regarding the pandemic.
Zhang et al. [28]	An increase in anxiety symptomatology was not found.	Depression symptoms are present and higher in students in the second wave of the cohort.

Results for depressive symptomatology

Three out of 27 studies looked only for depressive symptoms and 14 for anxiety and depressive symptomatology. Weight and sleep changes were mentioned in 3 different studies with disturbances in children and adolescents' mental health. Sixteen percent of a sample had the criteria for a major depressive disorder using the 5-item MHI-5 index of Veit and Ware (1983) [10]. One study was consistent with higher reports of female depression. After a multivariate analysis, the main difference was found in gender; girls presented higher depression than males [mean (M) = 2.85, standard error (SE) = 0.06 *vs* M = 2.26, SE = 0.15, respectively], loneliness (M = 2.64, SE = 0.03 *vs* M = 2.50, SE = 0.09, respectivel), and COVID-19 stress (M = 2.92, SE = 0.03 *vs* M = 2.69, SE = 0.06, respectively) [11].

Some positive correlations between depression and other factors were found in 17 included articles. Children and adolescents that were socially disconnected and did not have social support experienced more depressive symptoms (3/17). Children from lower-income families presented more depressive symptoms (1/17), mothers with higher levels of education and income were associated with happiness (2/17) as well as internet access (1/17). Age was also an important variable since three studies reported higher depression in higher grades.

The most consistent statement reported in seven studies was that higher levels of depression were found. Prevalence of youth with an emotional disorder increased from 58% in 2019 to 66% in 2020. The increase of emotional disorders tested statistically significant with an estimated odds ratio of 1.58, 95% confidence interval 1.06 to 2.36; $p = 0.025$). In 2019, 49% of children and adolescents were engaged in self-harm behavior with suicide intents, and in 2020, it was 55% ($p = 0.057$) [31]. Finally, there was one sample that reported that 68% of their population was feeling happy [10].

Discussion

To the best of our knowledge, this is the first systematic review to have exhaustively searched for the impact of the SARS/MERS/COVID-19 pandemic on children and adolescents' depression and anxiety symptomatology. On the one hand, the current studies demonstrate that the overall proportion of youth with an emotional disorder has increased. Anxiety symptomatology is one of the main concerns since it was found in 24 of our included studies. On the other hand, clinical depression was the second symptomatology most frequently found with a higher prevalence than the generally estimated in previous years. It is important to highlight that some of our included studies report greater symptoms of depression than anxiety [23]. However, more data directly reveal greater anxiety; thus, we can argue that anxiety has been more studied than depression in the current outbreak, and, therefore, more data can be found.

Additionally, different variables played an important role in several studies; some of the most consistent ones affecting anxiety and depression are children living in isolation without their parents or with no social support [33]. The level of parents' education was also a risk factor; children whose guardians had a postgraduate education ($p = 0.019$) had lower anxiety scores [12] and felt happier [10]. Moreover, data suggest that as the level of poverty increases, symptoms of anxiety and depression grow as well [20].

Furthermore, the usage frequency of social media, the internet, smartphones, and television [18] has escalated, in contrast to the past, prior to the pandemic [11]; there are positive relationships between online gaming with insomnia, depression, anxiety, and stress, with small to large effects. These findings indicate that as one variable increases, so do others [14]. The major comorbidity of anxiety is depression and

vice versa; thus, it is estimated that one variable affects the other in terms of risk factors.

Regarding population differences, the data show impressive and consistent results: female teenagers are experiencing greater declines in mood disorders than male teenagers during the COVID-19 crisis [11]. Briefly examining those numbers, the report of the NHS Mental Health of Children and Young People in England (2017) states that young women (17–19 years old) have been identified as a high-risk group in relation to emotional mental health. Therefore, this information confirms that the impact of the COVID-19 outbreak was not an exception, and rates were also higher within this population. It is hypothesized that young women rely more on their social circles as a coping strategy, and in the outbreak, this was difficult to achieve. A difference was also found in the prevalence of anxiety and depression regarding age. The older you are, the more likely you are to present symptoms of an affective disorder during SARS/MERS/COVID-19 [11]. At-risk populations with medically diagnosed children and adolescents experienced higher rates of anxiety due to the threat of infection and depressive symptoms like gaining weight [34].

Limitation of the study

A considerable limitation is that results are mainly from cross-sectional studies, so we cannot attribute causality to the rise of psychopathology criteria and COVID-19. Furthermore, some of the instruments included are not standardized and were designed uniquely for the study. Either way, these highlight key data and information to be examined. It is now crucial to observe whether these high levels of anxiety and depression will persist over time, disappear, become a clinical disorder, or whether there will be risk factors for other outcomes. Another limitation is that data collection was completed by online questionaries, and results are based on the comprehension of the instrument by young children and adolescents. Moreover, we are providing a range of quantitative data; however, the analysis is qualitative one, thus, a meta-analysis study will give us more accurate numbers and a broader understanding of this mental health matter. It is important to highlight that even though there was anxiety and depressive symptomology, a mental health disorder cannot be confirmed. Finally, the only two outcomes studied were anxiety and depression, which are two difficult outcomes to define.

Conclusion

The COVID-19 pandemic is having a strong impact on the mental health of children and adolescents regarding anxiety and depressive symptomatology. Public health systems should provide efficient and gold-standard interventions to this vulnerable group that could be damaged on a long-term basis. Prevention programs focused on coping strategies should also be conducted in elementary schools, middle schools, and high schools. Finally, mental health should become a priority matter for governments, and the current pandemic could be an opportunity to highlight the importance of mental well-being and to invest in the betterment of clinical training, treatments, and mental health research.

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