






Behavior changes in children/adolescents with attention deficit hyperactivity disorder during the COVID-19 pandemic: a systematic review


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Abstract

Objectives: to describe behavioral changes related to mental health in children and adolescents with Attention Deficit Hyperactivity Disorder during social isolation due to the COVID-19 pandemic.

Methods: this is a systematic review conducted under the PRISMA protocol (2020) in the PubMed, SciELO and VHL databases, with a period of 2019-2022.

Results: 3,735 studies were screened and ten were selected, according to the eligibility criteria. The sample had 4,688 participants. There was evidence of a worsening of signs and symptoms regarding the mental health of this population, expressed mainly through changes in mood, with increased anxiety, sadness or depressed symptoms, in addition to increased hyperactivity. Behavioral changes also included reduced sleep quality and physical activity, and increased use of digital technologies and screen time.

Conclusions: it was described that children and youth groups, especially those with attention deficit hyperactivity disorder, had increased emotional symptoms and conduct problems when compared to before the pandemic, making it possible to recognize the negative repercussions of the changes imposed by it. These factors are important for planning more effective care strategies.

Key words Attention deficit hyperactivity disorder; Child, Social isolation, Mental health, COVID-19



Introduction

In March 2020, the World Health Organization (WHO) declared a Public Health Emergency due to COVID-19.¹ The main containment measures were based on controlling the spread through isolation and social distancing.^{1,2} In this context, the psycho-socio-cultural dimensions of coping with a pandemic are highlighted, which can have psychological and psychiatric repercussions, such as depressed mood, irritability, fear and insomnia.³

In children and teenagers, social restriction may imply a deterioration of mental health due to the reduction of physical activity, weakening of social relations, and dysregulation of the circadian rhythm, for example, especially during prolonged periods.⁴ Children and teenagers with Attention Deficit Hyperactivity Disorder (ADHD) are potentially more vulnerable to the negative repercussions of the containment and coping measures of the pandemic.⁵

There is still a scientific gap regarding the mental health of this population during the COVID-19 pandemic. There is evidence that children and teenagers with ADHD are more prone to increased symptoms of inattention, hyperactivity/impulsivity, and oppositional/defiant during the COVID-19 pandemic.⁶ However, there was no systematic worsening of their symptoms during social isolation as the external environment could be a source of conflict and stress.⁷ Thus, social isolation could be related to both positive and negative impacts on the health of children and teenagers living with ADHD.⁸

Given the conflicting literature and the scientific gap on this topic, the objective of this study is to describe behavioral changes, related to mental health, in children and teenagers with ADHD during social isolation due to the COVID-19 pandemic.

Methods

This is a systematic review, guided by the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA, 2020).⁹ Based on the PECOS strategy: P) Patient, E) Exposure, C) Comparison, O) Outcome (outcome), and S (type of study),¹⁰ we established the research question: “What are the behavioral changes, related to mental health (O), of children and teenagers with ADHD (P) during social isolation, due to the COVID-19

pandemic (E), compared to the pre-pandemic period (C)?”. As it was a literature review, approval from the Research Ethics Committee was not required. There was no record of a research protocol.

The research and selection of studies were finalized on 07/20/2022, from the Health Science Descriptors (DeCS): “Child”, “Attention deficit hyperactivity disorder”, “Social Isolation”, “Physical Distancing”, “Quarantine”, “Lockdown”, “pandemics”, “COVID-19”, “Mental health”, “Quality of Life”, “Child Development” combined with the Boolean operators AND or OR the *Scientific Electronic Library Online* databases (SciELO), Regional Portal Virtual Health Library (VHL) and PubMed. Table 1 summarizes the six search strategies used. Each combined three topics related to the PECOS¹⁰ strategy with the Boolean operator AND.

To select the articles of the systematic review, the eligibility criteria were applied, according to the themes of the research question in Figure 1. Observational studies, published in English, Portuguese, Spanish or French, between the years 2019 and 2022 were included. Articles published outside the period of the COVID-19 pandemic, duplicates, reviews of any kind, as well as articles that were incomplete, or that did not address 1) children with ADHD were excluded; 2) social distancing during the COVID-19 pandemic; 3) mental health outcomes; 4) mental health impact assessment.

The findings were filtered by publication period (2019-2022), exported and inserted into the *Rayyan*¹¹ web application. The articles were screened by reading the titles and abstracts, followed by the full articles by two independent and anonymized evaluators (GGCL and DBR). The disagreements were resolved by consensus.

To prepare the analysis, the articles were systematized in a database using Microsoft Excel[®] software, considering the variables: journal, author and year of publication, title, place of research, study design, characteristics of the participants, exposure and outcome variables analyzed, evaluation instrument, main results, biases/limitations of the study.

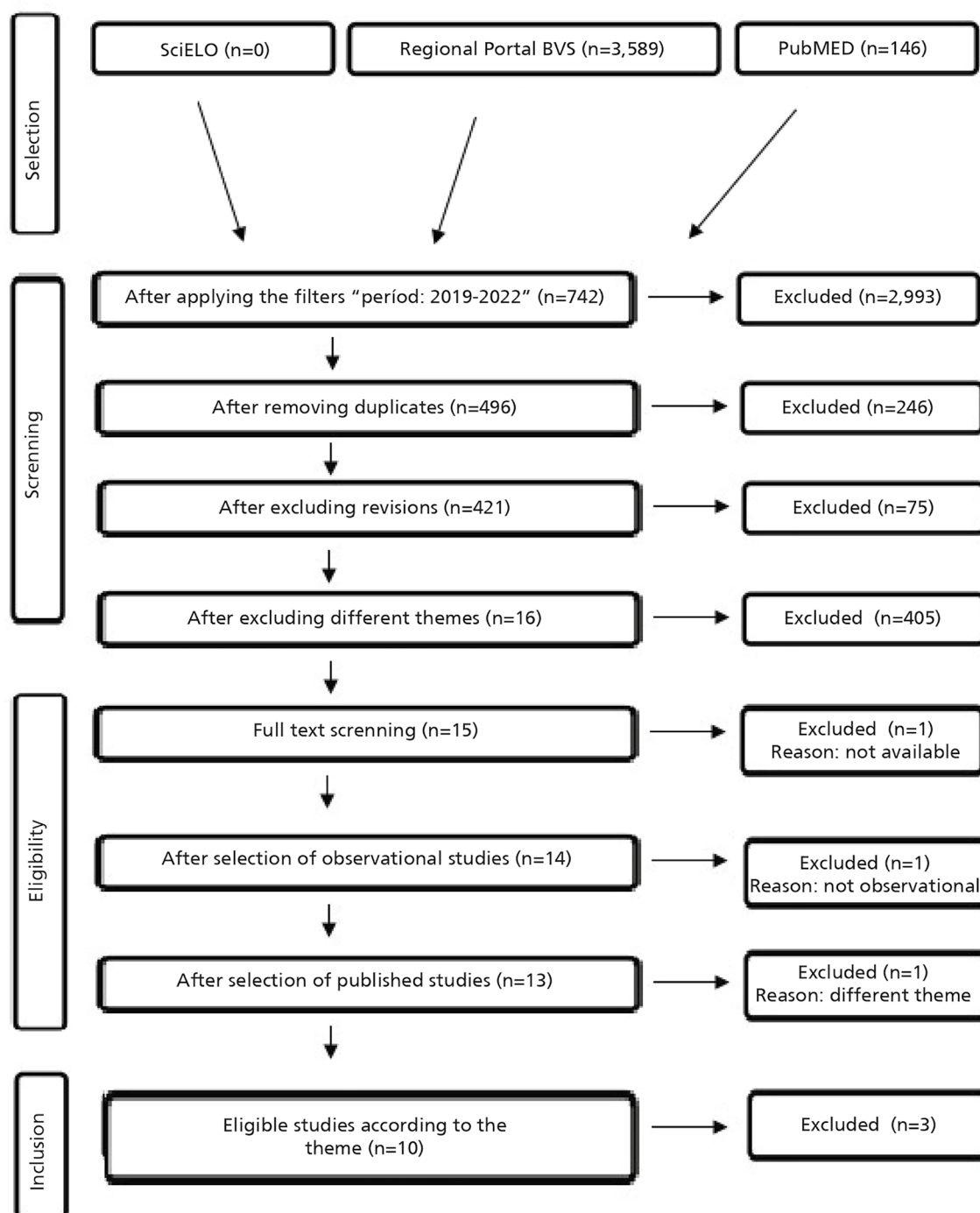
The quantitative data were presented based on Descriptive Statistics through graphs, in absolute numbers, percentages and/or means, according to the outcome and, the statistics were performed with the aid of the JAMOVI software. A table was elaborated presenting the quality information of the studies and their main results.

Table 1

Synthesis of search strategies.		
Population (P)	Exposure (E)	Outcome (O)
<ul style="list-style-type: none"> • (Child and Attention deficit hyperactivity disorder) 	<ul style="list-style-type: none"> • (Social Isolation or Physical Distancing or Quarantine or Lockdown) • (pandemics or COVID-19) 	<ul style="list-style-type: none"> • Mental health • Quality of Life • Child Development

Figure 1

Study selection flowchart.



This stage was conducted by two reviewers (BRMT and ABC) independently. When the article did not explicitly present some information for Table 1, it was standardized to describe with “-”.

Since this was a literature review, approval from the Research Ethics Committee was not required. No research protocol was registered.

Results

Selection of studies

Initially, the bibliographic research identified a total of 3,735 studies, and 10 studies were considered eligible.^{7,8,12,13,14,15,16,17,18,19} We excluded studies that did

not address the following topics: 1) the target audience of children with ADHD (N = 130); 2) social distancing during the COVID-19 pandemic (N = 265); 3) mental health outcomes 1 (N = 12); 4) mental health impact assessment (N = 1).

Characteristics of the studies

In total, 4,688 participants were included, of whom 46 (1.09%) were fathers, 1,296 (32%) mothers and 3,133 (66.83%) children and teenagers. Among the children and teenagers analyzed, 2,412 (72.8%) were boys and 721 (27.2%) girls, with ages ranging from 3 to 20 years and a mean of 13.5 years. Of the ten articles analyzed, most were conducted in developed countries (8/10). Regarding the period of confinement, nine articles contained an average duration of 5 weeks in the year 2020. Only the study by Zhang *et al.*¹³ did not provide information on the study time.

Of the 3,133 children and juveniles, 532 (16.98%) used ADHD medication. In four studies, the patients also had other comorbidities (N = 398)^{8,13,14,17}: 1) Autism Spectrum Disorder (28.14%); 2) Anxiety (27.14%); 3) Learning Disorders (17.34%); 4) Tics (10.05%); 5) Speech and Language Disorders (8.04%); 6) Obsessive-Compulsive Disorder (3.02%); 7) Depression (6.28%).

Six studies used validated instruments to measure the difficulties experienced by the sample during the pandemic period: 1) *Swanson, Nolan, and Pelham 26-question scale (SNAP-IV)*^{13,15}; 2) *Strengths and Difficulties Questionnaire (SDQ)*^{12,18} and 3) *Attention-Deficit Hyperactivity Disorder Rating Scale (ADHD-RS)*.¹⁹ According to the main theme and objective of each article, the number of instruments used varied, with some cases involving the use of two or more types. Table 2 describes the characteristics of the studies, the variables that were analyzed, the evaluation instruments used and the main findings of the sample database.

Summary of evidence

Regarding COVID-19, two studies showed that children were concerned about the pandemic period^{8,18} and 52% (N = 226) were apprehensive about their health status and/or their family and loved ones.¹⁸ Additionally, on average, 46.60% (N = 302) of the children and teenagers were distressed by the repercussions of the pandemic.^{8,18}

Four studies analyzed the mood state of the participants (N = 1,158) and showed worsening of the mood.^{8,14,15,16} The children and juveniles felt more anxious (33.07%), sad or depressed (25.56%), distracted (18.05%), restless (8.55%), lonely (7.60%), worried (4.49%) and/or aggressive (2.68%).

The behavior evaluated by the parents of 840 children showed that 40.95% had worsened, 25.83%

showed improvement, and in 33.21% no alterations were perceived.^{7,18} When analyzing the hyperactivity variable in 301 juveniles, it was found that 47.18% had worsened, 20.60% improvement and in 32.23% no alterations were evidenced.¹⁸

In comparison to the other studies, three evaluated variables of changes related to sleep and physical activity, quantified from the perspective of the parents.^{8,15,16} Then analyzing the total sample with results related to sleep (N = 651) and physical activity (N = 503), respectively, 22.12% (N = 144) and 25.84% (N = 130) of the sample showed improvement, while 77.88% (N = 503) and 74.16% (N = 373) worsened.^{8,15,16}

Regarding the studies that evaluated the use of technologies,^{8,16} the parents or guardians reported that 31.21% (N = 142) of the children spent more time playing; 28.57% (N = 130) watching TV; and 40.22% (N = 183) making use of social media. In terms of health care, 39.19% (N = 58) of the juveniles (N = 148) were assisted by pediatricians, 36.49% (N = 54) by psychologists, 11.49% (N = 17) by psychiatrists and 12.84% (N = 19) by occupational therapists. In studies conducted in Australia and Italy, an increase in the use of digital technologies was observed, and only this study identified the need for children to consult with specialists.^{8,16}

Main limitations of the studies

Some studies did not specify whether the results referred to the sample composed of children and/or teenagers. Samples with child and teenager populations were used,^{7,12,14} as well as joint analysis of children and teenagers,^{8,13,16,17,19} and a fixed parameter was not used to classify individuals as children or teenager.

Four studies did not present a representative sample due to the small sample size^{14,16,18,19}, while others had restrictions related to internet access^{12,13} or the need for fluency in languages.¹² It is important to emphasize that eight studies pointed out the limitation of not capturing the perspective of the child but relying solely on their parents' perspective.^{7,8,12-17}

One study pointed out that the methodological design does not allow formulating causal relationships between confinement and the evolution of the state of children with ADHD⁷ and three others reported as a relevant limitation the non-comparison of the behavior of children with attention deficit hyperactivity disorder with those of the general population.^{12,13,18}

Regarding the assessment instruments, six studies did not use standardized tools for the diagnosis of ADHD and comorbid conditions.^{7,8,13,14,16,17} The methodological heterogeneity between the studies may cause biases among the evidence and lead to challenges in the interpretation of the clinical relevance of the impacts on mental

Table 2

Characteristics and main findings of the selected studies.						
Author, year and place of the study	Study design and sample (children)	Sample (parents /caregivers)	Variables analyzed	Evaluation instruments	Major results	Main limitations
Bobo et al. ⁷ 2020 (França)	Observational (prospective cohort) 435 infants (377 M; 58 F) aged between 3 and <20 years.	533 parents	1) Mental health status; 2) environmental conditions of confinement; 3) feelings about the provision and continuity of care.	Questionnaires with open and closed questions	34.71% of parents reported worsening in their children's behavior; 34.33% observed no noticeable changes and 30.96% an overall improvement in behavior. They also reported reduced anxiety, improvement of the child's self-esteem, attention problems and agitation. In contrast, they described increased opposition or aggressiveness, sleep and emotional disturbances, and ADHD symptoms. The monitoring of schooling was the greatest challenge faced by parents during the lockdown.	1) Influence of the results due to the subjectivity of the parents; 2) the study design does not allow to formulate causal relationships between confinement and the evolution of the state of the child with ADHD.
Nonweiler et al. ¹² 2020 (Reino Unido)	Observational (transversal) 453 infants (320 M; 133 F), aged 4 to 15 years.	-	1) Parents' depressive symptoms and the different coping strategies they use to cope with lockdown during the pandemic; 2) emotional, behavioral and cognitive aspects of children with ADHD.	SDQ	When compared to a pre-COVID-19 mental health cohort, clinical sample scores evidence worse mental health in emotional symptoms, hyperactivity, and prosocial behavior. Compared with neurotypical controls, children with neurodevelopmental disorders had a higher prevalence of emotional symptoms, greater conduct problems, and lower prosocial behaviors. Children with ADHD had inflated conduct problems.	1) The study design did not assess how the behaviors of children with ADHD changed relative to those of the general population; 2) individuals without internet access and who do not speak French were not represented by the sample; 3) the reported parental depression levels are only an underestimation of the extent of depression experienced during lockdown; 4) influence of the results due to the subjectivity of the parents.
Zhang et al. ¹³ 2020 (China)	Observational (transversal) 241 children and teenagers (194M; 47F), aged between 6 and 15 years.	241 parents	1) Lifestyle changes due to lockdown, including impacts on parents' work, finances, and social relationships; 2) differences in children's physical health, media use, and mental health before and during the pandemic; 3) changes or barriers to health care during lockdown; 4) time of allocation of children's activities; 5) mood status of parents and children; 6) impacts that media use has had on children with ADHD.	SNAP-IV e CSDC	53.94% of parents reported that their children's ability to maintain focus worsened; 67.22% reported increased frequency of anger. On the other hand, more than half of parents reported that children's behaviors in other domains improved or maintained the same level. ADHD symptoms decreased with longer study time.	1) Influence of the results due to the subjectivity of the parents on the life of the child and/or adolescents in the pre-and pandemic period; 2) it is not possible to compare the effects of confinement between children with ADHD versus children in the general population with other neurodevelopmental and/or mental health disorders; 3) standardized diagnostic tools for ADHD and comorbid conditions were not used; 4) possible bias of the sample being composed of individuals with relatively high interest in seeking help; 5) individuals without internet access were not represented by the sample.

Shuai et al. ¹⁴ 2021 (China)	Observational (transversal) 192 infants (140M; 52F), aged between 8 and 16 years.	-	1) Symptoms of dependence on the use of mobile phones; 2) severity of ADHD symptoms, oppositional defiant disorder, conduct disorder and emotional problems; 3) behaviors in the daily life of the children; 4) environmental and social characteristics; 5) mental health.	SQPMPU, IAT, SNAP, BRIEF, ASLEC, FES-CV, SLMS, DSRSC, SCARED e HQIP	The ADHD group with digital media use (PUMD) problems had significantly worse symptoms for inattention, oppositional defiant, conduct problem, and emotional problem, showing, considerably more life event disorders for relationship pressure and learning pressure compared to the ADHD group without PUMD. In addition, they also had more significant problems in learning motivation, including initiative, awareness, and goal.	1) Small quantitative clinical sample; 2) use of a non-standardized questionnaire; 3) the data were reported by the mothers, and not directly by the children; 4) the relationship between altered behaviors among children with ADHD and their medication status has not been directly tested.
Swansburg et al. ¹⁵ 2021 (Canadá)	Observational (cross-sectional) 587 children (412M; 166F; 9 others), with a mean age of 10.14 years.	587 caregivers	1) Family demographics; 2) mental health; 3) quality of life; 4) lifestyle habits.	PHQ-9, GAD-7 e SNAP-IV.	The PHQ-9 showed that 17.4% of the children had moderately depressed symptoms severe to severe, while GAD-7 indicated that 14.1% had severe anxiety symptoms. In SNAP-IV, 73.7% of children had cutoff points for inattention, 66.8% for hyperactivity/impulsivity, and 38.6% for oppositional defiant disorder. Caregivers reported changes in sleep behaviors (77.5%), eating (58.9%), exercise (83.7%) and screen use (92.9%).	1) Self-selective nature of recruitment, 2) the majority of survey responses were from the provinces of Alberta and Ontario; 3) the child's perspective was not captured.
Tessarollo et al. ¹⁶ 2021 (Itália)	Observational (case-control) 276 children and teenagers (240M; 36F). 92 patients with ADHD and 184 controls without ADHD. Ages 6 to 15	276 mothers	1) Sociodemographic data; 2) organization of distance learning; 3) attitude and behavior change of the child and 4) mothers' difficulty and opinion about distance learning.	DSM-5, K-SADS, CBCL, CPRS-R, CTRS-R e CGI-S	Attention span was more limited in children with ADHD. During exposure to online teaching, about half of the students in both groups presented motor restlessness, with consequent interference in learning. Restlessness and anxiety were observed at greater intensity in the ADHD group. Aggressiveness, sleep disturbances and mood were equally reported for cases and controls.	1) The data were reported by the mothers and not directly by the children; 2) the relationship between behavioral changes in children with ADHD and their drug status was not evaluated; 3) small sample size; 4) use of a non-standardized questionnaire.
Werling et al. ¹⁷ 2021 (Suíça)	Observational (prospective cohort) 126 children and teenagers (94M; 32F), aged between 10 and 18 years.	126 parents	1) Impact on the use of media in everyday life; 2) parents' concern about problematic behaviors and 3) amount of time spent on digital activities.	PUI-SQ	46.8% of parents reported no change from ADHD, 33.3% improved and 19.8% worsened. 57.14% patients were classified as moderately, quite or very irritable, with estimated total media time higher than those who were classified as mildly/non-irritable. In addition, 46.82% of children and adolescents with low or very low ability to focus/concentrate had higher eTMT than patients with moderate or good concentration (53.17%).	1) Classification of change was based on retrospective evaluations of parents; 2) objective data on socioeconomic status and cultural context were not collected; 3) diagnostic categories were self-assessed.

health, in the differentiation of adaptive symptoms and mental illness, and possible geographical and cultural influences.^{8,14-17}

Discussion

The data obtained show several impacts on the mental health of children and teenagers with ADHD during the

COVID-19 pandemic social isolation. Among the studies that analyzed mood,^{8,14,15,16} they showed an increased in stress, depression and anxiety. These findings show the urgency for social policies and strategies that minimize the impacts of short- and long-term isolation on children and teenagers, especially those with ADHD.^{20,21,22}

Studies have described an association between ADHD and poor emotional regulation as a risk factor for

Bobo <i>et al.</i> ¹⁸ 2022 (França)	Observational (transversal) 435 children, (377M; 58F) with a mean age of 10.5 years.	533 parents	1) Difficulties of children with ADHD in the emotional, conduct and hyperactivity dimensions; 2) depressive symptoms of the parents; 3) strategies used by parents to cope with the pandemic.	Questionnaires SDQ, PHQ-2 e BRIEF COPE	Of the children, 56.5% had hyperactivity scores, 57.6% behavior scores above the clinical cutoff point and 32.3% pathological emotional score. 55% of children were concerned about the pandemic and 52% were apprehensive about the health of their loved ones. As for the parents, 54.6% reported sleep problems and 50.1% of irritability in their children.	1) A study did not evaluate how the behaviors of children with ADHD changed in relation to that of the general population; 2) the sample was not representative; 3) the increase in family time during lockdown may have altered the parents' perception of the child; 4) the study occurred in the initial stage of the first lockdown.
Sasaki <i>et al.</i> ¹⁹ 2022 (Japão)	Observational (case-control) 184 children and teenagers who visited the study site at different periods, 92 from the research group (March to May 2020) and 92 from the control group (April 2017 to March 2020). The two groups were compared in each age category: patients from elementary school aged between 6 and 12 years and from high school between 12 and 15 years.	-	1) Functions of daily life and limitations throughout the day; 2) the child's behavior; 3) ADHD symptoms; 4) diagnostic criteria for ADHD; 5) depression scale and 6) symptoms of anxiety disorders.	QCD, TABS, ADHD-RS, ODBI, DSRs e SCAS	In elementary school students, there were no significant differences in the TABS, ADHD-RS, ODBI, DSRs and SCAS scores between the two groups. In high school students, there were no significant differences in TABS, ODBI, DSRs and SCAS scores between the two groups. The "ADHD-RS" scores indicating ADHD symptoms were 16.78 ± 12.69 in the case group and 11.80 ± 10.40 in the control group. In elementary school students, the QCD scores indicating functionality or disability during school hours were 3.31 ± 2.52 in the case group and 4.52 ± 2.33 in the control group. For high school, there were no significant differences in QCD scores between the two groups.	1) Measurement bias and selection bias can be identified; 2) small sample size in the group of cases; 3) a study conducted in a single district.
Sciberras <i>et al.</i> ⁸ 2022 (Austrália)	Observational (longitudinal) 213 children and teenagers, (162M; 51F)	213 parents	1) Life changes due to COVID-19 restrictions; 2) barriers in health care; 3) stress and worry of the child.	CRISIS questionnaires and open-ended questions	54% of parents reported that the quality of family and social relationships worsened. 63.84% reported positive changes in their children's lives: more time with family, ability to learn at home without distractions, parents being able to help with learning. In contrast, increased sad/depressed/unhappy mood, reduced pleasure in usual activities, and increased loneliness were also reported.	1) Study used retrospective reports of parents; 2) absence of a control group; 3) online study with low confidence in the diagnosis of ADHD and in the conditions of comorbidities; 4) no data available on parents' COVID-19 stress and concerns.

F= Female; M= Male; ADHD-RS= Attention- Deficit Hyperactivity Disorder Rating Scale; ASLEC= Teenager Self-rating Life Events Checklist; BRIEF= Behavior Rating Inventory of Executive Function; CBCL= Child Behavior Checklist; CGI-5= Clinical Global Impressions-severity Scale; CPRS-R= Conners' Parent Rating Scale-revised; CRISIS= Coronavirus Health Impact Survey; CSDC= The Child Stress Disorders Checklist; CTRS-R= Conners' Teacher Rating Scale-revised; DSM-5= Diagnostic and Statistical Manual of Mental Disorders; DSRs= Depression Self-Rating Scale for Children; DSRSC= Depression Self-rating Scale for Children; eTMT= Tempo total de mídia estimado; FES-CV= The Chinese Version of Family Environment Scale; GAD-7= Generalized Anxiety Disorder 7; HQIP= Home Quarantine Investigation of the Pandemic; IAT= Internet Addiction Test de Young; K-SADS= Kiddie Schedule for Affective Disorders and Schizophrenia; ODBI= Oppositional Defiant Behavior Inventory; PHQ-2= Patient Health Questionnaire-2; PHQ-9= Patient Health Questionnaire 9; PUI-SQ= PUI-Screening Questionnaire for Children and Teenagers; QCD= Questionnaire - Children with Difficulties; SCARED= Screening Child Anxiety-related Emotional Disorders; SCAS= Spence Children's Anxiety Scale; SDQ= Strengths and Difficulties Questionnaire; SLMS= Students Learning Motivation Scale; SNAP= Swanson, Nolan e Pelham Rating Scale; SNAP-IV= Swanson, Nolan, and Pelham 26-question Scale; SQPMPU= Self-rating Questionnaire for Problematic Mobile Phone Use; TABS= Tokyo Autistic Behavior Scale; ADHD= Attention Deficit Hyperactivity Disorder.

maintaining mental health in the context of the pandemic. A higher risk of chronic stressors is present when compared to typical controls, which can affect behavioral, psychological and social domains.^{6,8} The children's groups, especially those with ADHD, had emotional symptoms and conduct problems, presenting behavioral changes associated with social isolation measures.²³

Other indicators of decreased in mental health were reduced sleep quality and physical activity,^{8,15,16} as well as increased use of digital technologies.^{8,16} There is also greater vulnerability to develop sleep disorders in children and teenagers with ADHD due to the pandemic period.²⁴ In addition, physical activity promotes improvements in ADHD symptoms in children, such as attention to

domains of executive functions.²⁵ However, there was a decrease in pleasure and time spent in outdoor activities, concomitantly with an increase in exposure to screens and solitude, when compared to the routine before the pandemic.²³

It should be noted that, although social media is able to promote greater social connection by maintaining affective ties with people outside the family nucleus, increased internet use and screen exposure may be associated with symptoms of depression and anxiety. In addition, the individual may present sleep alterations.²⁶

In several countries, there was a prioritization of remote services of health care, via telehealth, to the detriment of face-to-face care. Although, the optimization of these services for a digital approach is a continuous process, with logistical, technological and financial implications, prioritizing the quality of care,^{27,28} especially in children and teenagers with ADHD.

Some evidence can be applied to the current context, such as the importance of social contact, as it directly impacts the mental health of children and teenagers with ADHD. Changes in emotion and mood were associated with decreased activities that promote quality of life. Thus, it was demonstrated the importance of sleep quality, physical activity and regular use of digital technologies.^{23,25,26}

Regarding the limitations of the studies analyzed, three articles did not report whether there were exclusion criteria in the sample selection;^{13,14,17} two did not clearly present how the results of the open questionnaire⁷ and analysis instruments¹⁹ applied were measured and/or evaluated; one, when establishing criteria for the analysis of their results, did not inform how they were analyzed,⁸ and one did not use a validated analysis instrument.⁷ It is also noteworthy the predominance of studies conducted in developed countries and the heterogeneity of the studies in relation to the methodological design and age group considered.

Therefore, in order to develop more robust scientific evidence, it is necessary that samples be probabilistically representative of the population analyzed, carefully defining the population of interest and selecting the characteristics to be researched. Studies should also have methodological designs with greater homogeneity and should be carried out in developing and underdeveloped countries to understand the specificities of these locations. Such questions are able to reduce the chances of deviations from the analysis and interpretation of the data, for the success of the investigation.^{29,30}

Conclusion

This review showed a worsening of signs and symptoms related to the mental health of children and teenagers with ADHD, mainly due to changes in mood; increased

anxiety, sadness or depressed symptom and increased hyperactivity. Behavioral changes also included reduced sleep quality and physical activity and increased use of digital technologies and screen time. Despite the limitations of the studies and the incipient literature on the subject, recognizing the negative repercussions of the abrupt change in routine, structure, and social contact, as well as the restrictions imposed by the pandemic, is important for planning more effective care strategies for children and teenagers with ADHD.

More robust and methodologically structured research is needed to describe the impacts that pandemics may have on the mental health of individuals with ADHD, as well as its long-term consequences. This review provides a foundation for future research in the area and can help ensure that supports can meet the specific mental health needs of this population.

Author's contribution

Laguna GGC and Ribeiro DB: data collection; Laguna GGC, Tavares BRM and Cazé AB: data analysis and interpretation; Laguna GGC, Santos ACS and Borges GF: critical intellectual review. All authors contributed substantially in the planning, preparation of the study, approved the final version of the article and declared no conflict of the interest.

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