

## REVIEW

# Mental health indicators of children with autism spectrum disorder during the COVID-19 pandemic: a scoping review

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## ABSTRACT

**Introduction:** The COVID-19 pandemic has posed adaptive challenges for children with autism spectrum disorder (ASD) due to the disruption of health and educational routines and services.

**Objectives:** The scoping review aims to examine and integrate the literature on mental health indicators of children with ASD during the COVID-19 pandemic, focusing on emotional, social, behavioral, and cognitive aspects.

**Methods:** A systematic search for studies was conducted in PubMed, Google Scholar, PsycINFO, ScienceDirect, and Cochrane Central between January and February 2024.

**Results:** Twenty-five studies were identified that explored various aspects of mental health indicators in children with ASD during the pandemic. Only three of these studies developed a methodology that allowed pre- and post-pandemic change assessment by creating pre-established follow-up cohorts before the outbreak. Although some of the studies indicated stability or improvements in mental health indicators, several factors were identified that could worsen symptoms in these children, such as caregiver stress, low income, and interruption of face-to-face therapies.

**Conclusion:** The results of the reviewed studies are inconclusive due to methodological limitations in the research designs. The findings highlight the need to develop more robust and consistent methodological approaches to assess the impact of stressful events, such as the COVID-19 pandemic, on the mental health of children with ASD, emphasizing the creation of long-term follow-up cohorts, as it enables a comprehensive understanding of the effects over time.

**Keywords:** Mental Health; Child Development Disorders; Infantile Autism; COVID-19, Pediatrics (Source: MeSH)




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## Indicadores de salud mental de los niños con trastorno del espectro autista durante la pandemia por COVID-19: una revisión de alcance

## RESUMEN

**Introducción:** La pandemia de COVID-19 ha planteado desafíos de adaptación para los niños con el trastorno del espectro autista (TEA) debido a la interrupción de rutinas y servicios de salud y educativos.

**Objetivo:** La revisión de alcance tiene como objetivo examinar e integrar la literatura sobre los indicadores de salud mental de los niños con TEA durante la pandemia de COVID-19, centrándose en aspectos emocionales, sociales, conductuales y cognitivos.

**Métodos:** Se realizó una búsqueda sistemática de estudios en PubMed, Google Scholar, PsycINFO, ScienceDirect y Cochrane Central entre enero y febrero de 2024.

**Resultados:** Se identificaron 25 estudios que exploraban diversos aspectos de los indicadores de salud mental en niños con TEA durante la pandemia. Solo tres de estos estudios desarrollaron una metodología que permitía evaluar los cambios pre y post pandemia mediante la creación de cohortes preestablecidas de seguimiento antes del brote. Aunque algunos de los estudios indicaron estabilidad o mejoras en los indicadores de salud mental, se identificaron varios factores que podrían empeorar los síntomas en estos niños como el estrés en los cuidadores, el bajo ingreso económico y la interrupción de terapias presenciales.

**Conclusión:** Los resultados de los estudios revisados no son concluyentes debido a limitaciones metodológicas en los diseños de investigación. Los hallazgos sugieren la necesidad de desarrollar enfoques

metodológicos más sólidos y consistentes para evaluar el impacto de eventos estresantes como la pandemia de COVID-19 en la salud mental de los niños con TEA, con énfasis en la creación de cohortes de seguimiento a largo plazo que permitan una comprensión más completa de los efectos a lo largo del tiempo.

**Palabras clave:** Salud Mental; Trastornos del Desarrollo Infantil; Autismo Infantil; COVID-19; Pediatría (Fuente: DeCS)

## INTRODUCTION

Autism spectrum disorder (ASD) is a neurological condition that affects approximately 1 in 100 children worldwide (1,2). It is characterized by impairments in social communication and restricted, repetitive patterns of behavior (3). These characteristics cause children with ASD to prefer predictable environments and experience stress in the face of unexpected changes, such as those generated by the COVID-19 pandemic (4-6).

The COVID-19 pandemic, declared by the World Health Organization in March 2020, has had a significant impact on global health and well-being, with total confirmed cases exceeding 703 million by March 3, 2023 (7). Although there is no accurate epidemiological information on COVID-19 in children with ASD, it is identified that approximately 25 % of affected children may have asymptomatic or symptomatic immunodeficiency or dysfunction, making them more vulnerable to infection and complications associated with COVID-19 (8,9).

COVID-19 contagion prevention measures implemented during the pandemic have posed additional challenges to the development and emotional well-being of children with ASD. Growing evidence suggests that stressful traumatic events, such as routine changes resulting from the pandemic, are risk factors for worsening core ASD symptoms and for worsening emotional, social, behavioral, and cognitive mental health (5). These changes were of greater concern during the pandemic due to the widespread disruption of mobility that created obstacles to medical follow-up and access to available occupational therapies and educational facilities (6), forcing the search for alternatives such as telehealth and distance education.

To our knowledge, there are no scoping reviews that have analyzed mental health indicators, segmented by emotional, social, cognitive and behavioral aspects, of children with ASD during the COVID-19 pandemic. A comprehensive evaluation is needed to consolidate all relevant findings and obtain a complete picture of the characteristics of these children in times of health crisis. The objective of this scoping review is to comprehensively examine and integrate the literature describing mental health indicators of children with ASD during the COVID-19 pandemic.

## METHODS

### Study Design

The scoping review was conducted according to the methodology of the Joanna Briggs Institute (10). The original protocol was approved by all authors and registered with the Open Science Framework (OSF) on January 20, 2024 (<https://osf.io/pu9qd>)

### Studies selection

The population, concept and context (PCC) criteria for this scoping review are described in Table 01.

**Table N° 01.** Inclusion criteria based on PCC Guidelines

Criteria	Description
<b>Population</b>	Children with ASD under 18 years of age
<b>Concept</b>	<p>The main concept is to describe the psychosocial characteristics of the target population. Psychosocial characteristics focus on emotional, social, behavioral, and cognitive indicators.</p> <ul style="list-style-type: none"> <li>Emotional indicators include aspects such as emotional well-being, and symptoms of anxiety, depression and stress. This includes emotion regulation, abrupt changes in mood or intense responses to stressful situations, as well as difficulties in emotional expression.</li> <li>Social indicators include disturbances in social interactions, increased social isolation, and difficulties in developing communication skills.</li> <li>Behavioral indicators may include stereotyped behaviors, hyperactivity, conduct problems, such as tantrums or aggression, as well as self-injurious behaviors.</li> <li>Cognitive indicators may include difficulties in areas such as sustained attention, working memory and mental flexibility. In addition, they may present difficulties in understanding abstract concepts and in social problem solving, which may affect their academic and social functioning.</li> </ul>
<b>Context</b>	The COVID-19 pandemic. The period is from March 2020 to May 2023.

### Search strategy

The article search and selection process was carried out between January 10 and February 15, 2024. A comprehensive search was conducted in five databases: PubMed, Google Scholar, PsycINFO, ScienceDirect, and Cochrane Central. The search phrases used covered the domains associated with psychosocial characteristics of children with ASD during the COVID-19 pandemic.

Inclusion criteria included: (a) experimental, quasi-experimental, descriptive studies with a qualitative or quantitative approach; (b) studies in which at least 75 % of the total number of participants were children or adolescents

under 18 years of age with ASD, and (c) studies that described mental health indicators during the COVID-19 pandemic. On the other hand, the following were excluded: (a) studies published in a language other than Spanish or English, (b) studies in which a specific subanalysis was not performed for this group of patients.

We used the same search strategy in all databases, described below: Descriptors (MeSH) - "Autism Spectrum Disorder" OR "Autism Disorder" OR "Autism" AND "coronavirus disease-19" OR "COVID-19" OR "SARS-CoV-2. We did not impose any restrictions based on language, research design, or country of publication. In addition, we performed a manual literature search of selected journal articles, systematic reviews, and meta-analyses to locate other relevant studies not identified in the peer review.

### Evidence selection study

After the search was completed, all identified citations were collected and loaded into Rayyan bibliographic software, and duplicates were removed. Titles and abstracts of identified citations were screened to determine if they met specific criteria for inclusion in the scoping review. Two investigators (LLC and RGA) conducted the screening independently, and a third reviewer (RCA) resolved discrepancies between them. The full text was recorded and reasons for exclusion of full-text evidence sources that did not meet the criteria for inclusion in the scoping review were reported.

### Data extraction

The data collected include the name of the first author, country where the study was conducted, age, objective, study design, data collection period, instruments used, main findings related to emotional, social, behavioral and cognitive indicators of children with ASD.

### Data analysis

We performed a thematic analysis of the data collected for each mental health indicator assessed by the included studies (emotional, social, behavioral and cognitive).

## RESULTS

The initial literature search revealed 642 studies. After eliminating 295 duplicates, 329 studies remained for consideration. Subsequent screening of titles and abstracts resulted in the identification of 45 articles. Of these selected articles, 20 articles were excluded because they did not meet the inclusion and exclusion criteria. Consequently, 25 studies were selected to meet the objective of the present scoping review.

The included studies were conducted in different countries, including the United States (n = 3), United Kingdom (n = 3), China (n = 2), Netherlands (n = 2), Italy (n = 2), Spain (n = 2), Bulgaria (n = 1), Japan (n = 1), Turkey (n = 1), South Africa (n = 1), Chile (n = 1), Slovakia (n = 1), Canada (n = 1), India (n = 1), Poland (n = 1), and Portugal (n = 1). In addition, one multinational study (n = 1) was identified that

included Austria, Germany, Iran, Turkey, Australia, USA, and UK. Most studies (n = 18, 81.8 %) collected data in 2020, the first year of the pandemic. The other studies that reported the data collection period, did so in 2021 (n = 4; 18.2 %). Three studies were identified as not reporting the exact data collection period.

The total sample size reported in the included studies was 2,964. This calculation took into account that two identified studies used the same population. Data on the mean age of participating children with ASD were identified in 21 studies. Of these studies, 9.5 % (n = 2) reported an average age corresponding to early childhood (0 to 6 years), 52.4 % (n = 14) to middle childhood (6 to 11 years), and 38.1 % (n = 5) to adolescence (12 to 17 years).

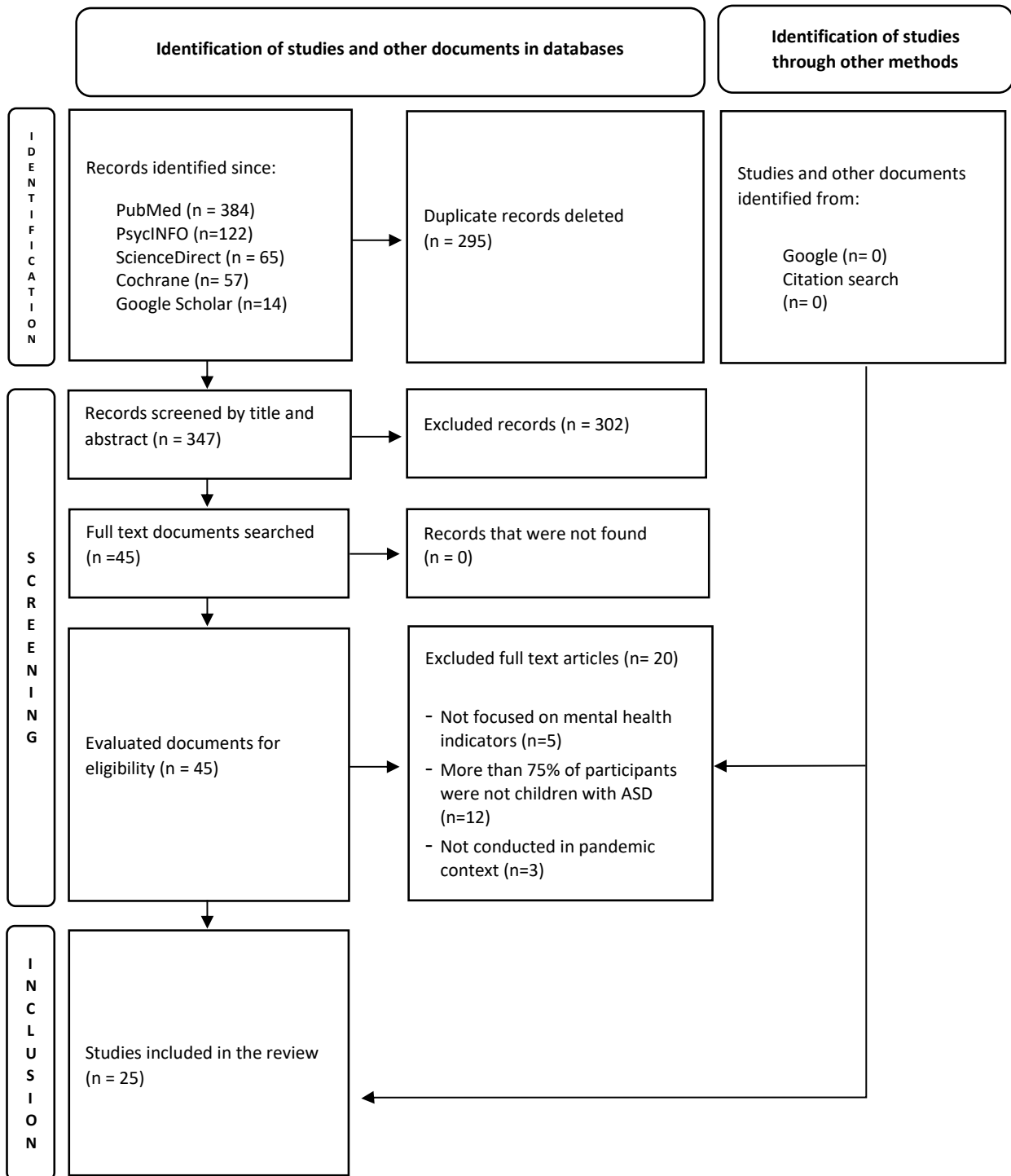
During study selection, we identified that 90.5 % (n = 19) aimed to identify changes in mental health indicators in children with ASD before and after the onset of the COVID-19 pandemic, whereas the remaining 9.5 % (n = 6) focused only on assessing the status of these indicators during the pandemic. Of the studies that compared mental health indicators before and after, only a few (n = 3; 15.8 %) adopted a longitudinal design with a quantitative approach, collecting data from cohorts established prior to the pandemic and comparing them with outcomes during the pandemic. In contrast, the remaining studies, which also had the same objective, only collected perceptions of pre-pandemic status, with no records of information collected prior to the pandemic. Additionally, some studies (n = 6; 24 %) conducted a sub-analysis that sought to inquire about factors related to mental health indicators of children with ASD.

Although most of the included studies collected information quantitatively (n = 20; 80 %), it should be noted that some studies collected information qualitatively (n = 5; 20 %). Regarding quantitative data collection instruments, most studies developed an online questionnaire (n = 10). Also, some studies used psychometric instruments such as the "Child Behavior Checklist" (n = 2), the "Revised Child Anxiety and Depression Scale" (n = 2), the "Strengths and Difficulties Questionnaire" (n = 1), the "Childhood ASD Severity Test" (n = 1), the "Aberrant Behavior Checklist" (n = 1), the "Vineland Adaptive Behavior Scale" (n = 1), the "Pediatric Quality of Life Questionnaire" (n = 1), the "Stress Response Questionnaire by COVID-19" (n = 1), and the "Trait Anxiety Inventory for Children" (n = 1), and the "Brief Problem Monitoring" (n = 1).

In the selection of articles, we identified studies that conducted an assessment of emotional (n = 21), social (n = 13), behavioral (n = 15), and cognitive (n = 3) indicators.

Several themes emerged from the included studies regarding their results. We have categorized these results into four distinct groups. A complete summary of the characteristics of the included studies is provided in Table N° 02.

**Figure 1.** Document search flowchart



Flowchart adapted from: Page *et al.* (11)

**Table 2.** Summary of included studies

	Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
1	Days (2023); USA (12)	51	12,8	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic. (2) Outcomes of children with ASD were compared with children without ASD.	Longitudinal design	Quantitative	Between June and December 2020.	Revised Child Anxiety and Depression Scale	Yes	No	No	No	Depressive and anxiety symptoms did not differ between children with ASD and without ASD in June or July 2020. At the end of follow-up, symptoms of depression and anxiety decreased in children with ASD with no statistical difference from their peers without ASD.
2	Zhao (2023); China (13)	4 138	4,2	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic. (2) To identify factors associated with psychosocial indicators.	Cross-sectional design	Quantitative	Not specified	Online questionnaire developed by the research team	Yes	No	Yes	No	The majority of children with ASD maintained the same or improved emotional regulation skills after COVID-19 pandemic. In bivariate analysis, it was identified that the interruption of face-to-face therapies was associated with worsening of negative emotional regulation and behavioral problems.
3	Plak (2023); Netherlands (14)	224	12,6	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Longitudinal design	Quantitative	Retrospectively obtained data from 2017 to 2020. Prospectively through December 2020.	Strengths and difficulties questionnaire	Yes	Yes	Yes	No	Emotional problems did not change over time when accounting for differences in type of education, gender and age. Although, when children had COVID-19-related concerns, this led to an increase in emotional problems over time. There was a remarkable and unexpected improvement in social outcomes from the pre-pandemic period to the closure of the first confinement. The prevalence of hyperactivity and conduct problems decreased. Prosocial behavior increased over time.

Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
4 Toseeb (2023); United Kingdom (15)	517	10,7	(1) To explore variations in psychosocial indicators of children with ASD during the COVID-19 pandemic. (2) Outcomes of children with ASD were compared to children with other disabilities.	Longitudinal design	Quantitative	Between march de 2020 and october 2020	Revised Child Anxiety and Depression Scale	Yes	No	No	No	Anxiety and depression were prevalent among children with ASD. During the first months of confinement, children with ASD had higher levels of anxiety compared to those with other disabilities.
5 Toseeb (2023); United Kingdom (16)		10,7	(1) To explore variations in psychosocial indicators of children with ASD during the COVID-19 pandemic.	Longitudinal design	Qualitative	Between march de 2020 and october 2020.	Online questionnaire developed by the research team	Yes	No	No	No	Just after the UK entered its first confinement was the peak of concern-related codes in the parent-child data. There was a slight decrease in the prevalence of these codes in the middle of the 2022 year and then an increase by the end of 2020, when most children had returned to school. Parents of children with ASD felt that the reduction in demands at school was beneficial.
6 Stankova <i>et al.</i> (2023); Bulgaria (17)	21	No data	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	June 2020	Childhood ASD severity test, Childhood Behavior Checklist and an online questionnaire developed by the research team.	Yes	Yes	Yes	Yes	Children with ASD exhibited higher scores on internalizing and externalizing problems, as well as total problems, compared to children without ASD. After the period of confinement in Bulgaria, the results indicated significantly lower scores on the attention problems scale for children with ASD. However, the overall findings did not reveal a significant difference in other aspects of internalizing and externalizing problems compared to the period before the first confinement.

Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
7 de Maat <i>et al.</i> (2023); Netherlands (18)	62	12,8	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic. (2) Outcomes of children with ASD were compared with children without ASD.	Longitudinal design	Quantitative	From march 1st 2019 to may 26th 2021	Brief problem monitoring	Yes	No	Yes	No	There was no significant difference in the change in emotional and behavioral problems between children with and without ASD after adjusting for child IQ and pre-pandemic levels of emotional problems. In addition, children with ASD showed stable levels of emotional and behavioral problems during the pandemic, whereas those without ASD showed a slight increase in these emotional and behavioral problems.
8 Asaoka <i>et al.</i> (2023); Japan (19)	13	11,3	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Qualitative	August 2021	Semistructured interview.	Yes	Yes	No	No	The findings revealed six general themes. Some children were unaffected because they had little or no previous social interaction or because their daily routines had not been significantly altered. mothers emphasized that their children behaved spontaneously, adapted to school life from a distance, and were relieved by the cancellation or shortening of school events.
9 Genc <i>et al.</i> (2023); Turkey (20)	40	14,5	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Longitudinal design	Quantitative	From february 2020 to february 2021	Aberrant Behavior Checklist	No	No	Yes	No	The exacerbation of aberrant behaviors in children with ASD was observed exclusively among those whose mothers experience elevated levels of anxiety.
10 Camia <i>et al.</i> (2023); Italy (21)	52	8,0	(1) To describe psychosocial indicators of children in the third wave of the pandemic. (2) Outcomes of children with ASD were compared with children without ASD.	Cross-sectional design	Quantitative	march 2021	Child behavior checklist	No	No	Yes	No	Although the behavioral problems of the children with ASD were significantly worse than their siblings without ASD, it does not represent a clinically significant problem due to the low scores obtained after the use of the CBCL.

Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
11 Adams y cols. (2022); South Africa (22)	21	6,2	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Qualitative	Between march and august 2020	Semistructured interview.	Yes	Yes	Yes	No	Negative aspects were observed such as adverse reactions of children to sudden alterations in their routines, increased emotional dysregulation, and regression of previously acquired skills due to restricted access to services during confinement. However, families also noted positive developments, including increased social interaction as children gradually adapted to their new routines in the midst of confinement.
12 Coelho-Medeiros <i>et al.</i> (2022); Chile (23)	118	6* (median)	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Qualitative	Between august and october 2020	Semistructured interview.	Yes	Yes	Yes	Yes	Parents noted that confinement increased children's anxiety, potentially intensifying behavioral problems. They also noted improvements in their children's social-affective behavior, personal independence and communication skills. There is a higher proportion of responses highlighting positive aspects of children's cognition, perceiving improvements in responsibility and organization, sustained attention, mental flexibility, symbolic play, imagination and interest in various activities.
13 Polónyiová <i>et al.</i> (2022); Slovakia (24)	155	7,7	(1) To explore variations in psychosocial indicators of children with ASD during the pandemic by COVID-19.	Longitudinal design	Quantitative	From june to july to december 2020	Vineland Adaptive Behavior Scales: Third Edition	Yes	No	Yes	No	Between the first and second waves, they found a significant increase in the internalization of maladaptive behavior for children with ASD. During the third wave, there were no significant changes for children with ASD.



Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
14 Turner y cols. (2022); Canada (25)	582	8,4	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	Between June and July 2020	Online questionnaire developed by the research team	Yes	Yes	Yes	No	About half of the children with ASD experienced more emotional symptoms, such as mood and anxiety, restrictive behaviors, and communication problems since the beginning of the pandemic. Children with ASD who were older, whose caregivers experienced more stress and greater disruption at home, reported experiencing more traits of autism.
15 Kaur <i>et al.</i> (2022); India (26)	30	No especifica-do	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	Not specified	Online questionnaire developed by the research team	Yes	Yes	Yes	No	The study found impairment in almost all areas of activities of daily living, language, and behavioral characteristics, as well as in performance during online therapies during confinement. Parents reported several problems after confinement, such as changes in sleep patterns, inappropriate sitting behavior, attention span, concentration, limited eye contact, mood changes, laziness, clumsiness, hyperactivity, and impulsivity, which were not very prominent before confinement.
16 Kreysa <i>et al.</i> (2022); Multinacional; Germany, Austria, Iran, Turkey, Australia, USA and UK (27)	70	10,2	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	Between July and September 2020	Online questionnaire developed by the research team and PedsQL in its dimensions of emotional functioning and social functioning.	Yes	Yes	No	No	Children with ASD showed lower levels of emotional and social functioning compared to their siblings without ASD. Both children with ASD and without ASD showed a decrease in general well-being and social behavior, as well as an increase in general anxiety compared to pre-pandemic time.

Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
17 Lew-Koralewicz, 2022; Poland (28)	10	16,7	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Qualitative	Not specified	Semistructured interview.	Yes	Yes	No	No	The results yielded categories related to the positive side of COVID confinement were that they were able to spend time with their family, isolate themselves from difficult social relationships, and feel better. Among the negative effects, adolescents report difficulties in emotional functioning; higher levels of stress and anxiety, as well as increased feelings of loneliness and difficulties with online education.
18 Salmerón-Medina <i>et al.</i> 2022; Spain (29)	65	13,3	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	Between march and december 2020	Online questionnaire developed by the research team	Yes	Yes	Yes	Yes	In the initial period of confinement, just over half of the ASD children had increased anxiety. Only one-third of the children with ASD without language understood why they should stay at home. Almost half of the children maintained their stereotypical behaviors. Most children with ASD decreased contact with peers during confinement. Only one-third of the children with ASD followed online classes during confinement. Of those who attended, almost half of the children decreased their academic performance from their previous level.
19 Panjwani <i>et al.</i> (2021); USA (30).	200	7,7	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	Between may and june 2020	Online questionnaire developed by the research team	Yes	No	Yes	No	Most of the children suffered moderate to high alterations in general behavior after the implementation of the COVID-19 regulations. These changes are greater in children from low-income and/or food insecure families. Most children experienced increased arguing or stubbornness, followed by hyperactivity, temper tantrums, and altered sleep patterns. Also, one-third of the children reported increased self-injurious behaviors and nightmares.

Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
20 Huang <i>et al.</i> (2021); China (31)	406	4,6	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	May 2020	Online questionnaire developed by the research team	Yes	Yes	No	No	One-third of the children with ASD worsened their social and emotional performance; however, the majority remained stable; about half were easily distracted or irritable.
21 Morris <i>et al.</i> (2021); United Kingdom (32)	176	9,0 (median)	(1) To explore variations in psychosocial indicators of children with ASD during the pandemic by COVID-19.	Longitudinal design	Quantitative	Between march and october 2020	Online questionnaire developed by the research team	Yes	Yes	No	No	More than half of the children with ASD did not change their children's communication skills during confinement. In particular, a worsening of self-regulation and cooperation skills was reported. In addition, the study found that support from schools and continuing to see friends and family during confinement positively influenced improvement in children's overall social-communicative behaviors.
22 Corbett <i>et al.</i> (2021); USA (33)	61	13,2	(1) To explore variations in psychosocial indicators of children with ASD during the COVID-19 pandemic. (2) Outcomes of children with ASD were compared with children without ASD.	Longitudinal design	Quantitative	Between april and september 2020	Stress Response Questionnaire by COVID-19. Trait Anxiety Inventory for Children.	Yes	No	No	No	While the group with ASD was consistently high compared to children without ASD, children with ASD did not have significant changes in stress or anxiety during the pandemic.
23 Lugo-Marín <i>et al.</i> (2021); Spain (34)	37	10,7	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Longitudinal design	Quantitative	May 2020	On-line questionnaire developed by the research team and Child Behavior Checklist	Yes	Yes	Yes	No	As for children and adolescents with ASD, the results show an overall improvement in psychopathological status after the onset of confinement.

Author (year); country	Sample size	Age	Objective	Study design	Approach	Data collection period	Instrument	Emotional indicator	Social indicator	Behavioral indicator	Cognitive indicator	Main findings
Colizzi <i>et al.</i> (2020); Italy (35)	527	13	(1) To explore variations in psychosocial indicators of children with ASD before and after the pandemic.	Cross-sectional design	Quantitative	April 2020	Online questionnaire developed by the research team	No	No	Yes	No	One third of the children experienced more intense and frequent behavioral problems. Pre-existing behavioral problems predicted a higher risk of more intense and frequent disruptive behaviors during the onset of confinement.
Amorim <i>et al.</i> (2020); Portugal (36)	43	9,8	(1) To explore variations in psychosocial indicators of children with ASD during the COVID-19 pandemic. (2) Outcomes of children with ASD were compared with children without ASD.	Cross-sectional design	Quantitative	April 2020	Online questionnaire developed by the research team	Yes	No	No	No	Children with ASD did not exhibit a detrimental effect on their ability to manage emotions, in contrast without ASD who mostly reported a positive or no impact. Similarly, both children with ASD and their parents exhibited elevated levels of anxiety compared to those without. Finally, among children with ASD, those who did not maintain routines had higher average levels of anxiety than those who did.

### Emotional indicators of children with ASD

A study comparing emotional indicators before and after the pandemic using prespecified cohorts identified that emotional problems remained stable before and after the pandemic ( $F = 3.90, p = 0.049$ ) (18). Compared with other population groups, it was identified that emotional problems did not differ significantly between children with and without ASD, after adjusting for child IQ and pre-pandemic emotional problems ( $\beta = 0.16, p = 0.222$ ) (18).

Other studies with lower methodological quality reported results indicating that during confinement, a significant decrease in symptoms of depression and anxiety was observed in children with ASD, without statistical differences with their peers without ASD, but greater than children with other disabilities (12). Likewise, it is identified that the interruption of face-to-face therapies was associated with a worsening of emotional regulation and negative behavior (13). The emotional well-being of children with ASD was also affected by elevated levels of stress among their parents or caregivers (20,25). The pandemic intensified the challenges faced by parents in addressing their children's needs, which in turn affected the emotional climate of the home (20,24,36).

### Social indicators of children with ASD

A longitudinal study comparing the general social behavior of children with ASD before and after the COVID-19 pandemic observed a gradual increase in prosocial behavior over time (14). In the analysis of associated factors, the study identified that requiring special education assistance is a predictor of social difficulties. On the other hand, it was found that older age was associated with improved prosocial behavior (14).

On the other hand, cross-sectional studies revealed a variety of results in different cultural and geographic contexts. For example, a study conducted in India found impairments in areas such as activities of daily living, language, and behavior, especially among adolescents with ASD, who also reported increased feelings of loneliness and difficulties with online education (26). However, other studies conducted in countries such as the United Kingdom (32), Japan (19), South Africa (22), China (31), and Chile (23) found that some children with ASD experienced improvements in their social-affective behavior, personal independence, and communication skills, especially with continued support from schools and contact with friends and family.

## Behavioral Indicators of Children with ASD

A study in Turkey (20) found a significant increase in irritability, stereotyped behavior, hyperactivity, and inappropriate speech between before and after the pandemic ( $p = 0.005$ ,  $p = 0.005$ ,  $p = 0.019$ ,  $p = 0.008$ ,  $p = 0.013$ , respectively); and remained stable one year later ( $p > 0.05$ ). However, no statistically significant changes were found in other areas such as lethargy, self-injury, sleep and sensory sensitivity during the course of the pandemic ( $p > 0.05$ ). Importantly, unfavorable outcomes were only identified in children with ASD whose mothers experienced moderate to severe levels of anxiety, in contrast to those whose mothers had minimal to mild anxiety symptoms, who did not experience significant changes during this period (20).

Regarding studies that collected information only post pandemic, changes in the internalization of maladaptive behavior in children with ASD were found, and it was observed that stress and disruption in the home contributed to the exacerbation of autistic traits in older children (25). Other factors reported to be related to disruption in areas of daily and behavioral functioning include low income and/or food insecurity and children with preexisting behavioral problems (30). Therapies or online education (26,28,29) are reported to have been counterproductive in certain respects, as some mothers have associated them with a regression in behavioral symptoms and performance during this period.

## Effect of COVID-19 on the cognitive abilities of autistic children

Among the outstanding results, the study carried out in Chile highlighted positive aspects in the cognition of children with ASD, pointing out improvements in responsibility, organization, sustained attention, mental flexibility, symbolic play, imagination and interest in various activities (23). However, other studies show a less encouraging picture. For example, in Bulgaria, they found that after the confinement period, children with ASD experienced significantly lower scores on the attention problems scale (17). In addition, a study in Spain revealed that during confinement, many children with ASD maintained stereotypical behaviors, had difficulties in understanding the situation and experienced a decrease in their academic performance (29).

# DISCUSSION

## Main findings

We reviewed the scientific and available evidence on mental health indicators for children with ASD during the COVID 19 pandemic. We identified that, of the 25 included studies, only 3 were designed to compare mental health indicators before and after the pandemic from established cohorts. Some studies report stability or improvement in mental health indicators; however, several factors, such as caregiver stress, low income, and interruption of face-to-face therapies, have been identified as potentially worsening emotional, social, behavioral, and cognitive symptoms in children with ASD during the COVID-19 pandemic.

## Interpretation of Results

The variability of the results reported in the included studies highlights the importance of considering contextual and individual factors in understanding mental health indicators during the COVID-19 pandemic in this population. The results of the study can be understood under Bronfenbrenner's theory, which proposes that human development is influenced by different levels of the environment, from the closest to the individual to the broader and external (37). In this case, the microsystem, mesosystem, exosystem, and macrosystem may have contributed to the experience of children with ASD during the COVID-19 pandemic.

In the microsystem, which comprises the immediate environment where the person interacts directly, such as the family, school, neighborhood, and other close contexts, it is observed that most children with ASD face significant challenges. The main findings highlight that anxiety experienced by mothers can have a direct impact on children's emotional and behavioral well-being (38). In addition, economic problems in the family can generate additional stress in the home, which has a negative impact on the family environment and, consequently, on the mental health of children with ASD (4,39).

In the mesosystem, which encompasses interactions between different microsystems such as home and school, it is recognized that close collaboration between parents, family, and health and education professionals is essential to tailor services and support to the individual needs of each child (40). Given that many children with ASD may require specialized therapies and services, such as speech therapy, occupational therapy, and behavioral therapy, there is a need to find creative and affordable ways to continue to provide these services effectively in times of health crises or other events that disrupt daily life routines (41). Transitioning to online therapies has been a common solution, but this may not be appropriate for all children, as some may need physical contact and direct interaction with therapists to fully benefit from therapy. Therefore, in the mesosystem, it is essential to establish close collaboration between parents, health and education professionals to identify the best intervention strategies for each child. This may involve tailoring online therapies such as empowering parents to actively participate as partners, adjusting the approach according to individual needs, and understanding family dynamics (41,42).

In the exosystem and macrosystem, broader contextual factors, such as government policies and social norms, could also have influenced the experience of children with ASD during the pandemic. Measures of confinement and social distancing, for example, could have limited the availability of services and supports for these children, thus impacting their emotional and behavioral development (4,6).

## Public Health Implications

The results of this scoping review highlight the importance of considering both individual and contextual factors in understanding mental health indicators in this population. This implies designing psychosocial support programs tailored to the specific needs of children with ASD and their

families, as well as strengthening long-term care and follow-up systems to ensure continuous and quality care, even in times of crisis.

In the research domain, it is important for the scientific community to prioritize the establishment of patient follow-up cohorts to better understand the impact of pandemic and other similar events on the development and well-being of children with ASD. This approach will identify long-term trends, evaluate the efficacy of interventions, and provide evidence-based recommendations to inform future policy and practice. While one study was found in Chile that addressed this issue (23), the lack of information in other Latin American and low-income countries highlights the need for further research in these regions to ensure a comprehensive and equitable understanding of the effects of the pandemic on children with ASD and other disabilities.

### **Limitations and conclusions**

The present scoping review faced several limitations that could influence the completeness of the results obtained. It is identified that of the 25 studies reviewed, 23 present a high probability of recall bias that affects the quality of data extracted. This bias may distort the understanding of how the mental health of children with ASD has evolved during the pandemic. On the other hand, although we conducted a thorough search of multiple databases, we did not include regional databases such as Scielo and omitted exploration of the gray literature, which could have provided additional information relevant to the objectives of the review. Furthermore, by restricting the inclusion of studies to those published in Spanish or English, valuable information available in other languages could have been excluded, potentially biasing the results by not fully reflecting the diversity of perspectives and findings at the global level.

Due to the lack of homogeneity in the way results are presented in the studies, it is impossible to consolidate the evidence by means of a systematic review with meta-analysis. In that sense, another limitation of our study lies in the fact that we cannot make definitive conclusions about specific mental health indicators of children with ASD during the pandemic, such as depression, anxiety, stress or communication skills. Despite these limitations, the review provides an overview of the mental health of children with ASD during the COVID-19 pandemic, which can serve as a basis for generating new hypotheses and planning future research.

## **CONCLUSION**

The state of knowledge of mental health indicators in children with ASD during the COVID-19 pandemic is variable and complex, as revealed by the scoping review conducted. Through the analysis of 25 selected studies, a wide spectrum in the results is observed, ranging from stability to variability in emotional, social, behavioral, and cognitive indicators in this population. However, it is important to note that the results of the pre- and post-pandemic comparisons are inconclusive due to methodological limitations in the study designs. Therefore, the implementation of patient follow-up

cohorts, independent of abrupt crises, is required to obtain less biased information and to better understand the long-term impact on the development and well-being of children with ASD.

### **Conflicts of interest**

The author has no conflict of interest associated with the material presented in the manuscript.

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### **Authors contribution**

RCA participated in the conceptualization, drafting and revision of the final version. LLC participated in the data analysis and drafting of the original version. RGA participated in the data analysis, drafting of the original version, and drafting and revision of the final version.

### **Ethical aspects**

Does not apply.

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