Sleep in Children With Neurodevelopmental Disabilities During COVID-19: An Integrative Review

Rebecca Kronk, PhD, MSN, CRNP, FAAN, CNE, ANEF, Inah Kim, PhD, RN, & David Nolfi, MLS, AHIP

Introduction: Sleep issues occur at higher rates in children with neurodevelopmental disorders than in the typical population. Little is known about the impact of COVID-19 on sleep issues in this population

Method: This integrative review aimed to characterize studies during the COVID-19 pandemic (2020−2022) addressing the prevalence and management of sleep issues in children and youth with neurodevelopmental disorders.Comprehensive database searches were used to identify articles, and 31 studies were considered suitable for this review.

Results: Most studies reported worsening sleep disturbances during COVID-19 restrictions. All studies were conducted when clinics were closed; only two studies addressed treatment options such as music therapy and sleep hygiene education and found improvement in sleep issues.

Discussion: Future research needs to concentrate on developing interventions to assist families remotely and empower families with a toolkit of preparedness in times of crisis J Pediatr Health Care. (2022) XX, 1−14

Rebecca Kronk, Professor and Inah Kim, Assistant Professor, School of Nursing, Duquesne University, Pittsburgh, PA

David Nolfi, Head, Research Engagement, Health Science/STEM Initiatives & Assessment Coordinator, Gumberg Library, Duquesne University, Pittsburgh, PA

Conflicts of interest: None to report.

Correspondence: Rebecca Kronk, PhD, MSN, CRNP, FAAN, CNE, ANEF, School of Nursing, Duquesne University, 600 Forbes Ave., Pittsburgh, PA 15282; e-mail: kronkr@duq.edu.

KEY WORDS

INTRODUCTION

A notable COVID-19 outbreak rapidly spread throughout many countries in December 2019; stay-at-home orders were issued to contain the virus in the ensuing months. These lockdown orders persisted for several weeks to months, causing a complete disruption of daily routines in the general population because of working from home, homeschooling, and reduced levels of physical activity and social gatherings (Cheng et al., 2020). During the COVID-19 restrictions, only 4.8% of children and 0.6% of youth met recommended activity guidelines, whereas leisure screen time and social media use were reported as much higher than before the COVID-19 lockdowns (Moore et al., 2021).

Children with neurodevelopmental disorders (NDD) such as autism spectrum disorder (ASD) commonly have difficulties in behavior, communication, and sensory integration (Masi et al., 2017), have high vulnerability to lifestyle changes (Barkley & Fischer, 2011), and often struggle with changes in routines (Touhy & Yazdani, 2018). Children with NDD are also at higher risk for various sleep disturbances (Chen et al., 2021; Esbensen & Schwichtenberg, 2016). According to previous studies, sleep disturbance has been reported in 67.3% of children with ASD (Chen et al., 2021), 28.5% to 44.8% of children with attention deficit hyperactivity disorder (ADHD; Sung et al., 2008), and 24% to 86% of children with intellectual disabilities (Korb et al., 2021). In addition, 35% to 95% of children with NDD reported sleep-related symptoms such as restless sleep, waking very early, and being tired during the daytime, but only 15% of them reported complaints about sleep problems (Ashworth et al., 2013).

Thus, disruption to daily activities, educational routines, and scheduled therapies because of COVID-19 lockdowns may have been a source of stress leading to an exacerbation of sleep problems. Synthesizing information on the impact of COVID-19 restrictions on sleep is crucial to recovering from the pandemic and may also assist in preparing this vulnerable population for future public health stressors. In addition, this information is crucial to providers in addressing parental questions and concerns while providing therapeutic advice.

METHODS

The authors conducted an integrative review following the updated methodology described by Whittemore and Knafl (2005), comprising a five-step process: (1) problem identification, (2) literature search, (3) data evaluation, (4) data analysis, and (5) presentation. The integrative review methodology allows researchers to summarize empirical studies with varied methodologies to better understand a health care phenomenon (Broome, 1993). Although the method explicitly allows for the inclusion of theoretical literature, the authors chose to restrict their analysis to empirical studies.

Problem Identification

Sleep issues occur at higher rates in children with NDD than in the typical population. Little is known about the impact of COVID-19 on sleep issues in this population. This integrative review aimed to characterize empirical studies focused on sleep behaviors in children and youth, aged from birth to 21 years, with NDD during the COVID-19 pandemic (2020–2022).

Literature Search

The authors created comprehensive searches in PubMed, CINAHL, Embase (Embase.com), American Psychological Association PsycINFO (EBSCOhost), and Scopus to identify articles that addressed sleep issues in children with NDD during the COVID-19 pandemic. The search strategy focused on four broad sets of terms, including (1) sleep and sleep disorders, (2) neurodevelopmental disorders, (3) children, and (4) COVID. The search included keywords, database-specific controlled vocabulary terms (e.g., MESH, Emtree, etc.), Boolean operators, and term truncation, as necessary, to maximize search results. When appropriate, controlled vocabulary terms were "exploded," a search process that simultaneously searches for a broad concept such as sleep disorders while searching for a list of specific sleep disorders. To maximize retrieval related to the COVID-19 pandemic, the authors used the Canadian Agency for Drugs and Technologies in Health PubMed and Scopus search strings and adapted the Embase search string, which was written for Ovid. Because the search strings were not written for CINAHL and American Psychological Association PsycINFO, the authors used them as a starting point to develop the COVID searches, substituting appropriate controlled vocabulary from each database (Canadian Agency for Drugs and Technologies in Health, 2022). The searches were finalized and conducted in each database on May 6, 2022, and were limited to English-language articles published in 2020–2022. Interested readers can view the full text of the searches at https://doi.org/10.6084/m9.figshare.20186600.

Inclusion criteria were empirical studies that addressed children with NDD and sleep issues that specifically addressed the COVID-19 pandemic. For this review, children were defined as aged from birth to 21 years because the U.S. Individuals with Disabilities Education Act provides services through 21 years of age (1990). Articles were excluded if they did not describe a study methodology, were not in English, not available in full text, or did not specifically address the impact of the COVID-19 pandemic on sleep in children with NDD.

The Figure shows the steps of the study selection process using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (Moher et al., 2009). The authors used Covidence systematic review management system (https://www.covidence.org/) to collaborate on the review process. Covidence removes duplicate references and enables team members to screen titles and abstracts independently for inclusion and full-text articles for exclusion. When team members' decisions differed, they discussed the studies via live meetings and email to reach a consensus. After completing all these steps, the authors identified 61 studies for full-text review and selected 31 studies for data extraction.
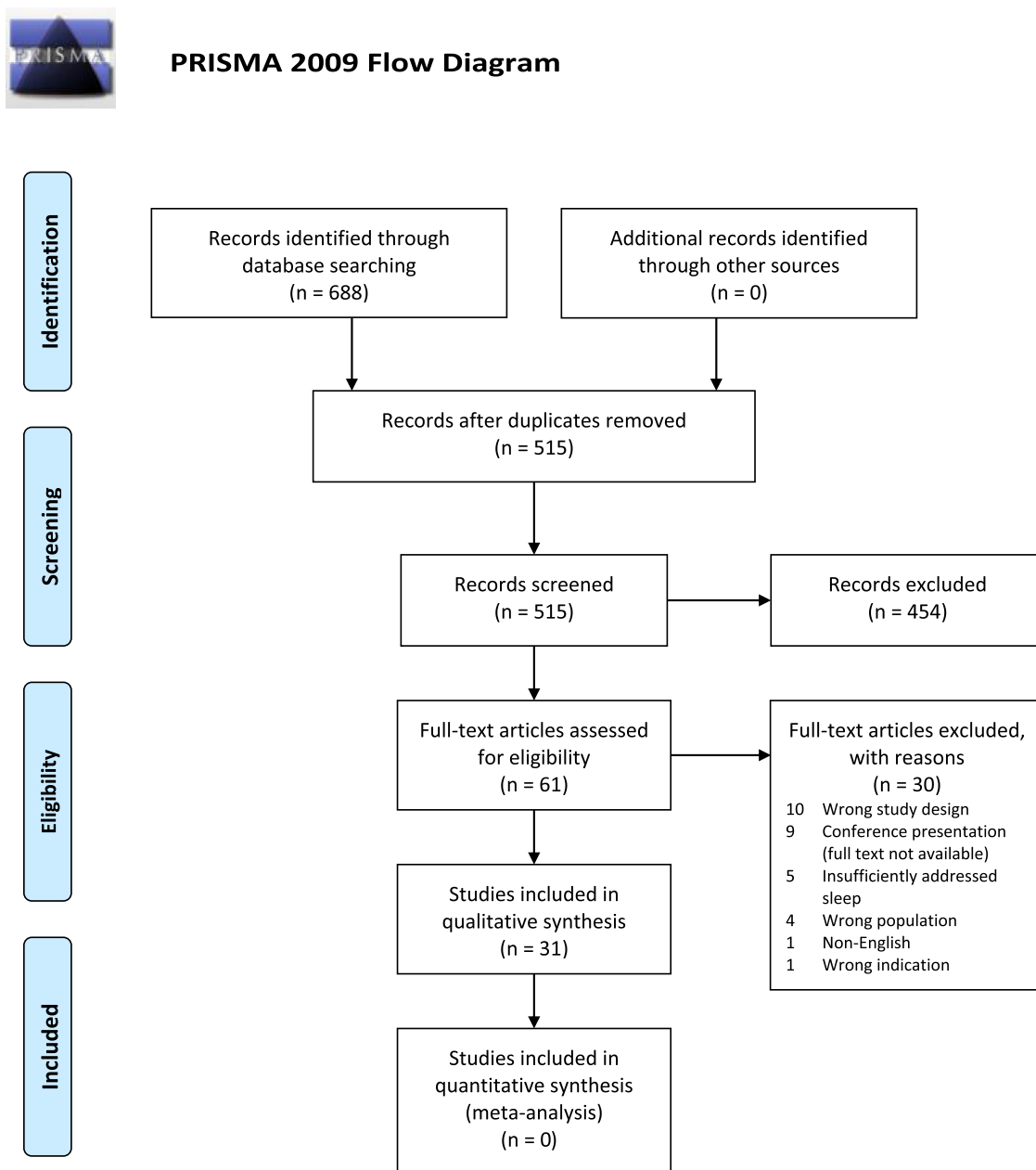
Data Evaluation

Studies were evaluated using the American Association of Critical Care Nurses Evidenced-Level hierarchy (Peterson et al., 2014). This system includes five levels, A through E, and is effective when quantitative and qualitative primary sources are included. Level A is the highest level of evidence and includes meta-analyses and meta-synthesis. Level E is the lowest level and includes case reports and expert opinions. All studies in this review met level C evidence, encompassing qualitative, descriptive, or correlational studies, integrative reviews, systematic reviews, or some randomized controlled trials that bear inconsistent results. Because relatively few empirical studies have been published that address the COVID-19 pandemic's impact on sleep in children with NDD, the authors chose the American Association of Critical Care Nurses hierarchy as the most appropriate method to evaluate the overall quality of studies. Evaluation methods also included ensuring that the studies fully addressed the research question and specific research method. The authors chose to eliminate case studies, which they concluded provided minimal evidence that could be used to address the research question.

Data Analysis and Presentation

The authors constructed a matrix table to capture study characteristics, including setting/country purpose, research design,

FIGURE. Preferred Reporting Items For Systematic Reviews and Meta-Analyses flow diagram. Moher et al. (2009). This figure appears in color online at www.jpedhc.org.

PRISMA 2009 Flow Diagram

Identification

Records identified through database searching
(n = 688)

Additional records identified through other sources
(n = 0)

Screening

Records after duplicates removed
(n = 515)

Records screened
(n = 515)

Records excluded
(n = 454)

Eligibility

Full-text articles assessed for eligibility
(n = 61)

Full-text articles excluded, with reasons
(n = 30)
- 10 Wrong study design
- 9 Conference presentation (full text not available)
- 5 Insufficiently addressed sleep
- 4 Wrong population
- 1 Non-English
- 1 Wrong indication

Included

Studies included in qualitative synthesis
(n = 31)

Studies included in quantitative synthesis (meta-analysis)
(n = 0)

period, sample size and characteristics, and measurements/instruments. After extracting the data from the matrix, the authors reviewed it for accuracy and completeness. The authors then thematically analyzed the results matrix to find their commonalities and differences.

RESULTS
Samples
All 31 studies focused on children and youth with NDD, grouped or separated into specific populations. Twelve studies (39%) focused solely on ASD, whereas six (19%) enrolled participants with ADHD only. One study compared these two sample populations. Nine studies (29%) enrolled participants with neurodevelopmental disorders, including ASD, ADHD, learning disabilities, cerebral palsy (CP), or other physical, sensory, neurological, or cognitive diagnoses. Three individual publications emerged for CP, epilepsy, and fragile X syndrome. See Table 1 for sample sizes.

Outcome Measures
Each of the 31 studies examined sleep in various ways. Six validated sleep instruments were employed in 11 quantitative

TABLE 1. Summary of included studies

Author (year), country	Purpose	Design	Period	Sample	Measurements
Becker et al. (2021), United States	To examine changes in adolescent sleep before and during the COVID-19 pandemic in adolescents with and without ADHD	Prospective	From September 2019 to February 2020 and from May to June 2020	122 adolescents aged 15−17 years with and without ADHD	SHQ, SDSC, COVID-19 Adolescent Symptom and Psychological Experience Questionnaire, Coronavirus Health Impact Survey
Berard et al. (2021), France	To examine the impact of COVID-19 containment and mitigation efforts on behaviors, communication, sleep, and nutrition	Cross-sectional, descriptive	April−May 2020	229 ASD children and youth part of the ELENA cohort aged 2−21 years	A four-part COVID-19 parent structured questionnaire, VABS-II, CSS of the ADOS-2
Bıyık et al. (2021), Turkey	To investigate the effects of the COVID-19 pandemic on body structures and functions, activity and participation levels, and environmental factors of children with CP	Prospective	May to June 2020	103 children with CP aged 2−18 years	COVID-19 stay-at-home cerebral palsy parental questionnaire, GMFCS-FR
Bompard et al. (2021), Italy	To investigate the feasibility and impact of a home-based music therapy program to sustain children with developmental disorders secondary to neurological diseases and their parents	Prospective, monocentric, noncontrolled pilot	May to March 2020	12 children with developmental delay	GMFCS, SDSC, PSI-SF
Bruni et al. (2021a), Italy	To evaluate different responses in two clinical conditions, ASD and ADHD, regarding sleep patterns and disturbances	Descriptive	May to June 2020	Parents of 100 ASD, 236 ADHD patients, and 340 healthy controls aged 4−18 years	A modified version of the SDSC
Bruni et al. (2021b), Italy	To examine the impact of home confinement (lockdown) because of the COVID-19 pandemic on the sleep patterns of children and adolescents with ADHD	Descriptive	June 2020	992 children with ADHD, aged 5−17 years	A modified version of the SDSC
Bruni et al. (2022), Italy	To evaluate the impact of the lockdown on sleep patterns and sleep disturbances with respect to the preceding conditions in children and adolescents with ASD	Descriptive	May to June 2020	111 participants with ASD, aged 1−18 years	A modified version of the Sleep Disturbance Scale for Children (SDSC)
Çetin et al. (2020), Turkey	To investigate the relationship between chronotype preference/sleep problems and symptom severity of children with ADHD and to assess the chronotype preference/sleep problems that may playa mediating role in the relationship between the reactions to trauma and the severity of ADHD symptoms	Cross-sectional	May 2020	76 children with ADHD, aged 8−12 years	CRIES-8, CSHQ, CCQ, T-DSM-IV-S

TABLE 1. (*Continued*)

Author (year), country	Purpose	Design	Period	Sample	Measurements
Conti et al. (2020), Italy	To investigate lockdown-related emotional and behavioral changes in the pediatric neuropsychiatric population	Observational, longitudinal	Prepandemic September 2019 and February 2020; pandemic collection from April to May 2020	141 children with neuropsychiatric disorders aged 1.5−18 years	General questionnaire, CBCL
Di Giorgio et al. (2021), Italy	To investigate how the lockdown impacted children with FXS	Descriptive	April−May 2020	53 children with FXS, aged 3−16 years	Ad hoc survey questions about children's sleep habits, CAPES-DD
Dondi et al. (2021), Italy	To evaluate the effects of COVID-19 quarantine on sleep quality as an indicator of psychological well-being among children and adolescents	Cross-sectional	September−October 2020	6,210 children aged 0−18 years, including children affected with specific learning disabilities, ASD, other disabilities, chronic diseases, and multiple conditions	78-question web-based survey
Garcia et al. (2021), United States	To examine changes in physical activity, screen time, and sleep in adolescents with ASD because of the COVID-19 pandemic	Observational	April 2020	Nine students with ASD, aged 16.87 ± 1.36 years	A survey measuring physical activity, screen time, and sleep duration before and during the pandemic
Guller et al. (2021), Turkey	To investigate the emotional and behavioral responses of children with neurodevelopmental disorders and their parents during the recent novel coronavirus disease (COVID-19) pandemic and the associated factors	Cross-sectional	April 2020	299 children and adolescents with neurodevelopmental disorders aged 2−18 years	Sociodemographic form and COVID-19 pandemic-related characteristics, HADS
Huang et al. (2021), China	To investigate the impact of the COVID-19 pandemic on ASD children and their families	Cross-sectional	May 2020	406 children with ASD, mean age 4.6 years ($SD = 2.3$)	4-part online survey with some questions specific to sleep, SAS for parent anxiety
Lugo-Marín et al., (2021), Spain	To study the psychological impact of the lockdown because of the social emergency (COVID-19) in children/adolescents and adults diagnosed with ASD	Not specified	8 weeks after lockdown	The sample was subdivided into two ASD groups, 37 children and adolescents (aged 3−17 years and 11 months), and 35 adults (aged $\geq$ 18 years)	CBCL, Symptom Checklist 90 revised (SCL-90) for adults

TABLE 1. (*Continued*)

Author (year), country	Purpose	Design	Period	Sample	Measurements
Masi et al. (2021), Australia	To examine the impact of the COVID-19 pandemic on child mental health and socioemotional and physical well-being (including sleep, diet, exercise, use of electronic media; caregiver perceptions of symptoms of child NDD and comorbidities), and caregiver mental health and well-being, social support and service use	Cross-sectional	May—June 2020	302 caregivers of children with neurodevelopmental disabilities aged 2—17 years	Child symptom severity and well-being, parent well-being, and service access and satisfaction questionnaire
Mete Yesil et al. (2022) Turkey	To explore how the lives of children with special needs and their families were affected by the COVID-19 pandemic	Descriptive	Enrolled in April 2020 (approximately 6 weeks after the lockdown)	117 children with DD, ASD, hearing or language impairments, and receiving special education, aged 4—6 years	Five-part questionnaire focusing on the amount of change caused by the COVID-19 pandemic on feeding, toilet habits, daily routines, development, physical activities, daily activities, one-on-one time durations with parents, screen time, and whether and how much they performed and maintained their previous educator-provided special education at home were collected using
Micheletti et al. (2021) Argentina	To define the frequency and types of sleep problems in a sample of children with DDs, determine the proportion of pediatricians who addressed such difficulties, assess the effects of SH, and describe the impact of the COVID-19 pandemic on sleep	Quasi-experimental	May 2020	161 children with DDs, ages 1—6 years, who attended clinic visits between July 2019 and March 2020 with follow-up before July 2020	Children's Sleep Habits Questionnaire, Spanish version (CSHQ-S), completed before and after interventions
Moore et al. (2021) Canada	To assess parent-perceived changes in physical activity, sedentary behavior, and sleep quality and quantity because of COVID-19 restrictions	Not specified	April and May 2020	151 children with disabilities aged 4—17 years	Online survey adapted from the Canadian Health Measures Survey, amended version of the 2020 COVID-19 and Childhood Movement behaviors survey
Mutluer et al. (2020), Turkey	To investigate how individuals with ASD responded to COVID-19 regarding their comprehension and adherence to implemented measures, changes in their behavioral problems, and how their caregivers' anxiety levels relate to these behavioral changes	Not specified	During the last 1-month, COVID-19 measures were implemented	87 individuals with ASD, mean age 13.96 ± 6.1, and age range of 3—29 years	ABC, PSQI, BAI

(*continued on next page*)

TABLE 1. (*Continued*)

Author (year), country	Purpose	Design	Period	Sample	Measurements
Navarro-Soria et al. (2021), Spain	To evaluate the consequences of the lockdown in children and teenagers diagnosed with ADHD, sleep-related problems, and problems with executive functions	Associative-comparative and explanatory	April 2020	234 children divided into two groups, confined ADHD and confined non-ADHD, aged 6–18 years	STAIC self-assessment questionnaire, BEARS sleep-screening tool for sleep disorders in childhood, BDEFS- CA, short form
Nithya et al. (2021), India	To systematically assess the impact of the COVID-19 pandemic on ADL, play, and sensory behaviors of children with ASD	Cross-sectional	Approved January 2021. performed for 1 month	100 children with ASD, ages 2 to above 10 years	A structured ADL, play, and sensory behavior questionnaire (45 items)
Polónyiová et al. (2022), Slovakia	To explore how the first and second waves of the COVID-19 outbreak affected the mental health of families in Slovakia, focusing on comparing families with autistic children to a general sample. Focused on the prevalence of depression, anxiety, and stress symptoms among the parents and maladaptive behavior or sleep disturbances of their children and their correlations	Not specified	First wave from June to July 2020, and second wave from November to December 2020	332 caregivers, 155 having children with ASD (179 surveyed during the first wave and 153 during the second wave)	DASS-42 subscales of Vineland-3 questionnaire
Rabbani et al. (2021), Bangladesh	To evaluate behavioral patterns of risk and resilience for children with ASD	Longitudinal	November 2019–November 2020	150 children with ASD, aged 2–9 years	Two mCARE tools assessed 30 behavioral parameters
Rosenthal et al. (2022), United States	To examine the impact of COVID-19 on youth with ADHD during two stages of the pandemic	Longitudinal	May 2020 and March 2021	620 youth with ADHD and 614 individually matched controls participating in the ABCD study	Prepandemic functioning: KSADS-5, ABCD PMP, ABCD PMQ, ABCD SRPF Pandemic functioning: COVID RRR CSHQ
Scarselli et al. (2022), Italy	To study the change in sleep habits of children with ASD during the COVID-19 pandemic	Not specified	April–June 2020	28 children with ASD, aged 2–6 years	
Swansburg et al. (2021), Canada	To understand the impact of the COVID-19 pandemic on lifestyle habits, mental health symptoms, and ADHD behaviors in children with ADHD	Not specified	May to June 2020	587 children with ADHD, aged 5–18 years	Survey with lifestyle questions; PHQ-9, GAD-7, SNAP-IV
Tokatly Latzer et al. (2021), Israel	To explore and characterize in depth the experiences of parents and children with autism who have been going through the COVID-19 lockdown	Qualitative	April 2020	25 children with autism, aged 4–6 years	Semistructured telephone interviews

ARTICLE IN PRESS

TABLE 1. (*Continued*)

Author (year), country	Purpose	Design	Period	Sample	Measurements
Trivisano et al. (2020), Italy	To assess how the COVID-19 pandemic has affected children with epilepsy	Not specified	May 2020	3,321 responses to the survey (96.6% caregivers of patients aged 0 to > 18 years), 59.7% of patients had an intellectual disability, and 44.3% had behavioral disturbances	45-item questionnaire
Türkoğlu et al. (2020), Turkey	To investigate the relationship between chronotype preference/ sleep problems and symptom severity of children with ASD during the confinement and social isolation of the COVID-19 outbreak	Not specified	May 2020	46 drug-naive children with ASD, aged 4−17 years	AuBC, CSHQ, and CCQ
Ueda et al. (2021), Japan	To evaluate how the QOL of children and their parents has been affected by changes in the sleep cycles of children with NDDs and stresses caused by mothers' work patterns during the COVID-19 pandemic	Not specified	April−May 2020	136 school-age children with IDD, mean age 10.6 ± 2.6	CBCL, WISC-IV, WHO-QOL-BREF, CES-D, STAI, PSI

Note. ABC, aberrant behavior checklist; ABCD, Adolescent Brain Cognitive Development study; ADHD, attention deficit hyperactivity disorder; ADL, activities of daily living; ADOS-2, Autism Diagnostic Observation Schedule-2; ASD, autism spectrum disorder; AuBC, autism behavior checklist; BAI, Beck Anxiety Inventory; BDEFS-CA, Barkley Deficits in Executive Functioning Scale—Children and Adolescents; CAPES-DD, Child Adjustment and Parent Efficacy Scale-Developmental Disability; CBCL, Child Behavior Checklist; CCQ, Children's Chronotype Questionnaire; CES-D, Center for Epidemiologic Studies Depression scale; CP, cerebral palsy; CRIES-8, Children's Impact of Event Scale;

CSHQ, Children's Sleep Habits Questionnaire; CSS, calibrated severity score; DASS-42, Depression Anxiety and Stress Scale; DD, developmental disorders; FXS, fragile X syndrome;

GAD-7, generalized anxiety disorder 7; GMFCS, Gross Motor Function Classification System; GMFCS-FR, Gross Motor Function Classification System Family Report; HADS, Hospital anxiety and depression scale; KSADS-5, kiddie schedule for affective disorders and schizophrenia for DSM-5; NDD, neurodevelopmental disorders; PHQ-9, Patient Health Questionnaire 9;

PMQ, parental monitoring survey; PSI, Parental Stress Index; QOL, quality of life; PMP, parent medications survey inventory modified from PhenX; PSI-SF, Parent Stress Index-short form

PSQI, Pittsburgh Sleep Quality Index; RRR, rapid response research survey; SAS, Self-Rating Anxiety Scale; SDSC, Sleep Disturbance Scale for Children; SH, sleep hygiene; SHQ, Sleep Health Questionnaire; SNAP-IV, Swanson, Nolan, and Pelham Teacher and Parent Rating Scale; SRPF, School Risk and Protective Factors Survey; STAI, State-Trait Anxiety Inventory; STAIC, State-Trait Anxiety Inventory for Children; T-DSM-IV-S, Turgay DSM-IV Disruptive Behavior Disorders Rating Scale; VABS-II, Vineland Adaptive Behavior Scales, second edition; WHO-QOL-BREF, World Health Organization quality of life; WISC-IV, Wechsler Intelligence Scale for Children (fourth edition).

studies. These tools included: the Sleep Habits Survey (Wolfson et al., 2003), original or modified versions of the Sleep Disturbance Scale for Children (SDSC; Bruni et al., 1996), Children's Sleep Habits Questionnaire (CSHQ; Owens et al., 2000), Children's Chronotype Questionnaire (CCQ; Zavada et al., 2005), Pittsburgh Sleep Quality (Buysse et al., 1989), or BEARS sleep-screening tool (Owens & Dalzell, 2005). Four studies assessed sleep using components of validated behavior assessment tools such as the Child Behavior Checklist (Achenbach & Edelbrock, 1991), Vineland Adaptive Behavior Scale (Sparrow & Cicchetti, 1989), Canadian Health Measures Survey (adapted version; Tremblay et al., 2007), Patient Health Questionnaire (Spitzer et al., 1999), and the COVID-19 Stay-at-Home Cerebral Palsy Parental Questionnaire (Bıyık et al., 2021). The remainder of the quantitative studies included ad hoc sleep questions in surveys or study-specific instruments (e.g., mCare tools). The one qualitative study employed a semistructured phone interview (Tokatly Latzer et al., 2021).

Findings

Findings are grouped by sample types and data collection measures.

ASD, ADHD, and controls: Validated sleep tool

During the lockdown, one study examined all 3 groups using the SDSC (Bruni et al., 2021a). Children with ADHD demonstrated later bedtime and rise time than those with ASD or controls. Both clinical groups significantly demonstrated a reduced sleep duration compared with controls. These two groups also had an increase in hypnic jerks, rhythmic movement disorders, night awakenings, restless sleep, sleepwalking, and daytime sleepiness over the control group. All groups had increased anxiety at bedtime, difficulties falling asleep, and daytime sleepiness.

ASD: Validated sleep tools

Using the SDSC, one study found a significant increase in sleep disturbances, difficulty falling asleep, anxiety at bedtime, sleep terrors, and daytime sleepiness (Bompard et al., 2021). Parents reported the following factors impacting their child's sleep: lack of obliged rise time, lack of sports activities, increased screen time, more time spent with family, and changes in routine (Bompard et al., 2021). A Pittsburgh Sleep Quality study reported significant changes in sleep disturbance, duration, and quality during the pandemic (Mutluer et al., 2020). Parents who were asked to complete one copy of the CSHQ with reference to behaviors during the pandemic and one copy with reference to prepandemic behaviors reported that 89.3% of children had clinically significant sleep disturbances during the pandemic (Scarselli et al., 2022). However, these parents reported that sleep disturbances present before the pandemic either did not change or improve (Scarselli et al., 2022). Employing both the CSHQ and CCQ, researchers reported that children with ASD had significantly greater sleep problems and chronotype score (eveningness) during home confinement, and

sleep problems mediated the relationship between chronotype score and severity of autism symptoms (Türkoğlu et al., 2020).

ASD: Surveys

When parents were asked to rate changes in their child's sleep during the pandemic, most respondents reported no change in sleep (55.5%), but when a change was reported, it was perceived as worsening (Berard et al., 2021). These authors also performed a multivariate analysis that revealed that a higher Autism Diagnostic Observation Schedule-2 score was associated with a decreased probability of improvement in sleep, and belonging to a single-parent home was associated with worsening sleep (Berard et al., 2021). An observational study of nine adolescents with ASD found that while sleep and wake times may have shifted, there were no reported differences in sleep duration prepandemic or during the pandemic (Garcia et al., 2021). A larger survey discovered that half the parents reported sleep problems in their children and reduced outdoor activity. These families also reported a lack of professional support during the pandemic (Huang et al., 2021). Similar findings were reported in Spain, in which 56% of caregivers reported sleep quality worsened in their children with ASD (Lugo-Marín et al., 2021). A parent survey that focused on activities of daily living, play, and sensory behaviors identified 67% of the sample as having inconsistent sleep routines; the occupation of homemaker was 2.51 times more likely to report difficulty in managing their child's sleep schedule (Nithya et al., 2021). When comparing children with ASD to a control group, children with ASD demonstrated a significantly later bedtime, but as the COVID-19 lockdown progressed, sleep routines partially returned to pre-COVID-19 condition (Polónyiová et al., 2022).

ASD: Study-specific tools

A longitudinal study that used two mCare tools to gather pre-lockdown, lockdown, and post-lockdown information on 30 behavioral parameters found four behaviors (i.e., aggression, lack of concentration, pain sensitivity, sleep problems) were negatively impacted during the lockdown (Rabbani et al., 2021).

ASD: Qualitative

Through a semistructured phone interview, researchers found sleep to be a common topic. Challenges were shared about children with ASD having difficulties falling asleep, frequent awakenings, or night terrors. The situation was compounded by closed outpatient clinics; some parents explored new ways to deal with their child's sleep issues (e.g., obtaining melatonin from another country; Tokatly Latzer et al., 2021).

ADHD: Validated sleep tools

In a prospective study, parents completed the Sleep Habits Survey and adolescents with ADHD completed the SDSC; findings indicated shifts in sleep/wake schedules and longer

sleep duration with clinically elevated rates of difficulties initiating and maintaining sleep; more worried/afraid effect, and less time outdoors correlated with more delayed sleep/wake behaviors (Becker et al., 2021). In a large sample of children and adolescents with ADHD, a modified version of the SDSC showed that the imposed COVID-19 lockdown affected sleep-wake rhythm dramatically from previous bedtime behaviors. These changes were associated with increased screen time (Bruni et al., 2021b). One study that used both the CSHQ and CCQ along with the perception of trauma found eveningness chronotypes exhibited higher trauma symptoms and sleep problems, higher trauma scores were associated with higher chronotype scores, sleep problems, and oppositional defiant disorder symptoms, sleep levels mediated the relationship between trauma and oppositional defiant disorder symptoms, and sleep levels mediated the relationship between trauma and chronotype scores (Çetin et al., 2020). When comparing children and adolescents with and without ADHD, those with ADHD were more negatively affected by the lockdown and had higher reported sleep problems, anxiety, and executive function issues (Navarro-Soria et al., 2021).

ADHD: Surveys

The Adolescent Brain and Cognitive Development Study compared youth with ADHD and matched controls without ADHD and found 1 year into the pandemic that youth with ADHD exhibited greater sleep problems with medium effect sizes (d = −0.52); the combined main effects of ADHD medication, ADHD diagnostic status, and screen time were significant predictors of sleep problems (Rosenthal et al., 2022). In a study investigating lifestyle behaviors in children with ADHD during the pandemic, these youth showed worsening changes in sleep, eating, screen time, and exercise with reported correlations to depression, anxiety, and ADHD symptoms (Swansburg et al., 2021).

Neurodevelopmental groups: Validated sleep tools

A prospective noncontrolled pilot study using the SDSC investigated the impact of a home-based music therapy intervention and observed significant improvements in sleep quality and reduction of parental stress in a cohort of children with developmental delay (Bompard et al., 2021). A quasi-experimental study using the CSHQ-S before and after pediatricians addressed sleep hygiene found half of the children with developmental delay had sleep problems that worsened during the pandemic, insomnia being most prevalent; pediatricians addressed sleep hygiene in only 45% of cases, but the intervention was found to be beneficial for most cases (Micheletti et al., 2021).

Neurodevelopmental groups: Surveys

The Child Behavior Checklist subscale for sleep problems revealed a clinically worsening condition during the pandemic in younger children with neurological and/or psychiatric disorders (Conti et al., 2020). A large web-based survey examined sleep disorders in children aged < 18 years,

including those with disabilities, ASD, chronic disorders, and specific learning disabilities; results indicated more difficulties falling asleep, staying asleep, and increased frequency of nightmares and/or sleep terrors with additional analyses identifying multiple risk factors (Dondi et al., 2021). Delayed sleep phase and dyssomnia were the most frequently reported sleep problems in a survey investigating emotional and behavioral responses of children with neurodevelopmental disorders to the pandemic (Guller et al., 2021). Two similarly designed studies reported reduced sleep quality and worsening sleep in children with neurodevelopmental disabilities and comorbidities (Masi et al., 2021; Mete Yesil et al., 2022). The National Physical Activity Measurement Study surveyed parents of children and youth with developmental, physical, and/or sensory type of disabilities and reported a slight increase in sleep quantity, and parent capacity and opportunity to support a child's sleep was associated with better sleep quality (Moore et al., 2021). Worsening sleep patterns in children with neurodevelopmental disorders was one of several factors associated with low quality of life for both parents and children during COVID-19 (Ueda et al., 2021).

Specific conditions: Surveys

A prospective investigation on the functional health status of children with CP reported that 17.5% experienced a decrease in sleep duration, whereas 25.2% experienced an increase in sleep duration (Bıyık et al., 2021). Children with fragile X syndrome demonstrated significant sleep changes during the lockdown, including difficulties falling asleep, longer falling asleep time, and frequency of night awakenings (Di Giorgio et al., 2021). During the lockdown, sleep disorders worsened by 17 %, with 2.2% needing pharmacological treatment (Trivisano et al., 2020).

DISCUSSION

The impact of the COVID-19 pandemic and subsequent lockdowns was a universal phenomenon. The studies selected in this review represented various countries that experienced similar restrictions. Although studies varied in the number of participants, tools used to measure changes in sleep, and study design, all participant sampling focused on children with NDD. A common hypothesis among the studies was that children with NDD have higher rates of reported sleep problems at the most typical times.

All but two studies that enrolled ASD participants reported worsening sleep behaviors. A noted difference between the two studies was the sample size. Scarselli et al. (2022) had 28 participants who had clinically significant sleep problems before the pandemic and reported that sleep problems either did not change or improved. Garcia et al. (2021) enrolled nine participants and reported no changes in sleep duration but only shifts in sleep times.

Several studies with ASD participants investigated correlations with sleep. Children with higher Autism Diagnostic Observation Schedule-2 scores, belonging to single-parent households, the occupation of homemakers, and less time

outdoors was associated with worsened sleep (Berard et al., 2021; Huang et al., 2021; Nithya et al., 2021).

All studies with ADHD participants reported consistent worsening sleep problems and other behavioral changes. Predictors of sleep quality in this population included ADHD medication, diagnostic status, and screen time (Rosenthal et al., 2022). Screen time also affected sleep-wake rhythms (Bruni et al., 2021b). Worsening changes in several lifestyle behaviors, including sleep, were associated with anxiety, depression, and ADHD symptoms (Swansburg et al., 2021). Sleep was also a mediator of behavior and perception of trauma during COVID-19 (Çetin et al., 2020).

Only two studies addressed treatment options for children with developmental delays and saw improvements in addressing sleep issues (Bompard et al., 2021; Micheletti et al., 2021). All studies included in this review were conducted when clinics were closed, and behavioral support and treatment options were minimally available. Without treatment options, the quality of life for families was challenged (Ueda et al., 2021).

Overall, this integrative review uncovered a trend toward worsening sleep problems in a sample of international studies focusing on children with NDD. These studies underscored that sleep behaviors rarely occur in isolation but can predict, mediate, or be associated with other personal or environmental factors. All studies included in this review measured sleep using subjective instruments. Strong evidence supports the use of actigraphy to objectively monitor and track sleep in children with neurodevelopment disorders (Alder et al., 2020; Yavuz-Kodat et al., 2019). The actigraph device measures sleep in-home setting and are considered an objective method for measuring sleep onset, sleep-wake patterns, and sleep duration. Future studies should consider this method to provide objective and detailed data to obtain valuable information about this population. Future research will also need to develop interventions that consider personal or environmental factors to assist families during periods of isolation and when clinical support are lacking. It would behoove clinicians to assimilate techniques that easily transfer to home-based interventions and that can empower families with a toolkit of preparedness in times of crises.

The authors would like to add one final note. Providing in-depth assessment and treatment options for sleep problems in children with NDD is beyond the scope of this integrative review. Comprehensive practice guidelines for treating insomnia and disrupted sleep in ASD have been developed by a subcommittee of the American Academy of Neurology (Williams Buckley et al., 2020). These guidelines

---

TABLE 2. Validated sleep assessment tools often used in children with NDD

Screening tool	Description	Reference
BEARS	BEARS is divided into 5 major sleep domains (B = Bedtime Issues, E = Excessive Daytime Sleepiness, A = Night Awakenings, R = Regularity and Duration of Sleep, S = Snoring). Each sleep domain has a set of age-appropriate "trigger questions" for use in the clinical interview	Owens and Dalzell (2005)
CSHQ	The 33-item scale consists of eight subscales: (1) Bedtime Resistance; (2) Sleep Onset Delay; (3) Sleep Duration; (4) Sleep Anxiety; (5) Night Wakings; (6) parasomnias; (7) Sleep-Disordered Breathing; and (8) Daytime Sleepiness	Owens et al. (2000)
FISH	The 22-item scale gathers comprehensive sleep habits information about daytime habits, prebedtime habits, presence of a bedtime routine, sleep environment, and parental behaviors surrounding bedtime	Malow et al. (2009)
MSPSQ	Fifty-one items are structured in two parts: Part 1 targets sleep quantity and quality, and Part 2 targets specific sleep disorders. The 36 items scored on a Likert scale pertain to six common sleep problem categories: bedtime resistance/struggles, sleep onset delay, parasomnias, sleep-disordered breathing, sleep anxiety, and daytime sleepiness	Simonds and Parraga (1982)
Sleep diaries	Various diaries are available to record information on a nightly basis. Preferred measurement for more detailed assessment of sleep-wake rhythms. Highly correlated to actigraphy for monitoring sleep schedule	Sadeh (2008)
Sleep Disturbance Scale for Children	26 Likert-type items were divided into six categories items into six categories: disorders of initiating and maintaining sleep, sleep breathing disorders, disorders of arousal/nightmares, sleep-wake transition disorders, disorders of excessive somnolence, and sleep hyperhidrosis (nighttime sweating)	Bruni et al. (1996)

Note. CSHQ, Children's Sleep Habits Questionnaire; FISH, family inventory of sleep habits; MSPSQ, Modified Simonds and Parraga Sleep Questionnaire; SDSC, Sleep Disturbance Scale for Children. Additional resources: Autism Treatment Network (2010), Mindell and Owens (2015) and Accardo (2018).

---

provide evidenced-based recommendations for both non-pharmacologic and pharmacological treatment options. We encourage clinicians to refer to these guidelines and develop their sleep assessment and treatment toolkit on the basis of the unique needs of their practice population. Because the first crucial step to effectively addressing sleep problems is gaining a thorough understanding of the scope and characteristics of the chief concerns, we offer Table 2, which includes a summary of validated sleep assessment tools and additional resources for ease of reference.

REFERENCES

Accardo, J. A.(Ed.). (Ed.). (2018). *Sleep in children with neurodevelopmental disabilities: An evidence-based guide*. Springer.

Achenbach, T. M., & Edelbrock, C. (1991). *The child behavior checklist manual*. The University of Vermont.

Alder, M. L., Ye, F., Run, F., Bagai, K., Fawkes, D. B., Peterson, B. T., & Malow, B. A. (2020). Application of a novel actigraphy algorithm to detect movement and sleep/wake patterns in children with autism spectrum disorder. *Sleep Medicine*, 71, 28–34.

Autism Treatment Network. (2010). Sleep Toolkit. https://holland bloorview.ca/sites/default/files/migrate/files/ATNAIRPPhysicia nASDSleepToolkitHandout.pdf.

Ashworth, A., Hill, C. M., Karmiloff-Smith, A., & Dimitriou, D. (2013). Cross syndrome comparison of sleep problems in children with Down syndrome and Williams syndrome. *Research in Developmental Disabilities,*, 34(5), 1572–1580.

Barkley, R. A., & Fischer, M. (2011). Predicting impairment in major life activities and occupational functioning in hyperactive children as adults: Self-reported executive function (EF) deficits versus EF tests. *Developmental Neuropsychology*, 36(2), 137–161.

Becker, S. P., Dvorsky, M. R., Breaux, R., Cusick, C. N., Taylor, K. P., & Langberg, J. M. (2021). Prospective examination of adolescent sleep patterns and behaviors before and during COVID-19. *Sleep*, 44(8), zsab054.

Berard, M., Rattaz, C., Peries, M., Loubersac, J., Munir, K., & Baghdadli, A. (2021). Impact of containment and mitigation measures on children and youth with ASD during the COVID-19 pandemic: Report from the ELENA cohort. *Journal of Psychiatric Research*, 137, 73–80.

Bıyık, K. S., Özal, C., Tunçdemir, M., Ünes, S., Delioğlu, K., & Günel, M. K. (2021). The functional health status of children with cerebral palsy during the COVID-19 pandemic stay-at-home period: A parental perspective. *Turkish Journal of Pediatrics*, 63(2), 223–236.

Bompard, S., Liuzzi, T., Staccioli, S., D'Arienzo, F., Khosravi, S., Giuliani, R., & Castelli, E. (2021). Home-based music therapy for children with developmental disorders during the COVID-19 pandemic. *Journal of Telemedicine and Telecare*. doi:10.1177/1357633X20981213.

Broome, M. E. (1993). Integrative literature reviews for the development of concepts. In RodgersB. L. , & K. A. Knafl (Eds.), *Concept development in nursing* (2nd ed.). (pp. 231−250). W. B. Saunders.

Bruni, O., Breda, M., Ferri, R., & Melegari, M. G. (2021a). Changes in sleep patterns and disorders in children and adolescents with attention deficit hyperactivity disorders and autism spectrum disorders during the COVID-19 lockdown. *Brain Sciences*, 11(9), 1139.

Bruni, O., Giallonardo, M., Sacco, R., Ferri, R., & Melegari, M. G. (2021b). The impact of lockdown on sleep patterns of children and adolescents with ADHD. *Journal of Clinical Sleep Medicine*, 17(9), 1759–1765.

Bruni, O., Melegari, M. G., Breda, M., Cedrone, A., Finotti, E., Malorgio, E., Doria, M., & Ferri, R. (2022). Impact of COVID-19 lockdown on sleep in children with autism spectrum disorders. *Journal of Clinical Sleep Medicine*, 18(1), 137–143.

Bruni, O., Ottaviano, S., Guidetti, V., Romoli, M., Innocenzi, M., Cortesi, F., & Giannotti, F. (1996). The Sleep Disturbance Scale for Children (SDSC). Construction and validation of an instrument to evaluate sleep disturbances in childhood and adolescence. *Journal of Sleep Research*, 5(4), 251–261.

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213.

Canadian Agency for Drugs and Technologies in Health. (2022). CADTH COVID-19 search strings. https://covid.cadth.ca/litera ture-searching-tools/cadth-covid-19-search-strings/.

Çetin, F. H., Uçar, H. N., Türkoğlu, S., Kahraman, E. M., Kuz, M., & Güleç, A. (2020). Chronotypes and trauma reactions in children with ADHD in home confinement of COVID-19: Full mediation effect of sleep problems. *Chronobiology International*, 37(8), 1214–1222.

Chen, H., Yang, T., Chen, J., Chen, L., Dai, Y., Zhang, J., Li, L., Jia, F., Wu, L., Hao, Y., Ke, X., Yi, M., Hong, Q., Chen, J., Fang, S., Wang, Y., Wang, Q., Jin, C., & Li, T. (2021). Sleep problems in children with autism spectrum disorder: A multicenter survey. *BMC Psychiatry*, 21(1), 406.

Cheng, C., Barceló, J., Hartnett, A. S., Kubinec, R., & Messerschmidt, L. (2020). COVID-19 Government Response Event Dataset (CoronaNet v.1.0). *Nature Human Behaviour*, 4 (7), 756–768.

Conti, E., Sgandurra, G., De Nicola, G., Biagioni, T., Boldrini, S., Bonaventura, E., Buchignani, B., Della Vecchia, S., Falcone, F., Fedi, C., Gazzillo, M., Marinella, G., Mazzullo, C., Micomonaco, J., Pantalone, G., Salvati, A., Sesso, G., Simonelli, V., Tolomei, G., & Battini, R. (2020). Behavioural and emotional changes during COVID-19 lockdown in an Italian paediatric population with neurologic and psychiatric disorders. *Brain Sciences*, 10(12), 1–15.

Di Giorgio, E., Polli, R., Lunghi, M., & Murgia, A. (2021). Impact of the COVID-19 Italian lockdown on the physiological and psychological well-being of children with fragile X syndrome and their families. *International Journal of Environmental Research and Public Health*, 18(11), 5752.

Dondi, A., Fetta, A., Lenzi, J., Morigi, F., Candela, E., Rocca, A., Cordelli, L. M., & Lanari, M. (2021). Sleep disorders reveal distress among children and adolescents during the Covid-19 first wave: Results of a large web-based Italian survey. *Italian Journal of Pediatrics*, 47(1), 130.

Esbensen, A. J., & Schwichtenberg, A. J. (2016). Sleep in neurodevelopmental disorders. *International review of research in developmental disabilities* (pp. 153−191). Academic Press.

Garcia, J. M., Lawrence, S., Brazendale, K., Leahy, N., & Fukuda, D. (2021). Brief report: The impact of the COVID-19 pandemic on health behaviors in adolescents with autism spectrum disorder. *Disability and Health Journal*, 14(2), 101021.

Guller, B., Yaylaci, F., & Eyuboglu, D. (2021). Those in the shadow of the pandemic: Impacts of the COVID-19 outbreak on the mental health of children with neurodevelopmental disorders and their parents. *International Journal of Developmental Disabilities*. doi:10.1080/20473869.2021.1930827

Huang, S., Sun, T., Zhu, Y., Song, S., Zhang, J., Huang, L., Peng, G., Zhao, D., Yu, H., & Jing, J. (2021). Impact of the COVID-19 pandemic on children with ASD and their families: An online survey in China. *Psychology Research and Behaviour Management*, 14, 289–297.

Korb, L., O'Regan, D., Conley, J., Dillon, E., Briggs, R., Courtenay, K., & Perera, B. (2021). Sleep: The neglected life factor in adults with intellectual disabilities. *BJPsych Bulletin*. doi:10.1192/bjb.2021.122.

Lugo-Marín, J., Gisbert-Gustemps, L., Setien-Ramos, I., Español-Martín, G., Ibañez-Jimenez, P., Forner-Puntonet, M., Arteaga-Henríquez, G., Soriano-Día, A., Duque-Yemail, J. D., & Ramos-Quiroga, J. A. (2021). COVID-19 pandemic effects in people with autism spectrum disorder and their caregivers: Evaluation of social distancing and lockdown impact on mental health and general status. *Research in Autism Spectrum Disorders*, *83*, 101757.

Malow, B. A., Crowe, C., Henderson, L., McGrew, S. G., Wang, L., Song, Y., & Stone, W. L. (2009). A sleep habits questionnaire for children with autism spectrum disorders. *Journal of Child Neurology*, *24*(1), 19–24.

Masi, A., DeMayo, M. M., Glozier, N., & Guastella, A. J. (2017). An overview of autism spectrum disorder, heterogeneity and treatment options. *Neuroscience Bulletin*, *33*(2), 183–193.

Masi, A., Mendoza Diaz, A., Tully, L., Azim, S. I., Woolfenden, S., Efron, D., & Eapen, V. (2021). Impact of the COVID-19 pandemic on the well-being of children with neurodevelopmental disabilities and their parents. *Journal of Paediatrics and Child Health*, *57*(5), 631–636.

Mete Yesil, A., Sencan, B., Omercioglu, E., & Ozmert, E. N. (2022). The Impact of the COVID-19 pandemic on children with special needs: A descriptive study. *Clinical Pediatrics*, *61*(2), 141–149.

Micheletti, M. B., Cafiero, P., Nápoli, S., Lejarraga, C., Pedernera Bradichansky, P., Vitale, M. P., Urinovsky, M. G., Escalante, A., & Rodríguez, E. (2021). Sleep problems in a sample of children with developmental disorders, before and during the COVID-19 pandemic. *Archivos Argentinos de Pediatria*, *119*(5), 296–303.

Mindell, J. A., & Owens, J. A. (2015). *A clinical guide to pediatric sleep: Diagnosis and management of sleep problems*. Lippincott Williams & Wilkins.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, PRISMA (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA statement. *PLoS Medicine*, *6*(7), e1000097.

Moore, S. A., Sharma, R., Martin Ginis, K. A., & Arbour-Nicitopoulos, K. P. (2021). Adverse Effects of the COVID-19 Pandemic on Movement and Play Behaviours of Children and Youth Living with Disabilities: Findings from the National Physical Activity Measurement (NPAM) Study. *International Journal of Environmental Research and Public Health*, *18*(24), 12950.

Mutluer, T., Doenyas, C., & Aslan Genc, H. (2020). Behavioral implications of the Covid-19 process for autism spectrum disorder, and individuals' comprehension of and reactions to the pandemic conditions. *Frontiers in Psychiatry*, *11*, 561882.

Navarro-Soria, I., Real-Fernández, M., de Mier, R. J. R., Costa-López, B., Sánchez, M., & Lavigne, R. (2021). Consequences of confinement due to COVID-19 in Spain on anxiety, sleep and executive functioning of children and adolescents with ADHD. *Sustainability*, *13*(5), 1–17.

Nithya, G. D., Damodaran, V., & Mythili, V. (2021). A study on impact of corona virus disease 2019 pandemic on activities of daily living, play, and sensory behaviors of children with autism spectrum disorder: A cross-sectional survey study. *Indian Journal of Occupational Therapy*, *53*(2), 64–76.

Owens, J. A., & Dalzell, V. (2005). Use of the 'BEARS' sleep screening tool in a pediatric residents' continuity clinic: A pilot study. *Sleep Medicine*, *6*(1), 63–69.

Owens, J. A., Spirito, A., & McGuinn, M. (2000). The Children's Sleep Habits Questionnaire (CSHQ): Psychometric properties of a survey instrument for school-aged children. *Sleep*, *23*(8), 1043–1051.

Peterson, M. H., Barnason, S., Donnelly, B., Hill, K., Miley, H., Riggs, L., & Whiteman, K. (2014). Choosing the best evidence to guide clinical practice: Application of AACN levels of evidence. *Critical Care Nurse*, *34*(2), 58–68.

Polónyiová, K., Belica, I., Celušáková, H., Janšáková, K., Kopčíková, M., Szapuová, Ž., & Ostatníková, D. (2022). Comparing the impact of the first and second wave of COVID-19 lockdown on Slovak families with typically developing children and children with autism spectrum disorder. *Autism*, *26*(5), 1046–1055.

Rabbani, M., Haque, M. M., Das Dipal, D., Zarif, M. I. I., Iqbal, A., Schwichtenberg, A., Bansal, N., Soron, T. R., Ahmed, S. I., & Ahamed, S. I. (2021). An mCARE study on patterns of risk and resilience for children with ASD in Bangladesh. *Scientific Reports*, *11*(1), 21342.

Rosenthal, E., Franklin-Gillette, S., Jung, H. J., Nelson, A., Evans, S. W., Power, T. J., Yerys, B. E., Dever, B. V., Reckner, E., & DuPaul, G. J. (2022). Impact of COVID-19 on youth with ADHD: Predictors and moderators of response to pandemic restrictions on daily life. *Journal of Attention Disorders*, *26*(9), 1223–1234.

Sadeh, A. (2008). Commentary: Comparing actigraphy and parental report as measures of children's sleep. *Journal of Pediatric Psychology*, *33*(4), 406–407.

Scarselli, V., Martucci, M., Prono, F., Giovannone, F., & Sogos, C. (2022). Sleep behavior of children with autism spectrum disorder during the Covid-19 pandemic: A parent survey. *Clinica Terapeutica*, *173*(1), 88–90.

Simonds, J. F., & Parraga, H. (1982). Prevalence of sleep disorders and sleep behaviors in children and adolescents. *Journal of the American Academy of Child Psychiatry*, *21*(4), 383–388.

Sparrow, S. S., & Cicchetti, D. V. (1989). *The Vineland Adaptive Behavior Scales*. Allyn & Bacon.

Spitzer, R. L., Kroenke, K., & Williams, J. B. (1999). Validation and utility of a self-report version of PRIME-MD: The PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *Journal of the American Medical Association*, *282*(18), 1737–1744.

Sung, V., Hiscock, H., Sciberras, E., & Efron, D. (2008). Sleep problems in children with attention-deficit/hyperactivity disorder: Prevalence and the effect on the child and family. *Archives of Pediatrics and Adolescent Medicine*, *162*(4), 336–342.

Swansburg, R., Hai, T., Macmaster, F. P., & Lemay, J. F. (2021). Impact of COVID-19 on lifestyle habits and mental health symptoms in children with attention-deficit/hyperactivity disorder in Canada. *Paediatrics and Child Health*, *26*(5), e199–e207.

Tokatly Latzer, I., Leitner, Y., & Karnieli-Miller, O. (2021). Core experiences of parents of children with autism during the COVID-19 pandemic lockdown. *Autism*, *25*(4), 1047–1059.

Touhy, R., & Yazdani, F. (2018). Family routines of adolescents with an autism spectrum disorder: A literature review. *Degenerative Intellectual & Developmental Disabilities*, *1*(4), 1–6.

Tremblay, M., Wolfson, M., & Gorber, S. C. (2007). Canadian Health Measures Survey: Rationale, background and overview. *Health Reports*, *18*, 7–20.

Trivisano, M., Specchio, N., Pietrafusa, N., Calabrese, C., Ferretti, A., Ricci, R., Renzetti, T., Raponi, M., & Vigevano, F. (2020). Impact of COVID-19 pandemic on pediatric patients with epilepsy — The caregiver perspective. *Epilepsy and Behavior*, *113*, 107527.

Türkoğlu, S., Uçar, H. N., Çetin, F. H., Güler, H. A., & Tezcan, M. E. (2020). The relationship between chronotype, sleep, and autism symptom severity in children with ASD in COVID-19 home confinement period. *Chronobiology International*, *37*(8), 1207–1213.

Ueda, R., Okada, T., Kita, Y., Ozawa, Y., Inoue, H., Shioda, M., Kono, Y., Kono, C., Nakamura, Y., Amemiya, K., Ito, A., Sugiura, N., Matsuoka, Y., Kaiga, C., Kubota, M., & Ozawa, H. (2021). The quality of life of children with neurodevelopmental disorders and their parents during the coronavirus disease 19 emergency in Japan. *Scientific Reports*, *11*(1), 3042.

Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, *52*(5), 546–553.

Williams Buckley, A., Hirtz, D., Oskoui, M., Armstrong, M. J., Batra, A., Bridgemohan, C., Coury, D., Dawson, G., Donley, D., Findling, R. L., Gaughan, T., Gloss, D., Gronseth, G., Kessler, R., Merillat, S., Michelson, D., Owens, J., Pringsheim, T., Sikich, L., & Ashwal, S. (2020). Practice guideline: Treatment for insomnia and disrupted sleep behavior in children and adolescents with autism spectrum disorder: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology. *Neurology,*, *94*(9), 392–404.

Wolfson, A. R., Carskadon, M. A., Acebo, C., Seifer, R., Fallone, G., Labyak, S. E., & Martin, J. L. (2003). Evidence for the validity of a Sleep Habits Survey for adolescents. *Sleep,*, *26*(2), 213–216.

Yavuz-Kodat, E., Reynaud, E., Geoffray, M. M., Limousin, N., Franco, P., Bourgin, P., & Schroder, C. M. (2019). Validity of actigraphy compared to polysomnography for sleep assessment in children with autism spectrum disorder. *Frontiers in Psychiatry*, *10*, 551.

Zavada, A., Gordijn, M. C., Beersma, D. G., Daan, S., & Roenneberg, T. (2005). Comparison of the Munich Chronotype Questionnaire with the Horne-Östberg's morningness-eveningness score. *Chronobiology International*, *22*(2), 267–278.