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REVIEW ARTICLE

Social and environmental effects of the COVID-19 pandemic on children

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Abstract

Objective: This study aimed to review the literature, summarizing the existing evidence on the effects of the pandemic on children, adolescents and parents, with an emphasis on the psychological, emotional, and sleep quality consequences.

Source of data: Empirical studies identified in the following databases: MEDLINE, ISI Web of Knowledge/Web of Science, and preprint servers.

Synthesis of data: The findings point to a wide range of consequences for children and adolescents resulting from the COVID-19 pandemic, which mainly includes an increase in depressive mood symptoms. There is also an increase in anxiety symptoms, suicidal ideation, as well as potential delays in language and motor development resulting from deprivation of social interaction and the closing of schools. These effects are more severe due to previous neuropsychiatric conditions. For parents, there is an increase in anxiety, depressive and post-traumatic symptoms, which are more accentuated in those who suffered socioeconomic damage due to the pandemic. There was an important increase in situations of violence towards children by parents and caregivers during the pandemic. Also, changes in routine and fear of the pandemic have negatively impacted sleep quality, globally.

Conclusions: It is noteworthy that most studies published to date used a cross-sectional design and applied online screening questionnaires. The few studies with a longitudinal design suggest that these changes may have been transitory and more prevalent at the beginning of the pandemic.

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Introduction

At the end of December 2019, a series of pneumonia cases of unknown etiology affected 41 patients in the city of Wuhan, China.¹ It was quickly discovered that the cause was contamination by a new type of coronavirus, initially called 2019-nCoV and later updated to SARS-CoV-2. The disease caused by the coronavirus was called COVID-19. Among patients with symptomatic COVID-19, cough, myalgia, fever, and headache are the most commonly reported symptoms. Other features, including diarrhea, sore throat, and loss of smell or taste, have also been described. Based on the rapid increase in the number of infections² and the possibility of transmission between asymptomatic individuals, the World Health Organization (WHO) declared that the outbreak of COVID-19 was a pandemic. As of July 2021, worldwide epidemiological data indicate more than 190,000,000 cases diagnosed with SARS-CoV-2 and more than 4,100,000 deaths from COVID-19.³

Although vaccines have been developed for the virus, several countries still use preventative guidelines that have been applied to contain the spread of SARS-CoV-2. The main containment strategies are non-pharmacological interventions, such as social distancing, the closing of educational establishments, cancellation of events and social gatherings, hand hygiene, body temperature examination, use of antiseptics and personal protective equipment, travel restrictions, and dissemination of SARS-CoV-2 screening tests.⁴ Moreover, several countries declared a state of emergency and imposed a partial quarantine, causing billions of people to go unemployed, or work from home using telecommunication technologies, except to perform tasks considered to be essential. Therefore, in addition to the broad socioeconomic impact, the prolonged social distancing measures introduced insecurity, psychological discomfort, including an overall exacerbation of anxiety, depression, and growing fear.

Particularly in the child population, several changes in children's routines occurred during the COVID-19 pandemic period. They have been instructed to respect rules and habits that are not always understandable to them (e.g., disinfecting their hands, not touching their eyes or nose, and covering their mouth), they are also unable to see the people they would like to be close with, due to the social distancing measures. These changes in routine can cause significant psychological and emotional distress. In this sense, this study aimed to describe and summarize the existing evidence on the effects of the pandemic on children, adolescents, and their parents, with an emphasis on the psychological, emotional, and sleep quality consequences.

Psychological and emotional consequences arising from COVID 19

Unlike adults, children infected with SARS-CoV-2 have a milder illness, low morbidity, and better prognosis. However, social distancing and quarantine measures can have several consequences for children's mental health. Home confinement is associated with drastic changes in the lifestyle of children and adolescents, mainly due to the decrease in the possibility of social interaction with peers.⁵

One of the first studies on the subject was carried out in China, through a web-based survey, which included the

participation of 1,784 children and adolescents. A high prevalence of depressive mood symptoms (22%) was observed, followed by a high presence of anxiety symptoms (18%). In this study, the participants had experienced on average 33 days of home confinement.⁶ Table 1 depicts a summary of the empirical studies cited in this section and in the section on consequences for parents.

Subsequently, other studies found that younger children (3 to 6 years) were more likely to manifest symptoms of fear and anxiety about the possibility of family members being infected with SARS-CoV-2 than older children (6 to 18 years).⁵ However, increased irritability and inattention were observed in children of different age groups. Based on questionnaires answered by the parents, the results show that children feel more insecure, fearful, and isolated in times of pandemic, compared to the pre-pandemic period.⁷ It has also been shown that children are often experiencing poor appetite, restlessness, inattention, and parents separation anxiety. In children, symptoms of depression and anxiety may present themselves more often as apathy and lack of self-care than verbal expressions of hopelessness. Difficulty in focusing and impaired concentration are also common and may be associated with symptoms of anxiety and depressive mood.⁸

However, most of the evidence in this regard is concentrated in studies with adolescent samples. For instance, a recent study conducted with 1,339 adolescents showed a 28% increase in depressive symptomatology in the first 6 months of the COVID-19 pandemic.⁹ Although these symptoms are not necessarily associated with a neuropsychiatric condition that emerged during the pandemic, these manifestations are warning signs for parents and guardians. These types of nonspecific yet severe presentations often benefit from an early diagnosis and referral to mental health services.

The estimates mentioned so far are derived from studies conducted through an online survey. A recent study conducted a screening for depression symptoms in pediatric primary care.¹⁰ The results indicated that the percentage of adolescents with depressive symptoms increased from 5.0% to 6.2%, with a greater increase among the female gender. Positive suicide risk screenings increased from 6.1% to 7.1%, with a 34% relative increase in the odds of reporting recent suicidal thoughts among adolescent girls. In this sense, children and adolescents at risk of suicide need immediate referral and follow-up. During the pandemic, the most common manifestations associated with suicidal behavior in adolescents were related to the pre-existence of mental disorders, as well as an exacerbated feeling of loneliness, and psychological suffering associated with online schooling.¹¹ Also noteworthy is the psychological suffering related to the dependence on digital media, and a positive test for SARS-CoV-2.

Particularly in relation to children and adolescents affected with neurodevelopmental disorders and other psychiatric conditions prior to the pandemic, there is a high risk of psychological and emotional manifestations in the pandemic context. For instance, in children with Cerebral Palsy, impairment in epileptic seizure control, worsening of spasticity, and motor control have been observed.¹² The Autism Spectrum Disorder (ASD) is also highlighted due to the following factors: 1) Individuals with ASD experience greater

Table 1 Characteristics of studies that evaluated the psychological and emotional effects of COVID-19 on children, adolescents and parents.

Author/Journal	Country	Sample size	Results
Xie et al. ⁶ JAMA Pediatrics, 2020	China	2,330 children/adolescents	High prevalence of depressive mood symptoms and anxiety symptoms
Barendse et al. ⁹ Psy Ar Xiv (preprint), 2021	USA The Netherlands Peru	1,339 adolescents	Depression symptoms increased significantly, while anxiety symptoms remained stable overall.
Mayne et al. ¹⁰ Pediatrics, 2021	USA	91,188 teenagers (47,684 during the pandemic period)	Symptoms of depression and suicidal ideation increased during the pandemic, especially in the female gender
Green et al. ¹⁷ Scientific Reports, 2021	The Netherlands	462 adolescents/371 young adults	Depressive mood symptoms increased between May 2020 and November 2020, especially in younger adolescents
Zhang et al. ¹⁸ JAMA Network Open, 2020	China	1,241 children/adolescents	Symptoms of depressive mood and suicidal ideation increased after the schools were closed
Orsini et al. ²¹ J Psychiatr Res, 2021	Italy	96 parents	Parents of children who tested positive for COVID-19 were more likely to develop post-traumatic, anxiety and depressive symptoms
Carroll et al. ²² Nutrients, 2020	Canada	254 parents	Changes in eating routines, increased screen time, decreased physical activity. The main factors that influenced family stress include balancing work with parenting, remote home education and financial instability.
Bailey et al. ²³ J Intellect Disabil Res, 2021	United Kingdom	294 parents	Similar levels in the pre- and post-pandemic period in relation to quality of life and psychological distress
Hampshire et al. ²⁴ E Clinical Medicine, 2021	United Kingdom	81,337 adults (including parents)	Cognitive consequences of COVID-19 persist after clinical recovery

social isolation and distress in situations of uncertainty compared to their typical peers; 2) Recent evidence indicate high levels of post-traumatic stress symptoms associated with social stressors in children diagnosed with ASD, indicating that this population is at high risk for developing post-traumatic stress disorder in the post-pandemic period¹³; 3) Any type of change in daily activities, such as changes in activity schedules and restricted access to schools, due to the quarantine periods, can cause great discomfort and consequent behavioral change; 4) These children usually undergo clinical follow-up for several hours during the week with a multidisciplinary team; however, due to contagion containment measures, families and children with ASD are facing several restrictions regarding the possibility of continued clinical care; and, 5) The sum of these factors resulted in the recent assessment of the Secretary General of the United Nations, António Guterres, who verified that the consequences of the COVID-19 pandemic for the lives of individuals with ASD is disproportionately greater and needs immediate attention and efforts at the public health level.¹⁴

In this sense, an extremely relevant aspect refers to social isolation. Although many families have been confined during the pandemic period, loneliness remains a significant problem for children and adolescents.¹⁵ A recent systematic review found that 63 of the 83 included studies documented the negative impact of loneliness on the mental health of previously healthy children and adolescents.¹⁶ Children affected by loneliness are more likely to have symptoms of anxiety and depression that persist in post-pandemic conditions.

Pre-existing family dysfunctions, such as frequent conflicts and marital violence, can increase the negative impact on the aforementioned manifestations. For instance, Green et al. conducted an online investigation of 462 Dutch adolescents in May 2020, with a follow-up in November 2020.¹⁷ They found that the severity of depressive mood symptoms increased between May 2020 and November 2020, especially for younger adolescents. There were positive associations between the intensity of negative emotions with exposure to family stressor factors.

Also, a very important aspect that should be considered is related to the interruption of classroom teaching during the COVID-19 pandemic. For example, Zhang et al., using a longitudinal design, observed that the closing of schools significantly increased depressive symptoms and suicidal ideation in children and adolescents.¹⁸ The home confinement of children and adolescents is associated with uncertainty and anxiety, which can be attributed to interruptions in their schooling, physical activities, and socialization opportunities.⁵ The absence of a structured school environment for a long period results in routine disruption, boredom, and lack of innovative ideas for engaging in several academic and extracurricular activities. Some children may express lower levels of affection due to not being able to play outdoors, not meeting friends, and not getting involved in face-to-face school activities. These children can also become more dependent, seeking frequent parental attention due to the long-term change in the routine. It is presumed that children may resist going to school after the quarantine ends and may face difficulties in establishing relationships with their teachers after the reopening of schools. Consequently, the movement restriction imposed on them can have a long-

term negative effect on their emotional, cognitive development, and overall psychological well-being.⁵

Children with hearing loss can also be disproportionately affected by virtual education when compared to their normal-hearing peers.¹⁹ Hearing-impaired individuals are particularly affected by what has been termed "zoom fatigue", which is due to increased auditory effort resulting from difficulties in interpreting non-verbal cues (e.g., inability to read lips due to pixelated video), low audio quality, and audio-visual dyssynchrony. This phenomenon is also associated with impairments and delays in language development for typical children.

Implications for parents and caregivers

A child's illness is recognized as one of the most destabilizing events for parents, having a significant impact on their mental health. There is an increased risk for the development of a wide range of psychopathological sequelae, such as depression, anxiety, and post-traumatic stress disorder. Although COVID-19 in children is mostly asymptomatic or shows milder symptoms than those typically seen in adults, the mere suspicion of SARS-CoV-2 infection in children can be a destabilizing event for a parent.²⁰

In this sense, Orsini et al. demonstrated that parents whose children tested positive for SARS-CoV-2 were more likely to develop post-traumatic, anxiety, and depressive symptoms.²¹ Similar results emerged for parents who were quarantined, as opposed to those who did not. Moreover, parents who suffered some type of economic loss as a result of the pandemic had a higher prevalence of anxiety and depressive symptoms, while post-traumatic symptoms were more common among parents who went unemployed during the pandemic period. Similarly, Carroll et al. found that in a sample of 254 families,²² more than half reported that their eating routines changed in the COVID-19 pandemic, as well as screen time increased for 74% of mothers, 61% of fathers, and 87% of the children. Additionally, physical activity decreased for 59% of mothers, 52% of fathers, and 52% of children. The main factors influencing family stress include balancing work and parenting, remote home education, and financial instability. These findings indicate that several socio-environmental factors can influence the vulnerability of parents and caregivers to the emergence of psychological and emotional manifestations associated with the COVID-19 pandemic.

It is important to highlight that recent evidence points to reversibility of the negative effects of the pandemic on children and parents, after the relaxation of social distancing measures and return to activities. Bailey et al. demonstrated in the United Kingdom that well-being (quality of life and measures of psychological distress) in families with children were found to be at similar levels in the pre- and post-pandemic period.²³ However, the cognitive effects on parents resulting from COVID-19 seem to persist even after the clinical recovery, including in asymptomatic cases.²⁴

Still, there is an important warning regarding the increase in situations of violence towards children by parents and caregivers during the pandemic. Cappa and Jijon conducted a literature review on the topic,²⁵ raising the following points: 1) Studies found a decrease in police

reports and referrals to child protection services, 2) mixed results were found regarding the number of calls to the police or domestic violence helplines, and 3) studies have shown an increase in child abuse-related injuries treated in hospitals and other health services. In this sense, emerging results indicate an increase in situations and frequency of family violence, which may be associated with several negative outcomes for the development of children exposed to such events.

Sleep and COVID 19

Sleep is an essential biological process for life and overall health. It plays an important role in the regulation of brain functions and in body physiology, such as metabolism and the immune, hormonal and cardiovascular system function.²⁶ Good sleep quality is mainly characterized by a sufficient duration of sleep, good quality and regularity, and absence of sleep disturbances.

Good quality sleep is essential for child development. Studies have suggested that sleep deprivation can compromise the physical and mental health of children and interfere with growth and development.²⁷ The wide variety of systems affected by sleep deprivation demonstrates the important role that sleep plays in controlling the adequate physiological function of both the central nervous system and peripheral signaling, which include total body function.²⁸

During the pandemic period, mobility restriction and home isolation measures adopted by several countries significantly changed family routines. People who go through a quarantine often report that it is an unpleasant experience. Being apart from loved ones, loss of freedom of movement, uncertainty, and fear regarding the disease usually bring psychological consequences, such as mood changes and anxiety symptoms.²⁹

Habit/routine changes, fear, depression, and anxiety are potential risk factors for sleep quality alterations. In clinical practice, complaints of sleep problems significantly increased during the pandemic. Several studies, carried out in all regions of the world, have evaluated the relationship between social isolation/pandemic and sleep disorders in children and adolescents. The majority of these studies had a cross-sectional design and used questionnaires sent via the internet (web-based survey) as the research instrument. [Table 2](#) summarizes these findings.

Among the studies carried out in European countries during the pandemic, those carried out in Italy stand out. Bruni et al. evaluated 4,314 children and adolescents (aged 0 to 18 years), divided into four groups by age group, through a digital platform using a previously validated sleep scale and demographic data.³⁰ They observed a significant delay in both going to sleep and waking up times in all groups, in addition to an increase in screen time. Sleep disturbances increased in all groups except for adolescents, with younger children showing a higher prevalence of difficulty initiating sleep, anxiety at bedtime and nocturnal awakenings. Celini et al. evaluated 299 dyads of mothers/children,³¹ the latter aged between 6 and 10 years. They observed a delay in bedtime in the child population and an increase in emotional and behavioral problems, in addition to hyperactivity, with

these changes being related to maternal psychological difficulties. Mothers also showed worsening of sleep quality depending on their working conditions (home vs. external). Those who maintained their professional activities that required work outside the home had fewer sleep alterations.

The study by Androutsos et al.³² carried out in Greece also evaluated children and adolescents. During the period of social isolation (lockdown), increased screen time, increased sleep duration, reduced physical activity, and increased body weight were observed. Alonso-Martinez et al.³³ evaluated preschool-age children in Spain. They observed a reduction in total physical activity, sleep efficiency, increased sedentary lifestyle, and internalizing and externalizing symptoms. Children who maintained their regular physical activity levels had fewer internalizing symptoms than their sedentary peers.

The study by Markovic et al. has a longitudinal design with two follow-up assessments,³⁴ all carried out in 2020 and online. A total of 452 infants (0 to 35 months) and 412 preschoolers from different European countries were included. An abrupt decrease in sleep quality, albeit transient, was observed in all groups. The caregivers' stress level was a significant risk factor for poor sleep quality in both groups during all assessments.

Studies carried out in Middle Eastern countries also showed significant changes in sleep during the pandemic. In Tunisia, Abid et al. evaluated 100 children (aged 8.66 ± 3.3 years) through an online study, using the Pittsburgh Sleep Quality Index.³⁵ They observed that during the confinement period, there was a worsening in all indexes, especially in girls, who showed longer screen time and worse sleep quality. There was a significant correlation between longer screen time and worse scores on the sleep scale.

The study by Ranjbar et al.³⁶ had a sample of 20,697 children with a mean age of 13.7 years, of which the majority (69.3%) was female, living in urban areas and attending public schools. Increased total sleep duration and screen use were observed. In the study by Ghanamah & Eghbaria-Ghanamah³⁷ also carried out online during the pandemic, with children of Arab origin living in Israel, it was observed that half of the sample demanded to sleep with their parents and showed fears that had not been previously reported. Most children also had increased complaints of irritability, mood swings, increased use of screens, reduced physical activity, and sleep problems (sleeping longer, among others).

In Asia, three studies are highlighted, two conducted in China and another in Singapore, with the Chinese studies,^{38,39} having large samples. The study by Zhou et al., which included 11,835 adolescents and young adults, showed a prevalence of insomnia of 23%, with female gender and living in urban areas being considered risk factors. Depression and anxiety were also risk factors for insomnia. The study by Liu et al. included children ($n = 1619$) aged 4 to 6 years evaluated during the pandemic. When the sample was compared with data collected in 2018, an increase in sleep problems (going to sleep and waking up later) was observed. Good sleep hygiene practices were positive in reducing the problems.

Lim et al. questioned the parents of 593 children/adolescents from Singapore, aged 3 to 16 years before and during school closure in the national lockdown period.⁴⁰ An

Table 2 Characteristics of studies that evaluated the consequences on sleep quality resulting from COVID-19 in children and adolescents.

Author/ Journal	Country	Sample size	Results
Androutsos et al. ³² Nutrients, 2021	Greece	397 children/ adolescents	Increased sleep duration and screen time.
Abid et al. ³⁵ Int J Environ Res Public Health, 2021	Tunisia	100 (mean of 8 years)	Reduction in physical activity Sleep quality worsening and screen time increase
Ghanamah & Eghbaria-Ghanamah ³⁷ Int J Environ Res Public Health, 2021	Arab population living in Israel	382 (5-11 years)	41.4% with sleep problems. Increased sleep duration and screen time. Reduction in physical activity
Ranjbar et al. ³⁶ Environ Health Prev Med, 2021	Iran	20,697 (Grades 1-12)	Increased sleep duration and screen time
Suffren et al. ⁴¹ Int J Environ Res Public Health, 2021	Canada (Quebec)	144 families (children aged 9-12 years)	Changes in family sleep habits related to the fear of COVID
Liu et al. ³⁹ J Sleep Res, 2021	China	1,619 (4-6 years)	Going to sleep and waking up later, longer night time, fewer naps
Cellini et al. ³¹ J Pediatr Psychol, 2021	Italy	299 (6-10 years)	Going to sleep and waking up later, worse sleep quality
Alonso-Martínez et al. ³³ Int J Environ Res Public Health, 2021	Spain (Pamplona)	268 (4-6 years)	Worse sleep efficiency
Lim et al. ⁴⁰ Sleep Med, 2021	Singapore	593 (3-16 years)	Longer sleep duration during the closing of schools
Aguilar-Farias et al. ⁴³ Int J Environ Res Public Health, 2020	Chile	3,157 (1-5 years)	Increased sleep duration and screen time
Kahn et al. ⁴² Sleep Health, 2021	USA	572 (1-12 months)	Going to sleep later and longer sleep duration
Zhou et al. ³⁸ Sleep Med, 2020	China	11,835 adolescents and young adults	23% of insomnia
Bruni et al. ³⁰ Sleep Med, 2021	Italy	4,314 children/adolescents	Quarantine caused a delay in the sleep schedule in all age groups, as well as an increase in sleep disturbances in all groups, except adolescents.
Wearick-Silva et al. ⁴⁴ Jornal de Pediatria (in press), 2021	Brazil (Rio Grande do Sul)	577 dyads (parents + children) 0-17 years	They observed sleep alterations in: 0-3 years 58.6% 4-12 years 33.9% 13-17 - 56.6%

increase in sleep time was observed, with going to sleep and waking up later being more evident in high school students.

In two studies carried out in North America, the Canadian one through telephone contact, the parent-child relationships were evaluated in 144 families with children aged 9 to 12 years during the pandemic. It was observed that the parents' fear of COVID was associated with more fear for the children, and changes in sleep habits were associated with greater concerns about COVID-19.⁴¹ In the United States study, the mothers of 572 infants were interviewed, comparing those in home confinement with those who were working regularly. The evaluation took place at four moments using videasonography. More sleep problems were observed at baseline in infants whose mothers were confined at home.⁴²

In South America, the authors of the present study highlight two studies, one carried out in Chile and the other in Brazil. In the Chilean study involving 3,157 parents of children aged 1 to 5 years, screen time, sleep habits, and physical activity were evaluated. In the initial period of the pandemic, there was a reduction in the time of physical activity, an increase in the recreational use of screens and in sleep duration, as well as a worsening in the quality of sleep.⁴³ In the study carried out in Brazil, 577 families with children aged 0 to 17 years were evaluated, and respondents were directed to online questionnaires according to the age group. Sleep alterations were observed in 69.8% of adults, 58.6% of the children aged 0 to 3 years, 33.9% in those aged 4 to 12 years, and 56.6% of the adolescents. The female gender and having children with sleep problems were predictors of sleep disorders in parents. The subjective perception of sleep worsening showed complaints in the emotional domain (anxiety and fear) in parents and changes in sleep routine (going to sleep later) in all groups of children/adolescents.⁴⁴

Regarding the comorbidities in the emotional/behavioral domain, during the pandemic, Bruni et al. evaluated 992 Italian children and adolescents with Attention Deficit Hyperactivity Disorder (ADHD).⁴⁵ They observed that the social isolation period had a negative impact on sleep organization, decreasing or increasing total sleep time. A significant association between increased screen time and delay in the onset of sleep, as well as shorter sleep duration, was also observed. Panda et al. performed a systematic review including 15 studies and a total assessment of 22,996 children/adolescents.⁴⁶ They observed high percentages of anxiety, depression, irritability, and inattention (respectively, 34.5%, 41.7%, 42.3%, and 30.8%). The behavioral/emotional state of almost 80% of the children in the sample was altered during the pandemic, with fear of COVID (22.5%), boredom (35.2%), and sleep disorders (21.3%) being the main factors. Children with prior neurobehavioral disorders, such as ASD and ADHD were more likely to experience symptom worsening.

Conclusion

As demonstrated, there is a wide range of consequences for children and adolescents resulting from the COVID-19 pandemic, which include, above all, an increase in depressive mood symptoms resulting from social interaction deprivation and the closing of schools. Moreover, some studies reported an increase in anxiety symptoms, suicidal ideation, as well as potential delays in language and motor development.

There are also important consequences for the mental health of parents and caregivers. The recommendations to ensure the mental well-being of children and adolescents during and after the pandemic are being discussed, and include a collaborative network between parents, teachers, pediatricians, psychologists, psychiatrists, neurologists, other health professionals, and public health policy managers.⁵ The role of parents and family members is fundamental in this regard, since in times of great stress and uncertainty, a safe and organized family environment regarding schedules and activities is a strong protective factor. There is evidence showing that parental stress coping strategies affect children's mental health after disaster situations.⁵

Regarding the impact of the pandemic itself and the consequent social isolation on sleep quality, in the pediatric age group (including from infants to adolescents), it is clear that routine changes and fear of the pandemic negatively impacted sleep quality, in a globalized way. However, it is noteworthy that most studies published to date used a cross-sectional design and applied online screening questionnaires. The few longitudinal studies suggest that these changes may have been transitory and more prevalent at the beginning of the pandemic, that is, they resulted from the sudden imposition of changes in habits and routines.

Conflicts of interest

The authors declare no conflict of interest.

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