

ORIGINAL ARTICLE

Sleep habits of preschool children after the COVID-19 lockdown in a municipality in Paraíba, Brazil

Dixis Figueroa Pedraza^{a,b}, Natalia dos Santos Silva^b, Luciane Bresciani Salaroli^a



^aPrograma de Pós-Graduação em Saúde Coletiva, Universidade Federal do Espírito Santo (UFES), Vitória, Espírito Santo, Brasil;

^bDepartamento de Enfermagem, Universidade Estadual da Paraíba (UEPB), Campina Grande, Paraíba, Brasil.

Corresponding author
dixisfigueroa@gmail.com

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Orcid authors

Dixis Figueroa Pedraza - <https://orcid.org/0000-0002-5394-828X>
Natalia dos Santos Silva - <https://orcid.org/0000-0002-3746-5851>
Luciane Bresciani Salaroli - <https://orcid.org/0000-0002-1881-0306>

Abstract

Introduction: the COVID-19 pandemic has brought changes in routines, use of time, behaviors, social relationships and concerns that can compromise children's sleep, and studies on the subject are essential.

Objective: to evaluate the sleep habits of preschool children after the COVID-19 lockdown in Brazil.

Methods: this is a cross-sectional study nested in a cohort of live births to assess growth and development up to 1,000 days of age. For this study, data were collected from children at 4 years of age related to biological profile, health status, maternal care, screen time and physical activity, and behavior during the COVID-19 pandemic. The mean scores of the children's sleep habits (bedtime routine, rhythmicity and affective separation) were analyzed according to the children's characteristics using the Student's t-test.

Results: sleep routine was the most impaired sleep habit, with lower averages in cases of hospitalization ($p = 0.047$), mother's difficulty in caring for the child ($p = 0.003$) and great concern about COVID-19 during the pandemic ($p = 0.003$); followed by rhythmicity, which was also worse in the previous situations. In addition, children with more than 60 minutes of recreational screen time ($p = 0.002$) and without a mask-wearing routine during the pandemic ($p = 0.003$) had lower average bedtime routines. Health problems at birth ($p = 0.001$), hospitalization ($p = 0.000$), special health needs ($p = 0.025$) and mother's difficulty in providing care ($p = 0.037$) negatively interfered with affective separation.

Conclusion: children with health problems, excessive screen time and concern about COVID-19 during the pandemic, as well as the difficulty of maternal care, influenced children's sleep habits.

Keywords: COVID-19, child, sleep, health behavior, health status.

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Authors summary

Why was this study done?

The quality of a child's sleep is of paramount importance for physical and mental health and child development. The COVID-19 pandemic has brought changes in routines, time use, behaviors, social relationships and concerns that can affect children's sleep. The global and Brazilian scientific literature on children's sleep habits during the COVID-19 pandemic is still scarce.

What did the researchers do and find?

Were analyzed 126 children at the age of 4 and examined their sleep habits. The children had average scores of 7.0 ± 3.4 for bedtime routine, 7.3 ± 3.6 for rhythmicity and 12.8 ± 4.1 for affective separation, representing 46.7%, 40.6% and 71.1% of the respective maximum scores. The findings also showed that children with health problems, excessive screen time and too much worry about COVID-19, as well as the mother's difficulty in caring for the child, negatively influenced sleep quality.

What do these findings mean?

The scientific evidence made available in this study showed that the child's worry about COVID-19 during the pandemic and the mother's difficulty in caring for the child influenced sleep quality. If children have concerns, it is important that they are listened to and supported to reduce their anxiety and minimize the negative effects of worry on sleep. The mother's ability to care for the child is fundamental to promoting healthy sleep for the child. In addition, children with health problems and who spend a lot of time using electronics can trigger sleep disorders. Therefore, interventions to improve children's sleep are necessary and should consider health care, reducing screen time, maternal care of the child and relieving worry.

Highlights

Children who were very concerned about COVID-19 during the pandemic had impaired sleep quality, as well as health problems at birth, more screen time than recommended and maternal difficulty caring for the child.

INTRODUCTION

Quality sleep is essential for physical and mental health, including organic and immune functions, as well as for the well-being and development of children¹⁻⁵. Good sleep is extremely important for children's neurodevelopment, cognitive performance, memory processes and decision-making. It also helps regulate emotions, behavior and stress⁵⁻⁸. Sleep disorders, on the other hand, can negatively affect these domains, with possible consequences for health, physical functioning, psychosocial development and cognition^{4,5,9-12}. There is also a consistent evidence base suggesting an association between these problems in childhood and behavioral and mental health alterations, thus representing an important pediatric outcome^{4,5,9-12}. These disorders are characterized by significant worsening in stressful situations such as those experienced during pandemics as a result of confinement and changes in social support⁶⁻⁸.

Pre-school children are at a crucial stage of development when it comes to establishing healthy sleep routines¹². In turn, children are at greater risk of sleep and mental health disorders as a result of the rapid changes that take place during development⁵. Children's sleep is intrinsically regulated by homeostatic and circadian processes¹³, and sleep and wake behaviors into adulthood are mediated by the characteristics of child development^{12,14}. However, extrinsic factors play an important role in determining sleep/wake patterns and circadian rhythmicity³. Thus, behavioral factors (screen time, physical activity and bedtime routine), the physical environment (exposure to light and noise) and parental factors (stress, upbringing and attachment between parents and children) influence children's sleep¹³. In addition, timetables, activities and teaching methods are mediators of exposure to sunlight and the use of technology, influencing children's sleep-wake cycle and sleep duration^{3,4}.

Overexposure to blue light, through the use of screen-based devices, especially at night, and less exposure to external light, can lead to disturbances in

the circadian sleep/wake rhythm and, therefore, sleep, due to the suppression of melatonin and activation of wakefulness systems^{5,10,11}. Compared to adults, children are more susceptible to the negative effects of exposure to artificial light at night, as melatonin is more sensitive to light at this stage of life¹⁰. In addition, the content consumed by screen devices can make it difficult to fall asleep⁵. On the other hand, physical activity and outdoor play, in particular, can help regulate melatonin secretion and the circadian rhythm, with positive results on sleep¹⁵.

With regard to behavioral factors and parenting practices, it should be noted that pre-school children require more attention and care from their parents, as they have more pronounced separation and attachment problems^{16,17}. In this sense, sleep disorders can appear as a result of parental stress and anxiety, especially maternal stress^{3,18}. The stress and sleep disorders have a bidirectional relationship in which non-harmonious, dysfunctional and less positive parental relationships can harm the child's behavior, well-being and quality of sleep^{19,20}. High levels of stress and anxiety can be passed on from parents to children, making it impossible to provide a supportive environment for them²¹.

Many of the factors that influence children's sleep patterns have been significantly affected by the lockdown caused by the coronavirus disease 2019 (COVID-19) pandemic, including limited access to areas for play and recreation, as well as school closures^{2-4,7,8,12,22,23}. With the lockdown, children have been exposed to routines, activities and changes in the use of electronic devices that trigger sleep disorders¹². In particular, children's absence from school, with increased screen time, less physical activity and irregular sleep patterns, can impair circadian rhythms and sleep¹⁰.

As a result of the lockdown, there was less exposure to daylight, changes in daily routines (increased use of electronics with more exposure to blue light, reduced physical activity, limited outdoor activities and reduced leisure time), continuous contact with family,

less social interaction, increased family worries, more stress and anxiety for parents, and unrestricted sleep schedules^{2-4,7,8,12,22,23}. In addition, confinement posed a challenge for parents to manage their children's behaviors¹⁶. Thus, the impact of COVID-19 on the lives of children and their parents can be striking, resulting in a significantly large number of consequences not only on health, but also on children's social, emotional and mental well-being, including their sleep patterns^{2,3,9,23}. This impact can be lifelong⁹.

The harmful effects of these changes on children's sleep have been examined by studies reviewing the world's literature²⁴⁻²⁶. In the first review on the subject, researchers showed a combined prevalence of sleep disorders in children and schoolchildren of 54% and a worsening of sleep quality of 27% during the pandemic²⁴. In children aged 12 and under, the most important changes related to the COVID-19 lockdown on sleep found were longer sleep duration, delays in going to bed and waking up, increased sleep latency, daytime sleepiness and other sleep disorders²⁵. In another systematic review with meta-analysis, the results suggest an influence of the pandemic on sleep characteristics, such as increased sleep duration, late bedtimes and decreased sleep efficiency²⁶. In addition, according to the study, changes in family routines during the pandemic were related to these sleep changes and increased use of screens/electronic devices was associated with poorer sleep quality²⁶. Thus, studies are needed to better understand the effects of social distancing and school closures on children's sleep during the COVID-19 pandemic²⁴⁻²⁶.

Thus, the aim is to assess the sleep habits of pre-school children when they return to school after the COVID-19 lockdown in Brazil. A better understanding of the effects of the pandemic on children's sleep can help to take the necessary measures aimed at changing behavior, and educating parents and health professionals, in order to avoid short- and long-term consequences.

■ METHODS

Study design

This is a cross-sectional study nested in a cohort of live births with no health problems, in a public hospital in the city of Mamanguape (PB), to assess growth and development up to 1,000 days of life²⁷. Initially, the cohort intended to carry out assessments at birth, at the 1st, 2nd and 6th months and at 1,000 days of life. However, follow-up at two years of age had to be interrupted as a result of the COVID-19 pandemic.

As a result, the previous reference project²⁷ was reformulated with the aim of examining the implications of the COVID-19 pandemic on children's growth and development. A total of 126 children were assessed at the age of four, enrolled in the five municipal schools in the municipality of Mamanguape (PB) with pre-school education and who were in class.

Data collection

For data collection, in August 2022, a structured questionnaire was administered to mothers with information about the children. The study focuses on children's sleeping habits, analyzing their relationship

with their biological profile, health conditions (health problems, vaccinations and special needs), maternal care, screen time and physical activity, and behaviors during the COVID-19 pandemic. The questionnaire used to assess sleep habits is based on parental practices at bedtime and the child's sleep hygiene, including indicators on bedtime routine, rhythmicity and affective separation²⁸⁻³¹.

Sex and race/color were the data of interest for the children's biological profile. Race was self-reported by the mothers.

The children's health status was related to health problems at birth, hospitalization since birth for 24 hours or more, immunization with the pentavalent vaccine and screening for children with Special Health Needs (SHN). Data on the child's vaccinations was obtained from the Child Health Handbook.

Screening for children with SHN was carried out using the Children with Special Health Care Needs Screener, validated in Brazil³². Children with SHN are clinically fragile children who are at high risk of developing or who already have chronic physical, developmental, behavioral or emotional conditions, and therefore require health services and special clinical care³². The questionnaire makes it possible to identify and assess the demands of caring for children with health needs in three domains: i. dependence on medication prescribed for a certain clinical condition, ii. use of health services above what is considered normal or routine, and iii. presence of functional limitations. It consists of 14 questions with yes (special need) and no answer alternatives, five of which are main and nine conditional (four of the main questions include two conditional questions; the other main question includes one conditional question). When at least one main question and its conditional question(s) were answered positively, it was classified as NES (special health need in at least one of the domains)^{32,33}.

Data on maternal care of the child referred to how easy it was to look after the child and advise them on health aspects, and the routine of doing activities and playing with the child. The questions had the alternative answers "Yes" and "No".

In addition, mothers were asked to report how much time their child had spent in the last month watching television, using a computer, playing video games, using a cell phone/tablet and playing outside on a normal weekday and on a normal weekend day. To calculate the total recreational screen time in a day, the minutes used for each of the activities mentioned, except playing outdoors, were added up and the average of the two reference times (Monday to Friday and the weekend) was determined. Daily physical activity time was obtained in a similar way based on the answers about time spent playing outdoors. For categorization, screen use ≤ 60 minutes/day and time playing outdoors ≥ 180 minutes/day were considered adequate, based on the World Health Organization's guidelines for physical activity, sedentary behavior and sleep for children under 5 years of age³⁴.

The child's behavior during the COVID-19 pandemic included information on the routine of wearing a mask and sanitizing hands, remaining in social isolation whenever/almost whenever recommended and worrying

about the disease. The questions were designed with three alternative answers (“Very little”, “Little” and “A lot”), with “Very little” and “Little” being grouped together for analysis.

Changes in children’s sleep habits were assessed using the Sleep Habits Inventory for Preschool Children, which has been previously validated²⁸. This instrument assesses parental practices at bedtime and the child’s sleep hygiene, covering three sleep habits during the previous week: bedtime routine (parental behavior at bedtime and the child’s independence when falling asleep), rhythmicity (regularity in the times and place of going to sleep and waking up, and nocturnal awakening) and affective separation (fear and difficulty of separation from parents at night at bedtime). The instrument consists of 17 questions (five for bedtime routine, six for rhythmicity and six for affective separation) which are answered on a Likert scale from 1 to 4 (1 = not this week, 2 = 1 to 2 times this week, 3 = 3 to 5 times this week and 4 = 6 or more times this week). The response scores were recoded as follows: positive and neutral habits (put to bed by one/both parents, take a nap in the afternoon and bring a safety object to bed): 4 = 3, 3 = 2, 2 = 1 and 1 = 0; negative habits (falls asleep before going to bed, wakes up during the night, takes more than 30 minutes to fall asleep, expresses fear of the dark after being put to sleep, wakes up distressed by dream or worry, needs night light on while sleeping, calls parents during the night and goes to parents’ bed at night): 4 = 0, 3 = 1, 2 = 2 and 1 = 3. Thus, the maximum and minimum possible scores were 15 and 0 for bedtime routine, 18 and 0 for rhythmicity and 18 and 0 for affective separation, respectively. The higher the final score for each sleep habit, the lower the number of sleep problems and the better the quality of sleep²⁸⁻³¹.

Data analysis

The independent variables used to characterize the children in the analyses were: gender (male, female), race/color (white, other), health problems at birth (no, yes), hospitalization for 24 hours or more since birth (no, yes), immunization with the pentavalent vaccine (complete schedule, incomplete schedule), screening for SHN (no, yes), mother’s ease of caring for the child and guiding them in health aspects (yes, no), mother’s routine of doing activities and playing with the child (yes, no), recreational screen time (≤ 60 min, > 60 minutes), physical activity time (≥ 180 minutes, ≤ 180 minutes), routine of wearing a mask during the COVID-19 pandemic (a lot, a little/very little), routine of sanitizing hands during the COVID-19 pandemic (a lot, a little/very little), remaining in social isolation whenever/almost whenever recommended during the COVID-19 pandemic (a lot, a little/very little), concern about the disease during the COVID-19 pandemic (a little/very little, a lot).

The mean scores for bedtime routine, rhythmicity and affective separation of preschoolers were analyzed according to the variables characterizing the children. The means were compared using the Student’s t-test. The criterion for statistical significance was $p < 0.05$. The analyses were carried out using the Stata version 11.0 statistical package.

Ethical aspects

The study was conducted under the guidelines of Resolution 466/2012 of the National Health Council. The children’s mothers signed the Free and Informed Consent Form as a precondition for taking part in the study after being informed of the objectives, procedures and advantages of their participation. The research projects were approved by the Research Ethics Committee of the State University of Paraíba (CAAE 81216417.0.0000.5187, Opinion 2.447.509 and CAAE 53281421.8.0000.5187, Opinion 5.137.768).

RESULTS

The results of the study are shown in Table 1. Of all the children in the study, the most prevalent negative health condition was hospitalization since birth for 24 hours or more (38.9%). The proportion of children with SHN was 26.2% and with a complete pentavalent vaccination schedule was 89.7%. Of the mothers, 19.0% said they found it difficult to look after their child and give them advice on health aspects. With regard to recreational screen time, 86.5% of the children spent more than 60 minutes. Physical activity time of less than 180 minutes was 58.7%. During the COVID-19 pandemic, 82.5% of the children wore a mask in their routine, 78.6% used to sanitize their hands, 63.5% were in social isolation whenever/almost whenever recommended and 72.2% felt worried about the disease.

Hospitalization since birth for 24 hours or more ($p = 0.047$, $p = 0.010$, $p = 0.000$) and the mother’s difficulty in caring for the child and guiding them in health aspects ($p = 0.003$, $p = 0.023$, $p = 0.037$) represented lower averages for both bedtime routine and rhythmicity and affective separation. Children with more than 60 minutes of recreational screen time also had lower bedtime routine averages ($p = 0.002$). For affective separation, health problems at birth ($p = 0.001$) and screening for SHN ($p = 0.025$) also influenced the averages negatively.

For the variables on behavior during the COVID-19 pandemic, children who did not express concern about the disease had better bedtime routine habits ($p = 0.003$) and rhythmicity ($p = 0.027$). In addition, children with a mask-wearing routine had a higher average bedtime routine ($p = 0.003$).

DISCUSSION

The present study provides an analysis of the sleep habits of preschool children on their return to school after prolonged confinement at home during the COVID-19 outbreak. The children’s sleep habits resulted in mean scores of 7.0 ± 3.4 for bedtime routine, 7.3 ± 3.6 for rhythmicity and 12.8 ± 4.1 for affective separation, representing 46.7%, 40.6% and 71.1% of the respective maximum scores. The child’s health conditions (health problems at birth, hospitalization and SHN), the mother’s difficulty in caring for the child, the child’s screen time being longer than recommended, the child not wearing a mask during the COVID-19 pandemic and the child’s worry about COVID-19 negatively influenced one or more of the sleep habits analyzed.

Table 1: Inventory of preschool children’s sleep habits according to children’s characteristics related to biological profile, health condition, care, screen time and physical activity, and behavior during the COVID-19 pandemic. Mamanguape, PB, 2022

Variables	n	%	Sleep Habits								
			Bedtime routine (7,0 ± 3,4)			Rhythmicity (7,3 ± 3,6)			Affective separation (12,8 ± 4,1)		
			Mean	Standard Deviation	p	Mean	Standard Deviation	p	Mean	Standard Deviation	p
Biological profile											
Sex					0.081			0.394			0.311
Female	66	52.4	7.424	3.365		7.242	3.490		12.636	4.044	
Male	60	47.6	6.583	3.356		7.416	3.814		13.001	4.242	
Race					0.475			0.423			0.299
White	38	30.2	7.052	3.548		7.421	4.123		13.105	4.488	
Others	88	69.8	7.011	3.316		7.284	3.427		12.681	3.981	
Health condition											
Health problems at birth					0.144			0.231			0.001
No	112	88.9	7.928	3.341		8.001	3.632		13.196	3.992	
Yes	14	11.1	6.910	3.626		7.241	3.721		9.714	4.008	
Hospitalization since birth for 24 hours or more					0.047			0.010			<0.001
No	77	61.1	7.653	3.060		8.265	3.837		13.727	3.571	
Yes	49	38.9	6.623	3.761		6.727	3.100		11.367	4.549	
Immunization with the pentavalent vaccine					0.489			0.460			0.094
Complete scheme	113	89.7	7.026	3.290		7.336	3.361		12.973	3.933	
Incomplete scheme	13	10.3	7.000	4.183		7.230	5.673		11.384	5.530	
Special health needs					0.259			0.314			0.025
No	93	73.8	7.139	3.235		7.419	3.609		13.236	3.716	
Yes	33	26.2	6.696	3.770		7.060	3.749		11.606	4.980	
Maternal care											
Mother's ability to take care of the child and advise on health aspects					0.003			0.023			0.037
Yes	102	81.0	7.411	3.407		7.637	3.573		13.127	4.125	
No	24	19.0	5.375	2.715		6.033	3.671		11.458	3.934	
Mother's routine of doing activities and playing with the child					0.288			0.405			0.464
Yes	118	93.7	7.067	3.375		7.625	3.591		12,796	4.168	
No	8	6.3	6.375	3.502		7.305	4.501		12,900	3.703	
Recreational screen time and physical activity											
Recreational screen time (minutes)					0.002			0.227			0.258
≤ 60	17	13.5	9.176	4.141		7.941	3.381		12.862	5.351	

Continuation - Table 1: Inventory of preschool children’s sleep habits according to children’s characteristics related to biological profile, health condition, care, screen time and physical activity, and behavior during the COVID-19 pandemic. Mamanguape, PB, 2022

Variables	n	%	Sleep Habits								
			Bedtime routine (7,0 ± 3,4)			Rhythmicity (7,3 ± 3,6)			Affective separation (12,8 ± 4,1)		
			Mean	Standard Deviation	p	Mean	Standard Deviation	p	Mean	Standard Deviation	p
> 60	109	86.5	6.688	3.129		7.229	3.678		12.460	3.931	
Physical activity (minutes)					0.139						0.466
≥ 180	52	41.3	7.297	3.272		7.729	3.558		12.846	3.947	
< 180	74	58.7	6.634	3.439		6.750	3.657		12.783	4.275	
Behavior during the COVID-19 pandemic											
Mask routine					0.027						0.301
Very much	104	82.5	7.288	3.145		7.471	3.522		12.721	4.176	
Little/very little	22	17.5	5.772	4.151		6.636	4.018		13.227	3.951	
Hand hygiene routine					0.158						0.420
Very much	99	78.6	7.181	3.224		7.212	3.540		12.848	4.023	
Little/very little	27	21.4	6.444	3.886		7.740	4.005		12.666	4.565	
Remain in social isolation whenever/ almost whenever recommended					0.071						0.185
Very much	80	63.5	7.296	3.495		7.560	3.618		13.342	3.253	
Little/very little	46	36.5	6.314	3.304		6.714	3.633		12.604	4.416	
Worrying about the disease					0.003						0.041
Little/very little	35	27.8	7.625	3.211		7.750	3.570		13.434	4.167	
Very much	91	72.2	5.978	3.428		6.586	3.667		12.450	4.025	

p-value: value of statistical significance according to the t-test.

The results of studies suggest an influence of the COVID-19 pandemic on the sleep characteristics of young children, such as increased sleep duration, late bedtimes and impaired sleep quality²⁶. For example, a Spanish study showed a decrease in sleep time in 3 to 4-year-old preschoolers³⁵. In France, researchers found a significant increase in sleep disorders in young children, with an increase in the overall score on the Sleep Disorders Scale for Children, a reduction in the number and duration of naps, and an increase in the duration of night-time sleep³⁶. In Italy, they also found disturbances in young children for sleep variables such as duration, falling asleep, nocturnal awakenings and parasomnias³. In contrast, observations of other realities have shown a deterioration in the routine and quality of sleep during the initial phase of confinement with subsequent stabilization, such as in Italian children aged 3 to 637, in Chilean children aged 1 to 538, and in infants (0-35 months) and preschoolers (36-71 months) from different countries, mainly European ones⁶.

Although the results of this study do not allow us to establish changes in sleep as a result of the lockdown, they indicate poor sleep quality during the pandemic, during the back-to-school period, in line with previous

studies^{3,6,35-38}. In Brazil, a study of adults found that sleep quality worsened during the distancing imposed by the COVID-19 pandemic³⁹. In this sense, it can be conjectured that children’s sleep is affected by the interaction between parents and children, including the reaction to adverse events such as confinement, and is related to the parents’ sleep^{18,40}.

For the sleep habits of interest in this study, rhythmicity and bedtime routine were the most compromised, which reinforces the findings of previous studies that have highlighted the presence of sleep disorders in children related to confinement^{3,6,7,10,18,36}. Thus, it is possible to point out that the children had problems with the regularity of bedtimes and wake-up times, nocturnal awakenings and dependence on sleep, which are plausible for modification through more positive parental practices related to sleep organization²⁸⁻³¹. Establishing a structured day with set times is an easy and efficient strategy for children to improve their behavior and sleep quality⁴¹. Maintaining a regular sleep schedule and using only the bed for sleeping, together with physical exercise and limited use of media before bedtime, are fundamental solutions for promoting good sleep quality⁴². In addition,

the importance of the family context, which should be harmonious and communicative, should be emphasized².

Changes in family routines and behaviors during the COVID-19 pandemic may have influenced children's sleep characteristics^{2,26,41}. In addition to isolation, the pandemic has led to the need to include contagion prevention habits in the routine, such as wearing a mask and hand hygiene⁴³, which, as previously observed⁴⁴, were frequent in this study. Good adherence to these measures is based on their preventive nature, functionality and safety⁴⁴. However, these habits are not always understood by children⁴³, in whom, in addition, environmental influences generate more consequences as a result of changes in the development process⁶. These circumstances can lead to unfavorable psychological and emotional outcomes and interfere with sleep^{6,40,43,45}, showing plausibility for the relationship found in this study between the mask-wearing routine and the bedtime routine. However, in another study, the quality of children's sleep was not associated with adherence to isolation recommendations or with social interaction⁶.

Negative repercussions on children's sleep during the pandemic may be related to problems with emotional well-being^{2,37,40,45,46}. In a study carried out in Italy, 72.2% of the parents interviewed said that their children had become more nervous, worried or sad six months after the start of the pandemic, representing a risk factor for sleep disorders such as difficulty falling asleep and staying asleep at night⁷. In Canada, researchers have shown changes in family sleep habits associated with fears and concerns about COVID-19 among both parents and children⁴².

In the present study, the proportion of children worried about the disease was significant and a determinant of bedtime routine and rhythmicity. These results may be related to anxiety, which translates into difficulties in self-regulation at bedtime⁴⁴ and interferes with sleep quality^{2,37,40,45,46}. Fear-mongering media and spending too much time reading news or talking about COVID-19 can exacerbate worry about the disease and anxiety^{18,42}. Educational tools that stimulate development, such as talking to children about COVID-19, practices such as meditation, yoga and listening to relaxing music/sounds before bed, can alleviate feelings of anxiety and improve sleep⁴¹.

In this study, more recreational screen time than recommended among children was 86.5% and led to lower average bedtime routines ($p = 0.002$). Other studies have shown that pandemic restrictions have led to reduced physical activity, increased screen exposure and altered sleep patterns among preschoolers^{35,38,45}. The increase in screen time during the COVID-19 pandemic as a condition associated with sleep disturbances was confirmed by a literature review²⁶, highlighting the need to monitor and reduce children's use of electronics, which could be replaced by social interaction, especially at bedtime^{38,41,45}. In addition, access to appropriate spaces for active play at home or in the environment can benefit both 24-hour movement behavior and sleep quality^{6,38}.

This situation is particularly important among preschoolers, who were the group most affected by restrictions during the pandemic, especially with regard to

physical activity and recreational screen time, as they have more access to electronic devices and need more space to play, compared to younger children³⁸. It is important to emphasize that restrictions on movement to contain the transmission of the virus have varied according to the country and other particularities, resulting in differences in children's physical activity patterns, sedentary behavior and sleep^{26,35,38}. The strength of this influence can be seen in a study which showed that isolation had an attenuated impact on physical activity levels, screen time and sleep quality when children had access to play spaces³⁸. Another important finding was the difference in screen time and sleep when comparing children in situations of strict and relaxed confinement found by other researchers³⁵.

With regard to maternal care, it was found that the mother's ease of caring for the child led to fewer problems with bedtime routine, rhythmicity and affective separation, reinforcing previous findings that emphasize the importance of childcare in meeting children's needs and protecting sleep quality^{2,6}. In this sense, caregiver characteristics such as knowledge about healthy sleep practices, the adoption of consistent sleep routines, communication with children, time available to provide care and resilience are relevant^{2,6,7,18,47}. However, the pandemic may have influenced these characteristics and caused damage both to parental behavior and control and to children's sleep quality^{24,26}. Improvements in the quality of care provided to children are essential, as positive behaviors and reflexes from parents towards their children, with the appropriate synchrony between them, facilitates the development of emotional self-regulation capacity and sleep regulation in young children, whose natural tendency is to synchronize with their social and family environment, especially mother-child, on both behavioral and physiological levels¹⁸. Adequate parental knowledge and practices related to children's sleep are essential for recognizing, avoiding and managing sleep problems in the first years of life⁴⁷.

Finally, the children's health conditions, as evidenced by health problems at birth, hospitalization and screening for SHN, also had a negative influence on their sleep habits. A study carried out in Italy six months after the start of the pandemic with ≤ 18 year olds including children with disabilities, autism spectrum disorders, chronic illnesses and specific learning difficulties showed related results. In this research, the presence of chronic illnesses was associated with difficulties in maintaining sleep, while difficulty falling asleep was greater in children with multiple conditions⁷. These results can be explained by the relationship between sleep and the stress response system. There is evidence showing a link between circadian rhythm and sleep and physiological adaptations and disturbances such as increases in blood pressure, insulin and glucose⁴⁸. Therefore, providing specific guidance on sleep to support family members of children with health-related vulnerabilities is essential, especially in the adverse conditions of confinement⁶.

The results of this study do not allow causality to be inferred based on its design. They should also be interpreted with caution, as they refer to a specific moment after the COVID-19 lockdown in Brazil. Another

limitation of this study is that the measurements were based on mothers' reports, which may not fully reflect the reality of children's concerns. However, they provide important results on children's sleep habits related to the pandemic. There is still little evidence on the effects of the pandemic on children's sleep obtained through face-to-face surveys and the studies carried out show great heterogeneity in the instruments used, with the findings for pre-school children standing out for being inconsistent²⁴⁻²⁶.

CONCLUSION

The averages of children's sleep habits indicated problems mainly with rhythmicity and bedtime routine. Children with health problems, excessive screen time and concern about COVID-19 during the pandemic, as well as the difficulty of maternal care, influenced the children's sleep habits.

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Author contributions

Dixis Figueroa Pedraza, Natalia dos Santos Silva and Luciane Bresciani Salaroli participated in the analysis and interpretation of the data, writing and final revision of the article. Dixis Figueroa Pedraza participated in the study design and conception of the article.

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Conflicts of interest

The authors declare that they have no conflicts of interest regarding the authorship and publication of this article.

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Resumo

Introdução: a pandemia da COVID-19 trouxe mudanças nas rotinas, utilização do tempo, comportamentos, relações sociais e preocupações que podem comprometer o sono das crianças, sendo essenciais estudos sobre a temática.

Objetivo: avaliar os hábitos de sono de crianças pré-escolares após o confinamento da COVID-19 no Brasil.

Método: trata-se de um estudo transversal aninhado a uma coorte de nascidos vivos para avaliar o crescimento e desenvolvimento até os mil dias de vida. Para este estudo, foram coletados dados das crianças aos 4 anos de idade relacionados a perfil biológico, condição de saúde, cuidado materno, tempo de tela e atividade física, e comportamento durante a pandemia da COVID-19. As médias dos escores dos hábitos de sono das crianças (rotina para dormir, ritmicidade e separação afetiva) analisaram-se de acordo com as características das crianças por meio do teste t-student.

Resultados: a rotina para dormir representou o hábito de sono mais prejudicado, com menores médias nos casos de internação hospitalar ($p = 0,047$), dificuldade da mãe para o cuidado da criança ($p = 0,003$) e muita preocupação com a COVID-19 durante a pandemia ($p = 0,003$); seguido da ritmicidade que também foi pior nas situações anteriores. Ainda, crianças com tempo de tela recreativa superior a 60 minutos ($p = 0,002$) e sem rotina de usar máscara durante a pandemia ($p = 0,003$) apresentaram médias inferiores de rotina para dormir. Problemas de saúde ao nascimento ($p = 0,001$), internação hospitalar ($p = 0,000$), necessidades especiais de saúde ($p = 0,025$) e dificuldade da mãe para prestar cuidado ($p = 0,037$) interferiram negativamente na separação afetiva.

Conclusão: crianças com problemas de saúde, tempo de tela excessivo e preocupação com a COVID-19 durante a pandemia, bem como a dificuldade de cuidado materno, influenciaram os hábitos de sono das crianças.

Palavras-chave: COVID-19, criança, sono, comportamentos relacionados com a saúde, nível de saúde.

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