

Sleep habits and electronic device use in primary school children

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Abstract

Introduction and Objectives: Excessive screen use by children may compromise sleep quality, school performance, and overall health. This study aims to explore parents' and primary caregivers' perceptions regarding the sleep habits of school-aged children (six to ten years old), as well as to identify the electronic devices they use and their screen exposure. **Methods:** Quantitative, descriptive-correlational, and cross-sectional study with a non-probabilistic sample of 365 parents or primary caregivers of children attending primary school in a municipality in inland Portugal. A sociodemographic questionnaire, a questionnaire on the use of technologies, and the *Children's Sleep Habits Questionnaire* were administered, the latter having been validated for the Portuguese population. **Results:** On average, children went to bed at 9:33 p.m. on weekdays and at 9:41 p.m. on weekends. The presence of electronic devices in the home was high, with computers, mobile phones, tablets, televisions, and gaming consoles being the most common. During the week, 45.5% of children used screens for less than one hour per day, while on weekends, 38.1% used them for one to two hours per day. Children with higher screen use during the week exhibited greater sleep-related anxiety ($p = 0.023$). On weekends, screen use exceeding three hours was significantly associated with several sleep disturbances, including anxiety ($p = 0.006$), daytime sleepiness ($p = 0.020$), and nighttime awakenings ($p = 0.020$). **Discussion:** Prolonged screen time is associated with changes in sleep patterns and quality in school-age children, which reinforces the need for educational strategies aimed at families. Excessive screen use is linked to poorer sleep quality.

Keywords: Sleep. Child. Digital technology. Sleep habits. Sleep wake disorders.

Hábitos de sono e uso de dispositivos eletrónicos em crianças do ensino primário

Resumo

Introdução e Objetivos: O uso excessivo de ecrãs pelas crianças pode comprometer a qualidade do sono, o desempenho escolar e a saúde global. Este estudo tem como objetivo explorar as perceções dos pais e cuidadores primários sobre os hábitos de sono de crianças em idade escolar (seis a dez anos) e identificar os dispositivos eletrónicos utilizados e a exposição ao ecrã. **Métodos:** Estudo quantitativo, descritivo-correlacional e transversal, com amostra não probabilística de 365 pais/encarregados de educação de crianças a frequentar o primeiro ciclo num concelho do interior de Portugal. Aplicou-se um questionário sociodemográfico e sobre o uso de tecnologias, e o *Children's Sleep Habits Questionnaire*, validado para a população portuguesa. **Resultados:** Em média as crianças deitam-se às 21h33 durante a semana, e às 21h41 ao fim de semana. A presença de dispositivos eletrónicos no domicílio é elevada, sendo o computador, telemóvel, tablet, televisão e

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consola os mais comuns. Durante a semana, 45,5% usam ecrãs menos de uma hora por dia; ao fim de semana, 38,1% usam entre uma a duas horas por dia. Crianças com maior utilização de ecrã durante a semana revelaram mais ansiedade associada ao sono ($p = 0,023$). Ao fim de semana, o uso superior a três horas esteve associado a alguns distúrbios do sono, como a ansiedade ($p = 0,006$), a sonolência diurna ($p = 0,020$) e os despertares noturnos ($p = 0,020$). **Discussão:** A exposição prolongada a ecrãs associa-se a alterações nos padrões e qualidade do sono em idade escolar, reforçando a necessidade de estratégias educativas dirigidas às famílias. O uso excessivo de ecrãs prejudica a qualidade do sono.

Palavras-chave: Sono. Criança. Tecnologia digital. Hábitos de sono. Transtornos do sono-vigília.

Keypoints

What is known

- Excessive screen time affects children's sleep quality, especially when used before bedtime.
- Children's use of digital devices has increased significantly.
- Parents play a key role in shaping children's sleep routines and screen use.

What is added

- More than three hours of screen time on weekends is significantly associated with anxiety, daytime sleepiness, and nighttime awakenings. On school days, screen time is associated with anxiety.
- The need for family-targeted education strategies to reduce screen time and improve sleep quality is highlighted.

Introduction

Children's sleeping habits are the result of a combination of routines, family interactions, rules, and sleeping environment. The consistency of these factors directly influences its quality.¹ Psychosocial and biological factors contribute to changes in sleep patterns and can compromise sleep hygiene.^{1,2} Elements such as the child's neurobiopsychological profile, their stage of development, and parental beliefs about sleep also play an important role.³ Daytime sleepiness, which is often associated with insufficient sleep, is common in children and tends to worsen during adolescence. Prolonged exposure to screens has been identified as a disturbing factor, although research in this area is limited due to rapid technological evolution.^{2,3}

Children's increasing exposure to new technologies in their daily lives, particularly through interactive screens and mobile devices, has significantly shaped their lifestyle – so much so that they are now considered “digital natives”.⁴ Despite the benefits in terms of access to information and learning, several studies have highlighted the negative effects of prolonged screen time, including an increased risk of obesity, behavioral disorders, sleep disturbance, and poor school performance.⁴ Although electronic devices are widely integrated into children's home and social environments, there is still limited understanding of their direct impact on sleep patterns.^{5,6,7} The literature points to a clear association between excessive screen use and changes in sleep quality and duration such as greater difficulty falling asleep, reduced total sleep time and increased daytime sleepiness, which can lead to negative consequences for school performance.^{7,8}

The widespread use of portable electronic devices with screens, particularly in the bedroom, is accompanied by a high prevalence of insufficient sleep, which affects the majority of school-age children. Studies indicate that three out of four children report the presence of at least one screen-based multimedia device in their bedroom, and around 60% report regular use of these devices during the hour before bedtime.⁹ In addition, World Health Organization guidelines recommend limiting recreational screen time to no more than two hours a day and ensuring sufficient sleep. Many parents, teachers, and health professionals are concerned that children's excessive screen time affects their sleep and well-being.¹⁰

The main objectives of this study were to characterize the habits related to the use of electronic devices in children in the first cycle of elementary school and to relate screen exposure time with sleep quality based on the perceptions of parents and caregivers.

Material and methods

Participants

A quantitative, descriptive-correlational, cross-sectional study was carried out in all the public schools in a municipality in the interior of the country. It was aimed at all the children attending primary school (ages six to ten years old). The non-probabilistic sample consisted of 365 children, who were evenly distributed across the four years of primary school. Exclusion criteria were children under six and over ten years old, and children on sleep-inducing medication. Clinical

information on neurodevelopmental disorders or sleep-related conditions was neither collected nor validated.

The study was approved by the Ministry of Education's Monitoring of School Surveys (registration no. 0012100025) and received a favorable opinion from the Ethics Committee of the Polytechnic of Viseu (no. 53A/SUB/2023).

Data collection tool

The data collection instrument, which parents and/or guardians can fill out themselves, was divided into two parts. The first part was a sociodemographic questionnaire designed exclusively for this study. It contained 24 questions on children's use of electronic devices, which were addressed in a closed dichotomous, multiple-choice format. The second part consisted of a scale to assess the sleep habits of children aged two to ten. It was translated and validated for the Portuguese population by Silva et al.³ and based on the Children's Sleep Habits Questionnaire made by Judith Owens in a community sample. The questionnaire consists of 33 items grouped into eight subscales: bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, nighttime awakenings, parasomnias, sleep disordered breathing, and daytime sleepiness. Each item is rated on a three-point scale: usually, sometimes, or rarely, with higher scores reflecting poorer sleep quality. The total score is the sum of all items, and values above 41 have been suggested as indicative of clinically significant sleep disturbance.

The European Union's online platform EUSurvey was used to collect the data.

Statistical analysis

The statistical procedures were executed using the IBM SPSS Statistics software (version 28.0). The Mann-Whitney and Kruskal-Wallis non-parametric tests were used, with a significance level of < 0.05 and a 95% confidence interval.

Results

Sociodemographic characterization of the children

The sample population comprised 365 children with a balanced gender distribution: 51.5% were boys and 48.5% were girls (Table 1). The distribution of children

by school year remained homogeneous across all four years. Regarding household composition, 49.0% of the children lived with their parents and siblings, while 36.2% lived with their parents exclusively.

Regarding the children's sleeping habits, the mean bedtime during the week was 9:33 p.m. (± 35 minutes), with the median being 9:30 p.m. On weekends, the bedtime for children was later, with the average being 9:41 p.m. (± 35 minutes) and the median being 10:00 p.m. and revealing a disparity of more than three hours between the earliest and latest reported bedtimes. The average wake-up time was 7:40 a.m. (± 26 minutes) on weekdays, with a median of 7:40 a.m.; and 9:00 a.m. (± 53 minutes) on weekends, with a median of 9:00 a.m., confirming the expected delay in waking on Saturdays and Sundays.

The mean total daily sleep duration was found to be nine hours and 39 minutes (± 50 minutes), with a median of ten hours and exhibited variability between a minimum of seven hours and a maximum of 12 hours and 30 minutes. This wide range, exceeding five hours between the shortest and longest durations, highlights substantial irregularity in sleep patterns. Despite this variability, the median and mean values were consistent with international recommendations for sleep duration in this age group.

Sociodemographic characterization of the parents

The majority of mothers (72.6%) and fathers (69.3%) were between 36 and 45 years old, with average ages of 40.64 ± 4.67 years and 42.44 ± 5.08 years, respectively. Most parents were married (72.6%), with cohabitation being the second most common situation (13.7%). Regarding professional status, 87.9% of mothers and 91.5% of fathers were employed, which indicates that the sample predominantly consisted of economically active families.

In terms of educational qualifications, mothers had a higher level of education, with 44.9% having a bachelor's degree and 20.3% having a master's degree. Among fathers, the most prevalent levels of education were secondary education (39.5%) and a bachelor's degree (34.5%). Nearly all participants (99.2%) reported having internet access at home, which may have influenced the amount of time children spent using digital devices.

Technologies at home

Children in 36.2% of households had access to a computer, mobile phone, tablet, television, and

Table 1. Sociodemographic characterisation

Characteristics	Male (n = 188; 51.5%)		Female (n = 177; 48.5%)		Total (n = 365; 100.0%)	
Age	n	%	n	%	n	%
6 years	32	17.0	35	19.8	67	18.4
7 years	41	21.8	54	30.5	95	26.0
8 years	57	30.3	37	20.9	94	25.8
9 years	49	26.1	42	23.7	91	24.9
10 years	9	4.8	9	5.1	18	4.9
School year	n	%	n	%	n	%
1st year	49	26.0	41	23.2	88	24.7
2nd year	39	20.7	60	33.9	99	27.1
3rd year	58	30.9	38	21.5	96	26.3
4th year	42	22.3	38	21.5	80	21.9
Who the child lives with	n	%	n	%	n	%
Mother	12	6.4	7	4.0	19	5.2
Mother; Grandparents	2	1.1	0	0.0	2	0.5
Mother; Grandparents; Other	2	1.1	0	0.0	2	0.5
Mother; Brother(s)	3	1.6	6	3.4	9	2.5
Mother; Brother(s); Grandparents	1	0.5	0	0.0	1	0.3
Mother; Brother(s); Other	2	1.1	0	0.0	2	0.5
Mother; Other	0	0.0	1	0.6	1	0.3
Father; Brother(s)	1	0.5	0	0.0	1	0.3
Parents	67	35.6	65	36.7	132	36.2
Parents; Grandparents	3	1.6	2	1.1	5	1.4
Parents; Brother(s)	87	46.3	92	52.0	179	49.0
Parents; Brother(s); Grandparents	5	2.7	3	1.7	8	2.2
Parents; Brother(s); Other	2	1.1	1	0.6	3	0.8
Parents; Other	1	0.5	0	0.0	1	0.3
Bedtime during the week	Min	Max	Min	Max	Min	Max
	8.00pm	11.30pm	8.00pm	11.30pm	8.00pm	11.30pm
Median	9.30pm		9.30pm		9.30pm	
$\bar{x}$	9.32pm $\pm$ 35 minutes		9.34pm $\pm$ 34 minutes		9.33pm $\pm$ 35 minutes	
Bedtime at the weekend	Min	Max	Min	Max	Min	Max
	8.00pm	11.45pm	8.00pm	11.50pm	8.00pm	11.50pm
Median	10.30pm		10.00pm		10.00pm	
$\bar{x}$	9.46pm $\pm$ 12 minutes		9.36pm $\pm$ 54 minutes		9.41pm $\pm$ 35 minutes	
Waking up on weekdays	Min	Max	Min	Max	Min	Max
	6.30am	9.00am	6.00am	10.00am	6.00am	10.00am
Median	7.40am		7.38am		7.40am	
$\bar{x}$	7.38am $\pm$ 23 minutes		7.42am $\pm$ 29 minutes		7.40am $\pm$ 26 minutes	
Waking up time at weekends	Min	Max	Min	Max	Min	Max
	7.00am	12.00am	7.00am	12.00am	7.00am	12.00am
Median	9.00am		9.00am		9.00am	
$\bar{x}$	9.03am $\pm$ 51 minutes		8.58am $\pm$ 55 minutes		9.00am $\pm$ 53 minutes	

(Continues)

Table 1. Sociodemographic characterisation (*continued*)

Characteristics	Male (n = 188; 51.5%)		Female (n = 177; 48.5%)		Total (n = 365; 100.0%)	
Total daily sleep time	Min	Max	Min	Max	Min	Max
	7h 00m	12h 30m	7h 00m	12h 00m	7h 00m	12h 30m
Median	10h 23 minutes		10h 30 minutes		10h 00 minutes	
$\bar{x}$	9h 41m ± 52 minutes		9h 38m ± 48 minutes		9h 39m ± 50 minutes	

console, this being the most frequent combination of technological devices. The various combinations observed and their high availability reveal a highly digital home environment. It should also be noted that, in most cases (95.6%), these technological devices were not intended for the exclusive use of adults, meaning that children had direct access to them. This may significantly impact screen time and, consequently, sleep habits.

Time spent per day using technological devices

Regarding the daily time spent using electronic devices (Table 2), 45.5% of children used them for less than one hour per day during the week, while 40.8% used them for between one and two hours per day. Only 13.7% spent more than two hours of screen time per weekday. On weekends, however, the numbers changed substantially: 53.4% of children spent more than two hours on screens per day, of which 16.4% spent more than three hours on screens per day.

Relationship between sleep habits and time children spent using technological devices on weekdays

The inferential analysis (Table 3) revealed a statistically significant association between weekday screen time and sleep anxiety ($p = 0.023$). Children who used devices for between two and three hours per day were the most affected by this.

Although not statistically significant, an increasing trend toward bedtime resistance ($p = 0.089$) and greater sleep fragmentation (as indicated by nighttime awakenings and shorter sleep duration) was observed in the groups with longer screen times. This data suggests that a screen time greater than two hours per day can compromise important aspects of sleep quality in school-age children, even on weekdays.

Table 2. Use of electronic devices per day during the week by the child

Use of electronic devices per day during the week	n	%
Less than 1 hour	166	45.5
Between 1 and 2 hours	149	40.8
Between 2 and 3 hours	36	9.9
More than 3 hours	14	3.8
Use of electronic devices per day during the weekend	n	%
Less than 1 hour	31	8.5
Between 1 and 2 hours	139	38.1
Between 2 and 3 hours	135	37.0
More than 3 hours	60	16.4

Relationship between sleep habits and time children spent using technological devices on weekends

The analysis of weekend data (Table 4) revealed statistically significant associations between screen time and three sleep habit domains: sleep anxiety ($p = 0.006$), nighttime awakenings ($p = 0.020$), and daytime sleepiness ($p = 0.020$). Children whose screen time was greater than three hours had higher levels of anxiety and sleepiness, while those whose screen time was between two and three hours showed more nighttime awakenings. These results suggest that prolonged use of electronic devices on weekends significantly compromises sleep quality and continuity.

Discussion

This research has deepened our knowledge of sleep habits and the use of electronic devices among primary

Table 3. Sleep habits and screen time during the week

Characteristics	Bedtime resistance	Sleep onset delay	Sleep duration	Sleep anxiety	Night wakings	Parasomnias	Sleep disordered breathing	Daytime sleepiness
Screen time								
Less than 1 hour	172.95	192.73	189.14	166.39	171.43	183.37	178.91	183.71
Between 1 and 2 hours	183.20	174.05	171.15	192.65	191.39	182.82	178.36	176.30
Between 2 and 3 hours	217.35	162.33	197.60	211.33	180.13	173.69	206.68	189.85
More than 3 hours	170.71	179.36	161.29	162.00	197.04	165.68	180.25	189.64
p	0.089	0.201	0.128	0.023	0.136	0.888	0.228	0.856

Table 4. Sleep habits and screen time during the weekend

Characteristics	Bedtime resistance	Sleep onset delay	Sleep duration	Sleep anxiety	Night wakings	Parasomnias	Sleep disordered breathing	Daytime sleepiness
Screen time								
Less than 1 hour	181.52	185.76	199.63	129.85	142.52	186.45	189.15	135.81
Between 1 and 2 hours	176.68	187.41	184.45	178.55	181.14	171.57	181.25	185.32
Between 2 and 3 hours	185.49	175.44	184.17	190.57	191.41	186.15	178.99	180.54
More than 3 hours	192.83	188.38	168.41	203.73	189.28	200.62	192.89	207.55
p	0.727	0.719	0.388	0.006	0.020	0.297	0.654	0.020

school children based on their parents' and caregivers' perception in a municipality in inland Portugal. This is a relevant contribution to understanding the impact of digital technologies on key areas of children's functioning, such as sleep.

The average sleep duration, calculated from the reported bedtimes and wake-up times on both weekdays and weekends, was within the nine to 12 hours per 24-hour period recommended by the American Academy of Sleep Medicine for children aged six to 12 years.¹¹

However, even if the average sleep duration remains within the recommended limits, this data alone may not be sufficient to assess sleep quality. The literature indicates that disordered sleep patterns can exist even when sleep duration is adequate, especially when late bedtimes, nighttime awakenings, or disturbances such as anxiety and daytime sleepiness are present.^{11,12} Poor sleep quality can compromise multiple domains of child development, including emotional regulation, cognitive functioning, school performance, and behavior.¹¹

In addition, irregular bedtimes and total sleep time, including weekdays and weekends, may help explain symptoms of partial sleep deprivation, even when the average sleep duration appears normal. Although the present study did not examine correlations between social jet lag and device use, this association has been

reported in the literature and deserves attention in future research.

Almost all households have internet access and multiple digital devices such as computers, tablets, televisions, and consoles. This translates to a technological reality that is highly present in everyday family life. This technological ubiquity has been described by other researchers^{8,13} who identified a significant increase in home digitalization after the COVID-19 pandemic; this has had direct consequences on children's sleep patterns and screen time.

Regarding the time children spend on electronic devices, moderate use was observed on weekdays, with 45.5% of children using the devices for less than an hour per day. In contrast, there was a significant increase on weekends, with over half of the sample using them for more than two hours per day. This difference is consistent with the breakdown of routines and reduced parental supervision during non-school periods, as mentioned in other studies.^{14,15}

The inferential analysis revealed a correlation between screen time during the week and sleep anxiety, with higher values among children who used devices for two to three hours a day. On weekends, the results were even more noteworthy, showing a statistically significant link between screen time and sleep anxiety, nighttime awakenings, and daytime sleepiness. These findings strengthen evidence that excessive use of electronic devices is associated with

sleep fragmentation and lower restorative function. Phillips et al.¹² report that the presence of technological stimuli before sleep compromises children's sleep hygiene, often results in prolonged sleep latency, nighttime awakenings, and shorter effective sleep duration. This study echoes these results, finding that symptoms suggesting poor sleep quality were more frequent in the groups with greater screen time, especially on weekends.

A systematic review conducted by Qi et al.¹⁵ confirms that screen time has increased significantly in the post-pandemic context, negatively impacting children's and adolescents' circadian rhythms and sleep quality. The pattern identified in this study, with greater exposure on weekends and an average of more than two hours per day, reproduces the global trends described by the authors, suggesting that this is a persistent phenomenon between contexts.

National studies such as the one carried out by Santos et al.⁸ also warn about the high prevalence of symptoms such as daytime sleepiness, bedtime resistance, insomnia, and parasomnia, particularly among children with more intense digital routines.

It is essential to involve families in implementing measures to promote healthy sleep habits, particularly by regulating electronic device use. Empowerment and negotiation methods can be a useful reference for health professionals, as they propose a collaborative approach that values the active participation of caregivers in building routines that protect children's sleep.¹⁶

This study has limitations that must be considered when interpreting and discussing the results. The cross-sectional design allows for the identification of statistically significant associations, but it does not establish causal relationships between screen exposure and sleep quality. The non-probabilistic sample from a single municipality limits the generalization of the results to other geographic contexts, since there are considerable cultural, social, and economic differences between municipalities. Self-reported data collected from parents or guardians may introduce recall and social desirability biases. The lack of individual clinical data, such as neurodevelopmental or sleep disorders, and objective sleep measures restricts control of potentially biased variables. Despite these limitations, the consistency of the findings with those of previous studies^{9,12} reinforces the plausibility of the observed associations and highlights the need for longitudinal research to clarify causal relationships and explore mediating and predictive variables.

In summary, this study shows that excessive screen time, particularly on weekends, is significantly associated

with poorer sleep quality in school-aged children, even when their average sleep duration remains within the recommended range. These findings underscore the importance of preventive strategies that limit screen time, especially before bedtime, and encourage consistent sleep schedules. Collaborating closely with schools and primary care to strengthen parental education and digital health literacy may help mitigate the adverse effects of screen time and safeguard children's sleep and overall well-being. However, the absence of individual clinical data on conditions such as autism spectrum disorder, attention-deficit or hyperactivity disorder, epilepsy, or obstructive sleep apnea limits the ability to control potential confounders in the relationship between screen time and sleep quality. Future longitudinal research with larger, more diverse samples that incorporates objective sleep assessment tools and detailed clinical information is necessary to consolidate and expand upon these findings.

Author contributions

L. Condeço: conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, supervision, validation, visualization, writing of the original draft, review, and editing. C. Lopes: conceptualization, formal analysis, investigation, resources, software, visualization, writing of the original draft. P. Pinho: conceptualization, formal analysis, investigation, resources, software, visualization, writing of the original draft. R. Fernandes: conceptualization, formal analysis, investigation, resources, software, visualization, writing of the original draft. S. Santos: validation, visualization, writing, reviewing, and editing.

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Conflicts of interest

None.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from patients, and received approval from the Ethics Committee. The SAGER guidelines were followed according to the nature of the study.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript, nor for the creation of tables, or their corresponding captions.

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