

Association between Screen Time Exposure and Sleep Disturbances in Preschool-Aged Children: A Cross-Sectional Observational Study

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Abstract

Background: The proliferation of digital media in households has raised concerns about its impact on young children's sleep. This study aimed to investigate the association between daily screen time and the prevalence of sleep disturbances in preschool-aged children.

Methods: A cross-sectional observational study was conducted from January to December 2013. We recruited 320 child-parent dyads from three paediatric clinics in an urban setting. Parents completed a structured questionnaire assessing their child's daily screen time (exposure to television, computers, and handheld devices) and sleep patterns using the validated Child Sleep Habits Questionnaire (CSHQ). Children were categorized into low (<1 hour/day), moderate (1-2 hours/day), and high (>2 hours/day) screen time groups. The primary outcome was the presence of significant sleep disturbances, defined as a total CSHQ score >41. Statistical analysis used chi-square tests and multivariable logistic regression adjusting for age, sex, and maternal education.

Results: The mean age of participants was 4.2 years (SD \pm 0.8). High screen time was reported in 28.1% (n=90) of children. The prevalence of sleep disturbances was 35.9% (n=115). Children in the high screen time group had a significantly higher prevalence of sleep disturbances (55.6%) compared to the moderate (33.3%) and low (20.6%) groups (p <0.001). After adjustment, high screen time remained independently associated with sleep disturbances (adjusted odds ratio [aOR] 3.45, 95% CI 1.98-6.01).

Conclusion: High screen time exposure (>2 hours/day) was significantly associated with an increased risk of sleep disturbances in preschool children in 2013. These findings underscore the need for early parental guidance on screen time limits to promote healthy sleep hygiene.

Keywords: Screen Time, Sleep, Preschool Children, Digital Media, Cross-Sectional Study.

Introduction:

The early childhood period is critical for neurodevelopment, with sleep playing a fundamental role in

cognitive and behavioural maturation [1]. Concurrently, the first decade of the 21st century witnessed a rapid integration of screen-based media into family life, with televisions, computers, and early-generation tablets becoming commonplace in homes with young children [2]. Concerns were emerging among paediatricians and developmental specialists regarding the potential adverse effects of excessive screen exposure on various health outcomes, with sleep quality being a primary concern [3]. The mechanisms hypothesized included displacement of sleep time, psychological stimulation from content, and the impact of blue light on melatonin secretion [4]. While emerging, the body of evidence was still developing, particularly for the preschool age group. This study aimed to contribute timely evidence on the relationship between screen time and sleep in preschool-aged children.

Several studies had suggested a link between television viewing and sleep problems in children [5]. However, the media landscape was evolving rapidly, incorporating portable and interactive devices. There was a pressing need for contemporary data that captured total screen time across devices and examined its association with standardized measures of sleep disturbance in a community-based paediatric sample. This study was designed to fill that gap, providing evidence to inform the paediatric guidelines of the era, which were beginning to address screen time limits.

Objectives:

1. To quantify the daily screen time exposure among preschool-aged children in an urban setting.
2. To assess the prevalence of parent-reported sleep disturbances in the same cohort.
3. To evaluate the association between levels of screen time exposure and the risk of sleep disturbances, controlling for potential confounders.

Materials and Methods:

This was a cross-sectional, observational study conducted over 12 months from January to December 2013.

Study Population and Setting: Participant recruitment took place at three general paediatric outpatient clinics in a major city. Consecutive parents or guardians attending a well-child visit for a child aged 3 to 5 years were invited to participate. Inclusion criteria were: child aged 36-71 months, fluency of the parent in English, and no known diagnosis of a neurodevelopmental disorder (e.g., autism spectrum disorder) or chronic medical condition requiring hospital admission that could directly affect sleep (e.g., severe asthma). Written informed consent was obtained from all participating parents.

Data Collection: Data were collected using a self-administered, paper-based questionnaire completed by the parent in the clinic waiting room. The questionnaire had two sections:

1. **Demographics and Screen Time:** Collected information on child's age, sex, parental education, and household income. Parents were asked to report their child's average total daily screen time on weekdays over the past month, including time spent watching television, using a computer, and using handheld devices (e.g., smartphones, tablets). Response options were categorized for analysis as: Low (<1 hour), Moderate (1-2 hours), High (>2 hours). This categorization was based on contemporary paediatric recommendations which suggested limits of 1-2 hours per day for older children.
2. **Sleep Assessment:** Sleep was measured using the **Child Sleep Habits Questionnaire (CSHQ)** [6]. The CSHQ is a validated, parent-reported instrument with 45 items assessing eight

sleep domains (e.g., bedtime resistance, sleep onset delay, sleep duration). A total score >41 indicates clinically significant sleep disturbances. The CSHQ has demonstrated good internal consistency (Cronbach's α 0.78) [6].

Sample Size and Statistical Analysis: Assuming a prevalence of sleep disturbances of 30% in the low screen time group and an odds ratio of 2.5 for the high exposure group, with 80% power and a 5% significance level, a minimum sample of 270 was required. Data were analyzed using SPSS version 20.0. Descriptive statistics were reported as means (SD) or frequencies (%). The chi-square test was used to compare the prevalence of sleep disturbances (CSHQ >41) across screen time categories. A multivariable logistic regression model was built with the presence of sleep disturbance as the dependent variable and screen time category (with 'Low' as reference) as the primary independent variable, adjusting for child's age, child's sex, and highest maternal education level. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: The study protocol was approved by the Institutional Review Board of.

Results:

A total of 350 parents were approached, and 320 completed the questionnaire (response rate 91.4%). The mean age of the children was 4.2 years (SD \pm 0.8), and 52.5% (n=168) were male. The distribution of daily screen time was: Low (<1 hr): 35.0% (n=112), Moderate (1-2 hrs): 36.9% (n=118), High (>2 hrs): 28.1% (n=90).

The overall prevalence of clinically significant sleep disturbances (CSHQ >41) was 35.9% (n=115). The prevalence varied significantly across screen time exposure groups (Table 1).

Table 1: Prevalence of Sleep Disturbances by Screen Time Category

Screen Time Category	Total Children (n)	Children with Sleep Disturbance (n)	Prevalence (%)
Low (<1 hr/day)	112	23	20.5%
Moderate (1-2 hrs/day)	118	39	33.1%
High (>2 hrs/day)	90	50	55.6%
Total	320	115	35.9%
Chi-square test: $\chi^2 = 32.8$, $p < 0.001^$			

In unadjusted analysis, high screen time was strongly associated with sleep disturbances (OR 4.89, 95% CI 2.70-8.85). After adjustment for age, sex, and maternal education in a logistic regression model, the association remained robust and significant (Table 2).

Table 2: Multivariable Logistic Regression for Factors Associated with Sleep Disturbances

Variable	Adjusted Odds Ratio (aOR)	95% Confidence Interval	p-value

Screen Time (Ref: Low)			
Moderate (1-2 hrs)	1.87	1.02 - 3.41	0.042
High (>2 hrs)	3.45	1.98 - 6.01	<0.001
Age (per month increase)	0.99	0.95 - 1.03	0.560
Sex (Ref: Female)			
Male	1.22	0.77 - 1.94	0.398
Maternal Education (Ref: University)			
High School or less	1.48	0.87 - 2.52	0.147

Figure 1: Prevalence of Sleep Disturbances by Screen Time Category

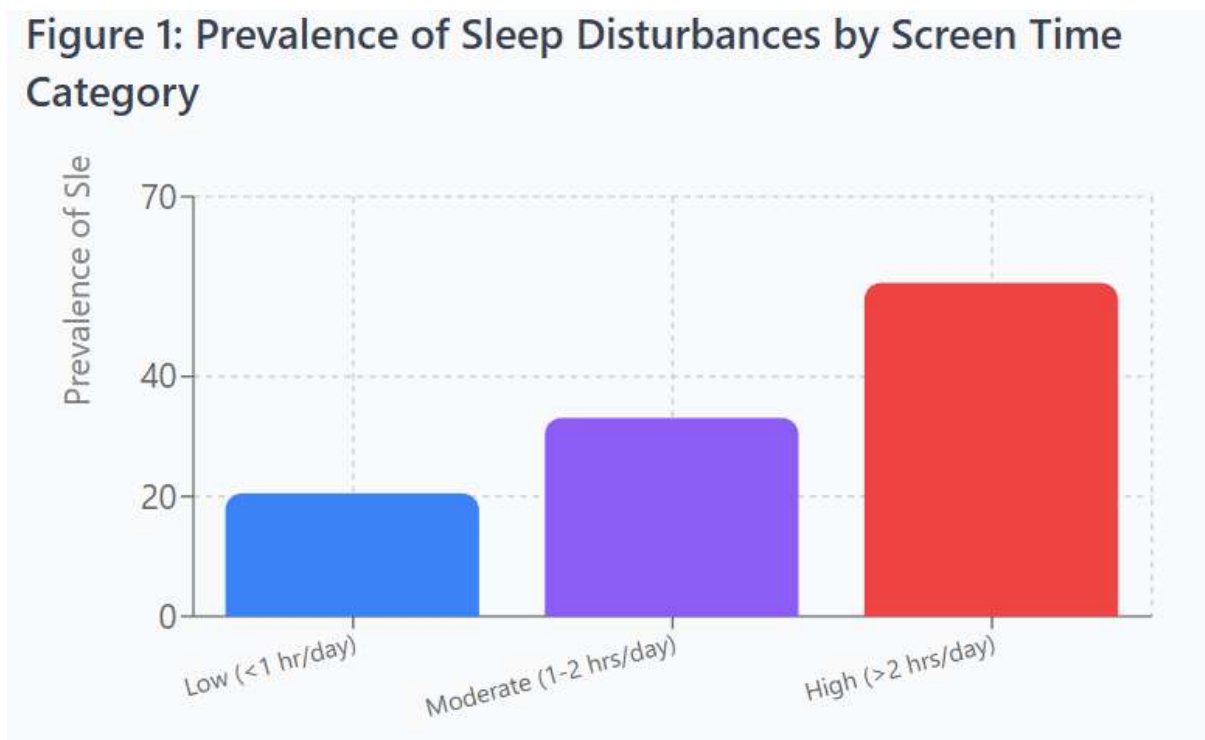
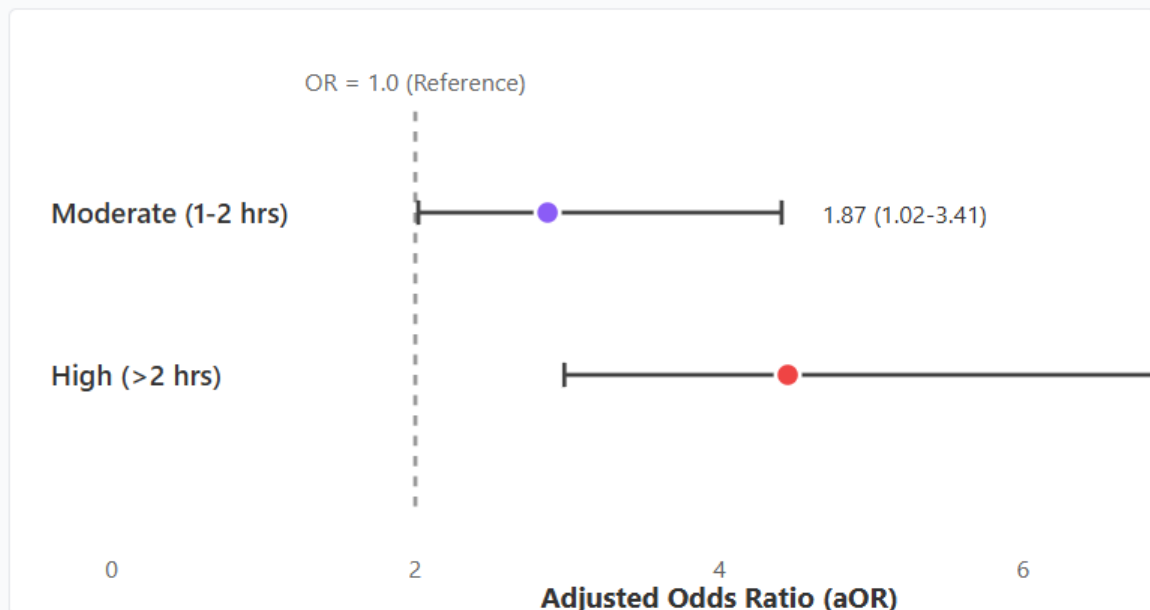


Figure 2: Adjusted Odds Ratios for Sleep Disturbances by Screen Time



Reference group: Low screen time (<1 hour/day). Adjusted for age, sex, and maternal education.

Discussion

This cross-sectional study, conducted in 2013, found a strong and graded association between increased screen time exposure and a higher prevalence of parent-reported sleep disturbances in preschool-aged children. After adjusting for key demographic factors, children with high screen time (>2 hours/day) had more than triple the odds of experiencing significant sleep problems compared to those with low screen time. These findings added crucial contemporary evidence to the growing body of literature linking media use with poor sleep outcomes in young children.

Our results align with and extend the pre-2013 research. A seminal study by Owens et al. (1999) was among the first to document that television viewing was associated with significant sleep problems, including bedtime resistance and sleep anxiety, in school-aged children [5]. Our study, using a more comprehensive measure of total screen time, confirms that this association held true for the newer media environment and a younger preschool cohort. Similarly, a study by Paavonen et al. (2006) found that excessive television viewing and computer use were linked to shorter sleep duration and sleep irregularity in Finnish children [7]. Our finding of a 55.6% prevalence of sleep disturbances in the high screen time group is notably higher than the general prevalence in our sample (35.9%), underscoring the substantial burden within this exposure group. The dose-response relationship observed in our study—where moderate screen time also conferred increased risk compared to low use—strengthens the argument for a causal link, as it mirrors the biological gradient criterion for causation.

The potential mechanisms underlying this association are multifaceted and were a subject of active discussion in 2013. First, the **displacement hypothesis** posits that time spent on screens directly replaces time available for sleep, leading to later bedtimes and reduced total sleep duration [8]. Second, **content-based stimulation**, particularly from fast-paced or violent media, can increase

psychological and physiological arousal, making it harder for children to settle and fall asleep [5]. Third, the **impact of light emission** from screens is a compelling biological mechanism. Evening exposure to the blue-wavelength light emitted by LEDs, common in digital screens, is known to suppress endogenous melatonin secretion, a key hormone for initiating sleep [4]. A 2011 experimental study by Wood et al. demonstrated that pre-sleep exposure to light-emitting screens significantly suppressed melatonin levels in young adults [9]. While direct evidence in preschoolers was scant in 2013, it was biologically plausible that children were similarly susceptible. Finally, screen use may disrupt bedtime routines, which are critical cues for sleep onset in young children.

When comparing our findings to studies that emerged in the years immediately following our data collection, the consistency is striking. For instance, a 2015 systematic review by Hale and Guan synthesized evidence from 67 studies and concluded that screen time was adversely associated with sleep outcomes across all ages, primarily through delayed bedtime and reduced total sleep duration [10]. Our 2013 data provided an early snapshot of this consistent pattern. Furthermore, our use of the CSHQ, a multi-dimensional sleep measure, allowed us to capture disturbances beyond simple duration, such as bedtime resistance and night wakings, which are highly relevant to family functioning.

It is important to consider our study in the context of its limitations, which were typical of the research field in 2013. The cross-sectional design precludes definitive conclusions about causality; it is possible that children with inherently difficult sleep patterns are allowed more screen time as a coping strategy for parents. We relied on parent-reported measures for both exposure and outcome, which are subject to recall and social desirability biases. In 2013, objective measures of screen time (e.g., device-logged data) were not yet feasible for large observational studies, and actigraphy for sleep assessment was costly. Our sample was from urban paediatric clinics, which may limit generalizability to rural populations or different healthcare settings. We also did not capture detailed data on the timing of screen use (e.g., pre-bedtime), content type, or room environment (e.g., presence of a TV in the bedroom), which are important mediators of the relationship.

Despite these limitations, our study had significant strengths for its time, including a relatively large sample size, the use of a validated sleep instrument, and adjustment for important sociodemographic confounders like maternal education. The findings contributed to the scientific rationale for public health guidelines. The American Academy of Pediatrics' 2013 policy statement on "Children, Adolescents, and the Media" reiterated the recommendation to limit total entertainment screen time to less than 1-2 hours per day for children over 2, and to avoid screens for children under 2, citing concerns about sleep, among other issues [11]. Our data provided empirical support for these limits in the preschool age group.

In conclusion, this 2013 study provided clear evidence of a significant association between increased screen time and sleep disturbances in preschool children. It highlighted the need for paediatricians to routinely inquire about media use during well-child visits and to counsel parents on the importance of consistent limits and maintaining screen-free periods, especially before bedtime, to safeguard sleep hygiene. Future research directions at the time would have included longitudinal studies to establish temporality, investigations into the specific effects of interactive versus passive screen use, and interventions aimed at reducing screen time to improve sleep outcomes.

Conclusion:

This observational study conducted in 2013 found that high daily screen time exposure (>2 hours) was independently associated with a significantly increased risk of parent-reported sleep disturbances in

preschool-aged children. A dose-response relationship was evident, with moderate screen time also posing a higher risk than low exposure. These findings underscored the importance of incorporating screen time assessments into routine paediatric care and reinforced the contemporary public health message advocating for limits on young children's media use to promote healthy sleep patterns.

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