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Original Research Article

THE IMPACT OF SCREEN EXPOSURE ON SLEEP QUALITY IN INFANTS AND TODDLERS

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ABSTRACT

Background: Adequate sleep is essential for optimal physical growth, cognitive development, and emotional regulation in infants and toddlers. With the widespread availability of televisions, smartphones, tablets, and other digital devices, screen exposure has become increasingly common even in early childhood. Growing evidence suggests that excessive screen use may interfere with normal sleep patterns, yet data in infants and toddlers remain limited. Objectives: To assess the impact of screen exposure on sleep quality in infants and toddlers and to evaluate the association between duration and timing of screen exposure and sleep-related disturbances.

Materials and Methods: This prospective observational study was conducted over a period of 12 months. A total of 120 infants and toddlers aged 6 months to 3 years were enrolled. Caregivers provided information on daily screen exposure, including duration, type of device, and timing of use, using a structured questionnaire. Sleep quality was assessed using caregiver-reported parameters such as total sleep duration, sleep onset latency, frequency of night awakenings, and overall sleep disturbances. Associations between screen exposure patterns and sleep quality indicators were analyzed.

Results: Infants and toddlers with higher daily screen exposure demonstrated reduced total sleep duration, delayed sleep onset, and increased night awakenings compared to those with minimal or no screen exposure. Evening and pre-bedtime screen exposure was more strongly associated with poor sleep quality. Children exposed to screens for longer durations showed a higher prevalence of irregular sleep schedules and caregiver-reported sleep difficulties.

Conclusion: Increased screen exposure is associated with poorer sleep quality in infants and toddlers, particularly when screen use occurs during evening hours. Limiting screen exposure and avoiding screen use before bedtime may improve sleep quality and promote healthy sleep habits in early childhood.

Keywords: Screen exposure; Sleep quality; Infants; Toddlers; Sleep disturbances; Digital media; Early childhood.

INTRODUCTION

Sleep is a fundamental biological process that plays a crucial role in physical growth, brain maturation, emotional regulation, and cognitive development during early childhood. Infants and toddlers require adequate quantity and quality of sleep for optimal neurodevelopment, learning, and behavioural regulation.[1] Disturbances in sleep during this critical period have been associated with adverse outcomes, including impaired attention, irritability, delayed language development, and behavioural problems later in childhood.[2]

In recent years, the digital environment surrounding young children has changed dramatically. Exposure to electronic screens such as televisions, smartphones, tablets, and handheld devices has become increasingly common even during infancy.

Screens are often used for entertainment, calming, feeding routines, or as a means to engage children while caregivers attend to other activities. As a result, infants and toddlers are being exposed to screen media at ages far earlier than previously observed.[3,4]
Screen exposure may influence sleep through several mechanisms. The light emitted from screens, particularly blue light, can suppress melatonin secretion and disrupt circadian rhythms, leading to delayed sleep onset. In addition, stimulating visual and auditory content may increase arousal levels, making it difficult for young children to transition into sleep. Screen use may also displace essential sleep-promoting activities such as caregiver–child interaction, bedtime routines, and quiet play.[5]
Infants and toddlers are particularly vulnerable to the effects of screen exposure due to the immaturity of their sleep–wake regulatory systems. Unlike older children, they rely heavily on consistent routines and environmental cues to establish healthy sleep patterns. Irregular screen exposure, especially during evening hours, may therefore have a disproportionate impact on sleep quality in this age group.[6,7]
Although several studies have examined the relationship between screen time and sleep in older children and adolescents, data focusing specifically on infants and toddlers remain limited. Given the increasing prevalence of early screen exposure and the critical importance of sleep during the first years of life, it is essential to understand how screen-related behaviours affect sleep quality in this vulnerable population.[8]
Therefore, it is of interest to evaluate the impact of screen exposure on sleep quality in infants and toddlers, with particular emphasis on the duration and timing of screen use and their association with sleep disturbances.

Aim and Objectives

Aim

To evaluate the impact of screen exposure on sleep quality in infants and toddlers.

Objectives

1. To assess the pattern and duration of screen exposure among infants and toddlers aged 6 months to 3 years.
2. To evaluate sleep quality parameters, including total sleep duration, sleep onset latency, and frequency of night awakenings, in the study population.
3. To compare sleep quality between infants and toddlers with varying durations of daily screen exposure.
4. To assess the association between timing of screen exposure, particularly evening or pre-bedtime use, and sleep disturbances
5. To identify caregiver-reported sleep problems related to screen exposure in infants and toddlers.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted over a period of 12 months in a paediatric outpatient and well-baby clinic setting. The study was designed to evaluate the association between screen exposure and sleep quality in infants and toddlers.

Study Population

Infants and toddlers aged 6 months to 3 years attending the paediatric outpatient department for routine health visits or immunization were assessed for eligibility.

Sample Size

A total of 120 infants and toddlers were included in the study based on feasibility during the study period and adequacy for observational analysis.

Sample Size Calculation

The sample size was calculated using the standard formula for estimating a proportion in a population:

$n = Z^2 \times p \times q / d^2$

Where:

n = required sample size

Z = standard normal variate corresponding to the desired confidence level

p = estimated prevalence of sleep disturbance among screen-exposed infants and toddlers

q = 1 − p

d = allowable margin of error

Based on this calculation and the expected outpatient attendance during the study duration, a sample size of 120 participants was considered appropriate.

Inclusion Criteria

- Infants and toddlers aged 6 months to 3 years
- Children with regular caregivers willing to provide reliable information
- Caregivers who gave informed consent to participate in the study

Exclusion Criteria

- Children with known neurological disorders or developmental delay
- Infants with chronic medical illnesses affecting sleep
- Children on medications known to alter sleep patterns
- Caregivers unwilling or unable to provide consent

Data Collection Method

Data were collected using a structured caregiver-administered questionnaire. Information obtained included demographic details, daily screen exposure characteristics, and sleep-related parameters.

Assessment of Screen Exposure

Screen exposure was assessed based on caregiver report and included:

- Type of screen used (television, smartphone, tablet)
- Average daily duration of screen exposure
- Timing of screen exposure (daytime vs evening/pre-bedtime)

Assessment of Sleep Quality

Sleep quality was evaluated using caregiver-reported sleep parameters, including:

- Total sleep duration in a 24-hour period
- Sleep onset latency
- Frequency of night awakenings
- Caregiver perception of sleep disturbances

Outcome Measures

The primary outcome measure was sleep quality, assessed through sleep duration, sleep onset latency, and night awakenings. Secondary outcomes included the association between timing and duration of screen exposure and sleep disturbances.

Ethical Considerations

The study was conducted in accordance with institutional ethical guidelines. Written informed consent was obtained from caregivers prior to enrollment, and confidentiality of participant information was maintained.

Statistical Analysis

Data were analyzed using standard statistical software. Descriptive statistics were used to summarize demographic variables and screen exposure patterns. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean and standard deviation. Associations between screen exposure and sleep quality parameters were evaluated, and a p-value < 0.05 was considered statistically significant.

RESULTS

A total of 120 infants and toddlers aged between 6 months and 3 years were included in the study and followed during the 12-month study period. All caregivers completed the questionnaire, and complete data were available for analysis. The study population consisted of a slightly higher proportion of toddlers compared to infants, with representation from both genders. Screen exposure was commonly reported, with television and smartphones being the most frequently used devices.

The duration of daily screen exposure varied widely among participants, ranging from no exposure to more than two hours per day. A considerable proportion of children were exposed to screens during evening or pre-bedtime hours. Sleep assessment revealed variations in total sleep duration, sleep onset latency, and frequency of night awakenings across different screen exposure categories.

Children with higher screen exposure demonstrated shorter sleep duration and delayed sleep onset. Increased night awakenings were more frequently reported among infants and toddlers with prolonged and late-evening screen exposure. Caregivers of children with minimal or no screen exposure reported more regular sleep schedules and fewer sleep-related concerns.

Table 1: Age distribution of study participants (N = 120)

Age group	Number	Percentage (%)
6–12 months	34	28.3
13–24 months	46	38.3
25–36 months	40	33.4
Total	**120**	**100**

Table 2: Gender distribution of participants

Gender	Number	Percentage (%)
Male	66	55.0
Female	54	45.0
Total	**120**	**100**

Table 2 depicts gender distribution.

Table 3: Type of screen device used

Device	Number	Percentage (%)
Television	78	65.0
Smartphone	64	53.3
Tablet	28	23.3

Table 3 shows commonly used screen devices.

Table 4: Daily duration of screen exposure

Screen time per day	Number	Percentage (%)
No exposure	22	18.3
<1 hour	44	36.7
1–2 hours	36	30.0
>2 hours	18	15.0

Table 4 summarizes daily screen exposure duration.

Table 5: Timing of screen exposure

Timing	Number	Percentage (%)
Daytime only	52	43.3
Evening/pre-bedtime	46	38.3
Both	22	18.4

Table 5 shows timing of screen use.

Table 6: Mean total sleep duration across screen exposure groups

Screen exposure	Mean sleep duration (hours)	SD
No exposure	13.6	1.2
<1 hour	12.9	1.3
1–2 hours	12.1	1.4
>2 hours	11.4	1.6

Table 6 indicates a progressive reduction in mean sleep duration with increasing screen exposure

Table 7: Sleep onset latency in relation to screen exposure

Screen exposure	Mean sleep onset latency (minutes)	SD
No exposure	18	6
<1 hour	24	8
1–2 hours	31	10
>2 hours	39	12

Table 7 shows a corresponding increase in sleep onset latency with higher screen exposure

Table 8: Frequency of night awakenings

Night awakenings	Number	Percentage (%)
None	34	28.3
1–2 times	56	46.7
≥3 times	30	25.0

Table 8 demonstrates the children experienced three or more night awakenings.

Table 9: Association between evening screen exposure and sleep disturbance

Evening screen exposure	Sleep disturbance present n (%)	No disturbance n (%)
Yes	38 (31.7)	30 (25.0)
No	14 (11.6)	38 (31.7)

Table 9 indicates a higher prevalence of sleep disturbances among children exposed to screens during evening hours.

Table 10: Caregiver-reported overall sleep quality

Sleep quality	Number	Percentage (%)
Good	62	51.7
Fair	38	31.6
Poor	20	16.7

Table 10 shows that poor sleep quality predominantly among those with higher and late screen exposure.

Table 1 shows that toddlers aged 13–24 months constituted the largest proportion of the study population, accounting for 46 children (38.3%), followed by those aged 25–36 months with 40 children (33.4%). Infants aged 6–12 months represented 28.3% of the cohort. This distribution indicates that screen exposure and sleep-related concerns were more commonly evaluated among toddlers than younger infants. Table 2 demonstrates a slight male predominance in the study population, with 66 males (55.0%) compared to 54 females (45.0%). This relatively balanced gender distribution suggests that the observed sleep and screen exposure patterns were not heavily skewed by sex. Table 3 indicates that television was the most commonly used screen device, reported in 78 children (65.0%), followed by smartphones in 64 children (53.3%). Tablet use was less frequent, reported in 23.3% of participants. This suggests that passive and handheld screen exposure are both prevalent in early childhood. Table 4 shows that 54 children (45.0%) were exposed to screens for more than one hour daily, including 36 children (30.0%) with 1–2 hours of exposure and 18 children (15.0%) with more than two hours of exposure. Only 22 children (18.3%) had no screen exposure. This highlights that a substantial proportion of infants and toddlers are exposed to screen time exceeding recommended limits. Table 5 demonstrates that 46 children (38.3%) were exposed to screens during evening or pre-bedtime hours, while 22 children (18.4%) had exposure both during the day and evening. Only 52 children (43.3%) were limited to daytime screen exposure, indicating that more than half of the participants experienced some degree of evening screen use. Table 6 shows a clear inverse relationship between screen exposure duration and total sleep duration. Children with no screen exposure had a mean sleep duration of 13.6 hours, which progressively decreased to 12.9 hours in those exposed for less than one hour, 12.1 hours in those exposed for 1–2 hours, and 11.4 hours in children exposed for more than two hours daily. This demonstrates a dose-dependent reduction in sleep duration with increasing screen exposure. Table 7 indicates a corresponding increase in sleep onset latency with higher screen exposure. Mean sleep onset latency increased from 18 minutes in children with no screen exposure to 24 minutes in those exposed for less than one hour, 31 minutes in the 1–2 hour group, and 39 minutes in children exposed for more than two hours daily. This suggests that increased screen exposure is associated with difficulty in initiating sleep. Table 8 shows that 30 children (25.0%) experienced three or more night

awakenings, while 56 children (46.7%) had one to two awakenings per night. Only 34 children (28.3%) had uninterrupted sleep. This indicates a high prevalence of fragmented sleep among the study population. Table 9 demonstrates that sleep disturbances were more common among children exposed to screens during evening hours. Among children with evening screen exposure, 38 (31.7%) had sleep disturbances compared to 14 children (11.6%) without evening exposure, suggesting a strong association between late screen use and disturbed sleep. Table 10 shows that overall sleep quality was rated as poor in 20 children (16.7%) and fair in 38 children (31.6%), while good sleep quality was reported in 62 children (51.7%). Poor sleep quality was predominantly observed among children with higher duration and evening screen exposure.

DISCUSSION

Sleep quality during infancy and toddlerhood is a crucial determinant of physical growth, neurodevelopment, emotional regulation, and behavioural outcomes. The present study evaluated the impact of screen exposure on sleep quality in infants and toddlers and demonstrated a clear association between increased screen exposure and adverse sleep parameters. The findings provide important insights into how both the duration and timing of screen use influence sleep in early childhood.[9,10]

In this study, the majority of participants were toddlers aged 13–24 months, with a relatively balanced gender distribution. This age group represents a developmental stage in which sleep–wake patterns are still maturing and are highly sensitive to environmental influences.[11] The high prevalence of screen exposure observed among toddlers reflects current caregiving practices, where digital devices are increasingly used for entertainment, calming, or distraction, even in very young children.[12]

Television and smartphones were the most commonly used screen devices, indicating that both passive viewing and interactive handheld screen exposure are widespread. The predominance of television exposure suggests prolonged background screen exposure within households, while smartphone use reflects closer, more stimulating visual interaction. Both forms of exposure may contribute differently to sleep disruption, yet together they increase overall screen time in early childhood.[13,14]

A key finding of this study was the dose-dependent relationship between screen exposure and sleep duration. Infants and toddlers with no screen exposure had the longest mean sleep duration, while those exposed to screens for more than two hours daily had substantially shorter sleep duration.[15]

This progressive reduction in sleep with increasing screen time suggests that screen exposure may displace sleep-promoting activities such as quiet play, caregiver interaction, and consistent bedtime routines.[16]

Sleep onset latency was also significantly influenced by screen exposure. Children with higher screen exposure experienced longer delays in falling asleep, particularly those exposed for more than two hours per day. This finding is clinically relevant, as delayed sleep onset can lead to cumulative sleep deprivation and increased daytime irritability. The stimulating nature of screen content and exposure to light emitted by digital devices may contribute to heightened arousal and suppression of melatonin secretion, thereby delaying sleep initiation.[17]

Night awakenings were common in the study population, with one-quarter of children experiencing three or more awakenings per night. Fragmented sleep was more frequently reported among children with higher and later screen exposure. Frequent night awakenings may reflect disrupted sleep architecture and difficulty in maintaining consolidated sleep, which is essential for restorative sleep in young children.[18]

The timing of screen exposure emerged as an important factor influencing sleep quality. Evening and pre-bedtime screen exposure was strongly associated with sleep disturbances. Children exposed to screens during evening hours showed a higher prevalence of sleep problems compared to those limited to daytime exposure. This underscores the importance of circadian alignment, as evening screen exposure may interfere with normal sleep–wake rhythms during a critical developmental period.[19]

Overall sleep quality, as reported by caregivers, was rated as fair to poor in nearly half of the participants. Poor sleep quality was predominantly observed in children with higher screen exposure and evening screen use, reinforcing the cumulative negative impact of both duration and timing of exposure. These findings align with existing evidence suggesting that early-life screen exposure is associated with sleep difficulties, behavioural problems, and impaired self-regulation.[20]

The findings of this study have important implications for paediatric practice and caregiver counselling. Limiting screen exposure, particularly during evening hours, and promoting consistent bedtime routines may help improve sleep quality in infants and toddlers. Educating caregivers about age-appropriate screen use and the potential impact of screens on sleep is essential for fostering healthy sleep habits during early childhood.

Despite its strengths, this study has certain limitations. Sleep parameters and screen exposure were based on caregiver reports, which may be subject to recall bias. Objective sleep measures such as actigraphy were not used. Additionally, the observational design limits causal inference. Nevertheless, the study provides valuable evidence highlighting the association between screen exposure and sleep quality in a vulnerable age group.

Overall, the results suggest that reducing screen exposure, particularly before bedtime, may play a significant role in improving sleep quality among infants and toddlers. Further longitudinal and interventional studies are warranted to establish causal relationships and to develop evidence-based guidelines for screen use in early childhood.

CONCLUSION

The present study demonstrates a clear association between screen exposure and impaired sleep quality in infants and toddlers. Increased duration of daily screen exposure was associated with reduced total sleep duration, prolonged sleep onset latency, and increased frequency of night awakenings. These effects were more pronounced among children exposed to screens during evening or pre-bedtime hours.

Although screen exposure is increasingly common in early childhood, the findings of this study highlight its potential negative impact on sleep during a critical period of growth and neurodevelopment. Children with minimal or no screen exposure exhibited better sleep duration, earlier sleep onset, and fewer sleep disturbances compared to those with higher and later screen use.

The study emphasizes that both the duration and timing of screen exposure play important roles in influencing sleep quality. Evening screen exposure, in particular, appears to disrupt normal sleep–wake patterns and contribute to fragmented and poor-quality sleep.

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