



SCREEN TIME AND ITS EFFECT ON NEUROCOGNITIVE DEVELOPMENT IN CHILDREN UNDER FIVE YEARS: AN OBSERVATIONAL STUDY

Paediatric Medicine

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ABSTRACT

Background: With increasing digital media use among young children, concerns about its impact on early brain development have intensified. This study aimed to assess the effect of screen time on neurocognitive development in children under five. **Aim and Objective:** To evaluate the correlation between screen exposure and neurocognitive development in children aged 6 months to 5 years. **Methods:** An observational study involving 120 children aged 6 months to 5 years was conducted at Kanti Devi Medical College, Mathura. Screen exposure was recorded via caregiver questionnaire, and developmental milestones were assessed using the Denver Developmental Screening Test II at baseline and after four months. **Results:** Children with daily screen time exceeding 2 hours demonstrated significantly lower scores in language and social domains. A statistically significant correlation ($p < 0.01$) was observed between high screen exposure and delayed development. **Conclusion:** Excessive screen time is associated with adverse neurocognitive outcomes in early childhood. Pediatricians and caregivers must be educated about healthy screen use practices.

KEYWORDS

Screen Time, Neurocognitive Development, Children Under Five, Early Childhood, Digital Media Exposure

INTRODUCTION

In today's world, digital screens are everywhere—from TVs and tablets to smartphones—and they're a part of many children's daily lives. While screens can offer fun and even educational experiences, too much screen time can take away from the kinds of activities young children need to grow and learn—like talking with family members, playing outside, or using their imagination.

Aim and Objectives

The aim of this study was to evaluate the relationship between daily screen time and neurocognitive development in children under the age of five.

Specific Objectives:

1. To determine the average duration of screen exposure among children aged 6 months to 5 years.
2. To assess developmental milestones using a standardized neurocognitive screening tool.
3. To compare developmental delays across categories of screen time exposure.
4. To evaluate associations between screen use and specific developmental domains such as language, motor, and social-emotional skills.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Pediatrics at Kanti Devi Medical College, Mathura, over a period of 4 months. A total of 120 children between the ages of 6 months and 5 years were enrolled from outpatient and inpatient services. The study obtained ethical clearance from the Institutional Review Board, and informed consent was taken from the parents or guardians.

Inclusion Criteria included: Children aged 6 months to 5 years, the willingness and ability to attend follow-up after four months and lastly parental consent to participate in the study. Whereas, the exclusion criteria consisted of: children with known neuro-developmental disorders (e.g., cerebral palsy, autism), children with chronic systemic illnesses or congenital anomalies and families unwilling to participate or unavailable for follow-up

Data Collection

Demographic data such as age, sex, socioeconomic status, parental

education, and occupation were recorded. Screen time was estimated based on caregiver reporting using a structured questionnaire. Information was collected on the type of screens used (TV, smartphone, tablet), the average duration per day, nature of content (educational v/s non-educational), and parental involvement. Neurocognitive development was assessed using the Denver Developmental Screening Test II (DDST-II), which measures age-appropriate functioning across four domains: gross motor, fine motor-adaptive, personal-social, and language. Assessments were carried out at the time of enrollment and again at the four-month follow-up.

Statistical Analysis

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize baseline characteristics. Correlation analysis (Pearson or Spearman) was conducted to determine the relationship between screen time and developmental outcomes. Multivariate regression models were used to control for confounding variables such as parental education and socioeconomic status. A p -value < 0.05 was considered statistically significant.

RESULTS

Out of the 120 enrolled children, 62 (51.7%) were males and 58 (48.3%) were females as shown in Table 1. The mean age of the participants was 2.8 ± 1.2 years. Socioeconomic status varied, with 55% of children belonging to middle-income households and 30% from lower-income families.

Distribution of screen time, as shown in Fig. 1: <1 hour/day: 35 children (29.2%), 1–2 hours/day: 45 children (37.5%), >2 hours/day: 40 children (33.3%)

Developmental Delays by Domain- among the children with screen time exceeding 2 hours/day, as shown in Fig. 2; Language delays were observed in 15 children (37.5%), Social delays in 10 children (25%), Motor delays in 6 children (15%)

In contrast, only 3 children in the <1 hour/day group showed minor delays. In the 1–2 hour/day group, 7 had language delays, 5 had social delays, and 4 had mild motor delays.

Regression analysis showed that there was a strong inverse correlation between screen time and language scores ($\beta = -0.41$, $p < 0.01$),

moderate association with social-emotional skills ($\beta = -0.32, p = 0.03$), weak association with motor development ($\beta = -0.21, p = 0.07$)

Children with higher screen time also had reduced caregiver interaction and limited outdoor playtime. These factors potentially mediated the observed developmental delays. Children in the >2 hours/day category also exhibited higher irritability and lower attention span during observation. Screen exposure was predominantly passive, with 65% of children watching cartoons or music videos and only 18% accessing educational apps. Parental co-viewing occurred in only 30% of cases, suggesting limited guided interaction.

Subgroup analysis showed that children with screen time >2.5 hours/day and low parental education had the highest risk for cumulative developmental delays. Children from households, with educated parents and regulated screen use (e.g., <1 hour of co-viewed content), exhibited better neurodevelopmental outcomes even when adjusted for income.

A notable pattern was the increased delay in children exposed to screens during meals or bedtime routines. Those not exposed during these times fared significantly better in language and social metrics.

Table 1: Demographic Characteristics of Study Participants.

Characteristic	Number (%)	Remarks
Total Participants	120	
Gender: Male	62 (51.7%)	
Gender: Female	58 (48.3%)	
Mean Age		2.8 ± 1.2 years
Socioeconomic Status: Middle-Income	66 (55%)	
Socioeconomic Status: Lower-Income	36 (30%)	
Other/Unspecified	18 (15%)	Remaining group

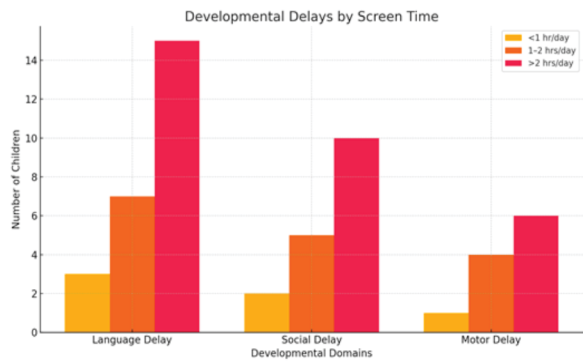


Figure 1: Developmental Delays in Language, Social, and Motor Domains by Screen Time Category.

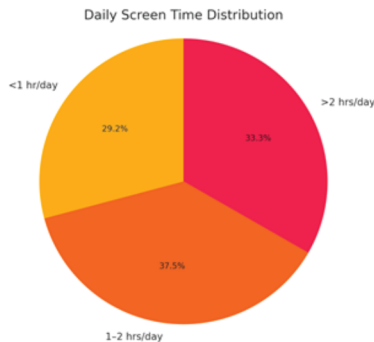


Figure 2: Daily Screen Time Distribution Among the 120 Children.

Discussion

The findings of this study reaffirm global concerns about the impact of digital media on early childhood development. Screen time above two hours daily was significantly associated with language and social developmental delays. These observations are consistent with a growing body of evidence that excessive exposure to passive screen content displaces valuable experiences such as parent-child verbal

interaction, imaginative play, and social exchanges.

Madigan et al.^{1^1} and Cheng et al.^{2^2} in large cohort studies found screen use at ages 2–3 predicted lower language and executive function scores by age 4. In the Indian context, Kaur et al.^{4^3} identified speech delays in toddlers with unregulated screen use, and Singh et al.^{3^4} noted reduced social reciprocity in children with heavy exposure to video content.

Our study contributes to this growing literature by presenting data from a semi-urban Indian population. Importantly, we observed a gradient effect—greater screen time was linked to progressively worse developmental outcomes. This dose-response relationship underscores the need for quantifiable recommendations.

While our methodology included objective developmental screening and accounted for socioeconomic and parental educational factors, it was limited by self-reported screen time and a relatively short follow-up period. Future studies could incorporate objective monitoring devices and longer observation to evaluate long-term neurocognitive trajectories.

Nonetheless, the evidence suggests that screen exposure should be limited and complemented with rich, interactive caregiving environments to optimize developmental potential.

CONCLUSION

Excessive screen time (>2 hours/day) negatively affects neurocognitive development, particularly language and social domains. Pediatricians must counsel families on minimizing passive media exposure and encourage interactive learning and play. Further large-scale, long-term studies are warranted to develop evidence-based screen time guidelines.

Ethical Approval

We followed all necessary ethical steps before starting this study. The parents or guardians of each child gave their informed consent, and the study received approval from the ethics committee at Kanti Devi Medical College.

Funding

This research was carried out independently, without any outside funding.

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