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Original Research Article

THE DIGITAL DIVIDE: SCREEN TIME EXPOSURE IN EARLY CHILDHOOD TO LATE ADOLESCENCE (01YR - 18 YRS)

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ABSTRACT

Background: The pervasive integration of digital devices into daily life has raised significant concerns about their impact on children and adolescents. With screens becoming ubiquitous in households, understanding the extent of exposure and its consequences is critical. This study investigates mobile and TV usage among children aged 1 to 18 years, focusing on its influence on behaviour, physical activity, and family dynamics. By examining these factors, the study aims to provide insights into the digital divide and inform strategies for healthier screen time habits.

Materials and Methods: A prospective observational study was conducted, involving parents and guardians of children across the 1-18 age range. Data was collected through structured questionnaires, capturing details such as the number of screens at home, individual device ownership, daily screen usage, and specific app preferences. Additional variables included behavioural indicators (e.g., irritability upon screen withdrawal), screen use during meals, parental control measures, and physical activity levels. Descriptive and inferential statistical analyses were employed to identify patterns and correlations, ensuring a comprehensive evaluation of screen time's multifaceted effects.

Results: The study revealed several key findings. First, device availability was widespread, with households averaging 3.2 screens, and personal mobile ownership increasing with age. Screen time varied significantly by age group, ranging from 2.5 hours/day in early childhood to 6.8 hours/day in adolescence. Behavioural impacts were notable, with 45% of parents reporting heightened irritability when screens were turned off. Screen use during meals was prevalent (40%), correlating with reduced family interaction. Parental controls were implemented in 55% of households, though their effectiveness diminished with older children. A significant inverse relationship was observed between screen time and physical activity (*r* = -0.41, *p* < 0.01), underscoring the sedentary risks associated with excessive digital exposure.

Conclusion: This study highlights the profound influence of screen time on children's behaviour, physical health, and family interactions. The findings emphasize the need for balanced screen use, active parental supervision, and targeted guidelines to mitigate adverse effects. Recommendations include age-appropriate screen limits, device-free meal times, and enhanced awareness of parental control tools. By addressing these challenges, stakeholders can foster healthier digital habits and improve developmental outcomes for children and adolescents.

Keywords: Screen time, children, adolescents, behavioural impact, physical activity, parental control, digital divide.

INTRODUCTION

The rapid proliferation of digital devices in the 21st century has fundamentally transformed childhood experiences, creating what researchers have termed a "digital revolution" in paediatric development.[1] From smartphones and tablets to interactive televisions and gaming consoles, screens have become ubiquitous in modern households, with children's exposure beginning as early as infancy.[2] This pervasive digital integration has raised significant concerns among healthcare professionals, educators, and developmental psychologists regarding its potential impacts on physical, cognitive, and psychosocial development across the critical growth periods from early childhood through adolescence.[3]

Recent epidemiological studies indicate that screen time among children and adolescents has increased exponentially over the past decade, with some reports suggesting average daily exposure exceeding 7 hours for teenagers.[4] This trend has been accelerated by several factors including the COVID-19 pandemic, which necessitated remote learning and consequently normalized extended screen use.[5], as well as the growing accessibility of affordable digital devices in both developed and developing nations.[6] The American Academy of Paediatrics (AAP) has established guidelines recommending limited screen time for children under 18 months and consistent boundaries for older children[7], yet adherence to these recommendations remains inconsistent across socioeconomic groups.[8]

The developmental implications of excessive screen exposure are multifaceted and potentially profound. Neuroimaging studies have demonstrated structural changes in brain development associated with high screen usage, particularly in areas related to language and cognitive control.[9] Behavioural research has linked prolonged screen time with increased risks of attention deficits[10], emotional dysregulation,[11] and sleep disturbances.[12] Furthermore, the displacement hypothesis suggests that time spent with screens often replaces crucial developmental activities such as physical play, face-to-face social interaction, and creative pursuits.[13]

This study focuses specifically on the Indian context, where rapid digitalization has created unique patterns of screen exposure that differ from Western models.[14] In developing nations, screen time often represents a complex interplay between educational aspirations, entertainment needs, and limited alternative recreational spaces.[15] The present research aims to bridge critical gaps in the literature by examining screen time patterns across the full developmental spectrum from 1 to 18 years, with particular attention to:

1. Age-specific exposure patterns
2. Behavioural correlates including irritability and social withdrawal
3. Physical activity displacement
4. Family dynamics and meal-time interactions
5. The role and effectiveness of parental mediation strategies

Our investigation builds upon previous work by Kumar et al.[16] on digital media use in Indian adolescents while expanding the age range to include critical early developmental periods. The study also incorporates recent findings from global research on digital media effects while contextualizing them within India's unique cultural and socioeconomic landscape.[17] As screen technologies continue to evolve at an unprecedented pace, with emerging concerns about algorithm-driven content and immersive technologies.[18] establishing evidence-based guidelines for healthy screen use has become an urgent public health priority.[19]

MATERIALS AND METHODS

Study Design and Setting: This prospective observational study was conducted at SSIMS & RC Hospital in Davangere, India. Designed in accordance with STROBE guidelines.[20] the hospital-based setting provided access to a diverse patient population spanning urban and semi-urban areas of Karnataka state. The location was strategically chosen to capture varying socioeconomic backgrounds and digital access patterns prevalent in both city and rural communities. Data collection occurred through routine paediatric outpatient visits and community outreach programs, allowing for comprehensive sampling across the 1–18-year age spectrum.

Participants: The study enrolled parents or primary caregivers of children aged 1-18 years who met stringent inclusion criteria. Participants were required to provide informed consent and have stable residence within the hospital's service area for at least six months prior to enrolment. We excluded children with diagnosed neurodevelopmental disorders (including autism spectrum disorder and ADHD) or chronic medical conditions requiring frequent hospitalization, as these factors could independently influence screen time patterns or behavioural outcomes. Special consideration was given to maintaining gender balance and proportional representation across age groups through stratified sampling techniques.

Variables and Data Collection: Our research examined multiple dimensions of screen exposure through carefully selected variables. The primary exposure variable quantified daily screen time across different device types (mobile, TV, computer) and usage purposes (educational, entertainment, social). Outcome measures included behavioural indicators (documented irritability, sleep disturbances), physical activity levels, and family interaction quality. We collected extensive covariate data including socioeconomic status (assessed using the modified Kuppuswamy scale.[21] parental education levels, and home environment characteristics. Data

collection employed a tripartite approach: validated questionnaires (including adaptations of the Screen Time Questionnaire.[22] and WHO-5 Well-being Index.[23] direct home observations using standardized protocols.[25] and 7-day device use diaries maintained by parents. This multimodal strategy enhanced data reliability through methodological triangulation.

Statistical Analysis: The analytical approach incorporated both descriptive and inferential techniques using SPSS v26 and R Statistical Software. Continuous variables were expressed as mean ± standard deviation, while categorical data were presented as frequencies and percentages. We employed multivariate linear regression for continuous outcomes and logistic regression for binary variables, with age-stratified analyses based on WHO growth standards.[26] The analytical framework included rigorous handling of missing data through multiple imputation for minor gaps (<5% missing) while maintaining complete case analysis for primary outcomes. All statistical tests were two-tailed with significance set at $p<0.05$, and we reported 95% confidence intervals for effect estimates to enhance interpretability.

Ethical Considerations: The study protocol received full approval from the Institutional Ethics Committee of SSIMS & RC. We implemented comprehensive ethical safeguards including written informed consent from all participating parents/guardians, with additional assent obtained from children aged 7-18 years. Confidentiality protections included de-identified data collection, secure electronic storage with restricted access, and anonymized reporting of results. Participants received detailed information about study objectives and their right to withdraw at any stage without affecting clinical care. The research team conducted regular ethical audits to ensure continued compliance with Declaration of Helsinki principles throughout the study duration.

RESULTS

The study yielded comprehensive findings on screen time exposure and its associated impacts across different age groups. The results are presented below in narrative form, supported by detailed tables for clarity.

Device Availability and Ownership:

The analysis revealed widespread access to digital devices among children. On average, households possessed 3.2 ± 1.1 screens, with television being the most common (98% of homes), followed by smartphones (92%), and tablets (45%). Personal device ownership increased significantly with age: while only 12% of children aged 1-5 years had their own devices, this proportion rose to 65% among adolescents (13-18 years). Notably, 78% of households reported having internet access, primarily through mobile data (64%) or broadband (36%).

Table 1: Device Availability and Ownership by Age Group

Age Group (Years)	Households with TV (%)	Children with Personal Devices (%)	Internet Access (%)
1-5	96	12	72
6-12	99	38	80
13-18	100	65	85
Total	**98**	**38**	**78**

Table 1: describes the prevalence of digital devices and internet access across different age groups. The data indicate a sharp increase in personal device ownership with age, particularly in adolescence.

Daily Screen Time Patterns: Screen time exposure varied significantly by age. Children aged 1-5 years averaged 2.5 ± 1.3 hours/day, primarily watching cartoons (62%) and educational apps (28%). Children aged 6-12 years spent 4.2 ± 2.1 hours/day, with increased use of gaming (35%) and social media (18%). Adolescents (13-18 years) had the highest exposure at 6.8 ± 3.0 hours/day, dominated by social media (42%), video streaming (30%), and online gaming (20%).

Table 2: Average Daily Screen Time and Primary Activities

Age Group (Years)	Screen Time (Hours/Day)	Top 3 Screen Activities (%)
1-5	2.5 ± 1.3	Cartoons (62%), Educational Apps (28%), YouTube Kids (10%)
6-12	4.2 ± 2.1	Gaming (35%), Social Media (18%), Homework (25%)
13-18	6.8 ± 3.0	Social Media (42%), Video Streaming (30%), Gaming (20%)

Table 2: summarizes daily screen time duration and dominant digital activities. Adolescents exhibited the highest screen exposure, with social media being the most prevalent activity.

Behavioural and Emotional Impacts: A significant correlation was observed between prolonged screen time and behavioural changes. 45% of parents reported increased irritability when screens were turned off, particularly in children aged 6-12 years (52%). Sleep disturbances were noted in 33% of adolescents, with late-night device use being a major contributor. Emotional regulation challenges were

reported for 28% of children overall, with higher prevalence among heavy users (>4 hours/day screen time).

Table 3: Behavioural and Emotional Outcomes

Outcome	Prevalence (%)	Age Group Most Affected	Correlation with Screen Time (r)
Irritability	45	6-12 years	0.38*
Sleep Disturbances	33	13-18 years	0.42*
Emotional Dysregulation	28	6-12 years	0.35*

Table 3: highlights key behavioral and emotional effects associated with screen time. Irritability and sleep issues were most prevalent in school-aged children and adolescents respectively.

Screen Time During Meals and Family Dynamics: 40% of children used screens during meals, with the highest prevalence in 6-12-year-olds (48%). Families reporting frequent meal-time screen use had fewer conversations (1.5 ± 0.8 topics/meal vs. 3.2 ± 1.1 in screen-free meals, $p < 0.01$) and lower parental satisfaction with family interactions (*p = 0.03*). Parent-child conflicts about screen use occurred 2.3 times per week on average, peaking during adolescence (3.1 times/week).

Parental Controls and Supervision: While 55% of parents used some form of screen time restrictions, effectiveness declined with child age:

- 1-5 years: 82% used controls
- 6-12 years: 60% used controls
- 13-18 years: 23% used controls

Common strategies included time limits (68%), content filters (45%), and device curfews (32%). Parents of adolescents reported significantly greater challenges in enforcing restrictions compared to parents of younger children ($p<0.001$).

DISCUSSION

The present study provides compelling evidence about the pervasive nature of digital device usage across childhood and adolescence, while highlighting significant associations between screen time and behavioural, emotional, and familial outcomes. Our findings align with yet expand upon previous research in this rapidly evolving field, offering several important insights for clinical practice and public health policy.

The observed pattern of increasing device ownership with age mirrors global trends reported in recent multinational studies,[27] though our data reveal some distinctive aspects of the Indian context. The dramatic jump from 12% personal device ownership in preschoolers to 65% in adolescents reflects both the growing affordability of smartphones and their perceived necessity for education and social connection in modern Indian society.[28] This transition coincides with what researchers have termed the "age of digital independence"[29], where early adolescence marks a critical period when children gain substantially more autonomy over their digital lives.

Our screen time duration findings demonstrate a clear developmental progression, with usage hours nearly tripling from early childhood to adolescence. The average of 6.8 hours/day among Indian adolescents exceeds figures reported in comparable Western studies.[30] possibly reflecting cultural differences in parental supervision and the integration of digital devices into daily routines. Of particular concern is our finding that 42% of adolescent screen time involves social media platforms, which emerging research links to increased risk of anxiety and depressive symptoms.[31] The predominance of entertainment-focused usage over educational content beyond early childhood suggests missed opportunities for leveraging digital technology's potential benefits.

The behavioural and emotional correlates of screen time observed in our study warrant careful consideration. The high prevalence of irritability (45%) and emotional dysregulation (28%) associated with screen withdrawal aligns with growing evidence about "digital stress" in paediatric populations.[32] Our sleep disturbance findings (33% in adolescents) are particularly concerning given the well-established bidirectional relationship between sleep quality and mental health.[33] These results support neurobiological research suggesting that excessive screen exposure, particularly in the evening, disrupts circadian rhythms through both physiological (blue light exposure) and psychological (cognitive arousal) mechanisms.[34]

The family dynamics findings offer important insights for family-centred interventions. The negative impact of meal-time screen use on family interaction quality (40% prevalence) corroborates previous research demonstrating the value of device-free family time for child development.[35] Our data suggest that what some researchers call "techno Ference" - technology interfering with family interactions.[36] - has become commonplace in Indian households, potentially undermining crucial opportunities for parent-child bonding and communication skill development.

The declining effectiveness of parental controls with age presents both challenges and opportunities. While 82% of parents of young children reported using controls, this dropped precipitously to just 23% for adolescents. This pattern reflects what digital

media researchers have identified as the "control paradox"[37] - as children develop greater digital literacy, they simultaneously develop more sophisticated methods to circumvent restrictions. Our findings suggest the need for more developmentally-appropriate approaches to digital supervision that balance autonomy with guidance, particularly during the transition to adolescence.

Several limitations should be considered when interpreting these results. The cross-sectional design precludes causal inferences about screen time effects. While we employed multiple data collection methods, parent-reported measures may be subject to recall and social desirability biases. The hospital-based sampling, while diverse, may not fully represent all socioeconomic groups in India. Future longitudinal studies incorporating objective screen time measurements (e.g., device usage trackers) would strengthen the evidence base.

CONCLUSION

DNI measured at presentation in emergency has the potential to function as an adjunctive marker for prediction of severity of acute pancreatitis. Intensive care and careful management should be considered for acute pancreatitis patients with a DNI value greater than 1.8% upon presentation.

Clinical and Policy Implications

1. **Age-specific Guidelines:** Our data support the need for differentiated screen time recommendations across developmental stages, with particular attention to limiting social media exposure in adolescence.[38]
2. **Family-centred Interventions:** Healthcare providers should counsel parents about preserving device-free family time, especially during meals.[39]
3. **Digital literacy Programs:** Schools and communities should implement education initiatives teaching children and parents about healthy digital habits.[40]
4. **Technology Design:** There is urgent need for collaboration with tech companies to develop more effective parental control features that adapt to children's developmental needs.[41]

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