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Original Article

Effects of Extended Screen Exposure in Early Childhood: Determinants, Developmental Consequences, and Evidence-Based Parenting Strategies.

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Abstract

Background:

The rapid expansion of digital technology has led to increasing screen exposure among toddlers, raising concerns regarding its potential implications for early childhood development. Excessive and poorly regulated screen use during critical developmental periods may influence cognitive functioning, language development, social interaction, and behavioral regulation.

Methodology:

A cross-sectional, questionnaire-based survey was conducted among parents of toddlers aged 1.5 to 5 years recruited from two kindergartens in Karachi, Pakistan. Parental perceptions of screen exposure, behavioral responses, and developmental indicators were assessed using a structured questionnaire. Descriptive statistics and chi-square goodness-of-fit tests were applied to examine response patterns related to screen use and parental practices. A narrative literature review was additionally undertaken to contextualize the findings within existing national and international evidence.

Results:

The findings indicated widespread screen exposure among toddlers, with a substantial proportion of parents reporting prolonged daily screen use. Behavioral reliance on screens was commonly reported, particularly in relation to feeding practices and irritability following screen removal. A strong preference for screens over physical toys and limited parental enforcement of screen-time rules were also observed. Parent-reported concerns regarding conversational engagement, speech development, and cognitive functioning were noted. Statistically significant associations were primarily observed for indicators of behavioral dependence and reduced parental mediation ($p < 0.05$).

Conclusion:

Screen exposure is common in early childhood and is associated with behavioral reliance and limited engagement in developmentally enriching activities. These findings underscore the importance of structured parental guidance, regulated screen-time practices, and increased promotion of sensory, physical, and language-based interactions to support healthy early childhood development in the digital age.

Keywords:

Screen Time, Toddlers, Early Childhood Development, Behavioral Dependence, Parental Mediation, Digital Media Exposure

Introduction

The unprecedented growth of digital technology has transformed modern lifestyles, making electronic media an integral part of daily living. Screen time refers to the duration spent engaging with electronic devices such as smartphones, tablets, televisions, computers, gaming consoles, and other screen-based technologies. Over the past two decades, the proliferation of these devices has raised significant concerns regarding their influence on early childhood development. This concern is particularly relevant during the first five years of life, a critical period for the development of cognitive, linguistic, emotional, and social skills [1].

Public apprehension regarding excessive screen exposure has intensified, fueled by growing evidence linking screen use to attention difficulties, behavioral problems, and developmental delays in young children [1]. The foundations of executive functioning, language acquisition, and socio-emotional regulation are established during early childhood, making this period especially vulnerable to environmental influences, including digital media exposure. Consequently, understanding the implications of screen time on toddlers has become a priority for parents, healthcare professionals, and policymakers [2].

The global expansion of digital media accelerated markedly during the COVID-19 pandemic, when education, communication, and entertainment shifted to remote and technology-based platforms. While this transition offered convenience and continuity in learning and social interaction, it also resulted in increased screen exposure among infants and toddlers, often as a coping strategy for caregivers managing work-from-home responsibilities [3,4]. The widespread availability of inexpensive internet services and free child-oriented content, particularly on platforms such as YouTube, has further normalized prolonged screen engagement among young children [5].

Despite potential educational benefits, excessive screen exposure during early childhood has been associated with multiple adverse outcomes. Language development, which relies heavily on direct interaction between children and caregivers, may be compromised by screen-based engagement that limits reciprocal communication and social exchange [6,7]. Furthermore, exposure to fast-paced or overstimulating content can activate dopamine-mediated reward pathways, contributing to behavioral dependence, irritability, and attentional difficulties [8].

Beyond cognitive and behavioral concerns, excessive screen time has been linked to physical health consequences, including reduced physical activity, increased sedentary behavior, obesity, postural issues, visual strain, and the early onset of myopia [9–11]. Emerging evidence also suggests broader impacts on executive functioning, sensory-motor development, and academic readiness, emphasizing the multifaceted risks associated with unregulated screen use [12–16].

Given the increasing integration of digital media into early childhood environments, it is essential to examine both the prevalence and consequences of screen exposure among toddlers. The present study was designed to assess parental perceptions of screen use and its impact on cognitive, speech, and behavioral development in children aged 1.5 to 5 years. By combining parental survey data with a supporting literature review, this study aims to contribute evidence that can inform parenting practices and guide public health recommendations for healthier digital engagement in early childhood [17–20].

Methodology

Study Design

The present investigation adopted a cross-sectional, questionnaire-based observational study design to assess early childhood screen exposure and its perceived behavioral and developmental effects as reported by parents. This design was selected to capture prevailing patterns of screen use, parental practices, and child responses within a defined time frame, allowing for descriptive and associative analysis without intervention. The study also incorporated a narrative literature review to contextualize survey findings within existing scientific evidence; however, this review did not constitute qualitative data collection and was used solely for interpretative support.

Ethics

Ethical approval for the study was obtained from the Review Board of the Institute of Pharmaceutical Sciences, Jinnah Sindh Medical University (Approval No. IPS/DRC/PCM/2023/09). Prior to data collection, parents were informed about the objectives, procedures, and voluntary nature of participation. Written informed consent was obtained from all participants. Confidentiality and anonymity were ensured throughout the study, and no identifying personal information was recorded.

Setting

The study was conducted in two kindergartens located within the same geographical area of Karachi, Pakistan. Data collection took place in a familiar and comfortable environment to encourage honest and accurate parental reporting. The overall data collection period extended over three months between April and December 2024.

Participants

Parents of toddlers aged between 1.5 and 5 years were approached for participation. A total of fifty parents were invited, of whom thirty-nine consented and provided complete responses, forming the final study sample. Inclusion criteria required that the child be within the specified age range and regularly exposed to digital screen devices. Parents who did not complete the questionnaire or declined consent were excluded.

Variables

Primary variables included duration of daily screen exposure, type of digital device used, nature of screen content, and parental screen-management practices. Secondary variables encompassed parent-reported child behaviors such as irritability, stubbornness, communication engagement, speech development, play preferences, sensory activities, reading habits, and perceived cognitive effects. Sociodemographic variables related to parental occupational engagement were also recorded.

Data Sources and Measurement

Primary data were collected using a structured parental questionnaire administered through face-to-face interactions. The questionnaire captured quantitative information on screen-time duration, device usage patterns, behavioral responses to screen exposure, and parental supervision practices. Responses were recorded in binary (Yes/No) format to facilitate statistical comparison. Secondary data were derived from a narrative literature review of peer-reviewed studies published from 2015 onward, identified through PubMed, Medline, and Google Scholar, including national and international research relevant to early childhood screen exposure [1–20].

Bias

The study is subject to potential reporting and recall bias inherent in parent-reported data. Social desirability bias may have influenced parental responses regarding screen-time practices. Selection bias is also possible due to the limited sample size and single-city setting. These limitations were acknowledged, and findings were interpreted cautiously within the scope of a cross-sectional survey design.

Study Size

The final sample consisted of thirty-nine completed parental questionnaires. While modest, the sample size was sufficient for descriptive analysis and chi-square testing to identify statistically significant response patterns. The study was exploratory in nature and not powered for causal inference.

Quantitative Variables

Results

Participants

A total of thirty-nine parents of toddlers aged 1.5 to 5 years completed the questionnaire and were included in the final analysis. Participants were recruited from two kindergartens located within the same geographical region of Karachi. All questionnaires were fully completed and considered valid for statistical analysis. The findings reflect parent-reported observations of early childhood screen exposure in an urban educational setting.

Descriptive Data

Descriptive analysis indicated widespread exposure to screen-based devices among toddlers. More than half of the parents reported that their children regularly used mobile phones or tablets, and a similar proportion indicated frequent cartoon viewing. Approximately two-thirds of parents reported prolonged daily screen exposure of eight or more hours. Parental regulation of screen use was limited, with only about one-quarter of parents reporting the enforcement of screen-time rules. Engagement in developmentally supportive activities such as sensory play, shared reading, and outdoor play was comparatively low across the sample.

Outcome Data

Parent-reported behavioral and developmental outcomes revealed notable patterns. A majority of parents reported behavioral dependence on screens, particularly the use of screens to facilitate feeding and irritability when screens were removed. Preference for screens over physical toys was frequently observed, whereas positive responses to new toys and regular engagement with physical toys were less consistently reported. Parental encouragement of sensory

Quantitative variables included daily screen exposure duration (categorized as ≥ 8 hours/day or < 8 hours/day), frequency of specific behaviors, and presence or absence of parental rules regarding screen use. All variables were treated as categorical and expressed as frequencies and percentages.

Statistical Methods

Data were analyzed using descriptive statistics to summarize frequencies and proportions. Chi-square tests of independence were applied to examine associations between screen-related behaviors and parental responses, with the null hypothesis stating no significant difference between “Yes” and “No” responses. A p-value of < 0.05 was considered statistically significant. Statistical findings were interpreted in conjunction with existing literature to strengthen contextual understanding.

play and shared reading activities was limited, suggesting reduced exposure to non-screen-based developmental stimulation.

Main Results

Chi-square goodness-of-fit analysis identified several statistically significant associations between screen-related behaviors and observed outcomes. The use of screens to facilitate feeding was significantly more common than expected ($\chi^2 = 7.41$, $p = 0.006$), as was irritability upon screen removal ($\chi^2 = 5.77$, $p = 0.016$), indicating behavioral reliance on screen use. A significant imbalance was also observed in parental enforcement of screen-time rules, with substantially fewer parents reporting rule implementation ($\chi^2 = 9.26$, $p = 0.002$).

Children’s preference for screens over physical toys demonstrated a highly significant association ($\chi^2 = 11.31$, $p < 0.001$), highlighting a strong inclination toward screen-based engagement. Additionally, limited parental encouragement of sensory play was statistically significant ($\chi^2 = 4.33$, $p = 0.037$).

In contrast, prolonged daily screen exposure of eight or more hours, regular cartoon viewing, touch-based screen interactions, shared reading practices, outdoor activity participation, and parental occupational engagement did not demonstrate statistically significant deviations from expected distributions ($p > 0.05$).

Collectively, these findings indicate that while high screen exposure is prevalent, the most robust associations are observed with behavioral dependence indicators and reduced parental mediation practices rather than with screen duration alone. These patterns suggest that contextual and regulatory aspects of screen use may play a critical role in shaping early childhood behavioral outcomes.

Table 1: Toddler Screen Exposure Patterns and Related Behaviors.

Item	Yes, n (%)	No, n (%)	χ^2	p-value
Child spends ≥ 8 hours/day on screens	25 (64.1%)	14 (35.9%)	3.10	0.078
Child primarily uses tablet/mobile devices	21 (53.8%)	18 (46.2%)	0.23	0.631
Child mainly watches cartoons	21 (53.8%)	18 (46.2%)	0.23	0.631
Child frequently uses touch interactions (tap/swipe)	16 (41.0%)	23 (59.0%)	1.26	0.262
Screens used to facilitate feeding	28 (71.8%)	11 (28.2%)	7.41	0.006
Child becomes irritable when screen is removed	27 (69.2%)	12 (30.8%)	5.77	0.016
Parents enforce screen-time rules	10 (25.6%)	29 (74.4%)	9.26	0.002
Child frequently engages with physical toys	17 (43.6%)	22 (56.4%)	0.64	0.423
Child prefers screens over physical toys	30 (76.9%)	9 (23.1%)	11.31	< 0.001
Child shows positive response to new toys	18 (46.2%)	21 (53.8%)	0.23	0.631
Parents actively encourage sensory play	13 (33.3%)	26 (66.7%)	4.33	0.037
Parents read books or tell stories regularly	14 (35.9%)	25 (64.1%)	3.10	0.078

Child participates in outdoor activities	17 (43.6%)	22 (56.4%)	0.64	0.423
Both parents engaged in full-time work	22 (56.4%)	17 (43.6%)	0.64	0.423

N = 39. χ^2 values are from a chi-square goodness-of-fit test (df = 1) comparing observed Yes/No responses against an equal expected distribution (N/2 each). p < 0.05 considered statistically significant.

Discussion

Screen exposure has become an increasingly dominant feature of early childhood environments, particularly within urban households. The findings of the present study indicate widespread screen exposure among toddlers and highlight its association with several parent-reported behavioral and developmental concerns. These observations are consistent with prior research suggesting that excessive and poorly regulated screen exposure during early childhood may interfere with optimal cognitive, linguistic, and socio-emotional development [12].

Early childhood represents a critical window for brain development, during which neural circuits responsible for language acquisition, executive functioning, and social interaction are rapidly forming. Prolonged engagement with screen-based media may displace essential caregiver-child interactions, thereby limiting opportunities for reciprocal communication and experiential learning [13]. In the present study, parents reported concerns related to conversational engagement and speech development, findings that are consistent with existing literature linking excessive screen exposure to delayed language acquisition and reduced expressive vocabulary [6,7].

Behavioral dependence on screens emerged as a prominent finding, particularly in relation to screen-assisted feeding practices and irritability upon screen removal. These patterns suggest the development of maladaptive self-regulation strategies, which are supported by evidence indicating that screen-based content can activate reward pathways in the developing brain, reinforcing habitual use and emotional dysregulation [8]. The significant association between screen use during feeding and behavioral distress following screen withdrawal underscores the risk of conditioning children to associate screens with emotional comfort and routine activities.

In addition, parents frequently perceived negative effects of screen exposure on memory and cognitive functioning. Such perceptions are supported by prior studies demonstrating associations between excessive screen time and impairments in attention regulation, working memory, and executive functioning [9–11]. The strong preference for screens over physical toys observed in this study reflects a shift in early play behavior that may limit sensory exploration and motor skill development, both of which are essential for cognitive growth during early childhood [14–16].

Interestingly, variables such as cartoon viewing, outdoor activity participation, and parental occupational engagement did not demonstrate statistically significant associations. This suggests that the context and regulation of screen use, rather than content exposure alone, may play a more influential role in shaping early childhood behavioral outcomes. These findings emphasize the importance of parental mediation, structured screen-time rules, and balanced engagement in non-screen-based activities [17].

Overall, the findings of this study align with ecological and developmental models emphasizing the interaction between individual behavior, caregiving practices, and environmental influences. The convergence of parent-reported observations with existing literature suggests that excessive and unregulated screen exposure may pose potential risks to early childhood development,

particularly in settings where alternative developmental stimulation is limited [18–20].

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the cross-sectional design precludes causal inference, and associations observed cannot establish directionality between screen exposure and developmental outcomes. Second, the reliance on parent-reported data introduces the possibility of recall bias and social desirability bias, which may influence the accuracy of reported behaviors. Third, the sample size was relatively small and geographically limited to two kindergartens in Karachi, potentially affecting the generalizability of the findings to broader populations. Additionally, objective developmental assessments and direct screen-time measurements were not employed, which may have provided more precise outcome evaluations. Despite these limitations, the study offers valuable preliminary insights into screen-related behaviors in early childhood and highlights areas for future longitudinal and experimental research.

Conclusion

The present study indicates that excessive and poorly regulated screen exposure is common among toddlers and is associated with behavioral dependence, reduced parental mediation, and parent-reported developmental concerns. These findings highlight the need for evidence-based parental guidance and public health strategies aimed at promoting balanced digital engagement during early childhood. Encouraging structured screen-time rules, reducing screen use during routine caregiving activities, and fostering sensory, physical, and language-enriching interactions may help mitigate potential developmental risks. As digital media continues to shape early childhood environments, proactive and informed parenting practices remain central to supporting healthy brain development and overall well-being in young children.

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