DOI: https://doi.org/10.54393/pjhs.v7i10.4034

PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 7, Issue 10 (October 2026)



OPEN ACCESS
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Original Article

Association of Screen Time Exposure with Developmental Delay in Communication and Problem-Solving Skills among Children Under 5 Years of Age Presenting at Children's Hospital: An Analytical Cross-Sectional Study

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ARTICLE INFO

Keywords:
Ages and Stages Questionnaire-3; Communication Skills, Developmental Delay, Screen Time, Under-Five Children

How to Cite:
Hassan, G., Afzal, E., Abbas, G., Anjum, N., Hanif, M. A., Zulqarnain, A., & Shadani, K. A. (2026). Association of Screen Time Exposure with Developmental Delay in Communication and Problem-Solving Skills among Children Under 5 Years of Age Presenting at Children's Hospital: An Analytical Cross-Sectional Study: Screen Time Exposure with Developmental Delay in Communication: 5-Year-Old Children. Pakistan Journal of Health Sciences, 7(10), 130-135. https://doi.org/10.54393/pjhs.v7i10.4034

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Received Date: 26th February, 2026
1st Revision Received: 29th April, 2026
2nd Revision Received: 20th May, 2026
3rd Revision Received: 2nd June, 2026
Acceptance Date: 8th June, 2026
Published Date: 31st October, 2026

ABSTRACT

Excessive screen exposure in early childhood has been increasingly associated with adverse neurodevelopmental outcomes. **Objectives:** To determine the association of screen time exposure with developmental delay in communication and problem-solving skills among children under five years of age presenting at a tertiary care hospital in Pakistan. **Methods:** This analytical cross-sectional study was carried out at Children's Hospital Multan. A total of 236 children aged 1 to 5 years were included using consecutive sampling. Information about children's screen use was collected from parents through a structured questionnaire. Child development in communication and problem-solving was assessed using the Ages and Stages Questionnaire (ASQ-3). Associations between screen exposure and developmental delays were evaluated using chi-square analysis and multivariable logistic regression. **Results:** More than half of the children (58.1%) were using screens for more than 2 hours per day. Communication delay was found in 34.3% of children, while 29.7% had delay in problem-solving skills. After adjusting for potential confounders, children who used screens for more than 2 hours daily had approximately 2.4 times higher odds of communication delay (AOR=2.41; 95% CI: 1.42–4.08; p=0.001) and 2.1 times higher odds of problem-solving delay (AOR=2.08; 95% CI: 1.19–3.64; p=0.010). **Conclusion:** Children under five who spend more time on screens were more likely to have speech delay, understanding, and problem-solving skills. Because of these findings, children should be screened regularly for development, and parents should receive advice about healthy screen habits. Parents spending time while talking, playing, and interacting with children may help to improve child development.

INTRODUCTION

The early years are very important for brain and child development. Children learn speaking, thinking, and social skills during this period [1]. Serve-and-return interactions, which involve back-and-forth communication between children and caregivers, play an important role in the development of communication and problem-solving skills [2]. The use of digital screen media has increased markedly in the daily lives of young children over the past decade.

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DOI: https://doi.org/10.54393/pjhs.v7i10.4034

Even babies and toddlers now have access to screens, which affects how they play, learn, and respond to the world [3]. World Health Organization (WHO) says children below 2 years should not use screens, and children aged 2–5 years should have no more than one hour daily [4]. American Academy of Pediatrics (AAP) also advises controlled screen use and encourages parents to watch or engage with children during media use [5]. Evidence from prospective cohort studies and meta-analyses suggests that excessive screen exposure in early childhood is associated with delays in expressive language, reduced attention span, and impaired social development [6]. A large Japanese birth cohort study demonstrated a dose-dependent relationship between screen time at one year of age and communication and problem-solving delays at ages two and four [7]. Biological mechanisms proposed to explain these associations include displacement of language-rich caregiver interactions, attentional disruption from fast-paced media content, and sleep disturbances from nocturnal screen exposure [8]. Most studies about screen time and child development come from Western countries. In Pakistan, family culture, parenting style, and financial conditions may affect both screen use and its impact on children. [9]. Because smartphones are common, parents often use screens to keep children calm or busy, especially during meals or housework. Despite the growing use of screens, developmental monitoring and counseling regarding appropriate screen use are not routinely integrated into pediatric care [10]. However, systematic developmental surveillance and evidence-based guidance on screen use remain limited in routine pediatric care in this setting. These findings may help clinicians counsel families according to local needs and practices. They may also provide useful information for child development policies in this region.

Developmental delays among children in Pakistan are an increasing public health concern. However, local research examining the relationship between screen time and specific developmental domains remains limited, particularly in communication and problem-solving skills. Many regional studies use screening tools that are not standardized. Researchers also do not use validated instruments to identify delays in specific developmental areas. Keeping these gaps in mind, Researchers conducted this study among children aged 12–59 months attending a tertiary care pediatric hospital in Multan, Southern Punjab. This study aims to explore whether screen time was linked with delays in communication and problem-solving skills.

METHODS

This hospital-based analytical cross-sectional study was conducted at the Department of Developmental and Behavioral Pediatrics, Children Hospital and Institute of Child Health, Multan, Pakistan, from January to December 2025. Ethical approval was obtained from the Institutional Review Board of the hospital. Ethical approval was granted by the Ethical Committee of Children Hospital Multan, No.1948, dated 01-01-2025, before study commencement. All children were enrolled after written informed consent had been obtained from their parents. Sample size was calculated using a 34% prevalence of communication difficulty from a Saudi Arabian study, as no comparable Pakistani population-based prevalence estimate was available. This may affect the precision of the sample size estimate [11, 12]. Using a 95% confidence level and a margin of error of 6%, the required sample size was estimated to be 229 children. A total of 236 children were enrolled. Children aged 12 to 59 months who attended the developmental outpatient clinic during the study period were recruited using consecutive sampling. Exclusion criteria included children with diagnosed genetic conditions (e.g., Down syndrome), cerebral palsy, major neurological disorders, significant sensory impairments (hearing or vision), long-term pharmacotherapy with potential behavioral or cognitive effects, or those requiring emergency care. A structured questionnaire was administered to caregivers to obtain information on daily screen time (categorized as <1 hour, 1–2 hours, 3–4 hours, and >4 hours/day), age at first screen exposure, type of content viewed (cartoons, educational, entertainment), screen use during meals, frequency of parental co-viewing, and caregiver regulation of screen use. Child development was assessed using the Ages and Stages Questionnaire, Third Edition (ASQ-3). It is a parent-completed developmental screening tool with reported sensitivity of 82–92% and specificity of 78–90% in different populations. The ASQ-3 has been validated in South Asian settings. It has shown satisfactory internal consistency (Cronbach's α = 0.51–0.87) and good reliability over repeated testing [13]. The questionnaire was administered according to the child's age in months and scored using standardized guidelines. This study focused on the Communication and Problem-Solving sub-scales. Children scoring below the recommended age-specific cut-off were classified as having a developmental delay in the respective domain. For analysis, screen time was dichotomized at >2 hours/day to facilitate comparison with existing literature; however, this cut-off exceeds the WHO recommendation of ≤ 1 hour/day for children aged 2–5 years. The primary outcome variables were communication delay and problem-solving delay on the ASQ-3. Covariates included child's age (in months), sex, area of residence, maternal education, household income, age at first screen exposure, and frequency of caregiver co-viewing. The amount of missing data was small and remained below 3% for all

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variables. Participants with missing data for the main exposure or outcome measures were not included in the final analysis. Excluding incomplete records did not meaningfully affect the study findings.

Data were analyzed using IBM SPSS Statistics Version 26. Descriptive statistics were used to summarize categorical variables as frequencies and percentages, and continuous variables as mean ± standard deviation (SD). Associations between screen time and developmental delays were examined using the chi-square test. Crude odds ratios (COR) with 95% confidence intervals (CI) were computed for unadjusted analyses. Multivariate logistic regression was performed to calculate adjusted odds ratios (AOR) with 95% CI, controlling for age group, sex, area of residence, maternal education, household income, and age at first screen exposure. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 236 children aged 12 to 59 months were included. The mean age was 37.8 ± 13.6 months. Among them, 132 (55.9%) were male, and 104 (44.1%) were female. Age distribution in months showed the largest group in the 48–59-month range (29.2%), followed by 36–47 months (26.7%), 24–35 months (24.6%), and 12–23 months (19.5%). Most children resided in urban areas (63.1%). Regarding maternal education, 37.3% had completed matriculation, 27.1% had intermediate education, and 35.6% were graduates or had higher qualifications. The socio-demographic and screen use characteristics of the study population are presented (Table 1).

Table 1: Sociodemographic Characteristics of Study Participants (n=236)

Characteristic	n (%)
Sex	
Male	132 (55.9%)
Female	104 (44.1%)
Age Group (months)	
12–23	46 (19.5%)
24–35	58 (24.6%)
36–47	63 (26.7%)
48–59	69 (29.2%)
Residence	
Urban	149 (63.1%)
Rural/Peri-urban	87 (36.9%)
Maternal Education	
Matric	88 (37.3%)
Intermediate	64 (27.1%)
Graduate or above	84 (35.6%)

Regarding screen use, 137 children (58.1%; 95% CI: 51.7–64.3) were exposed to screens for more than 2 hours daily. Among these, 83 (35.2%) had 3–4 hours/day exposure and 54 (22.9%) exceeded 4 hours/day. Only 28 children (11.9%) had less than 1 hour/day of screen exposure (Figure 1).

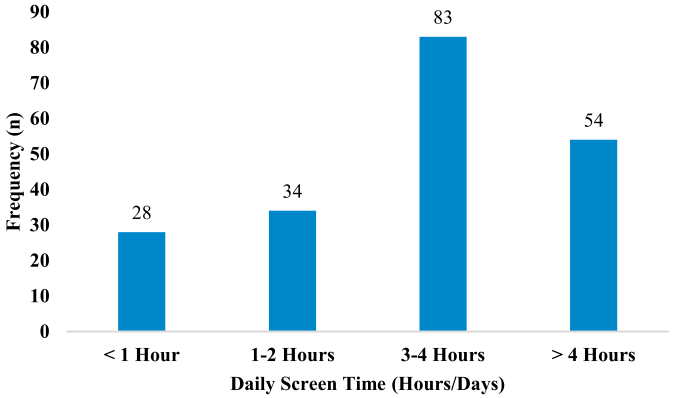


Figure 1: Distribution of Daily Screen Time (in Hours/Days) among Children Aged 12-59 Months (n=236)

Screen use initiated before 12 months of age was reported for 62 children (26.3%), and more than half (57.7%) were first exposed before 18 months. Cartoons were the most frequently viewed content type (52.1%). Screen use during meals was reported in 61.0% of households. Active parental regulation was reported in 41.1% of caregivers, and consistent co-viewing was noted in 37.3%. Developmental assessment using ASQ-3 revealed communication delay in 81 children (34.3%; 95% CI: 28.4–40.7) and problem-solving delay in 70 children (29.7%; 95% CI: 24.2–35.8). The univariate analysis of the association between daily screen time and developmental delays is presented (Table 2).

Table 2: Univariate analysis of screen time and developmental delays among children aged 12–59 months (n=236)

Variables	≤2 h/day (n=99), n (%)	>2 h/day (n=137), n (%)	COR (95% CI)	p-value
Communication Delay				
Yes	18 (18.2%)	63 (46.0%)	3.83 (2.10–6.99)	<0.001
No	81 (81.8%)	74 (54.0%)	Reference	
Problem-Solving Delay				
Yes	16 (16.2%)	54 (39.4%)	3.36 (1.80–6.29)	<0.001
No	83 (83.8%)	83 (60.6%)	Reference	

COR = Crude Odds Ratio; CI = Confidence Interval

Frequency of communication delay and problem-solving delay stratified by daily screen exposure (≤2 hours vs >2 hours). The results of multivariable logistic regression analysis identifying independent predictors of developmental delay are presented (Table 3).

Table 3: Multivariable Logistic Regression Analysis for Communication and Problem-Solving Delay (n=236)

Variables	Communication Delay AOR (95% CI)	p-value	Problem-Solving Delay AOR (95% CI)	p-value
Screen Time >2 h/day	2.41 (1.42–4.08)	0.001	2.08 (1.19–3.64)	0.010
Screen Initiation <12 Months	1.72 (1.01–2.94)	0.046	1.31 (0.76–2.26)	0.330
Screen Use During Meals	1.45 (0.87–2.43)	0.154	1.68 (1.00–2.83)	0.049

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DOI: https://doi.org/10.54393/pjhs.v7i10.4034

AOR = Adjusted Odds Ratio; CI = Confidence Interval. Adjusted for age group, sex, residence, maternal education, household income, and age at first screen exposure

DISCUSSION

This analytical cross-sectional study examined the association between screen time and developmental outcomes in children under five years attending a tertiary pediatric center in Southern Punjab. We found that screen exposure exceeding two hours per day was independently associated with significantly higher odds of both communication delay (AOR=2.41; 95% CI: 1.42–4.08) and problem-solving delay (AOR=2.08; 95% CI: 1.19–3.64), after controlling for sociodemographic and screen-related covariates. These findings are consistent with prospective evidence from high-income settings. McArthur *et al.* demonstrated that increased screen time at 24 and 36 months predicted poorer developmental outcomes at subsequent follow-up in the cohort [14]. A meta-analysis by Madigan *et al.* further confirmed significant associations between screen exposure and expressive language delay [15]. The current adjusted odds ratios are within the range reported by these international studies, suggesting that the developmental risks of excessive screen use may be generalizable across diverse socioeconomic and cultural contexts. Fast-paced digital content may impair executive functions including sustained attention and inhibitory control [16]. In the current sample, early screen initiation before 12 months was independently associated with communication delay (AOR=1.72; 95% CI: 1.01–2.94); screen use during meals independently predicted problem-solving delay (AOR=1.68; 95% CI: 1.00–2.83), a finding that may reflect disrupted mealtime interactions—an important context for early cognitive and social learning. Screen use exceeding two hours daily was observed in 58.1% of children in our cohort, surpassing WHO recommendations. Possible reasons include easy availability of screens, changing family routines, and the use of screens to engage children at home in urban Pakistani families. Studies from Pakistan and other South Asian countries have also reported high screen use and related developmental concerns among preschool children, indicating that this issue is not limited to Western countries [17]. Parental co-viewing is frequently cited as a moderating factor in screen time research. Structured co-viewing and guided discussion can mitigate the adverse effects of screen exposure by facilitating active engagement with content. Only 37.3% of children in the current study had regular co-viewing with caregivers. In contrast, screen use during meals was reported in 61.0% of cases. Using screens without supervision, particularly at mealtimes, may have a greater negative effect on child development. These are important times for caregiver-child interaction [18]. Although some research suggests that high-quality educational programming can support vocabulary acquisition when supervised by caregivers, these benefits are contingent on active caregiver engagement and age-appropriate content selection. When caregivers are unable to regularly watch screens with children, unsupervised screen use may provide little developmental benefit. It may also limit language-rich interaction during early childhood [19]. The findings of this study may help guide clinical practice. Pediatricians should routinely screen children under five years of age for developmental delays. Validated tools such as the ASQ-3 may be especially useful in settings where screen use is common [20].

This study has several limitations. First, the cross-sectional design cannot establish temporality, and reverse causality cannot be excluded; children with developmental delays may have been given more screen time as a behavioral management strategy. Second, screen time was reported retrospectively by caregivers, introducing potential recall and social desirability bias. Third, the > 2 hours/day cut-off exceeds the WHO recommendation of ≤ 1 hour/day for children aged 2–5 years. Fourth, consecutive sampling from a single tertiary clinic introduces selection bias and limits generalizability to community populations. Fifth, sample size was calculated using Saudi Arabian prevalence data, which may not apply to the Pakistani population. Sixth, screen use during meals was not adjusted for total screen time, so this finding should be considered exploratory. Finally, caregiver-child interaction was not directly measured; thus, recommendations regarding parental interaction are based on prior evidence, not current data. Despite these limitations, this study provides local data using a standardized screening tool, and findings are consistent with international studies. Longitudinal research is needed in Pakistani children.

CONCLUSIONS

Children under five using screens for more than two hours daily were more likely to have delays in communication and problem-solving skills. Early screen initiation and screen use during meals were also linked with developmental problems; however, reverse causality cannot be excluded given the cross-sectional design. Screen time should be limited to ≤ 1 hour/day for children aged 2–5 years and avoided for those under 2 years, consistent with WHO guidelines. Parents should be educated about healthy screen habits, and children should be screened regularly for developmental issues. Although caregiver-child interaction was not measured in this study, prior evidence supports parent-mediated intervention; this recommendation is not derived from the current data.

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DOI: https://doi.org/10.54393/pjhs.v7i10.4034

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Formal analysis: GH, NA
Writing and Drafting: GH, EA, GA, NA, MAH, AZ
Review and Editing: GH, EA, GA, NA, MAH, AZ, KAS

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflict of Interest

All the authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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