

Early Screen Exposure and Its Association with Communication and Cognitive Outcomes in Children Aged 6-24 Months: A Cross-Sectional Study Using the CSBS-DP

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Abstract

Background: Early exposure to screens during infancy and toddlerhood has become a significant public health issue as studies have found a possible impact on communication, cognition and social-emotional development. The first two years of life bring about rapid maturation of the neurodevelopmental system through symbolic exchange, reciprocal social interaction and through caregiver-mediated learning. Too much and/or unsupervised use of screens can disrupt these developmental processes. The aim and objective is to examine communication and cognition skills in children 6-24 months of age on the Communication and Symbolic Behaviour Scales Developmental Profile (CSBS-DP); identify and quantify children with abnormal scores; and identify factors associated with early screen exposure. **Material and Methods:** A cross sectional observational study was conducted in a hospital with respect to children aged 6-24 months attending Immunization Centre and Paediatric Out Patient Department of MGM Medical College and M.Y. Hospital, Indore. A structured questionnaire was used to collect data on the demographic characteristics and screen exposure patterns. The assessment tools for communication and cognitive development were CSBS-DP scale. Data analysis was carried out with SPSS 25.0 program, and $p < 0.05$ was accepted as statistically significant. **Results:** A total of 500 children aged 6-24 months with screen exposure were included in the study. Smartphones were the most commonly used devices (72%), and 23.0% of children had screen exposure exceeding 2 hours/day. Developmental concern on the CSBS-DP total composite score was identified in 54.0% of children, predominantly affecting speech (59.0%) and social communication (57.0%) domains. Mean CSBS-DP scores declined significantly with increasing screen exposure duration across all domains ($p < 0.001$), with prolonged screen time showing a significant dose-dependent association with adverse developmental outcomes. **Conclusion:** Early screen exposure during infancy and toddlerhood may be associated with adverse communication and symbolic behavioural outcomes, particularly when exposure is prolonged, unsupervised, and associated with reduced caregiver interaction. Early developmental surveillance and parental counselling regarding responsive caregiving and age-appropriate media practices are essential.

Keywords: Early childhood development, Screen exposure, Communication, Cognition, CSBS-DP.

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INTRODUCTION

The first 2 years of life constitute a critical period of rapid neurodevelopment, during which early caregiver-mediated interactions shape communication, cognition, social reciprocity, and emotional regulation.^[1,2] Increasing exposure to digital media during infancy and toddlerhood has raised concerns regarding its potential impact on these developmental processes. Smartphones, televisions, and other screen-based devices are now commonly introduced at very young ages, often during feeding, soothing, or daily caregiving routines.^[3,4]

Overt screen exposure can curtail opportunities for eye contact, shared attention, verbal interaction, and exploratory play, which are essential for early communication and symbolic development. In addition, background media exposure and parental device distraction may adversely affect caregiver-child interaction and language-rich environments.^[3,5]

The Communication and Symbolic Behaviour Scales

Developmental Profile (CSBS-DP) is a standardized tool designed to assess early communication competencies, including social communication, expressive speech, and symbolic behaviour, before the emergence of mature language.^[6] Emerging evidence reflects that prolonged screen exposure is associated with language delay, impaired social interaction, and poorer developmental outcomes, while caregiver engagement and co-viewing may mitigate these

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effects.^[7,8]

In spite of growing global concern regarding early digital media exposure, data from low- and middle-income countries, including India, remain limited.^[9] The present study was therefore undertaken to evaluate screen exposure patterns and their association with communication and symbolic-cognitive development among children aged 6-24 months using the CSBS-DP.

The present study was therefore undertaken to assess early screen exposure among children aged 6-24 months and evaluate its association with communication and cognitive outcomes using the Communication and Symbolic Behaviour Scales Developmental Profile.

Aim and objectives

To assess screen exposure patterns and their association with communication and cognitive outcomes among children aged 6-24 months using the Communication and Symbolic Behaviour Scales Developmental Profile (CSBS-DP).

MATERIALS AND METHODS

Study Design: A cross-sectional observational study was conducted to assess the association between early screen exposure and communication and cognitive outcomes among children aged 6-24 months.

Study Setting: The study was conducted at the Immunization Centre and Pediatric Outpatient Department of Mahatma Gandhi Memorial Medical College and M.Y. Hospital, Indore, Madhya Pradesh.

Study Duration: The study was conducted over a period of one year after obtaining Institutional Ethics Committee approval.

Study Population: Children aged 6-24 months attending the immunization clinic and paediatric outpatient department were screened for eligibility.

Inclusion Criteria

Apparently healthy children aged 6-24 months with varying degrees of screen exposure whose parents or guardians provided informed consent were included in the study.

Exclusion Criteria

Children with preterm birth, moderate-to-severe malnutrition, prolonged NICU stay (>7 days), neurological or developmental disorders, genetic syndromes, or hearing/visual impairment were excluded from the study.

Sampling Method: Stratified random sampling was used to ensure representation across age groups (6-12 months, 13-18 months, and 19-24 months).

Sample Size: The sample size was calculated using Cochran's formula for cross-sectional studies using prevalence from Takahashi et al,^[10] 2023. After accounting for feasibility and rounding, the final sample size was taken as 500 participants.

Data Collection and Study Variables: Data were collected using a structured proforma following written informed consent from parents or caregivers. Information regarding demographic characteristics, screen exposure patterns (device type, duration, age at first exposure, content, context, supervision, and co-viewing practices), and environmental factors was obtained through caregiver interview. All children underwent general physical and neurological examination. Communication and cognitive outcomes were assessed using the Communication and Symbolic Behaviour Scales Developmental Profile (CSBS-DP), administered by a trained investigator through direct observation and caregiver reporting.

Statistical analysis: Data were entered in Microsoft excel and analyzed using SPSS 25.0 trial version. Continuous data was expressed in terms of mean and standard deviation. Categorical data was expressed in terms of frequencies and percentages. Chi-square test was used to test categorical association, independent t-test for comparison of means, Correlation analysis between screen exposure duration and CSBS-DP scores, Multivariate logistic regression for independent predictors and $p < 0.05$ was considered significant.

RESULTS

The majority of study participants belonged to the 13-18 months age group (38.2%), followed by 19-24 months (34.8%) and 6-12 months (27.0%). Male children constituted 52.8% of the sample. Mothers were the predominant caregivers (84.4%), highlighting the central role of maternal caregiving in early developmental environments.

Table 1: Baseline Demographic Characteristics of the Study Population

Variable		Frequency (n)	Percentage (%)
Age group	6-12 months	135	27.0
	13-18 months	191	38.2
	19-24 months	174	34.8
Gender	Male	264	52.8
	Female	236	47.2
Primary caregiver	Mother	422	84.4
	Father	27	5.4
	Grandparents	51	10.2
Total participants		500	100

Table 2: Screen Exposure Characteristics Among Study Participants

Variable		Frequency (n)	Percentage (%)
Daily screen time	<30 minutes	78	15.6
	1-2 hours	301	60.2
	>2 hours	115	23.0
	No screen exposure	6	1.2
Device used	Smartphone only	360	72.0
	Smartphone + TV	99	19.8

Content Type	TV only	25	5.0
	No device use	16	3.2
	Entertainment content	333	66.6
	Educational content	97	19.4
	Parental convenience	52	10.4
Supervision Status	Educational + entertainment	1	0.2
	No specific content	14	2.8
	Always supervised	426	85.2
	Sometimes supervised	60	12.0
Content Orientation	No supervision	14	2.8
	Child-oriented content	366	73.2
	Adult-oriented content	120	24.0
	No exposure	14	2.8

Screen exposure was nearly universal in the study population, with 98.8% of children exposed to at least one form of digital media. Smartphones were the predominant device (72%), and entertainment was the commonest

content category (66.6%). Most children were supervised during screen exposure (85.2%), although developmental concerns remained common.

Table 3: Distribution of Children by CSBS-DP Developmental Category

Domain	Developmental Concern n (%)	Normal/Well n (%)	Total
Social communication	285 (57.0%)	215 (43.0%)	500 (100.0%)
Speech domain	295 (59.0%)	205 (41.0%)	
Symbolic domain	230 (46.0%)	270 (54.0%)	
Total composite score	270 (54.0%)	230 (46.0%)	

Baseline CSBS-DP assessment revealed a high prevalence of developmental concerns, with abnormalities identified in 54.0% of children overall. Speech (59.0%) and Social (57.0%) domains were most affected, while 46.0% demonstrated concerns in the Symbolic domain. These

findings indicate substantial early communication and cognitive vulnerability, supporting the need to evaluate the influence of environmental factors such as screen exposure on child development.

Table 4: Comparison of Mean Developmental Scores Across Screen Viewing Categories

Developmental Domain	<30 min/day Mean $\pm$ SD	1-2 hrs/day Mean $\pm$ SD	>2 hrs/day Mean $\pm$ SD	F-value	p-value
Social score	22.15 $\pm$ 2.63	17.61 $\pm$ 3.43	14.07 $\pm$ 3.65	175.2	<0.001
Speech score	13.45 $\pm$ 2.00	10.05 $\pm$ 2.97	8.05 $\pm$ 3.29	128.45	<0.001
Symbolic score	12.85 $\pm$ 1.94	9.55 $\pm$ 2.94	7.25 $\pm$ 2.86	115.1	<0.001
Total CSBS-DP score	49.41 $\pm$ 4.35	37.20 $\pm$ 5.59	29.13 $\pm$ 6.71	264.8	<0.001

There was a significant progressive decline in mean Social, Speech, Symbolic, and Total CSBS-DP scores with increasing daily screen exposure. The greatest reduction was observed in the Total Score, decreasing from 49.41 in

the low-exposure group to 29.13 in children exposed for >2 hours/day. High F-values and uniformly significant p-values (<0.001) indicate a strong negative association between prolonged screen time and developmental performance.

Table 5: Association Between Screen Viewing Time and Developmental Concern Among Children Aged 6-12 Months (n=135)

Domain	Screen Time	Concern Present n (%)	Concern Absent n (%)	Relative Risk (RR)	95% CI	p-value
Social	<30 min	10 (25.0%)	30 (75.0%)	1.0 (Ref)	-	-
	1-2 hrs	42 (58.3%)	30 (41.7%)	2.33	1.32-4.13	0.0008
	>2 hrs	17 (73.9%)	6 (26.1%)	2.96	1.64-5.33	0.0002
Speech	<30 min	9 (22.5%)	31 (77.5%)	1.0 (Ref)	-	-
	1-2 hrs	45 (62.5%)	27 (37.5%)	2.78	1.52-5.07	0.0001
	>2 hrs	18 (78.3%)	5 (21.7%)	3.48	1.88-6.43	<0.0001
Symbolic	<30 min	8 (20.0%)	32 (80.0%)	1.0 (Ref)	-	-
	1-2 hrs	38 (52.8%)	34 (47.2%)	2.64	1.37-5.09	0.0007
	>2 hrs	16 (69.6%)	7 (30.4%)	3	1.77-6.84	0.0001

Among infants aged 6-12 months, developmental concerns increased progressively with longer screen exposure across Social, Speech, and Symbolic domains. Children exposed to >2 hours/day demonstrated markedly higher risks of social (RR 2.96; 95% CI: 1.64-5.33; p=0.0002), speech (RR 3.48;

95% CI: 1.88-6.43; p<0.0001), and symbolic developmental concerns (RR 3.0; 95% CI: 1.77-6.84; p=0.0001), indicating a strong dose-dependent association between prolonged screen viewing and adverse developmental outcomes in early infancy.

Table 6: Association Between Screen Viewing Time and Developmental Concern Among Children Aged 13-18 Months (n=191)

Domain	Screen Time	Concern Present n (%)	Concern Absent n (%)	Relative Risk (RR)	95% CI	p-value
Social	<30 min	12 (24.0%)	38 (76.0%)	1.0 (Ref)	-	-
	1-2 hrs	70 (70.0%)	30 (30.0%)	2.92	1.75-4.86	<0.0001
	>2 hrs	32 (78.0%)	9 (22.0%)	3.25	1.93-5.47	<0.0001
Speech	<30 min	14 (28.0%)	36 (72.0%)	1.0 (Ref)	-	-
	1-2 hrs	75 (75.0%)	25 (25.0%)	2.68	1.69-4.24	<0.0001
	>2 hrs	35 (85.4%)	6 (14.6%)	3.05	1.92-4.84	<0.0001
Symbolic	<30 min	10 (20.0%)	40 (80.0%)	1.0 (Ref)	-	-
	1-2 hrs	65 (65.0%)	35 (35.0%)	3.25	1.83-5.76	<0.0001
	>2 hrs	30 (73.2%)	11 (26.8%)	3.66	2.04-6.56	<0.0001

Among children aged 13-18 months, prolonged screen exposure was significantly associated with increased developmental concerns across Social, Speech, and Symbolic domains. Children exposed to >2 hours/day demonstrated markedly higher risks of social (78%; RR 3.25; 95% CI: 1.93-5.47), speech (85.4%; RR 3.05; 95% CI:

1.92-4.84), and symbolic developmental concerns (73.2%; RR 3.66; 95% CI: 2.04-6.56), with all associations remaining highly significant ($p < 0.0001$), indicating a strong dose-dependent relationship between screen exposure and adverse developmental outcomes.

Table 7: Association Between Screen Viewing Time and Developmental Concern Among Children Aged 19-24 Months (n=174)

Domain	Screen Time	Concern Present n (%)	Concern Absent n (%)	Relative Risk (RR)	95% CI	p-value
Social	<30 min	6 (27.3%)	16 (72.7%)	1.0 (Ref)	-	-
	1-2 hrs	88 (68.2%)	41 (31.8%)	2.5	1.25-5.00	0.0005
	>2 hrs	18 (78.3%)	5 (21.7%)	2.87	1.40-5.87	0.0009
Speech	<30 min	7 (31.8%)	15 (68.2%)	1.0 (Ref)	-	-
	1-2 hrs	92 (71.3%)	37 (28.7%)	2.24	1.20-4.17	0.0006
	>2 hrs	19 (82.6%)	4 (17.4%)	2.6	1.37-4.92	0.0008
Symbolic	<30 min	5 (22.7%)	17 (77.3%)	1.0 (Ref)	-	-
	1-2 hrs	82 (63.6%)	47 (36.4%)	2.8	1.28-6.11	0.0007
	>2 hrs	16 (69.6%)	7 (30.4%)	3.06	1.35-6.93	0.0027

Among children aged 19-24 months, prolonged screen exposure was significantly associated with increased developmental concerns across Social, Speech, and Symbolic domains. Children exposed to >2 hours/day demonstrated markedly higher risks of social (78.3%; RR 2.87; 95% CI: 1.40-5.87; $p = 0.0009$), speech (82.6%; RR 2.6; 95% CI: 1.37-4.92; $p = 0.0008$), and symbolic developmental concerns (69.6%; RR 3.06; 95% CI: 1.35-6.93; $p = 0.0027$), indicating a strong dose-dependent association between prolonged screen exposure and adverse developmental outcomes.

DISCUSSION

The current study analyzed the association between early screen exposure and communication-cognitive outcomes among 500 children aged 6-24 months using the CSBS-DP scale. The observations displayed that screen exposure was universal, with smartphones being the predominant device and entertainment-oriented content accounting for the majority of exposure. Importantly, prolonged screen exposure was significantly associated with poorer developmental outcomes across social communication, expressive speech, symbolic behaviour, and total composite scores.

For the current cohort, 54% of children had a developmental concern on the overall CSBS-DP composite score, 59% had a concern regarding speech and 57% had a concern regarding social communication. In fact, these observations suggest there is a significant problem of

developmental vulnerability in vulnerable early childhood when children are exposed to screens. Consistent with this, Sundqvist A et al. (2021),^[7] found negative correlations between the TV time watched and vocabulary development in early childhood in Sweden, and highlighted that positive influence of conversational turn-taking and parent-child verbal interaction. Finally, Sundqvist A et al,^[11] (2022) also discovered that parental language engagement mediated the relationship between digital media exposure and vocabulary outcomes.

A dose-response effect was clearly found between screen exposure and developmental risk in this study. The mean CSBS-DP scores for the children who watched >2 hr of screens per day were significantly lower (at the highly significant level $p < 0.001$) than the other groups across all CSBS-DP domains such as Social (14.07 ± 3.65), Speech (8.05 ± 3.29), Symbolic (7.25 ± 2.86), and Total composite (29.13 ± 6.71). The results are congruent to the results found by Madigan S et al,^[12] (2020) which showed that greater screen time in early childhood was predictive of developmental screening results. Duch H et al,^[13] (2013) noted links between watching TV for longer than 2 hours a day and delayed language development, in children under 3 years of age.

The results also align with the systematic review by Guellai B et al,^[8] (2022) which demonstrated that duration of screen time exposure was not the only factor influencing developmental outcomes in children younger than three years, but contextual factors, including co-viewing, quality of education, interactivity, and parental involvement, also played a role. In this study, 85.2% of children reported to be supervised when viewing screens, but common developmental concerns indicate

that passive supervision alone may not be enough to support the development of children.

The current cohort (2016-18) made use of smart phones as their go-to technology, reflecting the evolution in the types of digital media that children are now exposed to at home. The same was found in smartphones as the major digital media among toddlers by Alroqi H et al,^[14] (2023) and the findings showed a link between passive screen time and less use of expressive vocabulary among toddlers. Smartphones are portable, accessible and always available which can drive their use in feeding, soothing and behavioural management.

The majority of the study media category in the present study is entertainment oriented (66.6%) and 24% children were exposed to adult oriented content. The results of these findings are problematic in terms of the developmentally appropriate media that are consumed during infancy. The results of these findings are problematic in terms of the developmentally appropriate media consumed during infancy. Rapid changes in the audiovisual stimuli and content that are age-inappropriate and affect attention regulation and symbolic processing negatively have been pointed out by Guellai B et al,^[8] (2022). Exposure to adult content can also decrease opportunities for language rich, child-focused interaction.

It is especially significant that there is a relationship between these scores of the symbolic domain and the amount of screen exposure, as symbolic behaviour is key to the development of representational thinking, pretend play, and language acquisition. Theoretical developmental models propose that symbolic cognition is a product of active exploration, imitation, object manipulation and socially mediated learning. Limited experiential activities and shared meaning construction resulting from passive viewing of the screen can affect symbolic development. These concepts have been discussed extensively in developmental literature focusing on early cognitive architecture and representational learning.

A second important direction for the present study was in support of neurodevelopmental theories which highlight the significance of early reciprocal caregiver interaction. Contingent responsiveness, eye contact, emotional reciprocity, and conversational engagement are three key elements of communication development. Sundqvist et al,^[7] (2021) Barr R (2019),^[15] and Pempek TA and Lauricella AR (2017),^[16] observed that increased parental device use and reduced parent-child interaction were associated with poorer early language and communication outcomes. Wan X et al. (2025),^[17] also demonstrated that parental and child screen time alone was associated with language development delay.

The high levels of screen exposure found in the current study mirror the fast uptake of screens in low and middle income communities. Massaroni V et al. (2024),^[18] have found that "prolonged screen time during early childhood (first two years) impairs language understanding, word acquisition, and expressive language skills. Pagani LS et al. 2010,^[19] also showed that early exposure to television was associated with later academic and psychosocial problems

in a longitudinal study.

The CSBS-DP was used as a developmental screening tool in the present study which proved valuable as an early developmental screening instrument. Eadie P et al. (2010),^[20] established the clinical validity and use of the CSBS-DP as an effective tool for detecting developmental and communication problems in infant children. Filipe MG et al., 2024,^[21] validated this CSBS-DP Checklist in Portugal with children and highlighted its value when children are between 6-24 months old. Likewise, Al-Bluwi GSM et al. (2025),^[22] successfully translated and culturally adapted the CSBS-DP for Arabic speakers, further strengthening its international applicability.

CONCLUSION

Children aged 6–24 months seem to be exposed to screening early and this exposure could be linked to communication/symbolic developmental effects, especially when exposure is prolonged and unsupervised. The study points to the need to implement developmental screening in the first years of life, responsive care, and evidence-based parental guidance on digital media use in the first years of life. Interactive communication-based and reducing excessive passive screen exposure strategies may play a role in supporting positive developmental pathways in this critical time of neurodevelopment.

Clinical Implications: Screen exposure and parental counselling should be part of routine developmental surveillance. However, caregiver-child interaction that is responsive and minimizing passive screen time can assist children's communication and cognitive development, and the CSBS-DP can be used to identify at-risk children early.

Recommendations: Longitudinal studies designed to assess the long-term neurodevelopmental consequences of early screen exposure use and the separation between passive and interactive screen use are needed. Age-appropriate digital media practices should be integrated into paediatric developmental surveillance and supported by evidence, and parental counselling should be integrated into routine paediatric care.

Strengths and Limitations

Strengths: The present study has the following strengths: a large sample size, an even age distribution, a developmental assessment instrument that was common to all, and assessment of several contextual variables associated with screen exposure. The study also provides valuable knowledge from the Indian context where information on infant screen time exposure is scarce.

Limitations: There are however some restrictions to note. Due to the cross-sectional design of the study, it is not possible to make causal inferences and there may be recall bias in the caregiver-reported screen exposure data. Very few people were completely untouched by screen time—therefore, this is not really a comparison with an outside control group. Additionally, qualitative components of parent-child interaction and social and economic factors that affect usage of digital technology were not fully evaluated.

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Conflicts of interest

There are no conflicts of interest.

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