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DEVELOPMENTAL IMPACT OF SCREEN MEDIA EXPOSURE IN EARLY CHILDHOOD: AN OBSERVATIONAL STUDY IN CHILDREN AGED 2–6 YEARS

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Abstract-

Introduction- Digital screen exposure in early childhood is rising globally, often exceeding recommended limits and potentially impacting development. Limited research exists in low- and middle-income countries like India. This study addresses the urgent need to understand screen media's developmental effects in Indian children aged 2–6 years for informed caregiving and policy.

Material and methods- A cross-sectional study of 80 children aged 2–6 years was conducted at a tertiary hospital in Jharkhand, India. Caregivers provided data on screen exposure and sociodemographics via questionnaires. Development was assessed using the Ages and Stages Questionnaire (ASQ-3). Data were analyzed with SPSS, exploring associations between screen time and developmental outcomes ($p < 0.05$).

Result- Among 80 children (mean age 4.1 years), 95% had screen exposure, mostly TV and smartphones. Early exposure (<12 months) and screen time over 2 hours daily were significantly associated with developmental delays (OR 2.95 and 3.81, respectively). Delays were most common in communication and personal-social domains. Parental co-viewing showed no significant protective effect. Educational content correlated with fewer delays compared to cartoons and video games.

Conclusion- This study highlights that early and prolonged screen media exposure in children aged 2–6 years is associated with increased developmental delays. Limiting screen time, delaying early exposure, and encouraging educational content with parental engagement may mitigate risks

Keywords- Screen time, children, developmental delay, parental co-viewing, ASQ-3 etc.

Introduction-

The integration of digital technologies into daily life has significantly reshaped early childhood experiences. Devices such as televisions, tablets, smartphones, and computers are now prevalent in most households, exposing children to screen media from a very young age. Despite recommendations by pediatric authorities like the American Academy of Pediatrics (AAP), which advises no more than

one hour of high-quality screen exposure per day for children aged 2 to 5 years, many children today exceed this limit regularly.[1] This early and often unsupervised interaction with screens has sparked growing concern about its implications for children's overall development. The first six years of life are crucial for neurodevelopment, as the brain undergoes rapid structural and functional changes during this period.[2] The type and quality of environmental stimuli a child receives during this phase can greatly influence developmental trajectories. While digital media can provide opportunities for learning, there is a risk that excessive screen exposure may replace essential activities like social interaction, active play, and quality sleep, all of which are vital for healthy growth.[3] Empirical studies have increasingly reported links between screen exposure and various developmental issues in early childhood. Longitudinal research has shown that high levels of screen use in toddlers may be associated with subsequent cognitive delays.[4] Similarly, a recent large-scale cohort study found that increased screen time at ages 2 and 3 was significantly associated with lower developmental scores at age 5.[5] Other investigations have linked prolonged screen use to behavioral challenges, such as reduced attention span and hyperactivity,[6] speech and language delays, [7] and sleep disturbances.[8]

Despite the concerns, not all screen interactions are harmful. When used in moderation and with appropriate content, screen media can support early learning. Educational programs that are designed for young children and viewed with adult supervision can help improve vocabulary and comprehension.[9] However, the impact of screen use varies widely depending on the content type, the presence of caregiver mediation, and the child's socio-cultural environment.[10] The global literature on this subject remains skewed toward high-income countries, where patterns of screen use, parenting styles, and access to digital content may differ significantly from those in low- and middle-income regions. In countries like India, where digital penetration has increased rapidly across all socio-economic strata, understanding the developmental impact of screen exposure is particularly important. Limited research exists that captures the context-specific effects of media use among young children in such settings.[11] Hence the present study aims to explore the developmental consequences of screen media exposure in Indian children aged 2 to 6 years. Through an observational approach, this research intends to generate local evidence to better inform caregivers, pediatricians, and policymakers about how digital environments are influencing early childhood development.

Material and methods-

This study was as a descriptive, observational cross-sectional analysis conducted over a period of ten months, from June 2024 to April 2025. The research was carried out in the pediatric outpatient department of Laxmi Chandravansi Medical College and Hospital, Bishrampur, Jharkhand, India. The primary objective was to examine the potential impact of screen media exposure on the developmental status of children aged 2 to 6 years. The study protocol received approval from the Institutional Ethics Committee. Written informed consent was obtained from all caregivers before enrollment. The confidentiality of personal data was strictly maintained, and participation was voluntary. The study included children aged between 24 and 72 months who attended pediatric consultations at the selected tertiary care hospital. Inclusion criteria was the children aged 2-6years, accompanied by a primary caregiver who could provide reliable information, and willingness of the caregiver to provide informed consent. Children with a history of developmental disorders such as autism spectrum disorder, cerebral palsy, down syndrome, or chronic systemic illnesses were excluded to minimize confounding effects on developmental outcomes. A total of 80 children were enrolled using a non-probability convenient sampling technique. Information was collected using a structured, pre-validated questionnaire administered to caregivers through face-to-face interviews. The questionnaire had three main sections i.e. sociodemographic details**,** screen media exposure and developmental assessment. Sociodemographic details included child's age, gender, parental education, occupation, family income, and urban or rural residence. Screen media exposure section captured the type of media devices used (television, mobile phones, tablets, etc.), average screen time per day, age at first exposure, types of content viewed (educational or entertainment), and level of parental involvement

during screen use. For developmental assessment, the Ages and Stages Questionnaire – Third Edition (ASQ-3) was used to assess developmental domains. This caregiver-completed tool screens for age-appropriate functioning in communication, gross motor, fine motor, problem-solving, and personal-social areas.[12] Each child was assessed using the age-appropriate version of ASQ-3, and scores were interpreted according to standardized scoring guidelines. Collected data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics software version 25. Descriptive statistics such as frequencies, means, and standard deviations were used to describe participant characteristics and screen time variables. The relationship between screen exposure duration and developmental delay was examined using chi-square tests and binary logistic regression. Statistical significance was set at $p < 0.05$.

Result-

The present study included a total of 80 children aged between 2 and 6 years, with a mean age of 4.1±1.2 years. Among the participants, 56.3% (n=45) were males and 43.7% (n=35) were females, indicating a slight male predominance as visible in figure 1.

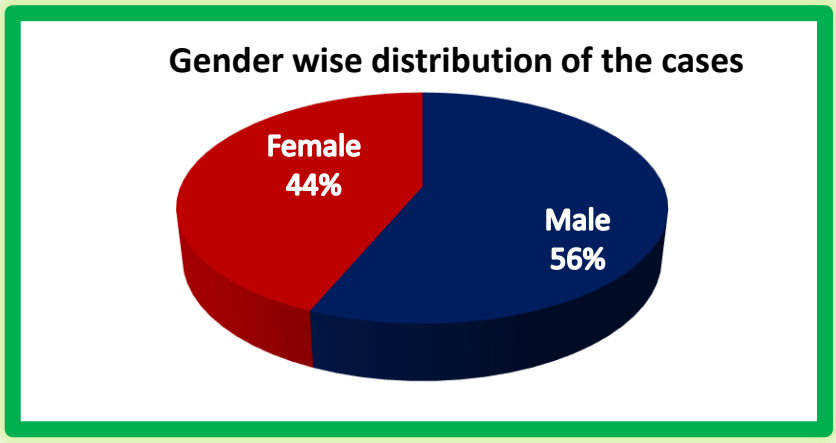

Figure 1- Gender wise distribution of the cases

Regarding family structure, table 1 shows that the majority of children, 65.0% (n=52), belonged to nuclear families, while 35.0% (n=28) were from joint or extended family settings. In terms of socioeconomic distribution (based on the Modified Kuppuswamy scale), most children came from middle-income families (60.0%, n=48), followed by lower socioeconomic groups (25.0%, n=20) and higher socioeconomic groups (15.0%, n=12). With regard to maternal occupation, 67.5% (n=54) of the mothers were homemakers, while 32.5% (n=26) were engaged in skilled, semi-skilled, or professional work. Among fathers, a majority (72.5%, n=58) were employed in skilled or salaried jobs, while 20.0% (n=16) were professionals. Only 7.5% (n=6) of fathers were unemployed or working in unskilled jobs.

Table 1- Socio-demographic profile of the study population (N = 80)

Variable		**n(%)**
Family Type	Nuclear	52(65.0%)
	Joint/Extended	28(35.0%)
Socioeconomic Status	Lower	20(25.0%)
	Middle	48(60.0%)
	Higher	12(15.0%)
Mother's Occupation	Homemaker	54(67.5%)
	Working (skilled/semi-skilled/professional)	26(32.5%)
Father's Occupation	Unemployed/Unskilled	6(7.5%)
	Skilled/Salaried	58(72.5%)
	Professional	16(20.0%)

As seen from figure 2, parental education levels were relatively high among the study population. 70.0% (n=56) of mothers and 85.0% (n=68) of fathers had attained at least secondary-level education. However, 30.0% (n=24) of mothers and 15.0% (n=12) of fathers had not completed secondary schooling.

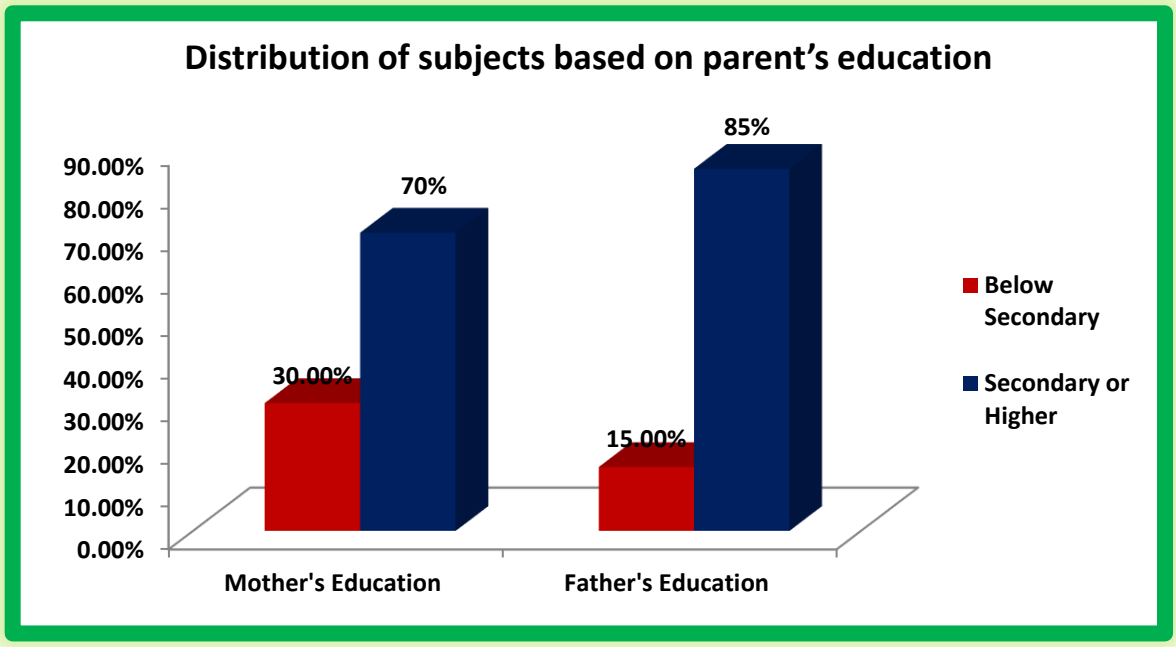

Figure 2- Distribution of subjects based on parent's education

Table 2 shows that, out of the 80 children included in the study, 76(95.0%) had been exposed to some form of screen media. Television was the most commonly used device, reported by 68 children (85.0%), followed by smartphones in 58 children (73.0%). Tablets were used by 22 children (28.0%), while 12 children (15.0%) reported use of computers. Many children had access to more than one type of screen device. The age at which children were first introduced to screen media varied. A substantial proportion (27.5%, n=22) had their first screen exposure before the age of 12 months. The majority (40.0%, n=32) were introduced to screens between 12 and 24 months of age, while 32.5% (n=26) began exposure after the age of 2 years. In terms of daily screen time duration, half of the children (50.0%, n=40) had a daily screen time of 2 hours or less. About 32.5% (n=26) were exposed for 2–3hours per day, while 10 children (12.5%) had screen exposure lasting 3–4hours. A small proportion (5.0%, n=4) reported daily screen time exceeding 4 hours. Regular parental co-viewing of screen content was reported in 27 cases (33.8%), indicating that in the majority of cases, children consumed screen media independently or with limited parental interaction.

Table 2- Screen media exposure patterns (N = 80)

Parameter		**Frequency n(%)**
Screen exposure (any type)		76(95.0%)
Device used (multiple responses possible)	Television	68(85.0%)
	Smartphone	58(73.0%)
	Tablet	22(28.0%)
	Computer	12(15.0%)
Age at first exposure	<12 months	22(27.5%)
	12–24 months	32(40.0%)
	>24 months	26(32.5%)
Screen time per day	≤2 hours	40(50.0%)
	2–3 hours	26(32.5%)
	3–4 hours	10(12.5%)

	>4 hours	4(5.0%)
Parental co-viewing (regular)		27(33.8%)

Table 3 shows that the analysis of the age at which children were first exposed to screen media had a significant association with developmental delays. Among children exposed before 12 months of age, 10 out of 22(45.5%) showed developmental delays. In comparison, delays were observed in 9 out of 32 children (28.1%) first exposed between 12 and 24 months, and in only 4 out of 26 children (15.4%) first exposed after 24 months. Study also depicts relationship between parental co-viewing of screen media and the prevalence of developmental delays. Among the 27 children who experienced regular parental co-viewing, 7 children (25.9%) had developmental delays. In comparison, 16 out of 53 children (30.2%) with irregular or no parental co-viewing exhibited delays. Although the prevalence of developmental delays was slightly lower in the regular co-viewing group, this difference was not statistically significant (p=0.06).

Table 3- Developmental delays by age at first screen exposure and parental co-viewing behavior

		Total Children (n)	**Developmental Delay (n)**	**Prevalence (%)**	**p-value**
Age at First Exposure	<12 months	22	10	45.5%	0.02
	12–24 months	32	9	28.1%	
	>24 months	26	4	15.4%	
Parental Co-viewing	Regular	27	7	25.9%	0.06
	Irregular/None	53	16	30.2%	

Assessment of developmental outcomes using the ASQ-3 tool revealed that delays were observed across various developmental domains as seen in table 4. The most frequently affected domain was communication, with 10 children (12.5%) demonstrating a delay. This was followed by delays in the personal-social domain in 8 children (10.0%) and the problem-solving domain in 6 children (7.5%). Delays in fine motor skills were noted in 5 children (6.3%), while the gross motor domain was the least affected, with delays reported in 4 children (5.0%). Overall, 23 out of 80 children (28.7%) exhibited developmental delays in at least one domain. This highlights a considerable prevalence of developmental concerns among young children, which may be influenced by environmental, familial, and behavioral factors—including screen media exposure.

Table 4- Developmental delay by ASQ-3 domains (N = 80)

Developmental Domain	**Number of children with delay n(%)**
Communication	10(12.5%)
Personal-Social	8(10.0%)
Problem-Solving	6(7.5%)
Fine Motor	5(6.3%)
Gross Motor	4(5.0%)
Any Delay (≥1 domain)	**23(28.7%)**

Table 5 shows that the study also examined the relationship between the primary type of screen content viewed and the prevalence of developmental delays. Among children whose main screen exposure was to cartoons, 18 out of 54(33.3%) exhibited developmental delays. For those primarily viewing nursery rhymes or music videos, 10 out of 36 children (27.8%) had delays. Children exposed mainly to educational content demonstrated a lower prevalence of delays, with only 3 out of 26 (11.5%) showing developmental concerns. Conversely, the highest prevalence of developmental delays was observed in children who primarily engaged with video games, with 8 out of 20 children (40.0%) affected.

Table 5- Developmental delay by type of screen content viewed

Primary Content Viewed	Total Children (n)	Children with Delay (n)	Prevalence (%)
Cartoons	54	18	33.3%
Nursery Rhymes/Music Videos	36	10	27.8%
Educational Content	26	3	11.5%
Video Games	20	8	40.0%

Table 6 depicts a significant association between daily screen time duration and the presence of developmental delays. Among children with screen exposure of 2 hours or less per day, developmental delays were present in 5 out of 40 children (12.5%). In contrast, among those with screen time exceeding 2 hours per day, 18 out of 40 children (45.0%) exhibited delays.

Table 6- Association between screen time and developmental delay

Screen Time per Day	Developmental delay present (n/N)	Percentage (%)	p-value
≤2 hours/day	5/40	12.5	0.001
>2 hours/day	18/40	45.0	

Multivariate logistic regression was conducted to identify factors independently associated with developmental delays in children as seen in table 7. Screen time exceeding 2 hours per day was significantly associated with an increased risk of developmental delay, with an odds ratio (OR) of 3.81 (95% confidence interval [CI]: 1.52–9.56, p=0.005). Similarly, screen exposure before 12 months of age was linked to nearly a threefold higher likelihood of developmental delay (OR=2.95; 95% CI: 1.12–7.74, p=0.028). Parental co-viewing of screen media, however, did not show a statistically significant protective effect in this model (OR = 0.72; 95% CI: 0.31–1.69, p=0.450), although the point estimate suggested a potential trend toward lower risk.

Table 7- Logistic regression analysis – predictors of developmental delay

Variable	Odds Ratio (OR)	95% CI	p-value
Screen time >2 hours/day	3.81	1.52 – 9.56	0.005
Screen exposure before 12 mo	2.95	1.12 – 7.74	0.028
Parental co-viewing (yes)	0.72	0.31 – 1.69	0.450

Discussion-

This study explored the relationship between screen media exposure and developmental outcomes among children aged 2 to 6 years. The findings reveal a high prevalence of screen use in early childhood, with 95% of children exposed to screen devices and nearly half exceeding the recommended two-hour daily limit. Overall, developmental delays were identified in nearly one-third of participants, with several factors—particularly early and prolonged screen exposure—significantly associated with these delays. One of the most important observations was the timing of initial screen exposure. Children introduced to screens before the age of 12 months exhibited a significantly higher rate of developmental delays compared to those introduced later. This supports earlier findings by Madigan et al.,[13] who showed that screen use during infancy was linked to lower developmental scores at subsequent ages. Similarly, Tomopoulos et al.[14] found that early screen exposure negatively impacted language and cognitive development during early childhood. These results highlight the importance of delaying screen use during the critical period of brain development in the first year of life. Duration of screen use also played a significant role in developmental outcomes. Children with daily screen exposure of more than two hours were almost four times more likely to have developmental delays compared to those with limited screen time. These findings reinforce current guidelines issued by the American Academy of Pediatrics,[1] which recommend restricting screen time to a maximum of one hour per day for children aged 2 to 5 years, and emphasize the importance of high-quality content and parental involvement. The type of screen content also appeared to influence developmental risk. Children who primarily watched educational programs

showed the lowest rate of developmental concerns, whereas those engaged with video games and cartoons had considerably higher rates. This observation is in agreement with prior research by Zimmerman and Christakis,[15] who reported that educational programming had more favorable cognitive outcomes, while entertainment content could adversely affect attention and learning. Lillard and Peterson[16] further demonstrated that fast-paced or fantastical content can disrupt executive functioning in young viewers, possibly due to the rapid visual and auditory transitions.

Parental co-viewing, although not statistically significant in our analysis, was associated with a modest reduction in developmental delays. Earlier studies suggest that co-viewing can enhance children's understanding and mitigate negative effects, especially when parents provide context or engage children in discussions about the content.[17] The lack of significance in our findings may stem from variability in how parents interacted during screen time—some may have been passive viewers rather than actively involved. Among the developmental domains assessed, communication was most frequently affected, followed by social and problem-solving skills. These findings are consistent with earlier reports such as those by Chonchaiya and Pruksananonda,[18] who noted language delays in toddlers with high screen exposure. In contrast, delays in motor domains were less frequent, suggesting that screen use has a more pronounced effect on cognitive and language-related aspects of development. Our regression analysis confirmed that both prolonged screen use and early exposure independently contributed to higher odds of developmental delay, even after accounting for other variables. These findings are consistent with studies like those by Hinkley et al.,[19] which identified excessive screen exposure as a key risk factor for developmental vulnerability in preschool-aged children. This study provides valuable insight into screen-related developmental concerns using a structured developmental assessment tool (ASQ-3) and considers multiple exposure factors such as device type, content, and co-viewing.

Conclusion-

This study provides critical insights into the relationship between screen media exposure and developmental outcomes in children aged 2 to 6 years. Nearly 29% of the children exhibited delays in at least one developmental domain, with communication and personal-social areas being most commonly affected. Early exposure to screens—particularly before 12 months of age—and screen time exceeding two hours per day were found to significantly increase the risk of developmental delays. Importantly, the type of content consumed also played a role. Children who primarily watched educational content showed lower prevalence of delays compared to those exposed to cartoons or video games. While regular parental co-viewing did not reach statistical significance, it showed a trend toward more favorable developmental outcomes, suggesting potential benefits of guided screen use. The study reinforces growing evidence that early and excessive screen media exposure is associated with a higher risk of developmental delays. Delaying the introduction of screens, limiting daily exposure, and promoting educational content with active parental engagement may help protect children’s developmental health. The findings have practical implications for pediatric healthcare providers, educators, and policymakers They emphasize the need to create awareness among parents about the potential developmental risks associated with early and prolonged screen exposure. The study supports recommendations to delay screen introduction until after two years of age, limit daily screen time, prioritize educational content, and encourage co-viewing practices. Furthermore, the study contributes valuable evidence for designing community-level interventions and parenting programs focused on promoting healthy media habits. Future longitudinal research is needed to explore the long-term effects of screen exposure on cognitive, behavioral, and emotional development in young children.

References

1. American Academy of Pediatrics (AAP). (2016). Media and Young Minds. Pediatrics, 138(5), e20162591. https://doi.org/10.1542/peds.2016-2591
2. Shonkoff, J. P., & Phillips, D. A. (2000). From neurons to neighborhoods: The science of early childhood development. National Academies Press.
3. Christakis, D. A. (2009). The effects of infant media usage: what do we know and what should we learn? Acta Paediatrica, 98(1), 8–16. https://doi.org/10.1111/j.1651-2227.2008.01027.x
4. Zimmerman, F. J., & Christakis, D. A. (2005). Children's television viewing and cognitive outcomes: a longitudinal analysis of national data. Archives of Pediatrics & Adolescent Medicine, 159(7), 619–625. https://doi.org/10.1001/archpedi.159.7.619
5. Madigan, S., Browne, D., Racine, N., Mori, C., & Tough, S. (2019). Association between screen time and children's performance on a developmental screening test. JAMA Pediatrics, 173(3), 244–250. https://doi.org/10.1001/jamapediatrics.2018.5056
6. Tamana, S. K., Ezeugwu, V., Chikuma, J., Lefebvre, D. L., Azad, M. B., Moraes, T. J., ... & Mandhane, P. J. (2019). Screen-time is associated with inattention problems in preschoolers: Results from the CHILD birth cohort study. PLOS ONE, 14(4), e0213995. https://doi.org/10.1371/journal.pone.0213995
7. Lin, L. Y., Cherng, R. J., Chen, Y. J., Chen, Y. J., & Yang, H. M. (2015). Effects of television exposure on developmental skills among young children. Infant Behavior and Development, 38, 20–26. https://doi.org/10.1016/j.infbeh.2014.12.005
8. Hale, L., & Guan, S. (2015). Screen time and sleep among school-aged children and adolescents: a systematic literature review. Sleep Health, 1(4), 302–310. https://doi.org/10.1016/j.sleh.2015.08.007
9. Linebarger, D. L., & Vaala, S. E. (2010). Screen media and language development in infants and toddlers: An ecological perspective. Developmental Review, 30(2), 176–202.
10. Barr, R., Lauricella, A., Zack, E., & Calvert, S. L. (2010). Infant and early childhood exposure to adult-directed and child-directed television programming: Relations with cognitive skills at age four. Merrill-Palmer Quarterly, 56(1), 21–48.
11. Kabali, H. K., Irigoyen, M. M., Nunez-Davis, R., Budacki, J. G., Mohanty, S. H., Leister, K. P., & Bonner, R. L. (2015). Exposure and use of mobile media devices by young children. Pediatrics, 136(6), 1044–1050. https://doi.org/10.1542/peds.2015-2151
12. Squires, J., Bricker, D., & Twombly, E. (2009). Ages & Stages Questionnaires, Third Edition (ASQ-3):A parent-completed child monitoring system. Paul H. Brookes Publishing Co
13. Madigan, S., Browne, D., Racine, N., Mori, C., & Tough, S. (2019). Association between screen time and children's performance on a developmental screening test. JAMA Pediatrics, 173(3), 244–250American Academy of Pediatrics. (2016). Media and Young Minds. Pediatrics, 138(5), e20162591.
14. Tomopoulos, S., Dreyer, B. P., Valdez, P., et al. (2010). Media content and externalizing behaviors in Latino toddlers. Pediatrics, 124(5), e993–e999.
15. Zimmerman, F. J., & Christakis, D. A. (2007). Associations between content types of early media exposure and subsequent attentional problems. Pediatrics, 120(5), 986–992
16. Lillard, A. S., & Peterson, J. (2011). The immediate impact of different types of television on young children's executive function. Pediatrics, 128(4), 644–649.
17. Nathanson, A. I. (2001). Mediation of children's television viewing: Working toward conceptual clarity and common understanding. Communication Yearbook, 25, 115–151.
18. Chonchaiya, W., & Pruksananonda, C. (2008). Television viewing associates with delayed language development. Acta Paediatrica, 97(7), 977–982.
19. Hinkley, T., Brown, H., Carson, V., & Teychenne, M. (2019). Early childhood electronic media use as a predictor of poor developmental outcomes at age 5. Acta Paediatrica, 108(1), 90–97.