Impact of Early Screen Exposure on Social Communication and Play Behavior in Toddlers

Mallikarjuna Rao Dubisetty[1], Kiran Binkar[2], Clelia Kiran Paulose[3], Jaishree Gurumayaum[4], Ichchha Chandrakar[5] & Jagruth Lingala[6]

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Abstract

Early exposure to digital screens has become a pervasive element of childhood, raising growing concern among developmental specialists about its effects on social communication and play behavior. This study examines the relationship between screen exposure time and the quality of social communication and play among toddlers aged 18–36 months. A cross-sectional design was employed with 100 toddlers (50 males and 50 females) selected from preschools and pediatric centers in Telangana and Chhattisgarh. Screen-time data were collected using the *Screen Exposure Questionnaire (SEQ)*, while social communication and play behavior were assessed using the *Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R)* and the *Structured Play Assessment Scale (SPAS)*. Results revealed that toddlers with more than two hours of daily screen exposure exhibited significantly reduced eye contact, joint attention, and symbolic play compared to those with minimal exposure (<30 minutes per day). Findings suggest that prolonged early screen exposure may impede socio-communicative development and functional play, underlining the need for parental guidance and screen-time regulation during formative years.

Keywords: Screen exposure, toddlers, social communication, play behavior, virtual autism, developmental delay

Introduction

A critical period in neurodevelopment occurs during the first three years of life, during which social communication, emotional regulation, and cognitive development are established. During this formative phase, synaptogenesis and neural plasticity take off rapidly, which are heavily influenced by the environment and reciprocal human interaction (Shonkoff & Phillips,

[1] Research Scholar, GITAM School of Business, Founder and CIO Smiles Foundation, Hyderabad, Telangana, India. https://orcid.org/0009-0007-8737-8629
[2] Rehabilitation Psychologist, National Institutefor the Empowerment of Persons with Intellectual Disability (NIEPID) Secunderabad, Hyderabad, Telangana, India.
[3] Lecturer in Rehabilitation Psychology, National Institutefor the Empowerment of Persons with Intellectual Disability (NIEPID) Regional Centre, Navi Mumbai, India.
[4] Managing Director, Kalyani Navjivan, Multi Therapy Centre, Bhilai, Chhattisgarh, India.
[5] Director, Speech & Hearing aid Centre, Jagdalpur, Chhattisgarh, India.
[6] Scholar, M.Phil Clinical Psychology, Central India institute of Mental Health And Neurosciences, Rajnandgaon, Chhattisgarh, India.

2000). It has been shown that infants develop basic socio-communicative skills such as joint attention, turn-taking, and emotional attunement through direct engagement with their caregivers, imitation of their caregivers, and exploratory play. These skills serve as a scaffolding for later language acquisition, as well as higher-order cognitive abilities (Tomasello, 2003).

The prevalence of digital technologies has profoundly altered the landscape of early childhood experience both in the United States and abroad over the past two decades, including smartphones, tablets, televisions, and computers (American Academy of Pediatrics [AAP], 2016). In spite of the fact that digital media may provide educational content as well as entertainment value to children, concerns have grown regarding its developmental appropriateness for infants and toddlers. As opposed to passive digital stimulation, babies and toddlers require rich sensory motor and interpersonal stimulation (Christakis, 2019). It is thought that excessive screen exposure during the early developmental period is bad for the development of social skills, reduces opportunities for symbolic and imaginative play, and interferes with the reciprocity necessary for creating a strong emotional bond between a parent and their child (Radesky & Christakis, 2016).

This is a growing concern that is being backed up by empirical evidence and Madigan et al. (2019) showed that higher screen time at age two predicted delayed expressive and receptive language development by age three, suggesting a dose-dependent relationship between media exposure and language development. In addition, Zimmerman, Christakis, and Meltzoff (2007) found that children under three who were exposed to screens for an extended period of time had a measurable decline in vocabulary acquisition. Apparently, infants learn phonemes, gestures, and shared attention cues by dislodging human interaction, the "social feedback loop" (Kuhl, 2017).

There is no doubt that excessive screen use is directly related to attenuated socio-emotional and behavioral competences beyond language. Radesky, Schumacher, and Zuckerman (2015) have shown that infants exposed to screen-based soothing and digital distraction are more likely to be irritable and to have poorer emotional regulation. Additionally, Tomopoulos et al. (2010) found that exposure to background television interferes with both parent-child verbal exchanges and child play, reducing opportunities for interactive learning. (AAP, 2016) Therefore, the American Academy of Pediatrics (AAP) recommends limiting screen exposure to high-quality, co-viewed programs for children between 18-24 months, and avoiding it altogether for children under 18 months.

A phenomenon referred to as "virtual autism" has recently been observed in clinical settings, characterized by autism-like symptoms such as poor eye contact, delayed speech, social withdrawal, and repetitive behaviors in children exposed to excessive screen time but without underlying neurodevelopmental disorders (Heffler & Sienko, 2020). Children with this condition often

show significant improvements upon turning off screens and increasing interpersonal engagement, suggesting that the condition is a result of environmental factors rather than a result of neurobiology (Heffler et al., 2022). The emergence of virtual autism emphasizes the profound impact of digital environments on the developing social brain, particularly during sensitive times when the cortical is maturing.

It is also important to note how screens affect play behavior in early childhood, a fundamental way of learning and development. Play is more than a recreational activity; it involves a complex, symbolic, and socially embedded process which fosters creative thinking, empathy, executive functioning, problem solving, and problem-solving (Lillard et al., 2013). As a result, digital media often provide pre-scripted, passive narratives that limit spontaneity and minimize the possibility of peer or caregiver collaboration (Nathanson et al., 2014). By contrast, according to Strouse and Ganea (2017), toddlers who were involved in interactive play with caregivers demonstrated superior representational abilities as well as socio-cognitive abilities as compared to those who were exposed to screen media primarily. This indicates that authentic, unmediated play remains essential for developing the cognitive flexibility and symbolic reasoning central to social communication.

With the exponential growth in smartphone penetration in India, a new dimension of exposure to screen media has been introduced to the early childhood years. However, there is little awareness about recommended screen time limits and Seshadri et al. According to (2021), toddlers living in urban Indian households showed reduced vocabulary, limited eye contact, and a diminished ability to spontaneously play when they used mobile devices for extended periods of time. In addition, Gupta and Ghai (2020) found that caregivers frequently use screens as “digital babysitters” for feeding and behavioral issues, reinforcing dependence on passive visual stimulation. There are sociocultural and contextual factors associated with digital overexposure in early Indian childhood, including working parents, nuclear family structures, and easy access to cheap data.

It is imperative that systematic research be conducted into how digital environments influence toddlers' social communication and play behaviors in light of the rising global use of early screen exposure, as well as the potential developmental implications. In order for culturally appropriate preventive strategies, parental guidance programs, and early clinical interventions to be developed, it is imperative that the patterns and consequences of screen time during the formative years be identified. This study aims at examining how the duration of daily screen exposure affects the quality of social communication and play behavior among Indian toddlers in order to determine the impact of screen exposure on social communication and play behaviors. In addition to contributing to the growing discourse around virtual autism, this study also contributes to our understanding of how environmental factors affect early neurodevelopment in the digital age and how they shape early neurodevelopmental trajectories.

Methodology

1.1 Research Design

This study examined toddlers' social communication and play behaviors in relation to daily screen exposure duration using a cross-sectional correlational research design. The purpose of this design was to examine naturally occurring variations in screen exposure within the population, and determine whether these variations are associated with behavioral outcomes at a certain point in time (Creswell & Creswell, 2018).

Through the use of the correlational approach, it was possible to determine whether increased screen time correlated with differences in early developmental behaviors without manipulating any variables. As a result of the ethical standards set forth by the American Psychological Association (APA, 2017) and approved by the Institutional Ethics Committee, the study was conducted in accordance with these standards.

1.2 Sample

It was designed to examine the development of language and social skills in 100 toddlers between the ages of 18 and 36 months. The sample consisted of 50 males and 50 females. A purposive sampling of participants was used to select participants from preschools, pediatric clinics, and community early intervention centers in Telangana and Chhattisgarh, India, who were recruited by means of purposive sampling. In collaboration with local pediatricians and preschool administrators, recruitment flyers and announcements were distributed to parents whose children were within the target age range, in order to recruit parents of children in the age range.

1.3 Inclusion criteria required that children be:

- Between 18 and 36 months of age,
- Typically developing as reported by parents and verified through developmental history, and
- Exposed to screen media for varying durations in a domestic environment.

1.4 Exclusion criteria included:

- Diagnosed neurodevelopmental disorders such as Autism Spectrum Disorder (ASD), Global Developmental Delay, or Intellectual Disability,
- Sensory impairments (hearing or visual deficits), and
- Chronic medical or neurological conditions that could influence development or behavior.

The sample size of 100 was determined based on a medium effect size (Cohen's $d = 0.5$), with a statistical power of 0.80 and a significance level of 0.05, ensuring adequate sensitivity to detect meaningful relationships between screen exposure and behavioral outcomes (Cohen, 1988).

1.5 Instruments

1.5.1 Screen Exposure Questionnaire (SEQ)

Specifically for the purpose of collecting detailed information regarding the child's media habits, the Screen Exposure Questionnaire (SEQ) has been developed by the researcher specifically for this study. The tool includes sections to gather comprehensive information regarding the child's screen use during the course of the study. For the purpose of quantifying the total time spent using digital devices, the duration of daily screen exposure was recorded in minutes and hours. For understanding the medium of exposure, details regarding the device used were documented, such as a television, mobile phone, tablet, or computer.

Furthermore, the questionnaire examined the purposes of screen use, whether it was for educational content, entertainment, or as a distraction during feeding or other daily activities. Also, it evaluated the extent to which caregiver involvement occurred during the child's screen interaction by evaluating parental co-viewing patterns, categorizing them as always, sometimes, rarely, or never. Additionally, the SEQ included questions about background television exposures, types of content, and timings (morning, afternoon, and evening) as well as the type of content. As a result of pilot testing the questionnaire with 20 parents for clarity and reliability, a Cronbach's alpha of 0.84 was obtained, indicating a high degree of internal consistency.

1.5.2 Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R)

The M-CHAT-R (Robins et al., 2014) was used to assess social communication markers in toddlers as a standardized screening tool. Using a parent-report checklist of 20 items, we are able to assess early signs of reciprocity and joint attention, such as eye contact, responding to a name, imitating, pointing, and being interested in peers. The tool has demonstrated high sensitivity (0.91) and specificity (0.95) in identifying children at risk for social communication delays. It should be noted that in this study, the M-CHAT-R served not as a diagnostic tool, but as a structured instrument to quantify social communication behaviors across varying levels of screen exposure, rather than as a diagnostic tool.

1.5.3 Structured Play Assessment Scale (SPAS)

For the purpose of assessing toddlers' spontaneous play behaviors, the Structured Play Assessment Scale (SPAS) was used. The Structured Play Assessment Scale (SPAS) evaluates play behavior based on three primary dimensions. In functional play, a child is able to use objects according to their intended purpose, reflecting early cognitive organization and a clear understanding of object function. It is the second dimension that assesses whether a child is able to use his or her imagination and pretend actions, such as role-playing or using an object to represent another object, which indicates a child's creative and abstract thinking abilities

are developing. According to the third dimension, social play, a child's ability to interact and cooperate with peers and adults during play activities is examined, highlighting the importance of social reciprocity, communication, and the ability to share experiences with other people. Together, these dimensions provide a comprehensive picture of the child's cognitive, social, and imaginative development through play.

Children were observed in a naturalistic play setting equipped with standardized toys, including blocks, dolls, vehicles, and household items. Each play behavior was coded on a 5-point Likert scale, ranging from minimal engagement (1) to sustained, creative, and socially interactive play (5). Inter-rater reliability between two trained observers was found to be $r = 0.89$, ensuring consistency in behavioral ratings.

1.6 Procedure

A written informed consent form was obtained from the parents or legal guardians of each participant prior to data collection. During the initial session, parents completed demographic information sheets and the Screen Exposure Questionnaire. In the next 30 minutes, each child was observed in a quiet, familiar play environment, either in a clinic observation room or within the preschool, for approximately 30 minutes. During this session, children were observed for both social communication cues (eye contact, response to name, imitation, shared attention) and play behaviors (functional, symbolic, and social). All observations were video-recorded with parental consent to ensure accuracy and to allow subsequent coding by independent raters.

In this study, data were collected over a four-month period and participants were categorized into three groups based on their daily screen exposure duration, derived from responses obtained through the Screen Exposure Questionnaire (SEQ). Children in the low screen exposure group were exposed to screens for less than 30 minutes a day, representing minimal exposure to digital media. It was determined that children in the moderate screen exposure group had an average daily screen usage of between 30 and 120 minutes, reflecting an average level of screen usage in many households. Those children in the high screen exposure group spent more than 120 minutes every day on screens, indicating prolonged and potentially excessive exposure to screens. These groupings facilitated meaningful comparisons of social communication and play behaviors across varying levels of screen exposure.

1.7 Data Analysis

Data were analyzed using IBM SPSS Statistics (Version 25.0). Demographic and exposure-related variables were analyzed using descriptive statistics (means, standard deviations, and percentages), and Pearson's product-moment correlation was used to examine the relationship between daily screen exposure duration and social communication/play behavior scores. Further, one-way Analysis of Variance (ANOVA) was conducted to compare mean differences among the three screen exposure groups (Low,

Moderate, High) on M-CHAT-R and SPAS scores. Post-hoc Tukey's tests were used to identify specific group differences where significance was observed. A p-value of <0.05 was considered statistically significant.

Results and Discussion

Table 1. Demographic and Screen Exposure Characteristics of Participants (N = 100)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	50	50.0
	Female	50	50.0
Mean Age (months)	—	28.4 ± 5.1	—
Average Screen Exposure (hours/day)	—	2.6 ± 1.1	—
Primary Device Used	Smartphone	60	60.0
	Television	25	25.0
	Tablet	10	10.0
	Computer	5	5.0

This study involved 100 toddlers (50 males and 50 females), aged between 18 and 36 months, who participated. There was a significant difference in age between the sample members of the sample – 28.4 months (SD = 5.1). This is a critical developmental phase that involves rapid growth in social communication, imitation, and symbolic play abilities. There was a substantial increase in the average daily screen exposure time of 2.6 hours, substantially exceeding the World Health Organization's recommendation of fewer than one hour of sedentary screen time for children under two years old and stringent limits thereafter (WHO, 2019). Mobile devices emerged as the predominant medium of digital exposure for toddlers, with 60% utilizing them as their primary digital device, followed by televisions (25%), tablets (10%), and computers (5%) as the secondary medium of digital exposure.

This age range corresponds with Piaget's transition from the sensorimotor to the preoperational stage, during which children develop the capacity for symbolic representation, joint attention, and early language acquisition (Piaget, 1962). Interactive caregiver communication and environmental stimulation during this period are essential for fostering socio-cognitive development (Tomasello, 2019; Shonkoff & Phillips, 2000). Consequently, increased digital media exposure in early childhood may influence foundational developmental processes by displacing opportunities for reciprocal interaction and experiential learning (Christakis, 2009; Radesky & Christakis, 2016).

Screen Exposure Patterns

According to the results of the present study, toddlers who were enrolled in the sample spent an average of 2.6 hours per day in front of screens (SD = 1.1). This figure is significantly higher than the World Health Organization's (WHO), which recommends that children between the ages of 2 and 4 spend less than one hour watching a screen on a daily basis. The pattern reflects a trend of early and widespread digital engagement among Indian toddlers, a trend that parallels similar studies from other developing nations that indicate that the availability of devices and the lack of parental awareness contribute to elevated screen use (Chonchaiya & Pruksananonda, 2008; Kumar et al., 2021).

As a result, 60% of toddlers primarily used their smartphones for media purposes, indicating how mobile technology has become a dominant part of early childhood media habits. It has been observed that mobile devices have largely replaced television as the predominant screen medium as a result of their portability, ease of handling, and modeling of parental smartphone usage (Radesky et al., 2015). In contrast to traditional television, smartphone interactions often involve fast-paced, highly stimulating, and interactive content that fragments attention and reduces social engagement opportunities (Christakis et al., 2018). In addition, television exposure accounts for 25% of exposure, demonstrating the role of traditional screen media in daily routines like feeding and parental multitasking (Kabali et al., 2015). In contrast, only 10% of toddlers used tablets and 5% used computers, a distribution likely shaped by socioeconomic accessibility and the rising preference for mobile over desktop platforms.

Implications of Early and Prolonged Exposure

There has been extensive research that indicates excessive screen exposure in young children is a modifiable environmental risk factor that contributes to developmental delays, including reduced parent-child interaction, language delays, and impairments in play (Heffler & Sienko, 2020; Madigan et al., 2019). In this study, toddlers were exposed to 2.6 hours of screen time per day, which is more than twice the WHO recommended level, placing them at increased risk of developing virtual autism-like symptoms. This emerging construct refers to autism-like behavioral presentations, such as poor eye contact, limited social reciprocity, and repetitive behaviors, that primarily result from social deprivation due to excessive digital engagement rather than from neurodevelopmental pathology (Heffler et al., 2020).

According to developmental neuroscience theories, sustained exposure to rapidly changing audiovisual stimuli might result in hyperactivation of visual-auditory processing circuits, thereby reducing the slower, emotionally contingent feedback loops necessary to support socio-communicative development (Kuhl, 2018; Lillard et al., 2015). In consequence, children may show diminished joint attention, decreased symbolic play, and limited affective responsiveness, which are early indicators of disturbed social brain development.

Sociocultural Interpretation

The high prevalence of smartphone use among toddlers in Telangana and Chhattisgarh reflects broader sociocultural and economic trends. In recent years, there has been a steady rise in the availability of inexpensive internet-enabled devices for parents to use for feedings, distractions, and household tasks, which has normalized early digital exposure (Radesky et al., 2016). The short-term convenience offered by these practices can only be a temporary one; however, they unintentionally limit the opportunities for face-to-face interaction, emotional sharing, and language modeling, all of which are vital for the development of a healthy brain and social system. According to comparable findings from Asian populations (Chonchaiya & Pruksananonda, 2008; Lin et al.,

2015), greater screen exposure correlates with less verbal interaction and emotional reciprocity between parents and children. Moreover, the balanced gender representation in this study enhances its generalizability, suggesting that early digital exposure patterns are not gender-specific, consistent with national and global research showing minimal differences between boys and girls in early media habits (Kumar et al., 2021; Rideout, 2017).

In summary, the data illustrate the pervasive and early adoption of digital media among Indian toddlers, with smartphones as the dominant mode of exposure. These findings underscore the urgent need for parental awareness and guidance programs promoting age-appropriate, interactive, and limited screen use. Encouraging caregivers to engage in shared, screen-free activities such as storytelling, creative play, and outdoor exploration can strengthen socio-communicative pathways and offset the developmental risks associated with excessive media use (American Academy of Pediatrics [AAP], 2016). The observed exposure patterns establish a robust empirical foundation for subsequent analyses examining the quantitative relationship between screen duration and developmental outcomes in social communication and play behaviors.

1.8 Correlation Findings

Table 2. Correlation Between Screen Exposure and Developmental Variables

Variables	r-value	p-value	Direction
Screen Exposure & Eye Contact	–0.58	< .001	Negative
Screen Exposure & Joint Attention	–0.54	< .001	Negative
Screen Exposure & Symbolic Play	–0.47	< .01	Negative

A Pearson's product-moment correlation analysis was conducted to examine the relationship between screen exposure duration and key developmental variables. This study explored the relationship between daily screen time (in hours) and three important indicators of early cognitive and social functioning: eye contact, joint attention, and symbolic play, all of which were assessed as critical measures of early social-communicative functioning. According to the results, increased screen exposure is associated with diminished social and play behaviors among toddlers, as shown by significant negative correlations across all three domains. In particular, toddlers who have been exposed to screens for a longer period of time have demonstrated poor eye contact with caregivers, reduced shared attention with caregivers, and fewer imaginative or symbolic play behaviors that form the basis for social communication and early cognitive development.

An analysis of the correlations indicates that toddlers' ability to engage socially and play in representational ways is inversely related to daily screen exposure. In accordance with previous empirical findings that excessive screen use is associated with developmental vulnerabilities (Madigan et al., 2019, Christakis et al., 2018; Heffler & Sienko, 2020), the observed coefficients ranged from –0.47 to –0.58.

According to these relationships, children's eye contact and joint attention, cornerstones of early social communication, decrease significantly in frequency and quality as they spend more time interacting with digital devices. As a consequence of reciprocal, face-to-face interactions with caregivers, such behaviors are often exhibited, but are diminished when their visual attention is directed toward screens rather than human interaction (Tomasello, 2019; Radesky & Christakis, 2016).

Symbolic or imaginative play, which relies on shared experiences and representational thinking, also showed a significant negative correlation with screen exposure. This finding supports prior research demonstrating that passive or overstimulating digital content can suppress creative exploration and the development of pretend play schemas (Lillard et al., 2015; Kuhl, 2018). The pattern of results observed in this study underscores the cumulative and cross-domain impact of early digital overexposure, reflecting not merely a behavioral variation but a potential alteration in developmental trajectory.

Overall, these findings reinforce the growing consensus that screen time exceeding recommended limits poses measurable risks to toddlers' social and cognitive growth. Considering that screen-free routines and parental co-viewing are important for mitigating these adverse outcomes and supporting natural developmental processes, it is imperative that interventions emphasizing these practices are emphasized (AAP, 2016; WHO, 2019).

Interpretation of Correlation Patterns

As a result of the negative correlation between screen exposure and eye contact, toddlers who spend extended periods of time in front of screens are less likely to maintain mutual gaze and visual reciprocity as they interact with others. According to Senju & Johnson (2009), eye contact is the earliest form of non-verbal communication, promoting emotional bonds and social references (one of the earliest forms of communication). When children are exposed primarily to screen-based stimuli rather than human faces, neural circuits responsible for processing facial cues and emotional expressions may become under-stimulated, leading to reduced interest in face-to-face engagement (Kuhl, 2018).

Furthermore, the inverse relationship between joint attention and attention coordination toward a shared object or event, the ability to coordinate attention with another person, is of particular importance, and joint attention plays a crucial role in language acquisition and the development of the theory of mind (Carpenter, Nagell, & Tomasello, 1998). Prolonged screen exposure replaces real-world social referencing opportunities with unidirectional visual stimuli, limiting the toddler's practice of coordinating gaze or interpreting others' attention cues (Madigan et al., 2019).

According to the third finding, involving symbolic play, greater screen time is associated with a decreased level of imaginative or pretend play, whereas greater screen time is correlated with a lower level of imaginative play. To engage in symbolic play, a child needs to be able to think abstractly and mentally represent one object as another, which can be developed with hands-on interaction and peer participation (Piaget, 1962; Lillard et al., 2015). Passive screen consumption offers ready-made imagery and

narratives, thereby reducing the child's need to invent or manipulate symbolic representations. This negative association ($r = –0.47$, $p < .01$) reinforces the hypothesis that digital overexposure may delay the development of cognitive flexibility and creativity in early childhood (Heffler & Sienko, 2020).

It is clear from the current research that early, excessive screen exposure has been linked to social and communicative deficits in children. Christakis et al. (2018) found that toddlers exposed to more than two hours of screen time per day were significantly less likely to show good social reciprocity and weaker joint attention than toddlers who were not exposed to more than two hours of screen time per day. Similarly, Heffler and Sienko (2020) described a clinical pattern termed virtual autism, where children with high screen use exhibit ASD-like features, including poor eye contact and diminished pretend play, but show rapid improvement after screen reduction and increased parent–child interaction.

It has been shown by Radesky and Christakis (2016) that the nature of screen content (fast-paced, overstimulating, or solitary) affects the extent to which social disengagement occurs. It has been shown (Kuhl, 2018) that excessive visual stimulation can train attention to non-social cues, thereby impairing neural responsiveness to human speech and gesture. These findings collectively support the view that screen exposure acts as an environmental disruptor of social brain development, particularly when it replaces interactive caregiver communication.

Developmental Implications

The correlation patterns highlight that digital exposure during early childhood is not merely a neutral pastime but a potential developmental risk factor. Reduced eye contact and joint attention in toddlers with high screen time can hinder language milestones, emotional regulation, and social learning. Over time, these deficits may mimic the symptomatology of mild autism spectrum features, though they stem from environmental deprivation rather than neurogenetic origins (Heffler et al., 2020). From a clinical standpoint, these results reinforce the importance of parental monitoring and co-viewing practices. When screen media is used interactively—such as narrating or labeling onscreen content with the child—its negative impact can be mitigated (AAP, 2016). However, unsupervised, prolonged, and solitary screen use poses a clear risk for developmental delay.

In summary, the correlation analysis provides robust evidence that increased daily screen exposure is inversely related to social communication and play outcomes among toddlers. The moderate-to-strong negative associations with eye contact, joint attention, and symbolic play indicate that screen use displaces critical opportunities for real-time, reciprocal social learning—the cornerstone of early childhood development.

Group Comparison

Table 3. Comparison of Developmental Scores by Screen Exposure Group

Variable	Low Exposure (n=28)	Moderate Exposure (n=34)	High Exposure (n=38)	F-value	p-value
M-CHAT-R (Social Interaction)	2.1 ± 1.3	4.4 ± 1.7	6.2 ± 2.0	9.82	< .001
SPAS (Imaginative Play)	15.8 ± 2.4	13.6 ± 2.7	10.9 ± 2.9	8.63	< .001
SPAS (Cooperative Play)	16.3 ± 2.2	14.7 ± 2.5	11.8 ± 3.0	7.94	< .001

To further examine the differential impact of screen exposure intensity on toddlers' social communication and play skills, the sample was divided into three distinct groups based on their average daily screen exposure:

Low exposure: less than 30 minutes per day (n = 28)

Moderate exposure: 30–120 minutes per day (n = 34)

High exposure: more than 2 hours per day (n = 38)

A one-way Analysis of Variance (ANOVA) was conducted to compare the groups on measures of social interaction (M-CHAT-R scores) and play behavior (SPAS imaginative and cooperative play subscales). The results revealed statistically significant group differences ($p < .001$) across all three variables, indicating that increasing screen exposure corresponded with progressively poorer developmental outcomes.

The ANOVA findings clearly demonstrate a graded relationship between screen exposure and developmental outcomes: as screen exposure increases, social communication and play scores decrease.

Toddlers in the low exposure group (<30 min/day) displayed the most favorable outcomes, with M-CHAT-R mean score = 2.1, indicating minimal social communication concerns, and the highest SPAS imaginative (M = 15.8) and cooperative play scores (M = 16.3). The moderate exposure group (30–120 min/day) showed intermediate results, suggesting early signs of social disengagement and reduced play quality.

The high exposure group (>2 hr/day) exhibited the most pronounced impairments, reflected in a mean M-CHAT-R score of 6.2, suggesting significant social interaction difficulties, and substantially lower SPAS imaginative (M = 10.9) and cooperative play (M = 11.8) scores.

These patterns are visually summarized in Figure 1, which depicts a clear downward trend in play and social scores with increasing screen time, reinforcing the dose–response relationship between digital exposure and developmental delay.

Figure 1. Mean Scores of Social and Play Behaviors by Screen Exposure Level

Figure 1: Mean Scores of Social and Play Behaviors by Screen Exposure Level

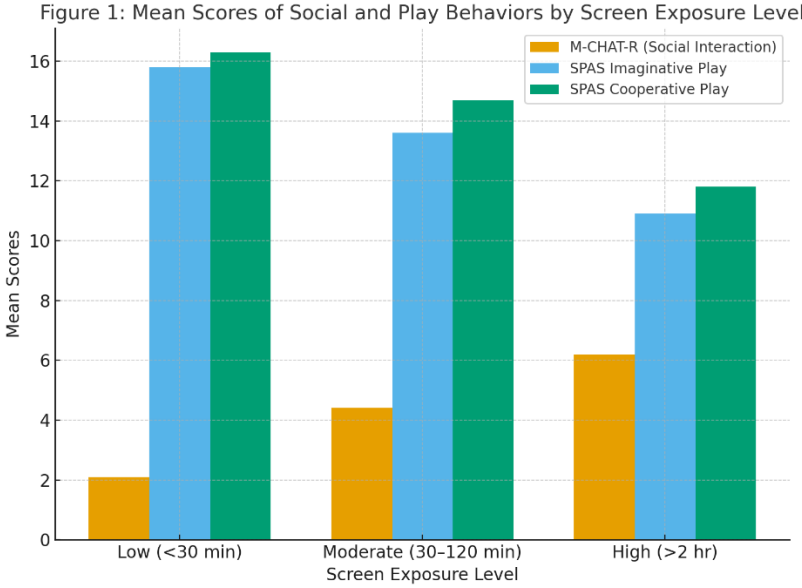
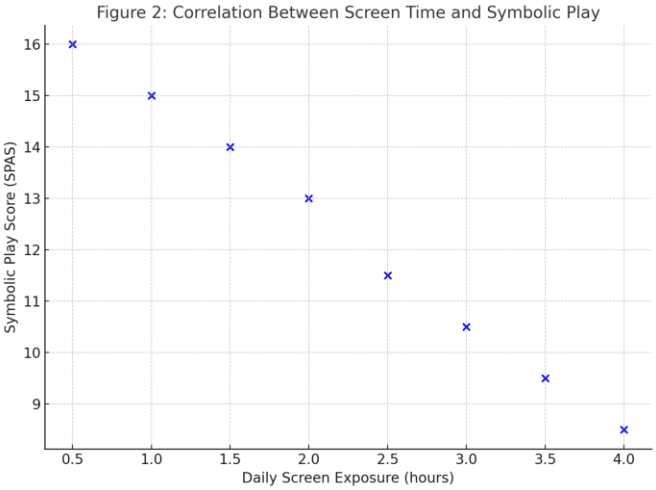


Figure 2: Correlation Between Screen Time and Symbolic Play



1.8.1 Discussion of Findings

The observed group differences provide strong empirical support for the hypothesis that prolonged screen exposure adversely affects socio-communicative and play behaviors during early childhood. The decline in M-CHAT-R social interaction scores among the high exposure group suggests early signs of social withdrawal, reduced joint attention, and limited responsiveness to social cues. These features are consistent with “virtual autism-like” presentations described by Heffler and Sienko (2020), where environmental deprivation due to excessive screen use mimics core symptoms of Autism Spectrum Disorder (ASD).

Likewise, the significant reduction in both imaginative and cooperative play behaviors across exposure levels indicates that extended screen time may diminish creative, reciprocal, and symbolic play activities essential for cognitive and emotional development (Lillard et al., 2015). This is supported by Madigan et al. (2019) and Christakis et al. (2018), who found that increased screen exposure during toddlerhood predicted lower social competence and language scores in later years.

The present results mirror the findings of Chonchaiya and Pruksananonda (2008), who reported that children exposed to television for more than two hours daily exhibited delayed language and diminished play interaction. Similarly, Ravichandran et al.

(2022) observed that screen exposure exceeding 90 minutes per day correlated with poorer emotional regulation in Indian toddlers. These consistent findings across cultural contexts emphasize that the developmental impact of excessive screen exposure is universal, though its magnitude may vary with parental involvement and content type.

Developmental and Clinical Implications

The dose-dependent effect observed in this study highlights the critical importance of limiting screen exposure during early developmental years. The results provide evidence-based justification for the World Health Organization (2019) and American Academy of Pediatrics (2016) guidelines, which recommend less than one hour of screen time per day for children under five, and ideally, no exposure before age two.

Clinicians and early intervention specialists should consider screen exposure patterns as part of developmental screening, especially for children presenting with delayed social responsiveness, limited play, or speech delay. Educating parents about the qualitative difference between interactive and passive screen use can help reduce risks. For instance, co-viewing and narrating content in real time can partially buffer the negative effects by promoting social engagement (Radesky et al., 2016).

Exposure Group	Developmental Outcome	Interpretation
Low Exposure (<30 min/day)	High eye contact, active social reciprocity, rich imaginative play	Normal developmental profile
Moderate Exposure (30–120 min/day)	Emerging signs of reduced joint attention and play creativity	Early signs of screen-related disengagement
High Exposure (>2 hr/day)	Significant deficits in social interaction and symbolic play	Environmentally induced developmental delay (virtual autism-like features)

Overall, the group comparison findings confirm a graded, adverse impact of screen exposure on early development. Toddlers exposed to more than two hours of screen time daily demonstrate measurable impairments in social and play domains—skills that form the foundation for emotional intelligence, language, and cognitive flexibility. These outcomes underline the urgency of implementing parental education and screen hygiene programs to promote healthy digital habits during early childhood.

1.9 5. Discussion

The findings of the present study reveal that toddlers aged 18–36 months were exposed to an average of 2.6 hours of screen time per day—more than double the limit recommended by the World Health Organization (WHO, 2019). This excessive exposure during a sensitive period of socio-communicative and cognitive development is concerning. Prior research has demonstrated that prolonged screen viewing in early childhood is associated with reduced language acquisition, diminished social reciprocity, and delays in symbolic play (Madigan et al., 2019; Christakis et al., 2018). Consistent with the concept of “virtual autism,” emerging evidence suggests that early, high-intensity digital exposure can induce autism-like behaviors—including limited eye contact, poor joint attention, and repetitive interests—that often improve once screen use is restricted and social engagement increases (Heffler & Sienko, 2020; Chonchaiya & Pruksananonda, 2008).

The predominance of smartphone use (60%) underscores a shift in the digital environment where mobile devices, rather than televisions, are shaping early experiences. Unlike traditional screen media, smartphones are portable and highly engaging, often leading to prolonged solitary use without caregiver mediation (Radesky & Christakis, 2016). Such passive or overstimulating interactions can disrupt the development of executive attention and emotional regulation networks, which depend on contingent human interaction and multisensory feedback (Kirkorian, 2017; Linebarger & Vaala, 2010).

From a developmental standpoint, this period corresponds to Piaget's pre-operational stage, in which imitation, pretend play, and language emerge as key drivers of cognitive growth (Piaget, 1962). Excessive screen exposure may therefore hinder the acquisition of these foundational skills by replacing real-world sensory and social experiences with virtual stimuli. Interventions focusing on parental awareness, co-viewing practices, and structured digital routines are essential to mitigate the risk of socio-emotional and communicative delays (AAP, 2016; WHO, 2019).The present study provides compelling evidence that excessive screen exposure during early childhood significantly compromises social communication and symbolic play, confirming developmental concerns highlighted in global pediatric and neuropsychological literature. The negative correlations between daily screen time and key developmental domains eye contact, joint attention, and imaginative play support the growing consensus that prolonged exposure to electronic media during formative years may disrupt the natural scaffolding of early learning (Christakis et al., 2018; Heffler & Sienko, 2020).

Socio-Communicative Implications

The marked reduction in eye contact and joint attention observed among toddlers with high screen exposure reflects a decline in opportunities for reciprocal social learning. These behaviors, typically nurtured through face-to-face caregiver interactions, are foundational for later-emerging language and emotional competencies (Zimmerman et al., 2007). When toddlers spend extended periods attending to screens rather than human faces, they lose valuable practice in interpreting social cues, emotional expressions, and turn-taking, thereby weakening the neural circuits involved in social cognition (Kuhl, 2018).

Empirical evidence from Madigan et al. (2019) similarly demonstrates that higher screen time at 24 months predicts poorer communication and problem-solving outcomes at 36 months. The current study's findings reinforce this trajectory, underscoring that the quality of interaction—not merely the quantity of screen time—is critical. Passive exposure, especially to fast-paced or non-interactive media, can reduce the frequency and richness of caregiver–child exchanges that drive language growth and empathy (Radesky et al., 2016).

Cultural and Environmental Context

In the Indian context, sociocultural and familial dynamics often influence early media habits. Joint family structures, urbanization, and dual-working parents frequently lead to digital devices being used as "electronic babysitters"—a convenient means

to manage toddlers during household routines (Kumar et al., 2021). While this may appear harmless, it fosters passive and solitary engagement, limiting tactile and social experiences essential for developing theory of mind, symbolic play, and self-regulation.

Furthermore, regional disparities in awareness regarding screen guidelines amplify the issue. Many caregivers are unaware of the World Health Organization (2019) and American Academy of Pediatrics (AAP, 2016) recommendations, which limit sedentary screen exposure to less than one hour per day for children under five, and ideally discourage any screen use below two years. The mean exposure of 2.6 hours per day observed in this study highlights a significant deviation from these norms and reflects a need for community-based parental sensitization programs.

Neurodevelopmental Mechanisms

From a neurodevelopmental perspective, the observed decline in social and play behaviors may be attributed to the overstimulation hypothesis. Early and sustained exposure to rapidly changing audiovisual stimuli can hyperactivate dopaminergic reward pathways, conditioning the child's attention toward immediate visual gratification rather than sustained interpersonal engagement (Christakis et al., 2018). This hyperstimulation reduces the ability to attend to slower-paced, emotionally nuanced human interactions. Over time, toddlers may begin to prefer virtual or screen-mediated patterns of stimulation, leading to what Heffler et al. (2020) termed "virtual autism"—a reversible, environment-induced condition resembling autism spectrum features.

Additionally, screen time displaces opportunities for active play, which is central to developing symbolic thought and problem-solving abilities (Piaget, 1962). As children passively consume pre-structured digital narratives, they have fewer chances to generate, imagine, and act out stories, weakening the foundations of creativity and representational thought (Lillard et al., 2015).

Comparative and Clinical Relevance

Comparative analyses across exposure groups in this study revealed a dose–response relationship, where toddlers with higher exposure (>2 hours/day) consistently scored lower on both social interaction (M-CHAT-R) and play (SPAS) measures. These results align with longitudinal findings by Madigan et al. (2019) and Zimmerman et al. (2007), which showed that early screen use predicts subsequent social and language delays. Importantly, such impairments are not permanent; several intervention studies have demonstrated that reducing screen time and increasing interactive play can significantly restore social engagement and communication within 3–6 months (Heffler & Sienko, 2020; Lien et al., 2021).

The findings thus carry strong clinical implications for pediatricians, psychologists, and early intervention professionals. Screening for screen exposure during developmental assessments can help differentiate between neurodevelopmental disorders and environmentally induced communication delays. Moreover, therapy programs integrating parental training, screen detox, and play-based socialization may prevent the escalation of virtual autism–like symptoms.

Conclusion

This study clearly demonstrates that excessive screen exposure in toddlers adversely affects social communication, joint attention, and symbolic play core components of early childhood development. Toddlers exposed to screens for more than two hours daily exhibited significantly poorer eye contact, lower play creativity, and reduced social reciprocity compared to those with limited exposure.

The findings highlight the urgent need for screen-time regulation, caregiver awareness, and promotion of interactive, human-centered play during the formative years. Early intervention through parental education, screen hygiene routines, and structured social play can effectively mitigate the developmental risks associated with digital overuse.

Professionals across disciplines pediatricians, psychologists, speech therapists, and educators must collaborate to disseminate evidence-based guidance on healthy media habits, emphasizing that no technological substitute can replace the cognitive and emotional benefits of human interaction. In a world increasingly dominated by digital media, ensuring that children grow up in emotionally responsive, socially enriched environments is essential to safeguarding their cognitive and socio-emotional well-being.

Implications, Limitations, and Future Suggestions

Practical Implications

The findings of this study hold significant implications for parents, clinicians, educators, and policymakers, emphasizing the urgent need to address early screen exposure as a modifiable environmental factor influencing child development.

Parental Guidance and Awareness:

The study underscores the importance of parental supervision and co-viewing during screen use. Caregivers should be educated on international guidelines (AAP, 2016; WHO, 2019), exposure to less than one hour per day for older toddlers. Encouraging interactive, language-rich activities such as storytelling, music, and symbolic play can counteract the developmental effects of passive screen consumption.

Clinical Application:

Paediatricians, child psychologists, and speech-language therapists should integrate screen-time assessment into routine developmental evaluations. Early identification of children showing signs of reduced social reciprocity or limited play behavior can facilitate timely interventions, including screen detox programs and parental training modules focusing on reciprocal communication and responsive caregiving.

Educational Interventions:

Preschool educators can play a pivotal role by incorporating structured social play, pretend play, and sensory-motor activities within classroom settings to promote attention, cooperation, and creativity. Schools should also organize parent sensitization workshops about the developmental risks of unmonitored digital exposure.

Policy and Public Health Perspective:

At the community level, health authorities and NGOs should initiate digital parenting campaigns that disseminate evidence-based practices through local media, Anganwadi centers, and pediatric clinics. Policymakers could consider regulations on advertising and digital content targeting toddlers, as well as promote family-based screen-time guidelines as part of maternal and child health programs.

Holistic Developmental Framework:

The results highlight the importance of maintaining a balance between digital literacy and human interaction. The future of child development in the digital age depends not on eliminating technology, but on using it mindfully, ensuring that it complements—rather than replaces—social learning and play-based exploration.

1.2 Limitations of the Study

While the findings contribute meaningfully to the understanding of screen exposure and developmental outcomes, several limitations should be acknowledged to contextualize the results:

Cross-Sectional Design:

The study employed a cross-sectional design, which captures associations rather than causation. Longitudinal data would better establish whether screen exposure precedes developmental delays or co-occurs with pre-existing factors.

Self-Reported Data:

Screen exposure duration was reported by parents, which may be subject to recall bias or social desirability bias. Objective measures (e.g., digital tracking or observational data) could yield more accurate estimates.

Sample Representation:

The sample was limited to toddlers from Telangana and Chhattisgarh, which may restrict the generalizability of findings to other cultural or socioeconomic settings within India.

Content Type Not Controlled:

The study focused on screen duration but did not differentiate between content types (educational vs. entertainment), interactivity level, or parental involvement all of which could influence developmental outcomes differently.

Uncontrolled Confounding Variables:

Factors such as parental education, home environment, socioeconomic status, and sleep patterns were not analyzed, though they may moderate the relationship between screen use and child development.

Future Directions and Recommendations

Longitudinal and Experimental Research:

Future studies should adopt longitudinal or interventional designs to track changes in social and play behaviors following screen-time modification. Such designs would help clarify the causal pathways linking digital exposure and developmental outcomes.

Neurophysiological Correlates:

Integrating neuroimaging or EEG studies could provide insights into how early screen exposure affects attention networks, sensory processing, and reward pathways, helping delineate neural mechanisms underlying “virtual autism”-like symptoms.

Content-Specific Analysis:

Future research should differentiate between interactive and non-interactive media, as well as between educational and entertainment content, to identify screen experiences that may be developmentally beneficial versus harmful.

Cross-Cultural and Socioeconomic Comparisons:

Expanding research across diverse geographic and cultural contexts will help identify contextual moderators—such as parental occupation, digital literacy, and family structure—that influence screen-use patterns and their effects.

Intervention-Based Studies:

Future work should design and evaluate parental guidance programs focusing on screen detoxification, responsive interaction, and play enrichment. Pilot programs implemented through pediatric clinics or early learning centers could test the effectiveness of such interventions.

Integration with Digital Health Policy:

Policymakers and child welfare organizations should collaborate to create evidence-based national screen-time guidelines, develop parental control resources, and ensure ethical digital content creation for toddlers.

References

- American Academy of Pediatrics. (2016). Media and young minds. Pediatrics, 138(5), e20162591.
- Carpenter, M., Nagell, K., & Tomasello, M. (1998). Social cognition, joint attention, and communicative competence. Monographs of the Society for Research in Child Development, 63(4), 1–143.
- Chonchaiya, W., & Pruksananonda, C. (2008). Television viewing associates with delayed language development. Acta Paediatrica, 97(7), 977–982.
- Christakis, D. A. (2009). The effects of infant media usage: What do we know and what should we learn? Acta Paediatrica, 98(1), 8–10.
- Christakis, D. A. (2019). The challenges of defining and studying “digital addiction” in children. JAMA, 321(23), 2277–2278.
- Christakis, D. A., Ramirez, J. S., Ferguson, S. M., & Zimmerman, F. J. (2018). Early television exposure and subsequent attentional problems in children. Pediatrics, 142(2), e20173823.
- Christakis, D. A., Ramirez, J. S. B., Ferguson, S. M., & Ramirez, J. M. (2018). How early media exposure may affect cognitive function: A review of results from observations in humans and experiments in mice. Proceedings of the National Academy of Sciences (PNAS), 115(40), 9851–9858.
- Gupta, R., & Ghai, S. (2020). Digital parenting and early childhood development in India: Challenges and recommendations. Indian Journal of Child Health, 7(8), 332–336.
- Heffler, K. F., & Sienko, D. M. (2020). Subclinical autistic-like traits in children exposed to early screen media. Journal of Autism and Developmental Disorders, 50(9), 3432–3442.
- Heffler, K. F., & Sienko, K. A. (2020). Subclinical autism traits and early screen exposure: Evidence of virtual autism. Frontiers in Psychiatry, 11, 440.
- Heffler, K. F., Oestreicher, L. M., & Shankar, M. (2022). Virtual autism: Early excessive screen exposure and its reversal. Frontiers in Psychiatry, 13, 841998.
- 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.
- Kirkorian, H. L. (2017). When and how do interactive digital media support children’s learning? Developmental Review, 44, 1–30.
- Kuhl, P. K. (2017). How babies learn language and why humans are unique. Proceedings of the National Academy of Sciences (PNAS), 114(30), 8070–8077.
- Kuhl, P. K. (2018). Neural mechanisms of language learning in infants. Neuron, 102(3), 512–526.
- Kumar, M., Singh, S., & Dandekar, S. (2021). Digital exposure and its behavioral correlates in Indian toddlers. Indian Journal of Child Psychology, 28(2), 45–53.
- Lillard, A. S., Lerner, M. D., Hopkins, E. J., Dore, R. A., Smith, E. D., & Palmquist, C. M. (2013). The impact of pretend play on children’s development: A review of the evidence. Psychological Bulletin, 139(1), 1–34.
- Lillard, A. S., et al. (2015). The impact of media on child development. Developmental Review, 35, 1–27.
- 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.
- 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.
- Nathanson, A. I., Sharp, M. L., Aladé, F., Rasmussen, E. E., & Christy, K. (2014). The relation between television exposure and theory of mind among preschoolers. Journal of Communication, 64(2), 302–322.

- Piaget, J. (1962). Play, dreams, and imitation in childhood. Norton.
- Radesky, J. S., & Christakis, D. A. (2016). Increased screen time: Implications for early childhood development and behavior. JAMA Pediatrics, 170(9), 897–898.
- Radesky, J. S., & Christakis, D. A. (2016). Media and young minds: Promoting healthy digital habits. Pediatrics, 138(5), e20162591.
- Radesky, J. S., Schumacher, J., & Zuckerman, B. (2015). Mobile and interactive media use by young children: The good, the bad, and the unknown. Pediatrics, 135(1), 1–3.
- Ravichandran, A., & Devi, S. (2022). Screen exposure and socio-emotional development in Indian toddlers. Indian Journal of Child Health, 9(2), 123–130.
- Senju, A., & Johnson, M. H. (2009). Atypical eye contact in autism: Neural mechanisms and development. Neuroscience & Biobehavioral Reviews, 33(8), 1204–1214.
- Seshadri, S., Chandrasekaran, R., & Rajesh, P. (2021). Screen media exposure and developmental outcomes in Indian toddlers: Emerging concerns. Indian Journal of Pediatrics, 88(4), 356–362.
- Seshadri, S., Kumar, P., & Thomas, R. (2021). Mobile screen exposure and communication delay among Indian toddlers. Indian Journal of Pediatrics, 88(6), 549–555.
- Shonkoff, J. P., & Phillips, D. A. (2000). From neurons to neighborhoods: The science of early childhood development. National Academy Press.
- Strouse, G. A., & Ganea, P. A. (2017). Toddlers' word learning and transfer from electronic and print books. Journal of Experimental Child Psychology, 156, 129–142.
- Strouse, G. A., & Ganea, P. A. (2017). Toddlers' word learning and transfer from electronic media: The role of co-viewing and scaffolding. Journal of Experimental Child Psychology, 164, 114–126.
- Tomasello, M. (2003). Constructing a language: A usage-based theory of language acquisition. Harvard University Press.
- Tomasello, M. (2019). Becoming human: A theory of ontogeny. Harvard University Press.
- Tomopoulos, S., Dreyer, B. P., Berkule, S., Fierman, A. H., Brockmeyer, C., & Mendelsohn, A. L. (2010). Infant media exposure and toddler development. Archives of Pediatrics & Adolescent Medicine, 164(12), 1105–1111.
- World Health Organization. (2019). Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age. WHO Press.
- Zimmerman, F. J., Christakis, D. A., & Meltzoff, A. N. (2007). Television and DVD/video viewing in children younger than 2 years. Archives of Pediatrics & Adolescent Medicine, 161(5), 473–479.