Paidéia
2022, Vol. 32, e3210.doi:https://doi.org/10.1590/1982-4327e3210
ISSN 1982-4327 (online version)

Digital Media use on Interactions Between Mother and Child: Differences in Infants' Early Years

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Abstract: Children are increasingly using digital media (smartphones, tablets, and television) at an early age, which is affecting their development. This study aims to describethe ways in which media isused by mothers and infants, and to examine similarities and differences between infants aged 0-3 years. 435 mothers of infants aged 0-36 months responded to an online survey. A sociodemographic questionnaire and media use questionnairewere used. The results show that mothers routinely use media to entertain infants, specially when they feel the need to rest or do household chores.We identified that media use differs and increases with the infants' age. The study addresses a current and culturally relevant phenomenon; it expands the understanding of media use, discusses their impact, addresses repercussions on child development, daily life, and family interaction, and offers recommendations on their use.

Keywords: childhood, family, technology

Uso da Mídia Digital nas Interações entre Mãe e Filho: Diferenças nos Primeiros Anos de Vida dos Bebês

Resumo: As crianças estão usando mídias digitais (smartphones, tablets e televisão) precocemente, de maneira crescente e com influência no desenvolvimento. Este estudo objetivou descrever o uso de mídias por mães e bebês, e examinar semelhanças e diferenças entre bebês de 0-3 anos. 435 mães de bebês de 0-36 meses responderam a um *survey* online. Foram utilizados: questionário sociodemográfico e questionário de uso de mídia. Os resultados mostram que as mães usam mídias na rotina, para entreter os bebês, e sentem mais necessidade de permitir que seus filhos usem mídias quando precisam descansar ou fazer tarefas domésticas. Identifica-se que o uso de mídias difere e aumenta conforme a idade dos bebês.O estudo aborda um fenômeno atual e culturalmente relevante. Amplia a compreensão do uso de mídias, discute o impacto destas, aborda repercussões no desenvolvimento infantil, no cotidiano e na interação familiar e oferece recomendações sobre o seu uso.

Palavras-chave: infância, família, tecnologia

Uso de Medios Digitales en Interacciones entre Madre e Hijo: Diferencias en los Primeros Años de los Bebés

Resumen: Los niños están utilizando, de manera temprana y creciente, los medios digitales (teléfonos inteligentes, tabletas y televisión), lo que impacta en su desarrollo. Este estudio tuvo como objetivo describir el uso de los medios por madres y bebés, así como examinar lassimilitudes y diferencias entre bebés de 0 a 3 añosde edad. Una encuesta en línea fue respondida por 435 madres de bebés de entre 0 y 36 meses. Se utilizaron elcuestionario sociodemográfico y elcuestionario de uso de medios. Los resultados muestran que las madres usan los medios de comunicación para entretener a sus bebés y también les permiten usar los medios de comunicación cuando necesitan descansar o hacer las tareas del hogar. Se identifica que el uso de los medios de comunicación difiere y aumenta con la edad de los bebés. Este estudio aborda un fenómeno actual y culturalmente relevante. Amplía la comprensión del uso de los medios digitales, analiza su impacto, aborda las repercusiones en el desarrollo infantil, la vida diaria y la interacción familiar, además de ofrecer recomendaciones sobre su uso.

Palabras clave: infancia, familia, tecnologia

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This article is derived from the first author's dissertation under supervision of the fourth, defended in 2020, in the Graduate Program in Psychology of the Universidade Federal do Rio Grande do Sul. Funding Support: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) 88882.346437/2019-01, Financing Code: 001 (from the first author) and Programa Nacional de Pós-Doutorado (PNPD) (from the third author).

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In recent years there was a significant increase in digital media use by children, who have been introduced to them at progressively younger ages (Rideout & Robb, 2020). Infants have become increasingly adept at using digital media, with the present generation of digital natives being the first to be immersed in technology from birth (Kildare & Middlemiss, 2017; Nevski & Siibak, 2016; Radesky & Christakis, 2016).

Digital media useis starting at a crucial developmental stage, in which infantsestablish the habits and relationships which will serve as a basis for future experiences (Mallmann & Frizzo, 2019). In their early years, children need to undergo a variety of sensorial experiences (Piaget, 1936/1978) and the quality of the first relationships between infants and caregivers will build subsequent emotional development (Winnicott, 1986/2005). It is crucial to understand the potential influence of digital media on child development and onparent-child interactions since positive experiences are the basis for a good brain (Shonkoff, 2017) and for cognitive (Piaget, 1936/1978) and emotional development (Winnicott, 1986/2005).

Pediatric organizations across the world have expressed concerns about the use of digital media in childhood. Current recommendations discourage the use of these technologies before 2 years of age (American Academy of Pediatrics [AAP] Council on Communications and Media [CCM], 2016). Despite these recommendations, Kabali et al. (2015) found that 92.2% of infants are first introduced to digital media before the age of one. Studies suggest that the pediatrics' orientations are not followed by families around the world (Duch et al., 2013; Kabali et al., 2015; Mallmann & Frizzo, 2019). There are changes in media use over time, as new devices and contents are made increasingly available. In 2011, for instance, fewer than 1% of children had their own tablets, in 2013 this number grew to 7%, and had an increase of 42% in 2017 (Common Sense Media, 2017); by 2020, nearly half (46%) of 2- to 4-year-olds have their own mobile device (Rideout & Robb, 2020).

Recent orientations are less pres criptive and encourage families to reflect on their use of digital media (Sociedade Brasileira de Pediatria[SBP], 2019; Royal College of Paediatrics and Child Health [RCPCH], 2019). They also emphasize the importance of preserving routine activities such as mealtime and bedtime (World Health Organization [WHO], 2019), which constitute crucial opportunities for parent-child interaction and should therefore be carried out without the use of screens. These findings suggest that, on its own, the duration of media use – the most frequently investigated variable in studies of the subject – may not be able to capture the complexity of the media usage patterns shown by infants and their families. Thus, it is relevant to investigate more aspects of the use of digital media, such as moments when the child uses it, parents' reasons for offering digital media, and parental mediation, for example.

Among the variables that seem to interfere with digital media use, age has been widely reported in studies (Arufe-Giráldez, Sanmiguel-Rodríguez, Zagalaz-Sánchez, Cachón-Zagalaz, & González-Valero, 2020; Cartanyà-Hueso et al., 2021; Kabali et al., 2015; Nevski & Siibak, 2016; Rideout & Robb, 2020), showing that screen time increases with age. The kind of media used also differs according to thechild's age (Rideout & Robb, 2020).

Kabali et al. (2015) also showed differences in the context of digital media use within the infant's first 4 years. According to them, the first use occurs mostly before their first year and digital media use becomes broader and more frequent, as well as with less parental mediation over time. Owning mobile devices is also more common among older children.

These differences can be related to the skills that children acquire over time, which generates more opportunities for engagement with the devices (Aguilar-Farias et al., 2020), as well as the fact that infants rely on their parents to access digital media since they cannot independently engage in leisure activities, unlike older children (Kildare & Middlemiss, 2017). Digital media use in infancy is necessarily contingent on the offer of these resources by parents.Thus, it is relevant to investigate similarities and differences in use according to age group from a developmental perspective to advance understanding of this phenomenon in early childhood.

Studies on the frequency of use have raised concerns about the potential effect digital media use can haveon the interaction between parents and children. The use of digital media is associated with reduced and altered family interactions, lower parental sensitivity and responsiveness, reduced nonverbal communication, and reduced attention to children (Kabali et al., 2015; Kildare & Middlemiss, 2017; McDaniel & Radesky, 2017; Radesky et al., 2015; Radesky, et al., 2016), all of which are indicative of low-quality interactions (Munzer, Miller, Weeks, Kaciroti, & Radesky, 2019). The constant and increasing use of digital media among infants is associated with delays in emotional (Napier, 2014; Raman et al., 2017), cognitive (Radesky & Christakis, 2016), and language development (Duch et al., 2013). No studies to date have revealed any benefits of digital media use at this age (Schmidt, Rich, Rifas-Shiman, Oken, & Taveras, 2009; Strasburger, 2007; Radesky & Christakis, 2016; RCPCH, 2019).

There is an overall need for studies that examine the influence of digital media on families with infants since this is a historically recent phenomenon. It is crucial to understand when and how infants use digital media, which types of technology are most commonly used,and the situations and reasons for using these devices. Considering this growing phenomenon and the current gaps in the scientific literature, this study describes the use of digital media by mothers and infants and verifies whether there are differences inthese behaviors between three age groups: 0-12, 13-24, and 25-36 months.

Method

Participants

This study was composed of 435 Brazilian mothers of infants aged 0-36 months.Mothers of children with genetic syndromes, congenital malformations, heart problems, neurological issues, or developmental delays diagnosed by a physician or other health professionals were excluded from the study. These criteria were examined using screening questions administered before the online questionnaire.

This exploratory, descriptive, cross-sectional quantitative study was conducted as part of a larger project "Infants, families and technology use: a multi-methods study of child development" (Frizzo et al., 2017).

Instruments

Sociodemographic questionnaire: This instrument was used to investigate the sociodemographic characteristics of participants and their families, including their age, education level, living conditions, and income (Núcleo de Pesquisa e Intervenção em Famílias com Bebês e Crianças[NUFABE], 2017).

Media use questionnaire: The "*Zero to Eight: Children's Media Use in America 2013*" (Common Sense Media, 2013) questionnaire was adapted to Brazilian Portuguese with the permission of the original researchers. The instrument collects demographic information about the respondents. It contains detailed questions about the types of media present in their homes, the devices used by infants and their parents, as well as the type and duration of this usage. Questions such as the following were also added to the instrument: "In what situations do you feel the greatest need to offer mobile devices (smartphone, tablet computer, or portable DVD player) to your child?", "Do you usually offer mobile devices (smartphone, tablet, or portable DVD player) to your child during any of the following routine activities?".

Procedures

Data collection. Participants were sampled by convenience. The study was advertised on social networks using the following invitation: "We would like to learn about tablet, computer, and cell phone usage by mothers of infants aged 36 months or younger." This prompt was accompanied by a link to an informed consent document and the online survey. Data were collected from October 2018 to April 2019.

Data analysis. Descriptive and frequency analyses were used to examine the sociodemographic characteristics of mothers and infants, as well as their digital media use (Robson, 2002). Bivariate analyses (X^2) were conducted to investigate differences in media use (routine use, reasons for use, method of use, infant's reaction when media use is not allowed, infant's reaction to mother's use of digital media, and interference in family life) between age categories (0-12 months; 13-24 months; 24-36 months). Analyses were conducted using the *Statistical Package for the Social Sciences* (SPSS), version 24.

Ethical Considerations

The project was approved by the Research Ethics Committee of the Instituto de Psicologia da Universidade Federal do Rio Grande do Sul (CAAE. No. 69947117.6.0000.5334).

Results

The survey was completed by mothers (median age of 33.37 year; standard deviation of 4.79) from all states in the country, though most participants were from Southern Brazil (84.1%)(Table 1). Most infants were born at full term (85,5%). Most mothers were white (88%) with high education levels (32.4% completed undergraduate degrees and 44.4% completed graduate degrees) from upper-middle-class families. Mean monthly family income was calculated based on the minimum wage, which at the time of data collection, was R$ 954,00. Most mothers (57.5%) reported that the income was used to support three people. The majority of participants were in a relationship with their child's father (96%). Most individuals (81%) were married.

Table 1
Sociodemographic characteristics of mothers and infants (N = 435)

	f[a]	%
Family Income		
Less than 1 minimum wage	6	1.40%
2 to 3 minimum wages	58	13.30%
3 to 6 minimum wages	93	21.40%
6 to 9 minimum wages	83	19.10%
9 to 15 minimum wages	102	23.50%
Over 15 minimum wages	93	21.40%
Mother's occupation		
Working	296	68.10%
On maternity leave	44	10.10%
Not working	95	21.80%
Infant Age		
12 months or less	126	28.96%
13 to 24 months	157	36.09%
25 to 36 months	152	34.94%
Infant Gender		
Male	226	52.00%
Female	209	48.00%
Number of siblings		
Only child	270	62.07%
1 sibling	132	30.35%
2 to 4 siblings	33	7.58%
Child Care Attendance		
Full-time	98	22.60%
Part-time	122	28.00%
Not enrolled	215	49.40%

Digital devices ownership and use

Internet access was highly prevalentand different forms of digital media were present in the homes of most participants (Table 2). Smartphones were owned by nearly

every participant and most families owned laptops. Some infants had their own mobile devices and also TV in the bedroom. Ownership of a digital device was more prevalent according to infant age. A total of 54.5% of infants used computers or mobile devices (smartphones or tablets).

Televisions were present in a large number of homes, as 43% of mothers reported that the TV was frequently on, even if no one was watching it. Also, most families (61.6%) alternated between TV programs directed at adults and children over the day.

Table 2
Items owned by the family and infant

		f[a]			%	
Items in the home						
High-speed Internet access		411			94.5%	
3G/4G Internet		383			88.0%	
Smartphones		430			98.9%	
Laptop		380			87.4%	
Cable TV		354			81.4%	
Streaming service		326			74.9%	
Smart TV		323			74.3%	
Items owned by the infant	0-12	13-24	25-36	0-12	13-24	25-36
Smartphone**	1	4	24	0.8%	2.5%	15.8%
Tablet*	7	16	28	5.6%	10.2%	18.4%
TV in bedroom	7	12	18	5.6%	7.6%	11.8%

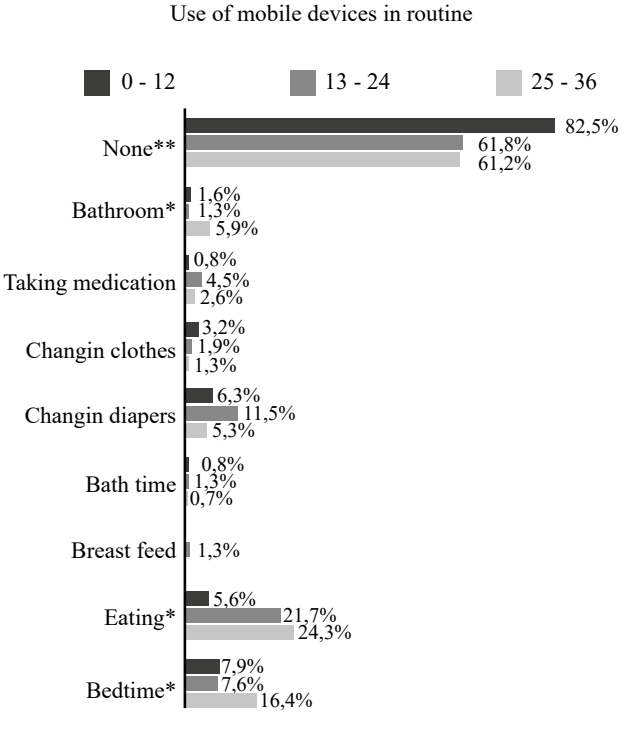
Note. *$p < 0.05$; **$p < 0.001$.

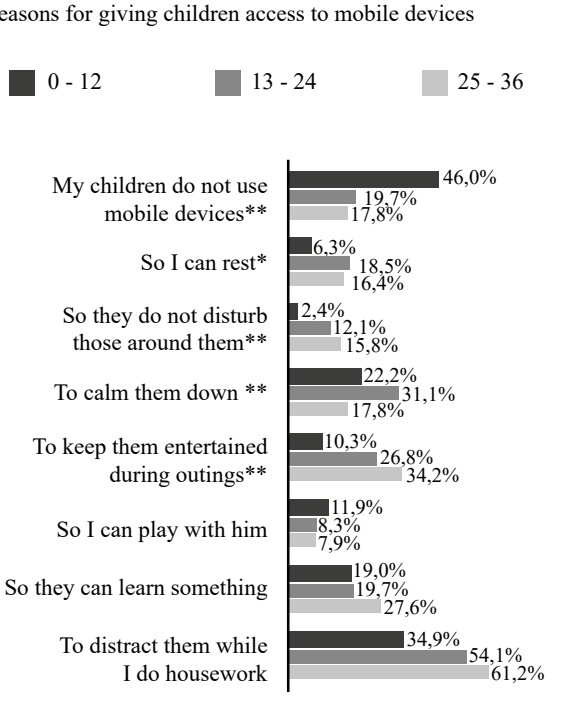
Downloaded apps

Some mothers (33.6%) downloaded apps for their children on their own smartphones, with 61.6% of these citing YouTube and Netflix. A few mothers (32.9%) also reported that they had downloaded apps designed to teach their children.

Contexts and behaviors related to digital media use

Bivariate analyses revealed differences in the use of mobile devices during daily routine, reasons for giving children access to mobile devices, method of use, infant's reaction when media use is not allowed, infant's reaction to mother's use of digital media, and interference in family life between age categories (Figure 1 and Figure 2).





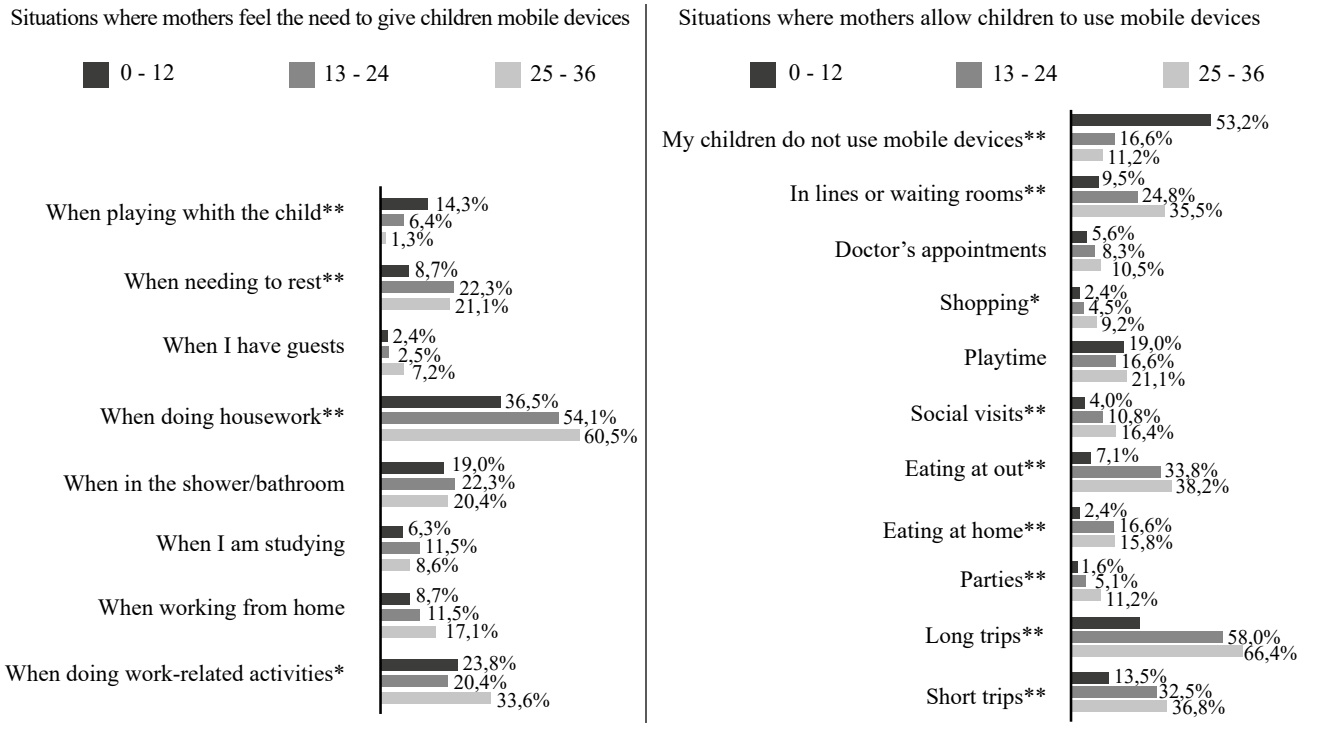
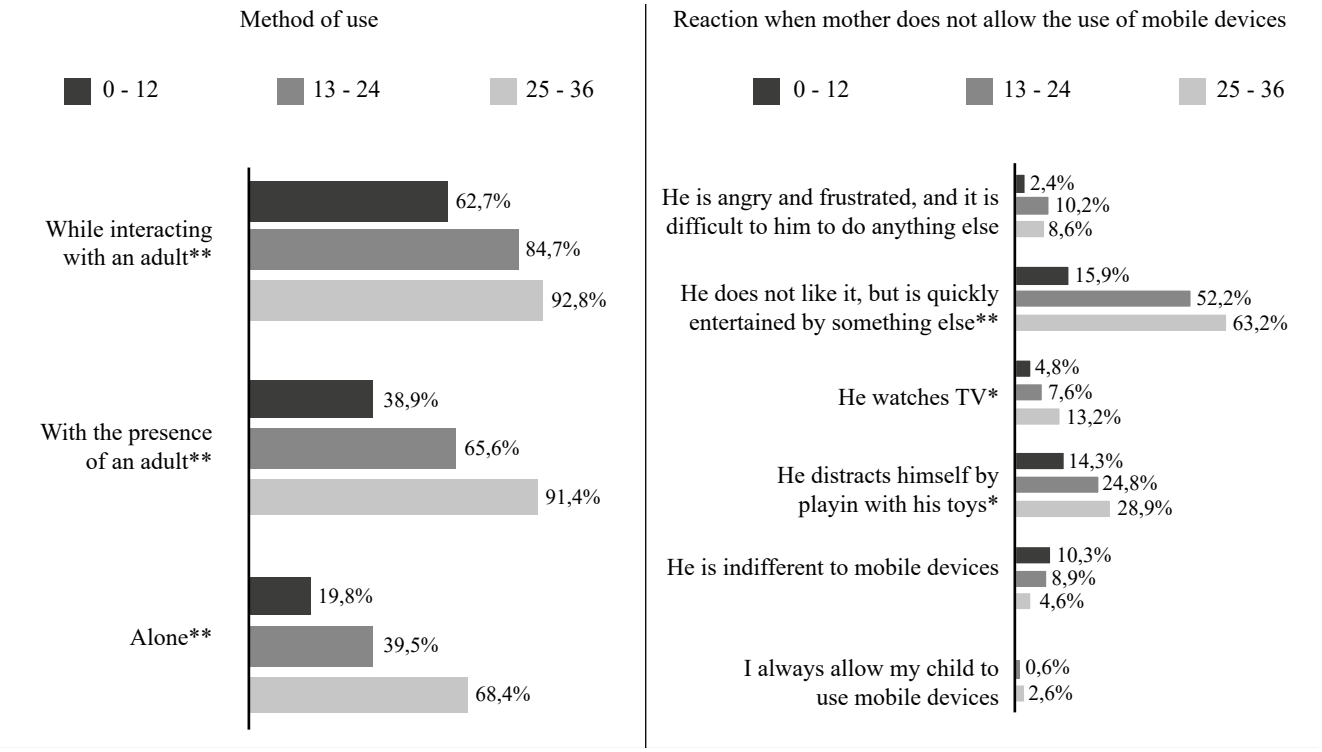


Figure 1. Routine use of digital media and reasons for use.



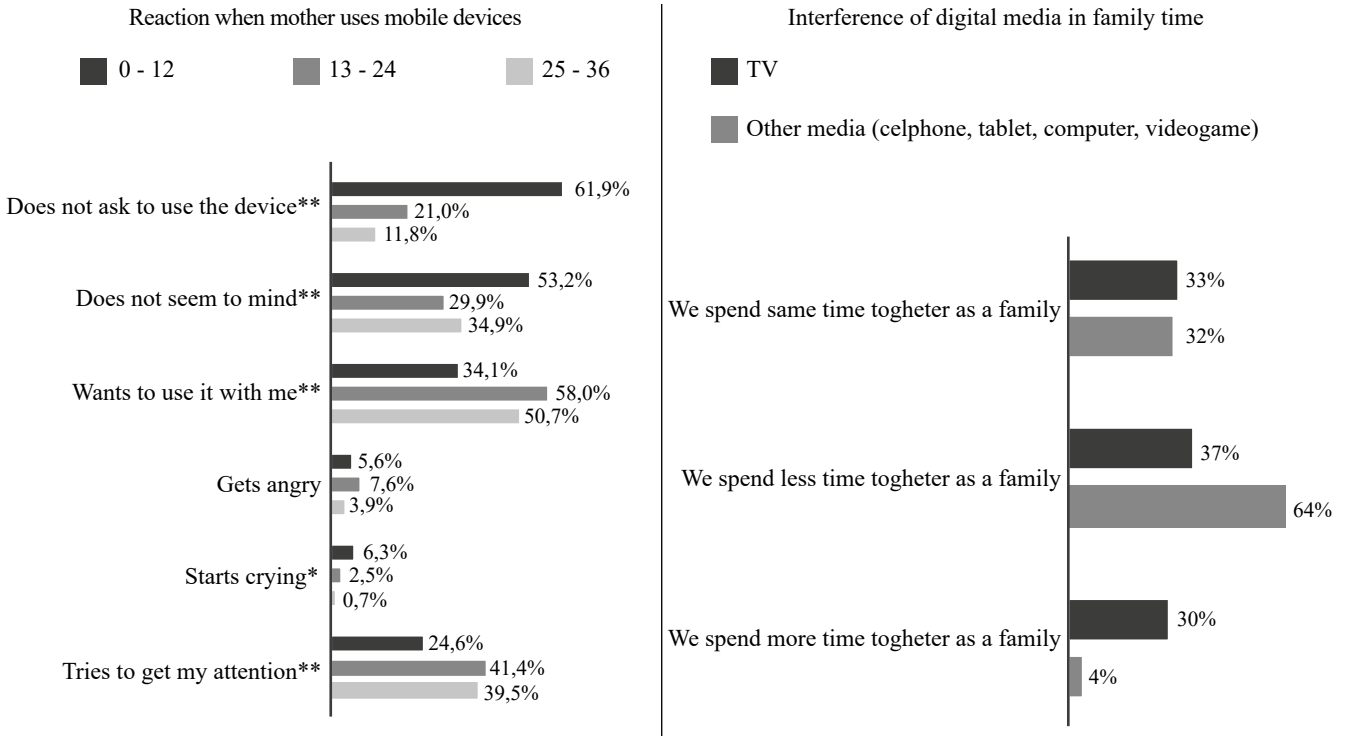


Figure 2. Interference and reactions to the use of digital media.

Routine use of digital media and reasons for use

Children's use of digital devices during meals increased in frequency with age. Mothers cited that they allowed their children to use mobile devices in restaurants and few of them reported giving mobile devices to their children at bedtime.

Participants reported using digital media to calm their children, especially those aged 13-24 months, and to keep them from disturbing those around them. Mothers also reported that sometimes they felt the need to give their children digital devices so they could carry out their own activities such ashousework, work from home, or rest. This was particularly true for older children. Mothers also allowed children to use digital media on other occasions, such as parties, when receiving guests, and during short or long trips. Some mothers, especially those whose children were less than one year old, reported feeling the greatest need to rely on digital media during playtime.

Method of use

Most infants used digital media during interactions with adults. Some mothers reported that their children used digital media on their own, although this was less frequent than the other types of usage observed. The frequency of independent media usage increased with age.

Infant's reaction when media use is not allowed

Most mothers observed a negative reaction in their children when access to mobile devices was denied;respondents noted, however, that,immediately after this happened,their children quickly turned to other toys or activities, especially those over 13 months.

Infant's reaction to mother's use of digital media and interference in family life

Many mothers noted that when using their own mobile devices, children often reacted by trying to get their mother's attention, asking to use the device with her. This behavior was observed across all age groups in this study.

Discussion

This study describes the use of digital media by mothers and infants and examines the differences in behavior between age groups 0-12, 13-24, and 25-36 months. The data provided a comprehensive picture of mothers' and infants' media use patterns and offers evidence-based recommendations on the use of digital media by families and infants.

Results confirmed the widespread presence of digital media in the participants' homes and infants' daily routines, similarly to what was found in previous studies (Common Sense Media, 2017; Rideout & Robb, 2020). The use of digital media differed in the age group of zero to 3 years, with increased use in older infants, as in the study by Kabali et al. (2015). More than half of infants in our sample used computers or mobile devices (smartphones or tablets), similarly to other studies, in which a high frequency of digital media use among

infants was noted (Kabali et al., 2015; Nevski & Siibak, 2016; Rideout & Robb, 2020), despite recommendations against the use of these technologies by children aged two years or younger (AAP & CCM, 2016; SBP, 2019). Within our sample, laptops were largely present at home,while tablets tend to be more popular in North America (Common Sense Media, 2017).

In our investigation, televisions are present in a great number of homes and are frequently on; the same was observed in the Common Sense Media (2017) study, in which many families with infants under two (42%) reported leaving their TV on in the background most of the time. This may be a problematic distraction, potentially interfering with parent-child interactions and leading to issues such as a marked decrease in maternal responsiveness (Napier, 2014; Schmidt et al., 2009), which can be a developmental risk factor for young children (Schmidt et al., 2009). In Rideout and Robb's (2020) study, most families alternate between TV programs directed at adults and children over the day.

The most downloaded app by mothers in this sample was YouTube, which seems to be the most popular app among infants aged 1 to 2 years, according also to Kabali et al. (2015) study. Rideout and Robb (2020) observed that 39% of children between two and four years of agewatch online videos on sites such as YouTube. The service has a simple, accessible interface so that even young children can use it. However, as noted by Elias and Sulkin (2017), children's underdeveloped technical, critical, and social skills make them especially vulnerable to commercial and/or age-inappropriate content, so that their use of this media should be mediated by an adult. As discussed in previous studies, parents often download apps for their children at an early age to not fall behind their peers (Radesky et al., 2016) due to a belief in digital media's educational value, which is reinforced by marketing strategies (Nevski & Siibak, 2016; Rideout & Robb, 2020). However, no studies have identified any benefits (Radesky & Christakis, 2016; Schmidt et al., 2009; Strasburger, 2007) or educational advantages of these technologies. Infants aged 30 months or younger can only learn from digital media through interactions with people around them (Radesky & Christakis, 2016). Many of the apps downloaded by parents also have questionable educational potential and may not be adequate for their children's age (Nevski & Siibak, 2016). In conclusion, digital media cannot play an educational or formative role without the participation and interaction of a caregiver who mediates the technological experience (AAP & CCM, 2016; RCPCH, 2019).

Media use during meals, largely reported in our sample, may have a negative impact on family interactions, or encourage bad behavior (Radesky et al., 2015). This behavior can also interfere with children's food experience, leading to decreased interest in food, loss of appetite, or weight gain (SBP, 2019; WHO, 2019).

Despite only a few mothers having reported giving mobile devices to their children at bedtime, this finding contrasts with studies in which this behavior has been reported with higher frequency (Common Sense Media, 2017; Kabali et al., 2015). The impact of media use on sleep has been associated with insufficient and poor-quality sleep and excessive day time sleepiness (Carter, Rees, Hale, Bhattacharjee, & Paradkar, 2016).

The use of digital media to calm children and to keep them from disturbing those around them–reported by mothers who took part in this study– was noted also by Kabali et al. (2015), who found that 60% of families with infants use mobile phones to calm their child in public places. At this age, infants display significant changes in their behavior, which can take the form of temper tantrums when their wishes are not met. This is a normal stage of development known as the "terrible twos," which mark the beginning of the infant's struggle for independence and parents may see them reacting aggressively in response to frustration or challenges to their wishes (American Academy of Pediatrics [AAP], 2008). In these situations, parents may offer their children digital devices to calm them down or stop a tantrum. Children with socioemotional difficulties are more likely to be given mobile phones to help them remain quiet and calm (Radesky et al., 2016). Infants and toddlers with self-regulation issues, in which children have difficulties calming down, may be associated to more frequent exposure to screen media by their caretakers (Radeskyet al., 2014).It is known that infants' ability to regulate their emotions and behavior develop gradually with caregivers' interactions, through a mutually regulated dyadic communication system (Chiodelli, Rodrigues, Pereira, Lopes dos Santos, & Fuertes, 2021). So it is difficult to determine whether media exposure was simply a parental strategy to manage children with pre-existing self-regulation issues or if the latter arose as a consequence of the media exposure itself.

Mothers in our study seem to have difficulties entertaining infants, as evidenced by the high number of respondents who use digital media with their children for entertainment purposes. Previous studies have shown that media use can interfere with playtime and emphasized the importance of children playing and interacting with others without the use of screens (McDaniel & Coyne, 2016; RCPCH, 2019). Playtime is an important moment for parents to establish emotional connection with their children, to stimulate their cognitive, physical,and social development, and also for the infant's brain development (Shonkoff, 2017). It is possible that mothers in our study do not know how to engage in unstructured play, resorting to technology as a means of interacting with their children. This is especially evident in the younger infants of our sample who require parental stimulation during play activities. The fact that parents use digital media to play and interact with their infants is, therefore, concerning.

Digital media is increasingly ubiquitous and, as a result, is often used by mothers. This may prompt a reaction from children that may initially appear to express their own need to access these devices but is actually an attempt to approach and interact with the mother. This hypothesis is supported by the literature since many studies show that infants compete for the attention of their parents when the latter are engrossed by digital media (Kildare & Middlemiss, 2017; Radesky et al., 2014, 2016). Radesky et al. (2016) noticed that children were calmer and more relaxed when parents interacted with them in

the absence of a telephone and that parents felt more present and connected to their children when digital media devices were put away. In this context, parents were more attentive, involved, and affectionatein their interactions. A similar observation was made in our study, where many participants felt that devices such as smartphones and tablets interfered with family habits, reducing the time they spent together.

The presence of affectionate and accessible caregivers is an important contributor to physical and emotional development. As such, excessive use or exposure to digital media should be minimized in favor of face-to-face interactions between parents and infants (RCPCH, 2019). It is important to ensure that interactions between parents and infants are not replaced or excessively mediated by digital media. This is especially relevant given recent findings on the impact of digital media use on parent-child relationships (Kildare & Middlemiss, 2017; McDaniel & Radesky, 2017; Munzer et al., 2019; Radesky et al., 2015).

The shared use of digital media between parents and children,with adults interacting and discussing its contents –as it was reported by a few mothers in our study– is considered an adequate use of digital media. In contrast, merely the use of digital media by children in the presence of an adult, commonly informed by many mothers in our sample – especially those with older children – does not indicate any involvement or interaction and is limited to distant supervision. The parent and infant could also be using the same device without talking about its contents, which would constitute a low-quality interaction (Munzer et al., 2019) and is considered a harmful use of technology that could interfere with family relationships (McDaniel & Coyne, 2016; McDaniel & Radesky, 2017). In the absence of eye contact between infant and caregiver, there is probably less interaction or emotional connection (Winnicott, 1986/2005), becoming a poor use of technology.

We observed that the frequency in which media is independently used increases with age,which is in line with findings reported in the literature (Rideout & Robb, 2020). As previously discussed,parents often use digital media as a way to entertain infants while they carry out necessary activities, and this can result in solitary media use. In these conditions, digital media may be acting as a substitute for interpersonal play and interactions and leading to long periods of screen time with no interactions (Fidler, Zack & Barr, 2010) or conversations with individuals who could give meaning to this experience. Infancy is a period of physical and psychological immaturity that results in profound dependency (Winnicott, 1986/2005). Individuals at this stage of development need help making sense of the information and virtual connections provided by digital media.

This study shows that mothers often use digital media as a way to entertain infants while they carry out necessary tasks. Previous studies (Kabali et al., 2015; Mallmann & Frizzo, 2019) found that the use of digital devices by infants was spurred by maternal necessity. However, it appears that infants may feel no need to use digital media, as they can distract themselves with other activities and toys rather than these devices and that they are given access to digital media to address mothers' needs, not theirs (Mallmann & Frizzo, 2019). Although it may be challenging to refrain from using digital media, it is important to identify these situations to help mothers find an alternative rather than resort to digital media as the first or only option. Above all, it is essential to ensure that in-person interactions within families are not disrupted or excessively mediated by technological resources.

One limitation of our study is the high socioeconomic and educational status of the sample – which can be the disadvantage of convenience samples on online surveys (Lourenco & Tasimi, 2020). Further studies should investigate these issues in samples with different socioeconomic backgrounds. Another limitation of this study is that mothers may have had difficulty providing accurate reports of their children's media use since children often use such devices in an autonomous and self-directed manner. An additional limitation is that data regarding the total duration of media use by mothers and infants were not collected. Accurate digital media usage time measurement is still a great challenge for researchers (Barr et al., 2020). Finally, another limitation is that the type of digital media most frequently used by children and the nature of the contents to which they are exposed were not investigated. Future studies should examine these aspects and also the on-set of digital media usage.

This study's major strength is its focus on a current and culturally relevant phenomenon, present in the daily lives of most families but still largely unexplored in literature. Our findings make a novel contribution to the literature since few studies have focused on examining the patterns and effects of digital media use in mothers with infants of different ages. This study adds to the current understanding of digital media use in infants and addresses many of its repercussions on child development, routine activities, and family interactions, with potentially wide-ranging public health implications.

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Authors' Contribution:
All authors made substantial contributions to the conception and design of this study, to data analysis and interpretation, and to the manuscript revision and approval of the final version. All the authors assume public responsibility for content of the manuscript.

Associate editor:
Fabio Scorsolini-Comin

Received: Aug. 26, 2021

1st Revision: Oct. 21, 2021

Approved: Dec. 07, 2021

How to cite this article:
Azevedo, E. C., Riter, H. S., Pieta, M. A. M., & Frizzo, G. B. (2022). Digital media use on interactions between mother and child: Differences in infants' early years. *Paidéia (Ribeirão Preto), 32,* e3210. doi: https://doi.org/10.1590/1982-4327e3210