

Exposure and Use of Mobile Media Devices by Young Children

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abstract

BACKGROUND AND OBJECTIVES: Research on children's use of mobile media devices lags behind its adoption. The objective of this study was to examine young children's exposure to and use of mobile media devices.

METHODS: Cross-sectional study of 350 children aged 6 months to 4 years seen October to November 2014 at a pediatric clinic in an urban, low-income, minority community. The survey was adapted from Common Sense Media's 2013 nationwide survey.

RESULTS: Most households had television (97%), tablets (83%), and smartphones (77%). At age 4, half the children had their own television and three-fourths their own mobile device. Almost all children (96.6%) used mobile devices, and most started using before age 1. Parents gave children devices when doing house chores (70%), to keep them calm (65%), and at bedtime (29%). At age 2, most children used a device daily and spent comparable screen time on television and mobile devices. Most 3- and 4-year-olds used devices without help, and one-third engaged in media multitasking. Content delivery applications such as YouTube and Netflix were popular. Child ownership of device, age at first use, and daily use were not associated with ethnicity or parent education.

CONCLUSIONS: Young children in an urban, low-income, minority community had almost universal exposure to mobile devices, and most had their own device by age 4. The patterns of use suggest early adoption, frequent and independent use, and media multitasking. Studies are urgently needed to update recommendations for families and providers on the use of mobile media by young children.

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Drs Kabali and Irigoyen conceptualized and designed the study, designed the data collection instruments, supervised data collection, carried out the analyses, and drafted the initial manuscript; Drs Nunez-Davis, Budacki, and Bonner participated in the study design, designed the data collection instruments, and critically reviewed the manuscript; Drs Mohanty and Leister participated in the study design and critically reviewed the manuscript; and all authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Interactive mobile media devices have revolutionized children's access to and experience of media, but research is lagging behind its adoption. A critical first step is to understand when and how young children adopt mobile media devices.

WHAT THIS STUDY ADDS: Our study found almost universal exposure, early adoption, and use of mobile media devices among young children in an urban, low-income, minority community. Studies are needed to update guidelines on the use of mobile media by young children.

Mobile devices are quickly becoming the preferred media choice for children because of their screen size, mobility, ability to stream content, interactive capability, and decreasing costs.^{1,2} Children use mobile devices to play games, watch videos, communicate, take pictures, and access applications (apps). According to Common Sense Media's nationwide survey, 72% of children ages 0 to 8 years used a mobile device in 2013, up from 38% in 2011.³ Even more dramatic was the increase in the use by children <2 years old: 38% in 2013, up from 10% in 2011.³ Despite an overall increase in access, the 2013 Common Sense Media survey found a large disparity in access to mobile devices and apps among low-income and minority children.³

The rapid adoption of mobile devices by children is likely to have an impact on family dynamics and child health, development, and literacy. However, research on the use of mobile devices by young children is lagging behind its adoption.^{2,4} The American Academy of Pediatrics' policy recommendation to "discourage the use of media by children under the age of two"¹ was drafted before the introduction of tablets in 2010.⁴ A critical first step is to understand when and how young children adopt mobile devices and whether this usage varies by population groups. The objective of this study was to examine exposure and use of mobile media devices by young children in an urban, low-income, minority population.

METHODS

Study Setting and Study Sample

We conducted a cross-sectional study with a convenience sample of parents of children 6 months to 4 years of age who made a well or sick visit between October and November 2014 to a pediatric practice at an academic medical center in a low-income minority community in Philadelphia, Pennsylvania. We invited parents to participate in an anonymous, self-

administered paper survey while waiting to see the health care providers. Parents who brought >1 eligible child to the visit completed the survey only for the youngest child.

The study received exempt status from the institutional review board. No financial incentives were provided for participation. After survey completion, we invited parents to enter a raffle for an iPad. The contact information of the raffle participants was not linked to their surveys.

Study Questionnaire

We developed a 20-item questionnaire (in English and Spanish) adapted from the Zero to Eight Common Sense Media 2013 nationwide survey.³ The questionnaire was determined to have face validity by senior faculty (M.M.I., R.L.B.) but was not tested for reliability. Demographics included child's age in years (<1, 1, 2, 3, or 4 years), gender, ethnicity, and parent education. Parents were asked whether they had previously completed the survey.

To determine children's access to media, we asked parents about media platforms and Internet connectivity in the household and whether their child had his or her own media platform. Media platforms were categorized into 4 types: television, mobile devices, computers, and video consoles. Mobile devices were categorized into 3 types: smartphones, iPods, and tablets (eg, iPad, Kids Tablet, Kindle eBook reader, Samsung Galaxy Tablet, Microsoft Surface Tablet). Computers included desktops and laptops. Video consoles included Xbox, PlayStation, and Nintendo.

To determine children's age at first use, we asked parents, "How old was your child when she/he first did various activities on a mobile media device?" The activities listed were touched or scrolled screen, called someone, played video games, watched television shows, and used apps.

To understand the circumstances under which parents let their children use mobile devices, we asked parents, "How often do you let your child use the mobile device when out running errands, doing chores around the house, keeping your child calm in public places, or putting your child to sleep?" Response options were "often," "sometimes," "hardly ever," and "never."

To measure children's frequency of use of media, we asked parents, "How often does your child watch television, play video games on a console, use a computer, watch video/television shows and/or use apps on a mobile device?" Response options were "several times a day," "once a day," "several times a week," "once a week," "less than once a week," and "never." We combined responses into "daily" (several times a day, once a day, several times a week), or "less than daily" (once a week, less than once a week, never).

To measure children's screen time, we asked parents, "How much time did your child spend *yesterday* by him/herself watching television, playing video games on a console, watching video/TV shows and/or using other apps on a mobile device?" Response options were "none," "less than 30 minutes," "about 30 minutes," "about 1 hour," and "more than one hour." To compare findings with the 2013 Common Sense Media survey, we created a continuous time variable by assigning a value in minutes to each response: "none" = 0 minutes, "less than 30 minutes" = 15 minutes, "about 30 minutes" = 30 minutes, "about 1 hour" = 60 minutes, and "more than 1 hour" = 90 minutes.

We asked parents how many apps they had downloaded for their child and the name of their child's most commonly used apps. For each app, we researched the description from the developer. Given the lack of a comprehensive, uniform rating system of apps by either industry or an independent consortium, we categorized apps based on the

developer's description as educational (to promote cognitive development), entertainment (to entertain, any cognitive benefit was secondary), and content delivery (to serve as a portal to mostly passive content, such as movies, cartoons, and video clips).

To assess children's ability with mobile devices, we asked parents, "Does your child need any help to navigate the mobile device?" and "How often does your child like to use more than one type of media device at a time?" Responses were "always/most of the time," "sometimes," and "never."

Data Analysis

In the analysis, we excluded repeat surveys. Statistical analysis was done with SPSS version 21 (IBM SPSS Statistics, IBM Corporation), with additional analysis and visualizations in Tableau version 8 (Tableau Software, Seattle, WA). We evaluated the survey data by using descriptive and bivariate analysis. Survey responses varied in completeness, and we report the sample size and response rate for each question. We used bivariate analysis (χ^2) to examine the relationship of child gender, age (in years), ethnicity (African American, Hispanic, all others), and parent education (less than high school, high school, some college, college graduate or higher) on the following outcomes: child mobile device ownership, child used mobile device before age 1, and frequency of mobile device use (many times a day vs daily or less). To delineate the characteristics of the study population, we aggregated the zip codes of the raffle participants and did a comparative demographic analysis with the US Census Bureau American Community Survey data for the 5-year data 2009 to 2013.⁵

RESULTS

We invited 423 parents of children 6 months to 4 years of age to participate in the study: 17 refused,

and 40 did not return the survey. We excluded an additional 16 surveys because parents acknowledged previous participation, leaving a final sample of 350. Most parents ($n = 289$, 81.2%) entered the raffle.

Demographics of Study Population

The study population was predominantly minority and low income (Table 1). Children's age and gender were uniformly distributed, and the ethnicity was predominantly African American. A zip code-level comparison with the US Census Bureau American Community Survey 2009 to 2013 showed that the educational level reported by the study participants was nearly identical to the census data distribution.⁵ The median household income in the study population zip codes was \$28 098 per year, with a poverty rate of 29.2% (at or below 100% of the federal poverty level).

Children's Media Exposure

Almost all households had televisions (97%), most had tablets (83%) and smartphones (77%), and more than half had video consoles (56%), computers (58%), and Internet access (59%). Child ownership of

media devices increased with age (Table 2). Starting at age 2, ownership of mobile devices surpassed that of television. At age 4, one-half of the children had their own television and nearly three-fourths their own mobile device. The most popular device was a tablet, owned by two-thirds of 4-year-olds. Child ownership of mobile devices was not associated with child gender, ethnicity, or parent education.

Age at First Use of Mobile Media Devices

Overall, 338 children (96.6%) had used a mobile device, and 12 (3.4%) had never used. The age of first use decreased with each successive age cohort (Table 3). Children's use of mobile devices under the age of 1 was not associated with child gender, ethnicity, or parent education.

Circumstances in Which Parents Let Their Children Use Mobile Media Device

Most parents let their children play with mobile devices (often or sometimes) to do chores (70%, 229/327), keep the child calm in public places (65%, 213/327), or run errands (58%, 190/327). One-quarter of parents (28%, 92/327) used a mobile device to put their child to sleep.

Frequency of Media Use

Most children watched television on a daily basis, regardless of age (Fig 1). Nearly half (43.5%) of children <1 year old used a mobile device on a daily basis to play games, watch a video, or use apps; the percentage increased to 76.6% in 2-year-olds and plateaued thereafter. The frequency of daily use of mobile devices significantly increased with age ($P < .001$) but was not associated with child's gender, ethnicity, or parent education.

Daily Screen Time

On average, children spent 45 minutes a day watching television,

TABLE 1 Demographics of Study Population

Child Age ($n = 348$)	n	%
<1 y	51	14.7
1 y	85	24.4
2 y	68	19.5
3 y	72	20.7
4 y	72	20.7
Gender ($n = 347$)		
Female	180	51.9
Male	167	48.1
Ethnicity ($n = 348$)		
African American	259	74.4
Hispanic or Latino	48	13.8
Other	23	6.6
Asian	13	3.7
White	5	1.4
Parent education ($n = 326$)		
Less than high school	41	12.6
High school graduate	129	39.6
Some college	93	28.5
College graduate	43	13.2
Graduate school	20	6.1

TABLE 2 Children's Ownership of Media Platforms by Age Cohort

Media Platform	Overall (n = 348), %	< 1 y (n = 51), %	1 y (n = 85), %	2 y (n = 68), %	3 y (n = 72), %	4 y (n = 72), %
Television	32.8	23.5	23.5	23.5	43.1	48.6
Mobile media device						
Tablet	36.2	9.8	20.0	27.9	54.2	63.9
Smartphone	5.5	3.9	5.9	4.4	5.6	6.9
iPod	2.6	0.0	0.0	1.5	6.9	4.2
Video game console	11.5	3.9	3.5	8.8	19.4	20.8
Computer	5.7	3.9	0.0	5.9	5.6	13.9

27 minutes watching television shows or videos on a mobile device, 22 minutes using apps on a mobile device, and 15 minutes playing games on a video console. Television screen time remained constant across all age groups, but mobile device screen time increased with age (Fig 2).

Applications

Half of the parents (52%) downloaded apps on their mobile devices, and of these, half downloaded 5 to 10 apps and half downloaded >10. Parents indicated that half or more of the apps had been downloaded for their child's use. Educational, entertainment, and content delivery apps were popular across all age groups (Fig 3). YouTube, a content delivery application, was popular among children <1 through 2 years of age. Use of Netflix, another content delivery application with a paid subscription, was first reported for 2-year-olds, with increasing use through age 4.

Child Ability With Mobile Media Device

One-quarter (28.2%) of 2-year-olds did not need any help navigating a mobile media device, and 60.9% needed help sometimes (Table 4). Almost half (42.9%) of 4-year-olds

never needed help. Half of 4-year-olds liked to use multiple media platforms (ie, television and a tablet) at the same time (28.6% sometimes, 21.4% most of the time).

DISCUSSION

This study describes the patterns of very early and nearly universal adoption of mobile media devices among children 0 to 4 years of age in an urban, low-income, minority community. Most children had access to mobile devices in their household, and by age 4, 3 out of 4 children had their own mobile device. At age 2, most children were using mobile devices on a daily basis and spending comparable screen time on television and the mobile device. Educational and entertainment apps were popular, in addition to content delivery sites such as YouTube and Netflix. Most 3- and 4-year-olds were able to use mobile devices without help, and 1 in 3 were media multitasking. Child ownership of a mobile device, use before age 1, and daily use of the device were not associated with the child's gender, ethnicity, or parental education.

Our study found that household ownership of tablets doubled since 2013,³ reflecting the pervasive nature

of digital technology. Moreover, we found that most children had their own tablet by age 4, a remarkable uptake of technology considering that in 2013, nationwide, ownership of mobile devices among children aged 0 to 8 years was in the single digits.⁶ By age 2, 3 out of 4 children were using mobile devices on a daily basis, quadruple the 17% rate reported in 2013 by Common Sense Media.³ We also found that daily screen time for television had decreased and mobile screen time had quadrupled compared with 2013.³ In a recent Miner & Company⁷ survey, children aged 2 to 12 years preferred to watch videos on a mobile device rather than on television. Increased ownership and patterns of use strongly suggest that mobile devices, more specifically tablets, are displacing television as major sources of media consumption for young children.⁷

Most children started using mobile devices in their first year of life, and use was enabled by parents who gave children a device to use and to keep. Three out of four parents gave children a mobile device when doing chores and to keep them calm; 1 out of 4 to put children to sleep, twice the rates reported in a 2013 Northwestern University national survey.⁶ The Northwestern and Miner studies also found that parents gave or took away mobile devices to reward or punish their child's behavior.^{6,7} This suggests that mobile devices are used as "digital pacifiers" to placate or distract children or as means to manage children's behavior. Alternative explanations include parents' desire to educate their child or have their child communicate with someone or engage in play.^{7,8} In the Northwestern study, although parents used media as a tool for managing daily life, most parents (70%) did not think the devices made parenting easier.⁶

Child ownership of a mobile device implies ready access and use on demand. Child ability to navigate the device also implies independent use

TABLE 3 Age at First Use of Mobile Media Device by Age Cohort, N = 348

Age at First Use	<1 y (n = 51), %	1 y (n = 85), %	2 y (n = 68), %	3 y (n = 72), %	4 y (n = 72), %
<1 y	92.2	69.4	50.0	48.6	40.3
1 y	0.0	28.2	41.2	31.9	20.8
2 y	0.0	0.0	7.4	15.3	23.6
3 y	0.0	0.0	0.0	2.8	12.5
4 y	0.0	0.0	0.0	0.0	0.0
Never used	7.8	2.4	1.5	1.4	2.8

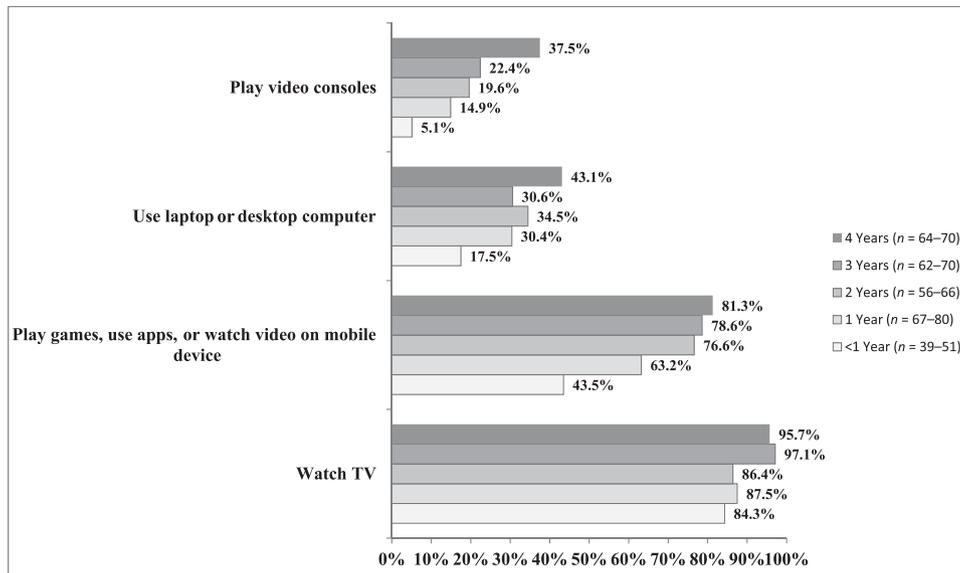


FIGURE 1
Percentage of children engaging in daily media use by activity and age cohort.

and exploration. Little is known about how children's independent activity on mobile devices affects their cognitive, social, and emotional development. What is known is that parental "joint media engagement" is an important way to enhance the impact of educational media.^{2,4,8,9} In a Cooney Center nationwide 2013 survey, parent engagement accounted for a third of the time 2- to 4-year-olds spent with mobile devices.⁸ Common reasons for parent engagement were to protect the child from inappropriate content and to spend time with the child.⁸ In a recent qualitative study,

parents of young children expressed ambivalence about the effects of mobile media exposure on their child and their own ability to set limits.¹⁰ Parents are seeking anticipatory guidance on the use of media for their children, and additional research is needed to develop recommendations in this area.^{8,10}

Our study also found that 1 in 3 children used several media devices at the same time. Media multitasking is a well-known behavior of youth, but our study is the first, to our knowledge, to describe it in children aged ≤ 4 years.

In youth and adults, media multitasking has been associated with task inefficiency, lapses in attentiveness, and safety hazards.¹¹ Media educational experts have called for the development of methods that more accurately replicate real-life multitasking to assess its impact on attention span, distractibility, time management, and social interaction.¹² Media multitasking is pervasive, both in school and at home, and additional research is needed to evaluate its impact on child development and ways to approach it constructively.^{11,12}

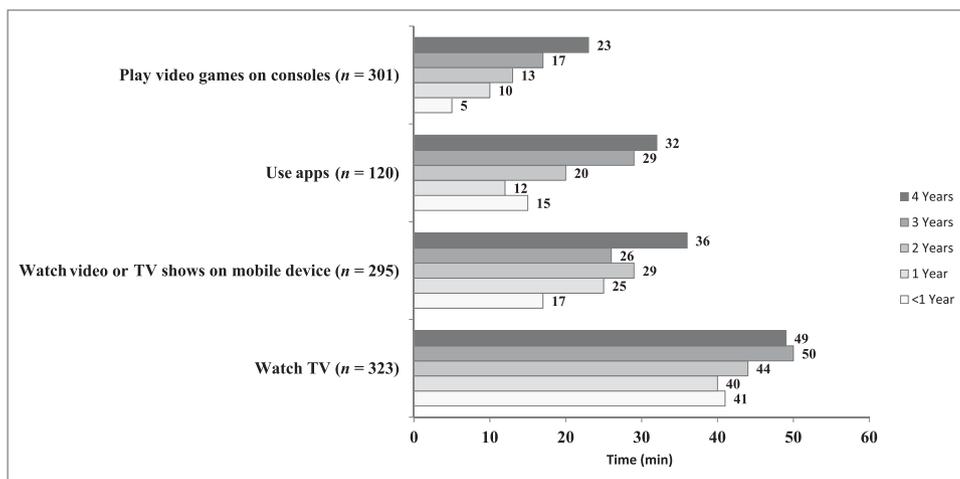


FIGURE 2
Daily media screen time in minutes by activity and age cohort.

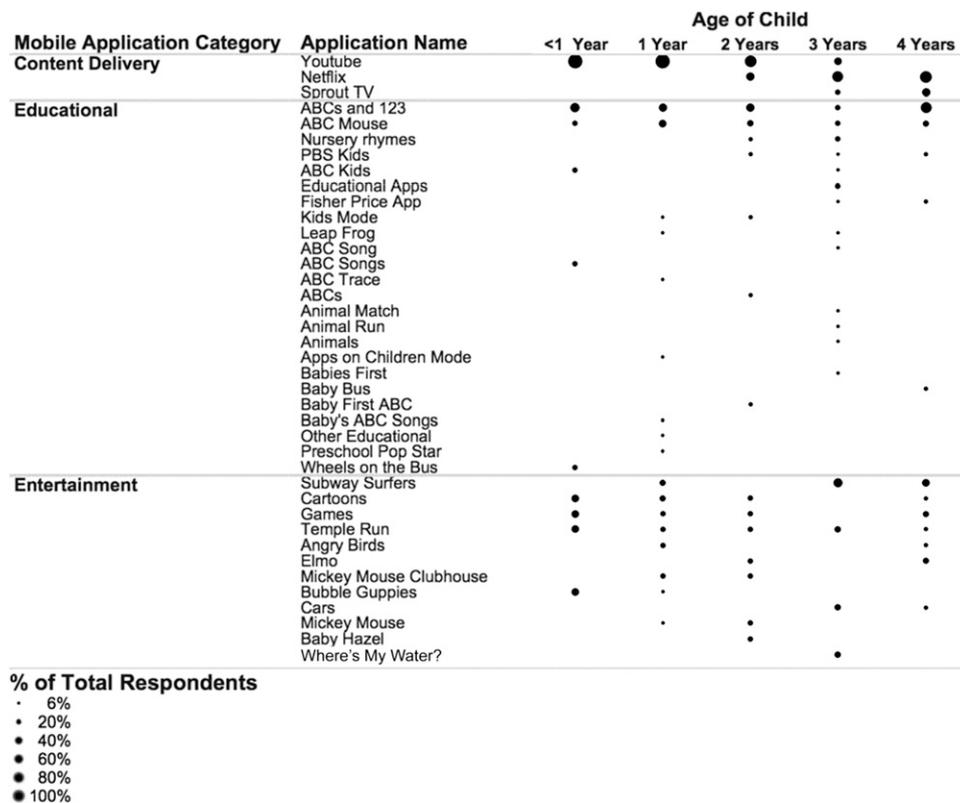


FIGURE 3 Children's Favorite Applications by Category and Age Cohort, *N* = 343.

Compared with 2013 nationwide surveys, our study found significantly increased access to mobile devices in this low-income community,^{3,6} documenting a rapid decline of the digital divide. Possible contributing factors are decreasing costs, marketing strategies, and subsidies by cellular service providers. The increase in mobile device ownership may provide opportunities to enhance school readiness and address educational

inequality for young children in low-income communities, such as this one. However, experts have voiced concerns about persistent ethnic and socioeconomic disparities in access to high-quality digital technology.^{8,11} The Cooney survey found that most parents would like expert guidance on media content quality, and low-income and minority parents were even more likely to express this need.⁸ Independent reviews can help

identify high-quality streaming content and apps, a major challenge considering the >80 000 “educational” apps for young children and the hundreds of thousands of titles available for streaming content.¹³ An additional challenge is how to disseminate this information to parents, educators, and health care providers.^{8,11}

This study has several limitations. We studied children’s use of media in an urban, low-income, minority population, and findings may not be generalizable. The Common Sense survey instrument has been used by subsequent studies⁶ and is presumed to have face validity, but data have not been published on its validity and reliability. The parent survey was self-administered and subject to recall and social desirability bias. Time and frequency estimates from parents may not be reliable; however, the question on screen time focused on “yesterday” in an effort to increase

TABLE 4 Children's Ability With Mobile Media Device by Age Cohort, *N* = 336

	<1 y (<i>n</i> = 51), %	1 y (<i>n</i> = 81), %	2 y (<i>n</i> = 64), %	3 y (<i>n</i> = 70), %	4 y (<i>n</i> = 70), %
Does your child need any help to navigate mobile device?					
Never	27.5	14.8	28.2	34.3	42.9
Sometimes	21.5	49.4	60.9	55.7	50.0
Always	51.0	35.8	10.9	10.0	7.1
How often does your child like to use multiple media devices at the same time?					
Never	69.3	62.6	57.5	48.6	50.0
Sometimes	28.8	21.7	25.8	30.0	28.6
Always	1.9	15.7	16.7	21.4	21.4

reliability. The strengths of this study are its large sample size and homogeneous population. The classification of apps was based on the description from the app developer and not by an independent reviewer.

CONCLUSIONS

Our study found early and almost universal exposure and early adoption of mobile media devices among young children in an urban, low-income, minority community. Our findings do not address the impact mobile media devices have on children and their families; they

simply describe the pervasive nature of digital exposure and the patterns of use. These findings can be used as a catalyst for additional discovery on the impact of mobile media in young children and their families. Access to, familiarity with, and skill using mobile devices are a first step in achieving digital literacy. However, socialization with parental engagement and modeling are critical for the development of healthy and productive ways to integrate digital technology into family life.^{11,14} Future studies are needed to guide the development of recommendations for both health care providers and families on the

use of mobile media by young children.

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ABBREVIATION

app: application

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