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# Mobile Media Device Use is Associated with Expressive Language Delay in 18-Month-Old Children

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**ABSTRACT:** *Objective:* The objective was to examine the association between mobile media device use and communication delays in 18-month-old children. *Methods:* A cross-sectional study was conducted from September 2011 and December 2015 within the TARGet Kids! primary care research network. Children were included if parents reported their child's mobile media device use and completed a validated questionnaire for communication delay at the 18-month well child visit. Mobile media device use was measured using a parent-reported survey instrument. Daily mobile media device use was calculated as a weighted average of typical weekday and weekend day mobile media device use. Two communication outcomes were investigated: (1) expressive speech delay and (2) other communication delays, as measured by the Infant Toddler Checklist. *Results:* The study sample included 893 children (mean age 18.7 months, 54.1% male). Most parents reported 0 minutes per day of mobile media device use in their children (n = 693, 77.6%). Among children whose parents reported any mobile media device use (n = 200, 22.4%), the median daily mobile media device use was 15.7 minutes (range 1.4–300). The prevalence of parent-reported expressive speech delay was 6.6%, and the prevalence of other parent-reported communication delays was 8.8%. For children who used a mobile media device, each additional 30-minute increase in daily mobile media device use was associated with increased odds of parent-reported expressive speech delay (OR<sub>a</sub> = 2.33, 95% confidence interval, 1.25–4.82). No relationship was observed between mobile media device use and other parent-reported communication delays. *Conclusion:* Our study demonstrated a significant association between mobile media device use and parent-reported expressive speech delay in 18-month-old children.

(*J Dev Behav Pediatr* 40:99–104, 2019) **Index terms:** communication delay, mobile media device use, children.

Increased television viewing is associated with language delays in early childhood.<sup>1</sup>

One of the mechanisms explaining this relationship is that television viewing is believed to reduce opportuni-

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ties for parent-child interaction and play, which is critical for early language development.<sup>2</sup> Audible television has been associated with significant reductions in observed parental word count and conversational turns in children aged 2 to 48 months.<sup>1</sup> Increasingly, screen time is not limited to televisions but widely accessible in the form of mobile media devices such as smartphones and tablets. A US national study in 2017 revealed that on average, 46% of children under the age of 2 years had used a mobile media device at least once.<sup>3</sup> In a US low-income urban population of 350 children, nearly half (43.5%) of the children aged <1 year used mobile media devices on a daily basis, and more than 30% of children owned a mobile media device at the age of 2 years.<sup>4</sup>

Unlike traditional screen time, mobile media devices offer the opportunity to interact with the interface. This interaction could potentially have a different influence on child communication outcomes. Although there is only sparse literature available that examines this relationship, preliminary studies have demonstrated that specific educational applications (“apps”) can promote early literacy skills in preschool children (3-year-olds) and vocabulary learning in school children (5–7-year-olds).<sup>5</sup> In addition,

some studies suggest that electronic books (e-books) could promote early literacy skills, although other studies have demonstrated that the electronic enhancements in electronic books can also distract children from learning.<sup>6,7</sup> One small cross-sectional study (n = 36) demonstrated that toddlers (24–30 months) were able to learn novel verbs from video chat conversations, yet most of the commercially available apps lack the unpredictability available in live video chat<sup>8</sup>

The recent policy statement by the American Academy of Pediatrics “Media and Young Minds” recommended to discourage screen media in children younger than 18 months (except video chatting) and to avoid solo media use in children aged 18 to 24 months.<sup>9</sup> Recommendations regarding the duration of screen time are among the top ten unanswered research priorities for preventative child health according to parents and clinicians.<sup>10</sup> Parents are concerned that their children will miss out on educational opportunities if their children are not permitted to use mobile media technology.<sup>11</sup> However, many parents are also worried about their own mobile device use in front of their children and acknowledge their mobile media device use as a source of distraction.<sup>12</sup> Studies examining the relationship between mobile media device use and developmental outcomes including communication outcomes in young children are lacking. The objective of our study was to examine the association between mobile media device use and communication delays in 18-month-old children.

## METHODS

### Study Design and Sample Population

A cross-sectional design was used for this study. Data were collected between September 2011 and December 2015 during scheduled 18-month health supervision visits from primary care practices participating in a community-based primary care research network in the Greater Toronto Area; the Applied Research Group for Kids! (TARGet Kids! [www.targetkids.ca](http://www.targetkids.ca)).<sup>13</sup> The study protocol, population characteristics, and recruitment procedures have been previously described.<sup>13</sup> Standardized questionnaires were completed by parents and collected by research assistants. A validated screening questionnaire assessing the child’s communication skills, the Infant Toddler Checklist (ITC), was completed by parents at the 18-month visit. Children were included if they had complete data on parent-reported daily mobile media device use and a completed ITC. Infants with a known diagnosis of autism spectrum disorder or severe developmental delay, chronic conditions (with the exception of asthma), and whose parents were not English speaking were excluded. All data were entered, stored, and accessed in Medidata RAVE. This study was approved by the Research Ethics Boards of from the Hospital for Sick Children and St. Michael’s Hospital.

### Measures

#### Exposure: Mobile Media Device Use

Mobile media device use was measured using a standardized survey instrument developed for TARGet Kids!

based on the Canadian Community Health Survey.<sup>14</sup> Parents were asked to provide the number of minutes their child typically spent awake, “playing with handheld devices (e.g., iPhones, iPads, Tablets, Nintendo DS).”<sup>14</sup> Daily mobile media device use was calculated as a weighted average of typical weekday and weekend day mobile media device use.

#### Outcome: Communication Delays

We examined 2 communication outcomes: (1) expressive speech delay and (2) other communication delays, as measured by the ITC. The ITC is a 24-item parent-reported questionnaire that measures early communication and symbolic skills in young children and was designed as a broadband screener for identifying children with early communication delays.<sup>15</sup> The ITC is a standardized questionnaire, with normative scores at monthly intervals for children aged 6 to 24 months, and has high reliability and validity.<sup>16</sup> Completion of the ITC produces a score for social (emotion and eye gaze, communication, and use of gestures), symbolic (understanding and object use), and speech composites (sounds and words), as well as a total score. Each of the 4 scores were dichotomized as “concern” or “no concern” using the 10th percentile set cutoffs identified by the developers.<sup>16</sup> A score below the 10th percentile for the speech composite indicated a concern for expressive speech delay; for children scoring below the 10th percentile, it is recommended that the child should be carefully monitored and the ITC should be readministered in 3 months. Scores below the 10th percentile in the social composite, symbolic composite, or total score indicate a concern for other communication delays, and it is recommended that the child should be referred for further evaluation.<sup>16</sup>

#### Covariates and Demographic Variables

A literature search was conducted a priori to identify potential confounders in the relationship between mobile media device use and communication outcomes. Given the limited literature on mobile media device use in relation to young children, studies on television screen time were also reviewed. Covariates included sex,<sup>17</sup> temperament,<sup>18,19</sup> non-mobile media use,<sup>1</sup> parent mobile media device use,<sup>20,21</sup> household income,<sup>22</sup> and parent education.<sup>22</sup>

Sociodemographic indicators, non-mobile media use, and parent mobile media device use were collected using the same standardized survey instrument described above. The duration of “non-mobile media use” was an aggregate of the number of minutes the child spent awake in a room with “(1) The television on; (2) Videos or DVDs on; (3) Playing the computer; and (4) Playing video game consoles (e.g., Playstation, Xbox, Nintendo Wii).” Parents were similarly asked as to how much time they used mobile media devices on a typical week- and weekend day. Temperament was assessed using the very short form of the Infant Behavior Questionnaire (for infants aged 3–12 months)<sup>23</sup> and the very short form of the Early Childhood Behavior Questionnaire (for infants aged 13–36 months).<sup>24</sup> We chose the temperament

questionnaire that was completed closest to the date when the ITC was completed. Both questionnaires evaluated 3 temperament domains: surgency/extraversion, negative affectivity, and effortful control.

## Analysis

Descriptive statistics for baseline characteristics are presented as mean values and SDs for continuous data, median and range for nonparametric distributed data, and counts and percentages for categorical data. To examine the relationship between the use of mobile media devices and expressive speech and other communication delays, logistic regression models were used. For subjects whose ITC items were missing, only those who produced a score for at least one of the outcomes were included. Three models were assessed: an unadjusted model; a minimally adjusted model that adjusted for child sex, maternal education, and family income; and a fully adjusted model. In the fully adjusted model, we also adjusted for child temperament (surgency/extraversion, negative affectivity, and effortful control), non-mobile media use, and parent mobile media device use. Mobile media device use was parameterized as follows: (1) a binary variable describing whether the child did not use mobile media devices (nonusers) versus users and (2) a continuous variable denoting the number of minutes of mobile media device use. This allowed us to assess the relationship between the outcome of interest and any additional minutes of mobile media device use among users. Bootstrapping with 1000 replications was used to obtain average effect estimates and 95% confidence intervals. This method was chosen to be more robust against influential outliers and skewed data. We tested for interactions between mobile media device use and sex, household income, maternal education, the 3 temperament domains (surgency/extraversion, negative affectivity, and effortful control), and participation year. To test for multicollinearity, variance inflation factors were examined. Missing confounding values were imputed using the multiple imputation (MICE) package in R. All analyses were performed in R version 3.3.0.

## RESULTS

Our study population included 893 children (mean age 18.7 months, 54.1% male). Baseline characteristics are presented in Table 1 (Supplemental Digital Content 1, <http://links.lww.com/JDBP/A198>). Most parents reported “0” minutes of mobile media device use in their children ( $n = 693$ , 77.6%). Among children who used mobile media devices ( $n = 200$ , 22.4%), the median daily mobile media device use was 15.71 minutes (range 1.43–300). Children who used mobile media devices had more minutes of daily non-mobile media device use (median of 44.3 minutes versus 30.7 minutes), and their parents had a higher median daily mobile media device use (30 minutes vs. 0 minutes). Figure 1 illustrates the distribution of daily mobile media device use in the

children who used mobile media devices. The proportion of mobile media device users increased from 2011/2012 through to 2015 (Fig. 2). The prevalence of parent-reported expressive speech delay according to the Infant Toddler Checklist was 6.6%, and the prevalence of other parent-reported communication delays was 8.8%.

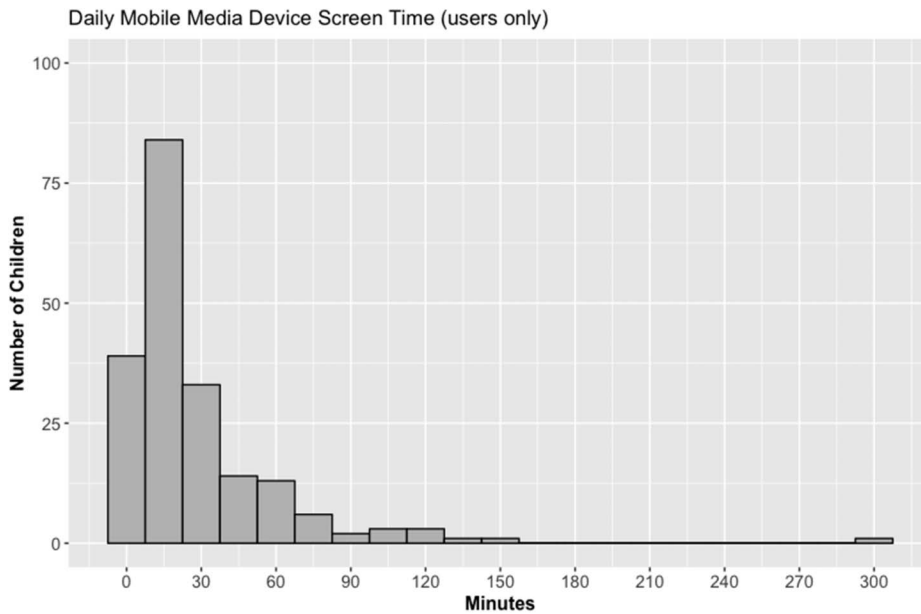
## Mobile Media Device Use and Communication Delays

In all models—unadjusted, minimally, and fully adjusted models—we found a significant association between mobile media device use and expressive speech delay among mobile device users (Table 2, Supplemental Digital Content 1, <http://links.lww.com/JDBP/A198>). In the fully adjusted model, each additional 30-minute increase in mobile media device use was associated with increased odds of parent-reported expressive speech delay ( $OR_a = 2.33$ ; 95% confidence interval [CI], 1.25–4.82). No association was observed between mobile media device use and other parent-reported communication delays in all models, including the fully adjusted model ( $OR_a = 1.01$ ; 95% CI, 0.33–2.49). Variance inflation factors ranged from 1.1 to 1.9, which suggested a lack of collinearity among covariates. Interaction terms were nonsignificant for sex, household income, maternal education, the 3 temperament domains, and participation year (data available on request).

## DISCUSSION

Our study demonstrated that in 18-month-old children, an increase in 30 minutes per day in mobile media device use was associated with a 2.3 times increased risk of parent-reported expressive speech delay but not an increased risk of other parent-reported communication delays. Almost a quarter (22.4%) of the 18-month-old children used mobile media devices on a daily basis, with a median duration of 15.7 minutes per day. Our findings address a gap in the literature on mobile media device use in 18-month-old children and its association with communication delays.

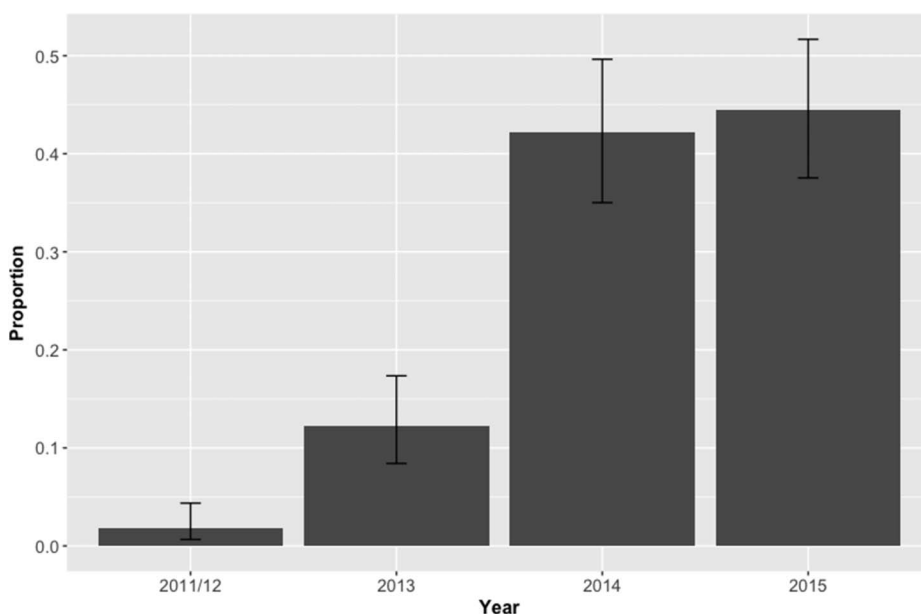
Our results align with previous studies reporting language delays in children in association with increased television screen time.<sup>1,25</sup> Mobile media devices may be used as a passive video screen in very young children, and children younger than 30 months may not be able to learn language from screen exposure.<sup>26</sup> Evidence from memory research demonstrated that infants have difficulty applying what they learn across different contexts; they do not transfer learning from media and they do from face-to-face interactions.<sup>27</sup> Another proposed mechanism to explain the increased risk of expressive speech delay with increased television time is the lower exposure to verbal stimulation and play-based interaction with caregivers.<sup>1,28</sup> Christakis et al.<sup>1</sup> described that with each hour of audible television, there were significant reductions in age-adjusted vocalizations, conversational turns, and adult word count. “Audible” mobile media device content could have the same effects as television on both child



**Figure 1.** Distribution of daily mobile media device use in children who were reported to use mobile media devices (n = 200).

and parents. Previous studies demonstrated that children’s non-mobile media use reflects their parents’ non-mobile media use, and emerging evidence draws the same conclusion for mobile media device use.<sup>12</sup> We explored the impact of the covariates in the fully adjusted model to gain a better understanding of the change in model estimates and identified that parent mobile use had the largest impact on estimate change (results available on request). Parents’ mobile media device use during parent-child interactions makes them both verbally and nonverbally less responsive to their children.<sup>12</sup> Parents’ time spent on mobile media devices may also reduce meaningful parent-child interactions.<sup>12</sup> An alternative explanation for the

association between mobile media device use and expressive speech delay could be that parents of children with expressive language delays may be allowing more mobile media device use and “educational apps” in the hope that they will be able to learn from these devices.<sup>11</sup> In a qualitative study of Radesky et al.,<sup>11</sup> caregivers with low-income believed that their child could learn better from educational apps than from toys because children are motivated to use them. At last, emerging evidence demonstrated an association between mobile media device use in toddlers and reduced sleep, which also could be related to poorer child development outcomes.<sup>29</sup>



**Figure 2.** Proportion of handheld device users by year.

This study did not identify an association between mobile media device use and other communication delays, including social and symbolic communication. Although the relationship between increased exposure to television and social-emotional delays has been described in young children,<sup>9</sup> this relationship has not been investigated for exposure to mobile media device use specifically. A recent cross-sectional study described the association between parent-reported social-emotional problems in young children and the increased use of mobile media devices to calm them during daily routines.<sup>30</sup> Longitudinal studies are needed to investigate the possibility of a bidirectional relationship between the use of mobile media and social-emotional development.<sup>29</sup> The use of social and symbolic communication, including the use of gestures, predicts children's vocabulary skills at the age of 4 years.<sup>31</sup> It is possible that the association between mobile media device use and expressive language could only be apparent in a specific age range. Although there are no longitudinal data available that examine mobile media device use and language delays, a previous study by Zimmerman et al.<sup>25</sup> demonstrated a significant association between DVD/video exposure and language delays in 6-to-8-month-old children, but this association did not persist by age 17 to 24 months.

The strengths of this study include the large sample size from a diverse multiethnic population, which may improve the generalizability of our results. Importantly, we adjusted for potential confounders previously described in the literature such as non-mobile media use by the child, parents' mobile media device use, and child temperament.<sup>9</sup> The adjustment for non-mobile media use by the child and parents' mobile media device use strengthened the association between mobile media device use and expressive speech delay. Child temperament may affect communication outcomes. Infants with more positive affect have reported better expressive language development.<sup>17,19</sup> Temperament might also influence mobile media device use; infants with lower self-regulation had increased media viewing at the age of 2 years.<sup>18</sup>

One of the main limitations of our study is that we were unable to identify the content of the mobile media device, the types of activities children were in engaging in when they used their mobile media devices, and/or parents' and caregivers' interaction with their children during this time. By asking parents about the amount of time their children "played" on a mobile media device, we could have underestimated our prevalence of any mobile media device "use" (e.g., passively watching videos on a mobile media device might not have been included in parents' answer). In the recent policy statement by the American Academy of Pediatrics, families who want to introduce digital media are advised to use digital media together with their child and to choose high-quality applications.<sup>9</sup> This information may be useful in developing effective mobile media interventions

for families. Our results need to be interpreted with caution; causal associations cannot be inferred due to the cross-sectional nature of the design. There were fairly wide confidence intervals around the associations, indicating imprecision in the estimates. Outcomes were also based on a validated parent-reported screening tool for communication delay, however, not on a definitive diagnosis of expressive speech delay. Parent-reported measures may be subject to recall or social desirability bias, particularly around screen media exposure. The TARGet Kids! cohort predominantly comprised relatively high-income families, and these findings may not be the same in low-income populations. In addition, our ethics board did not approve of collecting demographic information from parents who refused to participate in TARGet Kids!, so selection bias cannot be ruled out.

## CONCLUSIONS

Our study demonstrated a significant association between mobile media device use and parent-reported expressive speech delay in young children. To further explore mechanisms to explain the association between mobile media device use and expressive speech delay, future studies examining the use of mobile media devices in young children should include the type and content of activities young children are engaging in and the time spent together with parents on mobile media devices and longer-term definitive communication outcomes in early childhood.

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