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Touchscreen Device Usage in Infants and Toddlers and its Correlations with Cognitive Development

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Abstract

Background: The 2011 AAP policy (which predated the rising use of “new media” such as smart phones and tablets) discouraged the use of electronic media by children younger than age 2 citing potential adverse developmental effects and lack of evidence of educational benefit. The new 2013 AAP policy recognizes “important positive and pro-social effects of media use” but does not address children ages 0-3. The relationship between touchscreen device usage (TDU) and cognitive development of children younger than 3 years has yet to be studied.

Objectives: 1) To assess touchscreen device usage in infants and toddlers. 2) To identify association between TDU and cognitive development.

Design/methods: A questionnaire was given to parents of high-risk infants and toddlers to assess touchscreen device usage. Results were paired to the child's Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale (CAT/CLAMS) development quotient (DQ) scores. Bivariate associations were examined using a two-sample t-test.

Results: Of 65 families, 63 (97%) reported owning a touchscreen device (TSD). Of these, 44 (70%) reported TDU by a child of age <3 years. The mean chronological age of children who did and did not use a TSD was significantly different (17.4 ± 9.2 months vs. 9.4 ± 5.9 months, $p < 0.001$). Mean age at initial TDU was 11.2 ± 7.6 months, and daily TDU ranged from 1-240 minutes with a median of 17.5 minutes. The most common forms of TDU reported were: watching children's “educational shows” (30%), using educational applications (26%), and pressing buttons on the screen aimlessly (28%). 60% of parents selected “educational benefits” of TDU as a reason for child TDU. 57% believed “other children” have higher TDU. There was no significant difference in CAT/CLAMS DQs between children with and without TDU (CAT 99.6 ± 19.5 vs. 103.4 ± 19.8 ; CLAMS 104.0 ± 24.0 vs. 113.5 ± 26.2). Children who played “non-educational games”

during TDU had lower CLAMS DQs than those who did not (86.5 ± 34.2 vs. 106.7 ± 21.4 ; $p \leq 0.054$).

Conclusion: The majority of the families in this study allowed their children to use touch screen devices with a mean age of initial play below a year of age. Although the majority of surveyed parents reported they believed TDU had educational benefits, developmental scores showed no significant difference between children with and without TDU. Children who played non-educational games had lower receptive and expressive language scores compared to children who engaged in other types of TDU. Although our results do not imply a causal relationship, parents should be encouraged to restrict TDU for children under the age of three as no educational benefits were noted.

Keywords: Toddlers; Touch screen device usage

Introduction

Preceding the introduction of touchscreen devices, television was a major source of electronic media for children below the age of three years [1,2]. The American Academy of Pediatrics (AAP) stated that the potential negative effects of electronic media consumption outweigh any benefits and discourages television viewing for children under the age of two years [3]. The advent of touchscreen devices has introduced another form of electronic media that young children are exposed to. In 2013, the AAP expressed its concern about the potential harmful effects of messages and images consumed through what it calls “new media,” including cell phones and iPads. Yet, it also acknowledged that the usage of “new media” may have positive and prosocial effects [4,5]. However, the AAP focuses its discussion of touchscreen device usage on adolescents, and specifically does not address infants and toddlers.

The AAP's discussion of electronic media distinguishes between “foreground media” and “background media.” Foreground media refers to age-appropriate content which children actively pay attention to and can comprehend to a

certain extent [3-6]. There is research that shows certain television programs had educational benefits, specifically improved social skills, language skills, and school readiness in children above two years of age [7]. However, this is not the case for children younger than two years. Several studies have found no evidence of the educational benefit of television media in this age group [8-10]. Television viewing has even been shown to be detrimental for language development [11-15].

Furthermore, it has been shown that children learn less from television programs than real-life experiences. For example, 2-year olds who watch a live video of an adult placing an appealing toy in the room next-door are unable to find it when encouraged to search for it immediately afterward [16]. Another study found that 12 to 18-month old children learned more words when taught by parents through everyday interactions than by watching videos, either with or without parental interaction [17].

Like certain television programs, some applications available on touchscreen devices either imply or explicitly state their educational benefits for young children. Although it is tempting to judge touchscreen devices based on studies of television, the effect of exposure to smartphones and tablets are still unclear. These devices have the added benefit of touchscreen technology, which allows infants to interact with the content they see on the screen. This increased degree of interactivity may mean that children are more mentally active when using touchscreen devices. In contrast, viewing television involves simply consuming media with few opportunities for interaction. Therefore, "foreground" touchscreen device usage may be more beneficial for infant mental development than foreground television.

Although there is less research concerning background television, several studies indicate it is detrimental to infant development [18-21]. Background television refers to age-inappropriate content to which children generally do not pay attention [5,6]. The detrimental effect of background consumption has been associated with a lower quality of play, which has been shown to be harmful to cognitive development [6,19]. It is also thought that background television causes decreased parental attention, which in turn also has a negative effect on development [20,21].

Past research has shown that parental interaction is important for proper development in children because it increases the complexity of play [20]. Unfortunately, studies have shown that some parents avoid co-viewing television with their children because this allows them time to do other things [3]. In addition, television viewing by parents diverts attention away from their children [6,20-23]. As a result of these two factors, television viewing is likely detrimental to infant development. However, these results may or may not apply to touchscreen devices. It is possible that touchscreen devices draw away the attention of parents, just as television viewing does. Due to the existence of multiplayer applications, it is quite possible for more than one person to interact with the device at one time, increasing the likelihood of parental co-viewing. However, other factors such as the smaller screen

size may discourage parental co-viewing. As a result of these novel variables, the prevalence and effect of "background" touchscreen device usage is still unclear.

Ever since the introduction of the first Apple iPhone in 2007, touchscreen media has become increasingly pervasive. Several companies are producing smartphones and tablets that utilize the touchscreen technology. Therefore, the effect of touchscreen device usage on the mental development of infants and young children must be investigated. Currently, there is a dearth of research that addresses the effect of the novel touchscreen technology on children. As a result, further research is required to better understand the effect of touchscreen device usage in infants and toddlers. The purposes of this study are twofold: (a) to assess the prevalence of smartphone and tablet usage in children between 0 to 3 years of age, and (b) to determine the relationship between smartphone and tablet usage and infant development.

Methods

Area of study

This study is carried out in outpatient of sub centre of a rural hospital of Medinipur district, some girls are school dropout and some are regular school goers, study group girls are 10-19 years old, 100 girls in each group, Anthropometry are used to take measurement of height (anthropometre rod) weight (weighing machine), harpendent to take skinfold measurement.

Measurements

Usage of touchscreen devices: First, participants were asked to report whether there are smartphones or tablets in their household and to identify these devices. Then, participants reported whether their child used any of these devices. Respondents that answered "yes" to both questions were asked to continue on with the section while those that answered "no" were asked to move on to the next section.

For children who did use touchscreen devices, the age in years and months at which the child first started using touchscreen devices was obtained. Parents quantified the amount of hours and minutes per day that their children used touchscreen devices, designated as "foreground" touchscreen device usage.

Parents were asked whether their children engaged in the following activities while using touchscreen devices: (1) using educational applications; (2) reading children's books on the device; (3) watching educational children's movies and videos such as Little Einsteins; (4) watching YouTube videos and others movies or shows; (5) playing non-educational games; (6) pressing buttons on the screen aimlessly and (7) Other. Parents that responded with "Other" were asked to elaborate. In the following question, parents indicated which of the aforementioned activities their child used touchscreen devices for most often. It is important to note that the classification of "educational applications" is purely a label. The educational

value of electronic media is not proven in children of ages 0-3 [1]. In order to assess other electronic media usage, parents were asked to quantify the hours and minutes of television that their child watches daily.

Parent perceptions: Parents were asked to select any of the following statements that accurately represent their reason for allowing their children to use touchscreen devices: (1) It is educational and/or is good for my child's brain; (2) It is something my child really enjoys doing; (3) It prevents my child from getting bored; (4) It allows my child to relax; (5) It keeps my child occupied so I can do other things (6) It allows my child to spend more time with his/her sibling(s); (7) Other. Respondents that selected "Other" were asked to elaborate. Parents were asked to select one of the aforementioned reasons as their most important reason for letting their child use touchscreen devices. Parents were also asked whether they believed other children of similar age as their child used touchscreen devices more or less than their child.

Cognitive and language ability comparison: A chart review was conducted to obtain Cognitive Adaptive Test/Clinical Linguistic and Auditory Milestone Scale (CAT/CLAMS) Developmental Quotient (DQ) scores in order to ascertain early cognitive development. The CAT/CLAMS was selected to be the measurement tool due to its ease of administration and established use by developmental pediatricians within the Division of Developmental and Behavioral Pediatrics [24]. Several studies have confirmed the utility of the CAT/CLAMS in comparing language and non-language problem solving abilities, as well as detecting and quantifying cognitive impairment [25-28].

Statistical Analysis

Descriptive statistics were calculated and continuous variables were reported as mean \pm standard deviation and median. Categorical variables were reported as a frequency (percent). Comparisons made between two groups for Final CAT DQ scores and Final CLAMS DQ scores were analyzed using a two sample t-test. The association between a variable with 3 or more categories and continuous variables were analyzed using the Kruskal-Wallis test and was reported as median (25th percentile, 75th percentile). Spearman correlation coefficients were used to assess the relationship between continuous variables on the survey. These include hours of television viewing and hours of touchscreen device usage. A result was considered statistically significant at the $p < 0.055$ level of significance. All analyses were performed using SAS version 9.3 (SAS Institute Inc., Cary, NC).

Results

Touchscreen prevalence and usage

Of 65 families, 63 (97%) reported owning a touchscreen device. Of these, 36 (57%) own an Apple iPad, 41 (65%) own an Apple iPhone, 29 (46%) own an Android smartphone, 11 (17%) own an Android tablet, and 10 (16%) own some other tablet or smartphone. Of the 63 families that reported owning

a touchscreen device, 44 (70%) reported TDU by a child younger than 3 years of age? The mean age at which children started using touchscreen devices was 11.2 ± 7.6 months. The median age was 9.5 months. Furthermore, the mean age of children who did and did not use a touchscreen device was significantly different (17.4 ± 9.2 months vs. 9.4 ± 5.9 months, $p < 0.001$). Mean age at initial TDU was 11.2 ± 7.6 months, and daily TDU ranged from 1-240 minutes with a median of 17.5 minutes.

When parents were asked to report all types of TDU their children engaged in, 29 (66%) said educational apps, 8 (18%) said reading children's books on the touchscreen device, 29 (66%) reported watching educational children's movies and shows, 13 (30%) reported watching YouTube videos and other non-educational movies, 6 (14%) said playing non-educational games, 25 (57%) said listening to music, 34 (78%) said pressing buttons on the screen aimlessly, and 6 (14%) reported some other activity. The three forms of TDU that parents reported their children engaged in most often were: watching children's "educational shows" (30%), using educational applications (26%), and pressing buttons on the screen aimlessly (28%). 60% of parents selected "educational benefits" of TDU as a reason for child TDU. Using the Spearman Correlation method, no correlation was found between age and daily hours of TDU. There was also no correlation found between parental TDU and child TDU.

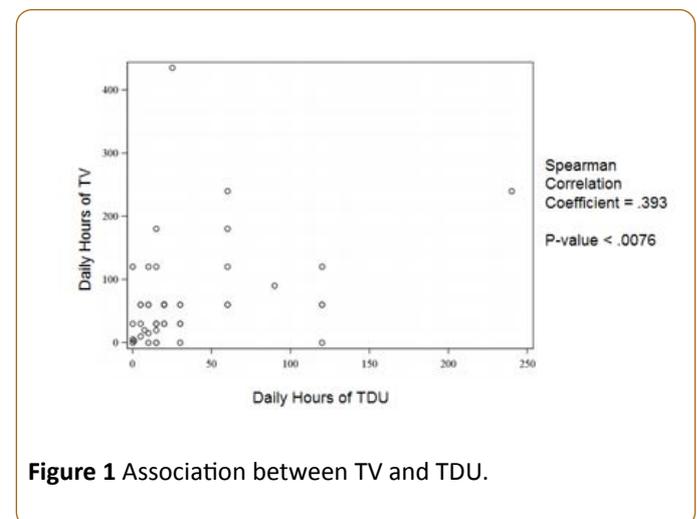


Figure 1 Association between TV and TDU.

Other media usage

Of all children surveyed, 54 (83%) watched television. Overall, the amount of television viewing was highly variable, with a mean of 57.1 ± 73.5 hours. The median hours of television viewing were 30 hours. There was a positive association between child TDU and child television viewing ($r = 0.393$, $N = 45$, $p < 0.01$) (**Figure 1**).

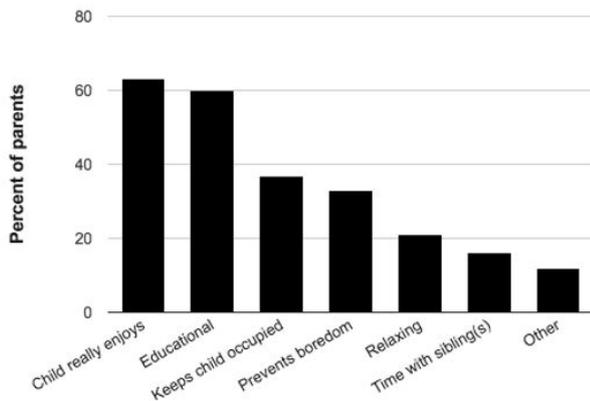


Figure 2 Parent-reported reasons for allowing children to use touch screen devices.

Parent perceptions

About 57% of parents believed “other children” have higher TDU than their child. When parents were asked why they allow their children to use touchscreen devices, 26 (60%) reported that “it is educational and/or is good for my child’s brain,” 27 (63%) reported that “it is something my child really enjoys doing,” 14 (33%) reported that “it prevents my child from getting bored,” 9 (21%) reported that “it allows my child to relax,” 16 (37%) reported that “it keeps my child occupied so I can do other things,” 7 (16%) reported that “it allows my child to spend more time with his/her sibling(s),” and 5 (12%) reported some other reason. When asked which was their primary reason, 23 (54%) reported that educational reasons were the most important. The next most important reason was child enjoyment, which 15 (35%) parents selected (**Figure 2**).

CAT/CLAMS results

There was no significant difference in CAT/CLAMS DQ scores between children with and without TDU (CAT 99.6 ± 19.5 vs. 103.4 ± 19.8 ; CLAMS 104.0 ± 24.0 vs. 113.5 ± 26.2). Notably, there was also no significant difference in CAT/CLAMS DQ scores between children that did and did not use “educational apps” (CAT 98.4 ± 20.5 vs. 101.8 ± 17.8 ; CLAMS 101.8 ± 23.4 vs. 108.1 ± 25.4). There was also no difference in CAT/CLAMS DQ scores based on participation in the following types of TDU: reading children’s books on a touchscreen device, watching children’s movies and shows, and pressing buttons on the screen aimlessly. Children who played “non-educational games” during TDU had lower CLAMS DQ scores than those who did not (86.5 ± 34.2 vs. 106.7 ± 21.4 ; $p=0.054$). However, children who played “non-educational games” did not have statistically different CAT DQ scores from those who did not (94.3 ± 8.3 vs. 100.4 ± 20.7).

Discussion

Touchscreen devices are immensely popular, appearing in almost all households surveyed. Furthermore, most parents

allow their children to use these devices. However, smartphone usage is still less prevalent than television viewing in children below 3 years of age. Whereas 83% of children watched some amount of television, only 70% of children used touchscreen devices. Parents allow their children to use touchscreen devices at a very early age, often before they reach 12-months of age. As expected, children who used touchscreen devices were significantly older than children who did not. This presumably reflects the increased understanding of stimuli and ability to interact with electronic media that occurs as children grow older.

Parents overestimated the benefits of touchscreen device usage on the development of their children. As stated previously, over half of all parents cited educational benefits as the most important reason for allowing their children to use touchscreen devices. In addition, educational apps and games were the most common activities reported in this young age group. However, our analyses showed that regardless of the type of TDU, CAT/CLAMS DQ scores were not significantly different between children that did and did not use touchscreen devices. Thus, TDU was not associated with any benefit on cognitive or language development.

However, we found that playing non-educational games on touchscreen devices did correlate with lower language scores in our study. Children who played non-educational games had lower CLAMS DQ scores than children who did not. However, the direction of this association is unclear. It is possible that playing these types of games causes slower language development. It is equally possible that children who have lower language development to begin with prefer playing non-educational games.

Our analyses showed that children who frequently use touchscreen devices are likely to also watch large amounts of television. This population is at major risk for the possible compounding effects of screen time. In addition, overall screen time safety in regards to eye development and other possible physical involvement has not been studied in children this age, and it is possible that these daily dual screen times may exacerbate any heretofore unknown medical issues caused by prolonged screen exposure at a young age.

Clinicians should be aware of the AAP recommendations and discuss limiting screen time for infants and toddlers [4]. This includes discouragement of all exposure to media at this age group including foreground and background media. Although this may seem like a daunting request for clinicians to make, there is substantial research showing that both physicians and nurses communicating directly with patients can help them make lifestyle changes [29]. As research on the impact of these devices on child development continues it is imperative that clinicians err on the side of caution and recommend minimal screen time exposure.

Conclusion

The overwhelming majority of parents in our study reported touch screen usage for their children under the age of three. Although many parents believed there to be educational

benefits of using touchscreen devices, language or cognitive task scores did not positively correlate with increased educational TDU usage. However, playing non-educational games on smartphones and tablets was associated with significantly decreased language scores. Moreover, children who watched large amounts of television were also likely to use smartphone devices for longer periods of time. Thus, children who use smartphones and tablets may experience compounded negative effects resulting from both excessive television consumption and touchscreen usage. It is important for physicians and parents to be aware of the potential negative effects of electronic media consumption by young children, whether it be television, smartphones, or other electronic devices, and advise against usage by small children.

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