Original Article

ICT Exposure in Children Younger Than 2 Years: Rates, Associated Factors, and Health Outcomes

Adisak Plitponkarnpim MD, MPH[1,3], Chiranuwat Srikaew MD[1], Pongtong Puranitee MD[1], Sakda Arj-Ong Vallibhakara MD, PhD[2,3]

[1] Department of Pediatrics, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
[2] Section for Clinical Epidemiology and Biostatistics, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
[3] Child Safety Promotion and Injury Prevention and Research Center, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Background: The exposure of children on information and communication technology [ICT] devices have raised concern about the potential harmful effects on children's health and development. The American Academy of Pediatrics [AAP] has recommended to limit the time children spending on ICT. In Thailand, the study regarding ICT exposure, its associated factors, and consequences among children age less than two are limited.

Objective: To investigate the prevalence, impact of associated factors that contribute to children exposing various types of ICT, and health related consequence outcomes in cognitive and language development.

Materials and Methods: The cross-sectional study of information from the parents of children younger than 2-years-old who visit Well Baby Clinic [WBC], Pediatric Department, Ramathibodi Hospital, between December 2014 and November 2015. The present study aimed to find out the information of exposure and technology devices used, time of screen-time spent, other interested factors that associated to ICT exposure, usage rate, and health related outcomes. The descriptive statistic and comparative statistics were used to analyze and summarize. Chi-square tests or Fisher exact test were used to compare among these associated factors and health related outcomes.

Results: The rates of children exposed to ICT were 98.3 percent. Mean (SD) times of ICT exposure was 16.6±12.9 minutes per day, and median time (min, max) was 14 (0, 135) minutes per day. The result showed 8.5% of children met the category of high exposure definition and 36.2% was moderate exposure. The highest rank of exposure was 95.9% to TV viewing, 78.3% exposed and used the smartphone/tablets, and 15.4% reported usage or exposure to desktop or laptop computer. Only 0.2% of exposure was reported using handheld game console. Apart from game console, most parents were not aware of the negative effects of other ICT devices. The association of ICT exposure with parental education and household income was not found to be statistically significant (p-values >0.05). Regarding developmental issues, significant associations among ICT exposure with delay cognitive (p = 0.034) and language (p = 0.004) development were found.

Conclusion: Most Thai children age younger than 2-years-old were found to be exposed to ICT devices. Most parents lack awareness of negative effects of ICT exposure. The present study found association between screen-time and level of language and cognitive developmental delay.

Keywords: ICT, ICT exposure, Screen-time, Children, Game

J Med Assoc Thai 2018; 101 (3): 345-9
Website: http://www.jmatonline.com

Information and Communication Technology [ICT] is rapidly growing, covering almost all areas worldwide, and connects users of all ages. Most of the children spend their time on ICT including television, computer, internet, video games, and mobile devices (smart phone or tablet), which play an important role in our everyday life[1].

A recent study of screen-time 2013 in USA demonstrated that nearly 38% of toddlers and infants under the age of eight used a mobile device such as a tablet or smartphone. This was rising when compared to 10% in 2011[2,3]. The amount of total screen time spent was approximately 1 hour and 55 minutes a day (57 minutes per day watching TV, 22 minutes watching DVDs, 11 minutes using computers, 10 minutes playing video games, and 15 minutes using mobile devices).

Correspondence to:
Vallibhakara SA. Section for Clinical Epidemiology and Biostatistics, Child Safety Promotion and Injury Prevention Research Center (CSIP)/ Safe Kids Thailand, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, 270 Rama VI Road, Ratchathewi, Bangkok 10400, Thailand.
Phone & **Fax**: +66-2-2011284
Email: dr.sakda@gmail.com, sakda.arj@mahidol.edu

How to cite this article: Plitponkarnpim A, Srikaew C, Puranitee P, Vallibhakara SA. ICT exposure in children younger than 2 years: rates, associated factors, and health outcomes. J Med Assoc Thai 2018;101:345-9.

Ruangdaraganon et al (2009) found the percentages of children that watched television at the age of 6 months, 1 year, and 2 years were 98, 95.3, and 96.7, respectively[4]. On average, 1-year-old children watched television 1.23±1.42 hours per day and at 2 years old, 1.69±1.56 hours per day. There was no report of association between delayed language development and longer time spent on television viewing (two hours or more per day).

Several studies showed potential harmful effects and negative health outcomes of ICT exposure in children or prolong screen-time usage such as childhood obesity[1], lack of sleep, school problems, aggressiveness and other behavior issues[5], and media violence[6]. American Academy of Pediatrics [AAP] issued the new guideline and recommendation calling on parents to strictly limit the time of their children spend in front of a screen[7].

In Thailand, for children that are older than 2-years-old, physicians follow the guideline and recommendations from the AAP. There is limited information on ICT exposure in children younger than 2-years-old and the associated factors of children exposed to the various types of ICT. Moreover, the consequence of ICT exposure on the health in very young children has not been established.

Materials and Methods

A cross-sectional study was conducted. The information was collected from the parent of children younger than 2-years-old visiting Well Baby Clinic [WBC], Pediatrics Department, Faculty of Medicine, Ramathibodi Hospital, Mahidol University between December 2014 and November 2015. The parents signed an informed consent. The designed survey questionnaire was aimed to find the reason of the young children exposure, the technology devices used, and the average screen time. The authors developed a daily record of screen time (minutes/day) for four ICT devices, TV (on-air, DVDs), computer PC & tablet, smart phone, and handheld game consoles by using a 6-hour diary record blocks-recall input questionnaire at the out-patient unit, and confirmed their reliability of 6-hour diary record-recall questionnaire by every 1-hour blocks diary record at the end of the interview. Prospective 1-hour blocks diary home recording was done and sent them back by post to the authors' office (Figure 1). The ICT exposure was classified as low (0 to 14 minutes per day), moderate (14 to 29 minutes per day), and high exposure (30 minutes or more per day). The variables consisted of demographic

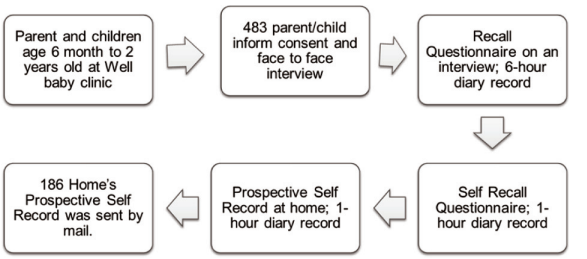

Figure 1. Flow of data collection.

factors (household incomes, parent's education, and attitude) that might associate with ICT exposure. Other associated consequences (heath outcomes, overweight, cognitive, or language development) of ICT exposure in children younger than 2-years-old were determined. The overweight children were weight for length's Z-score greater than 1.5 SD. The developmental status was evaluated with the Capute Scales (by Developmental Quotient [DQ]), that determined the presence of atypical development in two streams of cognitive development (visual-motor functioning) and expressive-receptive language.

The statistical analyses were summarized with appropriate descriptive statistics, which comprised the frequencies, percentages, mean (SD), and median (ranges). The secondary objective was to study the association between overweight, delayed language and cognitive development and exposure time on ICT usage. All data were analyzed by using a multivariate logistic regression model and Kruskal-Wallis test. The *p*-value smaller than 0.05 was assigned as statistically significant. All of analyses were performed by Stata version 14 (College Station, TX: StataCorp LP).

Results

Four hundred eighty-three families were enrolled in the present study. The mean (SD) of children age was 13.1±4.9 months, median was 12 months (6, 24), and 51.3% of children were male (n = 217). The proportion of children exposed to ICT was 98.34%, which consisted of 95.9%, 15.4%, 78.3%, and 0.2% in exposure to television, computer, smartphone, and handheld game console, respectively (see Table 1, 2). Mean (SD) of ICT exposure time was 16.6±12.9 minutes per day, and median time (min, max) was 14 (0, 135) minutes per day. The daily duration of ICT exposure was categorized as 9.4±7.5 minutes for television, 1.2±4.2 minutes for computer, as 5.6 (6.6) smartphones, and 0.3 (0.6) as handheld game consoles. Eight-point five percent met the definition of high

exposure, and 36.2% was moderate exposure based on AAP criteria. The parents' attitude towards ICT was because most parents were not aware of the adverse effects and health related outcomes of ICTs media exposure. The present study found that Thai parents had positive attitude towards all of ICT devices, except for handheld game consoles (Figure 2). Besides, most of the parents allowed their children to use various forms of other ICT devices, ignoring the fact that those devices might also have adverse effects.

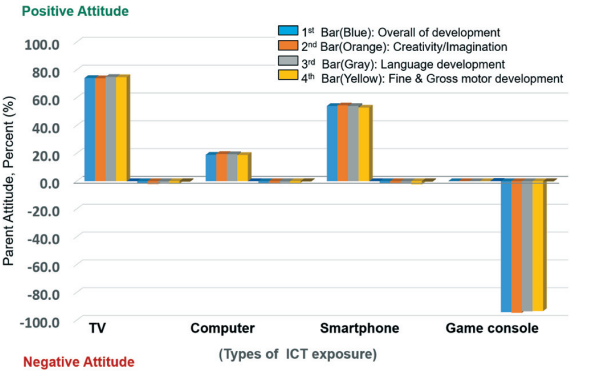

Figure 2. Parental attitude of ICT effect on child health and development.

Using ICT exposure duration as a continuous variable, univariate and multivariate analysis showed non-significant relationships between exposure duration and overall monthly household income levels and other interesting factors (parental education, number of children in family, and number of household ICT devices) (p-value >0.05). On non-parametric analysis (Kruskal-Wallis test for K-independent sample) of total ICT exposure time and Capute Scale, DQ Score in cognitive and language development, the present study found statistically significant association of high ICT exposure with abnormal Capute Scales, DQ Score in cognitive and language development (p-value 0.042 and 0.004, respectively) (Table 3). However, our study showed non-association between total ICT

Table 1. Descriptive characteristics by screen-time in children and parent (total 423 cases)

Factors	Number (%)
Sex: child, mean ± SD	
Male	217 (51.3)
Female	206 (48.7)
Age (year), median (ranges)	
Child	1 (0.5 to 2)
Parent	33 (18 to 68)
Father	34 (16 to 57)
Mother	31 (15 to 54)
Occupation: house-wife	167 (39.5)
Parent education	
Bachelor's degree	295 (61.0)
Household income (Baht)	
10,001 to 50,000	251 (59.3)
ICT devices usage	
Television	453 (95.9)
Computer	77 (15.4)
Smartphone	738 (78.3)
Handheld game	75 (0.2)
Duration of ICT usage (minute), median (ranges)	
Television	9 (0 to 61.5)
Computer	0 (0 to 60)
Smartphone	4.3 (0 to 90)
Handheld game	0 (0 to 15)

ICT = information and communication technology

Table 2. Percentage of children in categories of ICT exposure in each device

ICT exposure	Television, n (%)	Computer, n (%)	Handheld game, n (%)	Smartphone, n (%)	Total, n (%)
Low exposure	388 (80.33)	471 (97.51)	351 (72.67)	482 (99.79)	267 (55.28)
Moderate expose	78 (16.15)	10 (2.07)	28 (5.80)	1 (0.21)	175 (36.23)
High exposure	17 (3.52)	2 (0.42)	5 (1.03)	0 (0.00)	41 (8.49)

ICT = information and communication technology

Table 3. Association between ICT magnitudes of exposure and health related outcomes

ICT exposure	Overweight** Case/N (%)	Delay language development Case/N (%)	Delay cognitive development Case/N (%)
Low exposure	42/225 (15.73)	4/263 (1.50)	6/261 (2.25)
Moderate exposure	30/145 (17.14)	4/171 (2.29)	3/172 (1.71)
High exposure	9/32 (21.95)	1/40 (2.44)	1/40 (2.44)
p-value*	0.941	0.034*	0.004*

ICT = information and communication technology; N = total

* Kruskal-Wallis test, p-value <0.05 is statistically significant

** Based on severity scale in obesity for Thai children (weight for length), Nationwide Survey 1993 to present

exposure time and overweight status (p-value >0.77) as previous studied[1].

According to adverse effect information of ICTs exposure, the present study found only 15.6% of the parents had known the adverse effects of ICT devices and exposure. Most of them received that information from healthcare workers 49.17%, followed by information from friend/acquaintance 42.79% and from internet 38.53%.

Discussion

From present study, the authors found that most Thai children younger than two years old were exposed or used ICT at an early age. Overall, 98.34% were exposed or used ICT devices. For these, the highest rank was 95.9% exposed to TV viewing, followed by 78.3% exposed and used smartphone or tablets, 15.4% were exposed or used a desktop or laptop computer, and the rest, only 0.2% were exposed to handheld game console (Table 1). The present study found significant association between screen-time on ICT devices and delay in language and cognitive development (p-value 0.034 and 0.004, respectively). Most parents had no awareness to the adverse effect of exposure and appropriate time spent on ICT devices.

A recent study on "screen-time" in USA 2013 found that 38% of toddlers and children under the age of eight have used a mobile device[3]. From this evidence, AAP issued guidelines and measures to help parents for child-appropriated situations.

The authors found that the rate of children exposed to ICT was as high as 98.34%. This result was relevant and seemed to be higher than previous report in Thailand. Ruangdaraganon et al (2009) found that 98.0% of Thai infants and toddlers had begun to watch television at the age of six months and increasing to 95.3% and 96.7% at 1-year and 2-years-old, respectively[4]. In that study, they found that 1-year-old children watched television at the average of 1.23±1.42 hours per day, higher than the rate of the present study, mean (SD) of total ICT exposure time was 16.6±12.9 minutes per day and longest time of exposure was reported at 135 minutes per day.

In the present study, we found significant association between time spent on ICT and level of language and cognitive developmental delay from Capute Scales, DQ (p-value 0.042 and 0.004, respectively), which were consistent with recent research from Intusoma et al (2013) about the effects of TV viewing on the social-emotional competence [SEC] of Thai infants[8]. The study showed that viewing duration exceeding 120 minutes per day was associated with an increased risk of low overall SEC. However, the viewing had beneficial effect when the duration was 30 to 120 minutes per day[2].

The present study was initially concerned about the reliability of the 6-hour-block diary record questionnaire as compared to the 1-hour-block diary record questionnaire. To evaluate the reliability, the authors ended up doing both variations, which yielded almost the same results. Hence, the present study chose to use the 6-hour diary record as it was easier for the subjects to recall the amount of time they spent on ICT devices and to monitor when having any new policy to implement and evaluate in future.

For obesity, strong evidence showed that the number of ICT devices such as TVs and computers or game consoles in the household was positively associated with screen-time of children, and children with a TV or computer or game console in their bedroom were more likely to watch TV or had screen-time of more than two hours per day or spend more than 30 minutes at time per day on ICT devices[9-14]. These results were different from the present study, which could not demonstrate association between duration of screen-time on overall ICT devices with obesity (p-value 0.941). This result differed from the reports in Western countries, which might be caused by the different activity, socioeconomic and environment, and lifestyle.

Conclusion

Healthcare workers should be more aware of negative effects of ICT devices' viewing on children younger than 2-years-old and should encourage parents and the public to limit screen-time and duration of usage of ICTs devices.

What is already known on this topic?

In Asian countries, there were few studies about this topic, especially in younger age group. The results interestingly showed the potential harm on the health such as cognitive and language development, but there was no significant association with obesity. Potential associated symptom or diseases that are linked with excessive screen time usages are poor sleep, increase risk factors for cardiovascular diseases (high blood pressure, obesity, low HDL cholesterol), poor stress regulation (high sympathetic arousal and cortisol dysregulation), insulin resistance, impaired vision, reduced bone density, psychological effects (depressive symptoms and suicidal event), ADHD-

related behavior, delay development (social, language, and cognitive), and antisocial behaviors. However, few studies have been conducted in children younger than 2-years-old or in preschool age.

What this study adds?

This study aimed to explore the result of ICTs devices exposure in younger age children, to determine the association of interested factors, and measure for health-related outcome by comparing between level of screen-time exposure with cognitive and language development and obesity. The results showed that about 98% of children have been exposed to ICT and most duration exposure was categorized in moderate exposure. Eight-point-five percent was classified as high exposure. Background of knowledge and family income had no effect with attitude of ICT exposure in younger children. Delay cognitive and language development were statistical significant in group of premature exposure to ICT (long screen time).

Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Council on Communications and Media. Children, adolescents, and the media. Pediatrics 2013;132: 958-61.
2. Common Sense Media. Zero to eight: Children's media use in America. San Francisco: Common Sense Media; 2011.
3. Common Sense Media. Zero to eight: children's media use in America. San Francisco: Common Sense Media; 2013.
4. Ruangdaraganon N, Chuthapisith J, Mo-suwan L, Kriweradechachai S, Udomsubpayakul U, Choprapawon C. Television viewing in Thai infants and toddlers: impacts to language development and parental perceptions. BMC Pediatr 2009;9:34.
5. Strasburger VC. Children, adolescents, obesity, and the media. Pediatrics 2011;128:201-8.
6. Council on Communications and Media. From the American Academy of Pediatrics: Policy statement--Media violence. Pediatrics 2009;124: 1495-503.
7. Brown A. Media use by children younger than 2 years. Pediatrics 2011;128:1040-5.
8. Intusoma U, Mo-suwan L, Ruangdaraganon N, Panyayong B, Chongsuvivatwong V. Effect of television viewing on social-emotional competence of young Thai children. Infant Behav Dev 2013;36:679-85.
9. Adachi-Mejia AM, Longacre MR, Gibson JJ, Beach ML, Titus-Ernstoff LT, Dalton MA. Children with a TV in their bedroom at higher risk for being overweight. Int J Obes (Lond) 2007;31: 644-51.
10. Jones BL, Fiese BH. Parent routines, child routines, and family demographics associated with obesity in parents and preschool-aged children. Front Psychol 2014;5:374.
11. Kristiansen H, Juliusson PB, Eide GE, Roelants M, Bjerknes R. TV viewing and obesity among Norwegian children: the importance of parental education. Acta Paediatr 2013;102:199-205.
12. Sisson SB, Sheffield-Morris A, Spicer P, Lora K, Latorre C. Influence of family structure on obesogenic behaviors and placement of bedroom TVs of American children: National Survey of Children's Health 2007. Prev Med 2014;61:48-53.
13. Tandon PS, Zhou C, Sallis JF, Cain KL, Frank LD, Saelens BE. Home environment relationships with children's physical activity, sedentary time, and screen time by socioeconomic status. Int J Behav Nutr Phys Act 2012;9:88.
14. Veldhuis L, van Grieken A, Renders CM, Hirasing RA, Raat H. Parenting style, the home environment, and screen time of 5-year-old children; the 'be active, eat right' study. PLoS One 2014;9:e88486.