



Effects of television exposure on developmental skills among young children



Ling-Yi Lin^a, Rong-Ju Chheng^b, Yung-Jung Chen^{c,*}, Yi-Jen Chen^d,
Hei-Mei Yang^d

^a Department of Occupational Therapy, College of Medicine, National Cheng Kung University, Tainan, Taiwan

^b Department of Physical Therapy, College of Medicine, National Cheng Kung University, Tainan, Taiwan

^c Department of Pediatrics, College of Medicine, National Cheng Kung University, Tainan, Taiwan

^d Division of Speech/Language Therapy, Department of Otorhinolaryngology, National Cheng Kung University Hospital, Tainan, Taiwan

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ABSTRACT

Background: Literature addressing the effects of television exposure on developmental skills of young children less than 36 months of age is scarce. This study explored how much time young children spend viewing television and investigated its effects on cognitive, language, and motor developmental skills.

Methods: Data were collected from the Pediatric Clinics at University Medical Center in Southern Taiwan. The participants comprised 75 children who were frequently exposed to television and 75 children who were not or infrequently exposed to television between 15 and 35 months old. The age and sex were matched in the two groups. The Bayley Scales of Infant Development-second edition and Peabody Developmental Motor Scales-second edition were used to identify developmental skills. Independent *t*-tests, χ^2 tests, and logistic regression models were conducted.

Results: Among 75 children who were frequently exposed to television, young children watched a daily average of 67.4 min of television before age 2, which was excessive according to the American Academy of Pediatrics. Viewing television increased the risk of delayed cognitive, language, and motor development in children who were frequently exposed to television. Cognitive, language, and motor delays in young children were significantly associated with how much time they spent viewing television. The type of care providers was critical in determining the television-viewing time of children.

Conclusion: We recommend that pediatric practitioners explain the impacts of television exposure to parents and caregivers to ensure cognitive, language, and motor development in young children. Advocacy efforts must address the fact that allowing young children to spend excessive time viewing television can be developmentally detrimental.

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1. Introduction

Current research on children has addressed the entire functional scope of the International Classification of Function, Disability, and Health for Children and Youth (ICF-CY): activities and participation (World Health Organization, 2007). Engaging

* Corresponding author at: Department of Pediatrics, National Cheng Kung University Hospital, 138 Sheng-Li Road, Tainan 704, Taiwan.

Tel.: +886 6 235 3535x5285; fax: +886 6 209 2317.

E-mail address: pcyj@mail.ncku.edu.tw (Y.-J. Chen).

in activities such as play and learning are vital to a child's development (Certain & Kahn, 2002). Children most commonly participate in screen-based activities (television exposure) and physical activities (outdoor playground activities). Children have more access to media, such as through television, smartphones, and computer games, compared with children a decade ago (Common Sense Media, 2011). Very young children spend more time watching television, and then they spend less time playing (Anderson & Pempek, 2005). Children may not have sufficient time and opportunities to develop cognitive, language, and motor developmental skills. However, research on television exposure has primarily focused on preschool or school-aged children. To our knowledge literature regarding television exposure and developmental skills in young children is limited, particularly for those younger than 36 months. Studies have investigated relationships of television exposure and development in young children is scarce. Therefore, we examined the amount of time that young children engaged in viewing television, and its effects on cognitive, language, and motor developmental skills.

In recent decades, children's lifestyles have become more sedentary. Television viewing is a common type of media use among young children (Smith & Biddle, 2008; Vandewater et al., 2007). One study investigated 1384 parents of children aged 0–8 years old (Common Sense Media, 2011). The findings indicated that 10% of 0- to 1-year-olds and 39% of 2- to 4-year-olds had access to popular media such as smartphones, video iPods, iPads, or other tablet device. The average daily screen time was 25 min per day for children younger than 4. Numerous researchers have reported that children who watch excessive amounts of television are likely to develop health and developmental problems, such as obesity and delayed cognitive and language development (Chonchaiya & Pruksananonda, 2008; Christakis, 2009; Linebarger & Walker, 2005; Okuma & Tanimura, 2009; Zimmerman, Christakis, & Meltzoff, 2007). In response to the developmental and health issues associated with television viewing, the American Academy of Pediatrics recommends that children 2 years and older watch less than 2 h of television per day, and that children younger than 2 years watch no television (American Academy of Pediatrics [AAP], 2011). However, there is little evidence to suggest that television viewing is related to the developmental skills of young children.

Previous studies have indicated that parental screen-based behaviors may increase the sedentary behaviors of children (Sallis, Prochaska, & Taylor, 2000; Salmon, Timperio, Telford, Carver, & Crawford, 2005; Songul-Yalcin, Tugrul, Nacar, Tuncer, & Yurdakok, 2002). Regarding variables that account for media use patterns, factors such as types of care providers and parental demographics should not be ignored. For instance, nonparental care providers allowed the children to spend more time viewing television than would their parents (Benjamin et al., 2009). Parental educational levels are also a critical indicator (Guryan, Hurst, & Kearney, 2008). Highly educated parents devote less time to viewing television than do less educated parents. To date, insufficient information is available on the variables that account for media use patterns among young children.

In this study, we addressed the following questions: (1) How many minutes do young children who are frequently exposed to television spend watching television a day?; (2) How do television exposure relate to their developmental skills?; and (3) What possible factors account for television exposure patterns among young children?

2. Methods

2.1. Procedures

Ethical clearance for the study was received from the National Cheng Kung University Hospital internal review board (B-BR-101-075). Data were collected from the pediatric outpatient clinics (e.g., vaccinations, well-child clinics, general pediatric clinics) at university medical center in southern Taiwan. A standard protocol was applied to all children; when the children and their caregivers first came to the pediatric clinic, they were met by a pediatric neurologist and a trained case manager (certified nurse). The caregivers were asked whether or not the child used any media such as television, smartphone, iPad, and computer and if they were willing to have their children take part in research that involved developmental assessments. The case manager explained the research procedures to the primary caregivers, who provided their written informed consent and subsequently completed a primary interview with the case manager. Then the children were assessed by a team of qualified professionals, comprising a pediatric neurologist, a psychiatrist, an occupational therapist, a physical therapist, a psychologist, and two speech therapists. The Bayley Scales of Infant Development-second edition (BSID-II) and Peabody Developmental Motor Scales-second edition (PDMS-2) were used.

2.2. Participants

Children were divided into two groups according to the AAP recommendations. For children 2 years and older, if they watched television more than 2 h per day, they were assigned to the television exposure group; on the contrary, if they watched television less than 2 h, they were assigned to the control group. For children younger than 2 years, if they watched television, they were assigned to the television exposure group; conversely, if they did not watch television, they were assigned to the control group.

Then we focused on children between the ages of 12 and 35 months to eliminate the effects of certain internal and external factors (e.g., existing disorders and schooling). The inclusion criteria were (1) between the ages of 12 and 35 months; (2) no previous diagnosis of diseases or disorders related to developmental delays (such as cerebral palsy, chromosomal anomalies

Table 1
Participant characteristics ($n = 150$).

Variables	Television exposure mean (SD) or n (%)		Control mean (SD) or n (%)	
	15–23 months ($n = 29$)	24–35 months ($n = 46$)	15–23 months ($n = 29$)	24–35 months ($n = 46$)
Children				
Mean age (months)	18.9 (2.5)	28.4 (3.4)	18.9 (2.5)	28.4 (3.4)
Boys	18 (62.1%)	36 (78.3%)	18 (62.1%)	36 (78.3%)
Girls	11 (37.9%)	10 (21.7%)	11 (37.9%)	10 (21.7%)
Only child in the family	18 (62.1%)	19 (41.3%)	15 (51.7%)	18 (39.1%)
Nonparental care providers ^a	12 (41.4%)	20 (43.5%)	3 (10.3%)	13 (28.3%)
Father				
Father's level of education: college and above	18 (62.1%)	33 (71.7%)	16 (57.1%)	29 (63.0%)
Father was employed	29 (100%)	44 (95.7%)	27 (93.1%)	42 (91.3%)
Mother				
Mother's level of education: college and above	21 (72.4%)	27 (58.7%)	20 (69.0%)	30 (65.2%)
Mother was employed	15 (51.7%)	20 (43.5%)	11 (37.9%)	25 (54.3%)
Family				
Average number of children per family	1.5 (0.7)	1.7 (0.6)	1.6 (0.7)	1.7 (0.7)
Double-income family	15 (51.7%)	20 (43.5%)	12 (41.4%)	26 (56.5%)

^a $\chi^2 = 7.3$, $p < .01$.

or abnormalities, preterm, small for gestational age, and low birth weight); and (3) not attending preschools or day care centers.

2.2.1. Television exposure group

Seventy-five children (mean age 24.8, range 15–35 months) who were frequently exposed to television were recruited for this study. There were 54 boys and 21 girls. The participants lived in communities in southern Taiwan when the data were collected. Approximately 49.3% of the children were the only child in their family.

2.2.2. Control group

The control group comprised 75 children. A comparison sample was selected by matching the age and sex of the children with those of the television exposure group. We used one-to-one exact matching. Finally, there were 54 boys and 21 girls, with a mean age of 24.8 months (range 15–35 months). Approximately 44.0% of the children were the only child in the family. Table 1 lists the sample characteristics. No significant differences in sample characteristics between groups were yielded, with the exception of the type of care providers.

2.3. Measures

2.3.1. Developmental assessments

The BSID-II was used to identify children's cognitive and language development skills (Bayley, 1993). The BSID-II is a norm-referenced measurement tool used primarily for infants and toddlers from 1 month to 42 months old. It provides a mental developmental index (MDI) and a psychomotor developmental index (PDI) of the assessment results. The MDI assesses cognitive, language, and personal social abilities. The PDI assesses fine and gross motor skills. Each score under 85 was classified as delayed. The Chinese version of the BSID-II has been used in children with developmental delay and demonstrated good reliability in Taiwan (Huang, Chuang, Jong, Yu, & Shien, 2000).

The PDMS-2 was used to assess gross and fine motor skills and ability (Folio & Fewell, 2000). The PDMS-2 is a valid, reliable measure of motor skills and a standardized instrument for children younger than 72 months. It contains six subtests: reflexes, stationary, locomotion, object manipulation, grasping, and visual-motor integration. The Chinese version of the PDMS-2 demonstrated high levels of test–retest reliability and acceptable responsiveness among Taiwanese children (Wang, Liao, & Hsieh, 2006). In this study, children who scored at or below the 15th percentile were defined as possessing gross motor problems.

2.3.2. Demographic information

The demographic information gathered for the participating children included age, sex, birth order, body weight, height, preschool attendance, types of care providers (nonparental care provider versus parents), types of media use, and how much time was spent on these activities. The parental and family characteristics included marital status, nationality, parental education level, and employment status.

Table 2
Television exposure and results of developmental assessments ($n = 150$).

Results of developmental assessments	Television exposure			Control			Statistic
	15–23 months ($n = 29$)	24–35 months ($n = 46$)	Overall ($n = 75$)	15–23 months ($n = 29$)	24–35 months ($n = 46$)	Overall ($n = 75$)	
Cognition							
Typical	79.3%	58.7%	66.7%	82.8%	89.1%	86.7%	$\chi^2 = 8.4^{**}$
Delayed	20.7%	41.3%	33.3%	17.2%	10.9%	13.3%	
Language							
Typical	69.0%	39.1%	50.7%	72.4%	78.3%	76.0%	$\chi^2 = 10.4^{**}$
Delayed	31.0%	60.9%	49.3%	27.6%	21.7%	24.0%	
Motor							
Typical	82.8%	60.9%	69.3%	79.3%	87.0%	84.0%	$\chi^2 = 4.5^*$
Delayed	17.2%	39.1%	30.7%	20.7%	13.0%	16.0%	

* $p < .05$.

** $p < .01$.

2.4. Data analysis

SPSS, version 17.0 for Windows (SPSS Inc., Chicago, IL) was used to analyze the data. Descriptive statistics were used to examine the demographic data and activities. Independent t -tests, χ^2 tests, and two-way ANOVA were performed to examine the differences among groups (e.g., television exposure frequently or infrequently) regarding the study variables. Fisher's exact tests were used when more than 20% of the values were less than the expected value of 5 in a contingency table. Associations between delayed cognitive, language, and motor development and television exposure were analyzed using logistic regression models. Odds ratios and 95% confidence intervals were reported.

3. Results

3.1. The amounts of time spent watching television

Among 75 children who were frequently exposed to television, their average amount of time spent watching television was 137.2 min per day. Children in the control group spent less time viewing television (16.3 min) than those in the television exposure group ($t = 10.4$, $p < .001$). Among 58 children younger than 2 years, half of them spent an average of 67.4 min per day on watching television. Only seven children spent at least 2 h per day viewing television. Among 92 children older than 2 years, they spent an average of 103.8 min per day on watching television. Approximately 45.7% of them spent at least 2 h per day viewing television. Their average viewing time was 181.1 min per day.

3.2. Television exposure, other factors, and developmental skills

Table 2 presents the relationships between television exposure and developmental skills. Children who were frequently exposed to television were more likely to have delayed in cognitive, language, and motor development than those in the control group. To examine the association of each possible factor while controlling for the others, multivariate logistic regression models were analyzed. The most significant risk factors that could strongly predict cognitive developmental delay were time exposed to television and maternal education. Children who were frequently exposed to television were 3.9 times (95% CI: 1.4–5.9) more likely to have delayed cognitive development than those who were infrequently exposed. Mothers with lower education levels were more likely to have children with cognitive development delay (OR = 4.3, 95% CI: 1.7–10.4) than were highly educated mothers. For children with delayed language development, the sole predictor is time exposed to television. Viewing screens increased the risk of delayed language development by 3.3 (95% CI: 1.5–7.3) times in children who were frequently exposed to television. For children with delayed motor development, the predictors were time exposed to television and lived in a double-income family. Children who were frequently exposed to television were more likely to have delayed motor development than those who were infrequently exposed (OR = 3.7, 95% CI: 1.5–9.3). Children lived in a double-income family were more likely to have motor development delay (OR = 2.7, 95% CI: 1.0–7.1) than those did not live in a double-income family. No other predictors were significant in analyses.

Differences were examined regarding time spent watching television between children with and without developmental problems (Fig. 1). Children with cognitive developmental delay tended to spend more time watching screens (129.3 min vs. 60.7 min; $t = 3.1$, $p < .01$) than did children without cognitive developmental delay. Children with language developmental delay tended to spend more time viewing screens (117.3 min vs. 53.2 min; $t = 3.8$, $p < .001$) than did children without language developmental delay. Children with motor developmental delay tended to spend more time viewing screens than did those without motor developmental delay (116.9 min vs. 64.4 min; $t = 2.3$, $p < .05$). Two-way ANOVA models were also conducted to examine the relation between television exposure and developmental skills. Two significant interactions were found between delayed developmental skills and television exposure, indicating that children with cognitive and language development delay in the television exposure group were more inclined to engage in viewing screens compared to children with cognitive and language development delay in the control group.

3.3. Possible factors that account for television exposure patterns

Finally, we examined other variables that account for television exposure patterns. Only maternal education ($r = -.18$, $p < .05$) and the type of care providers ($r = .26$, $p < .001$) were found to have a significant relationship with television exposure patterns. Mothers with lower education levels allowed children to spend more time viewing screens per day (mean: 114.4 min) than did highly educated mothers (mean: 67.1 min; $t = 2.1$, $p < .05$). Nonparental care providers included grandparents (80%) or nannies (20%). Nonparental care providers allowed children to spend more time viewing television (mean: 111.1 min per day) than did parents (mean: 60.5 min per day; $t = -3.2$, $p < .01$).

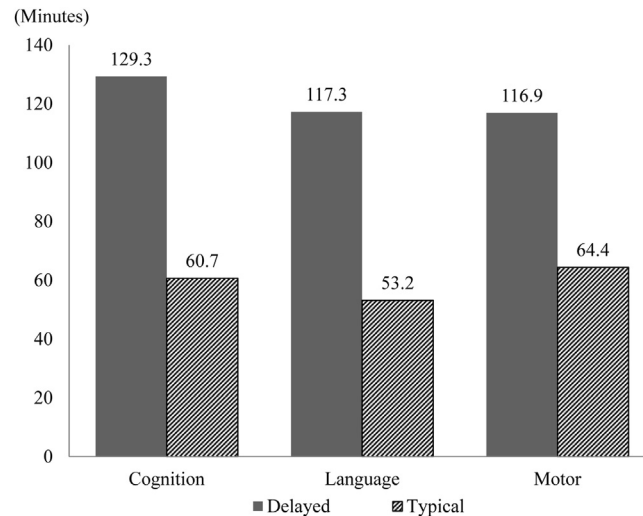


Fig. 1. Comparisons of total daily screening time among children with and without developmental delay.

4. Discussion

We endeavored to extend current knowledge regarding the amount of time that young children spent viewing television and its effects on cognitive, language, and motor developmental skills. The study yielded three primary findings. First, young children were typically exposed to more than 1 h of television daily before they were 2 years old. Approximately 45.7% of children older than 2 years spent at least 2 h per day viewing television. Second, cognitive, language, and motor developmental delays in young children were significantly associated with how much time they spent watching television. Children with developmental delay tended to spend more time viewing screens than did children without developmental delay. The other possible factors associated with developmental delay were maternal education levels and lived in a double-income family. Third, the type of care providers determined how much time the children in their charge spent viewing television.

Numerous children in Taiwan are exposed to television early in life. We determined that children younger than 2 years watched approximately 67.4 min of television daily; children older than 2 years spent approximately 103.8 min daily. Based on the recommendations of the AAP, the children in this study younger than 2 years watched excessive television (AAP, 2011). Viewing excessive television may have adverse effects to child development, potentially contributing to poor verbal and memory skills, emotional difficulties, and attention problems (Anderson & Pempek, 2005; Chonchaiya & Pruksananonda, 2008; Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; Mistry, Minkovitz, Strobino, & Borzekowski, 2007; Pagani, Fitzpatrick, Barnett, & Dubow, 2010). The results from this study were consistent with those of studies that reported a negative relationship between language development and television viewing for children younger than 2 (Chonchaiya & Pruksananonda, 2008; Zimmerman et al., 2007). In addition to language development, allowing young children to spend too much time watching television could be detrimental in cognition and motor developmental skills. Children who watch too much television have less time to spend on developmentally enriching activities that promote cognitive, behavioral, and motor development (Pagani et al., 2010).

Notably, caregivers are critical in determining the television-viewing times of children. The results of this study were consistent with those reported by Benjamin et al. (2009), which suggested that the children with nonparental caregivers spent more time watching television than would those with their parents. Because more and more mothers in Taiwan are undergoing higher education and working full-time, they spend relatively little time with their children (Westley, Choe, & Retherford, 2010). Grandparents are common childcare providers in three-generational Taiwanese families (Chen, Short, & Entwisle, 2000). Therefore, the primary caregivers could be grandparents or nannies. Moreover, the fertility rate in Taiwan was 0.9 in 2010 and 1.07 in 2011 (Taiwan Ministry of the Interior, 2012). Because a family may have only one child, certain parents may overindulge this child, and grandparents may tend to be less strict with a child, allowing him or her to spend more time viewing television, exacerbating physical and mental development (Lin, Leung, Hui, Lam, & Schooling, 2011). It is also reasonable that children lived in a double-income family were more likely to engage in watching television if their parents had little time with them to engage in other activities.

Additionally, maternal education levels were critical in determining the television-viewing times of children. Our results were consistent with those of several previous studies, suggesting that highly educated mothers allowed their children less time to engage in screen activities than did mothers who possessed low levels of education (Certain & Kahn, 2002; Guryan et al., 2008; Hinkley, Salmon, Okely, & Trost, 2010; Kourlaba, Kondaki, Liargiovinos, & Manios, 2009). It is plausible that

highly educated parents were less likely to engage in screen activities if they believed these activities negatively affected their children.

According to caregivers' report, the television programs that the children were most commonly exposed to were *Teletubbies*, *Thomas and Friends*, and *Dora the Explorer*. Many caregivers believed that some television programs could be beneficial for children's development, especially intellectual development (Rideout, Vandewater, & Wartella, 2003; Weber & Singer, 2004). They considered that the content of these television programs consisted of instructional or educational objectives. Weber and Singer (2004) indicated that the types of television program that were most attractive to children under the age of 3 included songs, animals, movement, rhythm, animation, and babies. Many caregivers in this study selected such educational and age appropriate television programs for their children. However, the long-term effects of television content and features on the developmental skills of young children remain understudied. More studies in the future are thus warranted to examine the effects of television content and features on children's development.

Children who spend too much time on sedentary activities (e.g., viewing television) may decrease the time they spend engaging in physical activities (Anderson & Pempek, 2005). Children may miss opportunities to hone their motor skills and improve their motor development (Fisher et al., 2005; Mistry et al., 2007). However, young children who possess motor problems may be forced to spend their time viewing television because their lack of motor skills limits their participation in physical activities. For instance, low levels of activity participation among children with disability may encourage sedentary behavior (Frey & Chow, 2006).

Too much screen time can interfere with activities such as playing with friends and doing physical activities (Anderson & Pempek, 2005). Play is the primary occupation of children, who typically spend a substantial amount of time participating in physical activities (Case-Smith & O'Brien, 2010). Pediatric practitioners believe that engaging in physical activities is the optimal way for young children to develop their motor skills (Case-Smith & O'Brien, 2010). This finding should encourage healthcare professionals to explain the relationship between television viewing time and development and advocate developmentally positive activities for young children in the home. Therefore, pediatric practitioners should encourage parents to limit the sedentary activities of their children, providing play strategies and physical activity recommendations to the caregivers of young children.

A nation survey conducted in the United States estimated that the prevalence of developmental delay among children aged 0–2 and 3–5 years was 33% and 36%, respectively (Zimmer & Panko, 2006). In this study, the rates of cognitive, language, and motor developmental delay were 23.3%, 36.7%, and 23.3%, respectively. The incidence of developmental delay among the participants was extremely high. One explanation could be the sources of recruitment. All participants were recruited from the university medical center. In pediatric hospital settings, the prevalence of developmental delays among children was higher than that expected for children in the general population (Petersen, Kube, Whitaker, Graff, & Palmer, 2009). Study population differences and aspect of the diagnostic evaluation were potential factors related to the wide variations (Moeschler, Shevell, & Committee on Genetics, 2006). Larger studies in general population are warranted to confirm the findings.

This study possesses certain limitations. First, we experienced difficulty using the cross-sectional results to determine the long-term effects of television exposure on developmental skills of young children. A longitudinal study on this topic would be extremely valuable. Second, the major limitation of this study was a small-sized sample in a hospital-based setting. Future research using larger samples in community-based settings is needed. Despite these limitations, our findings provide considerable information on the amount of time that young children spend viewing television and its effects on developmental skills. As a result, this study extends the findings of the previous works in a younger age group.

5. Conclusion

These findings relate to the information that pediatric practitioners currently or should provide to the parents and caregivers of young children. Pediatric practitioners should provide parents and caregivers with information on these findings regarding the relationship between television exposure and development. Pediatric practitioners can encourage parents and caregivers to limit the sedentary activities of their children, and advocate developmentally positive at-home physical activities for young children. Furthermore, the findings indicated that researchers should focus on the long-term effects of television exposure on cognitive, language, and motor development for young children.

Competing interest

None declared.

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