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Predicting children's media use in the USA: Differences in cross-sectional and longitudinal analysis

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Abstract

The purpose of this paper is to examine the predictors of children's media use in the USA, comparing cross-sectional and longitudinal analyses. Data come from Waves 1 and 2 of the Child Development Supplement (CDS-I; CDS-II), a nationally representative sample of American children aged 0–12 in 1997 and 5–18 in 2002. Twenty-four hour time use diaries are used to assess children's time spent with media (television, video games, computers, and reading). Predictors examined include socio-demographics, neighbourhood quality, family factors, and other media use. Ordinary least square (OLS) multiple regressions were performed by three age groups (preschoolers, early school age, and preadolescence). The findings suggest that neighbourhood quality, parental limits and family conflict are significant predictors of children's media use within time or over time, but the significance depends on the type of media and child's developmental stage. In addition, children's television viewing and reading habits are formed early in life and reinforced over time. This study is among the first to provide empirical evidence for the effect of early contextual factors on the life course of children's media use from a developmental perspective.

American children and adolescents average over 21 h of television viewing per week. Adding estimates of video game and other media to this figure, media use estimates increase to 35–55h (Gentile & Walsh, 2002; Nielson Media Research, 1998; Roberts, Foehr, Rideout, & Brodie, 1999). Preschool children spend between 2 and 2.5 h per day watching television while older children in primary school watch between 2 and 4.5 h per day (Roberts *et al*., 1999; Vandewater *et al*., 2007; Wright *et al*., 2001). The prevalence of media in children's lives has prompted research on the effects of media on children. Most research on children and media focuses on both negative concerns and potential outcomes of media on children's development, while relatively little research beyond demographic factors examines influences on children's use of a particular medium (Anand & Krosnick, 2005). We lack a clear understanding of whether the factors assumed as predictors of children's television viewing will hold for other media use, including video games, computers, and reading. Particularly, little is known about the long-term influence of predictors on later media use. This study takes an ecological perspective in examining predictors of media use and a developmental approach in analysis (cross-sectional age comparisons and longitudinal analysis by children's developmental stage) to address these issues.

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Ecological perspective

Media use occurs in a complex environment. As suggested by Bronfenbrenner's (1979, 1986, 1993) ecological theory, an individual can be influenced directly, and indirectly through five environmental settings: the microsystem, mesosystem, exosystem, macrosystem, and chronosystem. Contextual factors may thus, exert some external influence on the leisure choices of children. Context or settings provide both opportunities and constraints on the behaviour participants will display (Huston, Wright, Marquis, & Green, 1999). Barker's (1968) ecological theory defines behaviour settings as composed of the physical context, human components, and expected patterns of behaviour. Settings allow for certain behaviours and limit others. Human development occurs through a process of reciprocal interaction between the evolving person and people, objects and symbols in its environment (Bronfenbrenner & Ceci, 1993, 1994). 'To the extent that the necessary conditions and experiences are not provided,. . . potentials will remain unactualized' (Bronfenbrenner & Morris, 1998, p. 995). Learning theorists such as Bandura (1978) suggest that behaviours that are practiced and repeated lead to lasting characteristics in the individual. Thus, it is important to determine how children spend their time as this may affect patterns of behaviour over the long term. As Huston *et al*. (1999, p. 912) note, 'children not only are influenced by environments but choose their environments on the basis of individual skills and preferences that they can exercise there'.

Although context is emphasized in studying children, a small number of studies examine how contextual factors influence children's media use. Thus, using a sample of children aged 0 to 12 years old representative of the US population, this study comprehensively examines factors at the microsystem level. According to Bronfenbrenner (1979, 1986, 1993), the individual is at the centre of his or her environment and is actively involved in interactions with it. The first environmental system the individual encounters is the microsystem which is composed of the family, peers, school, and neighbourhood. As this level is where the individual child has the most direct influence and interaction, we choose to focus our study here. We assess factors assumed as important predictors of four different types of media use, including socio-demographic factors, and neighbourhood and family contexts.

Based on the findings of previous studies, primarily about television viewing, we offer hypothesized relations of socio-demographic factors, neighbourhood, and family contexts with media use among children. Lack of prior research on longitudinal trajectories of media use and on media types beyond television viewing, however, limits our ability in many cases to make specific hypotheses. Thus, the purpose of this study is to examine the relative significance of predictors of media use both within and over time.

Socio-demographic factors

Family income and parental education—Children from families with low education and income watch more television than do children from families with higher SES (Comstock, 1991; Truglio, Murphy, Oppenheimer, Huston, & Wright, 1996). Lower parental education is associated with higher viewing for European American and African American children and is more predictive for children of younger ages (0–5) than older children (6–12; Bickham *et al*., 2003). Thus, we predict parental education and SES will be negatively related to television viewing and video game play, and positively related to computer use and reading.

Race—Prior research has shown ethnic differences in the amount of television viewed (Blosser, 1988; Roberts *et al*., 1999). Research has shown that African-Americans watch 1.5–2 times more television than European Americans (Roberts *et al*., 1999; Tangney & Feshbach, 1988) and watch more regardless of income level (Greenberg & Dervin, 1970). Hispanic Americans watch more television than European Americans but less than African-Americans

(Bickham, *et al*., 2003; Blosser, 1988; Greenberg & Brand, 1994; Roberts *et al*., 1999). African-Americans also played more video games than European Americans and Hispanic Americans (Bickham, *et al*., 2003). Thus, we predict African-American and Hispanic American children will use media more than White children.

Age—Television is an activity that occupies the largest amount of young children's time except for sleep and play (Huston *et al*., 1999; Vandewater, Bickham, & Lee, 2006). Children at any age watch television more than they play video games, but video game play increases for older children (Wright *et al*., 2001). We expect the home environment to have a greater influence on children's media use at younger ages, as by 12–13 children may be more influenced by peers.

Gender—Differences in media consumption patterns of boys and girls have been found (for an overview, see Roe, 1998). Boys watch more television than girls (Huston, *et al*., 1999) and spend more time playing video games (Bickham *et al*., 2003; Wright *et al*., 2001). However, there is some controversy in these findings. Van den Bulck and Van den Bergh (2000) found no differences in television or computer game use for boys or girls aged 10–11. They did however, find that boys read fewer books. Thus, we predict that boys will watch more television, play more video games, and read less than girls, but expect no differences in gender for computer use, especially at younger ages.

Neighbourhood quality

The neighbourhood environment is considered an influential factor in children's developmental outcomes as well as their activity or time use. Buckingham (2000) proposes that parents' perception of risk of the neighbourhood compels households to have domestic entertainment media which can displace children's play on the street. Danger and lack of facilities in neighbourhood contexts may make parents purchase media related products for their children's indoor play and increase the likelihood that children spend their leisure time watching television or playing video games (Medrich, Roizen, Rubin, & Buckley, 1982). The media-rich bedroom can be understood as a refuge from the dangers of the outside world (Bovill & Livingstone, 2001). Bickham *et al.* (2003), however, found no relationship between neighbourhood quality and television viewing. Thus, we predict children in more dangerous neighbourhoods will use media more than children in less dangerous neighbourhoods, but this relationship may vary by type of media and child's developmental stage.

Family context

Parental mediation—Parental mediation or restriction has been examined as one of the important factors influencing children's media use in a family system. Restrictive guidance — limiting or restricting use — leads to a reduction in media use by children (Truglio *et al*., 1996; Van den Bulck & Van den Bergh, 2000). Vandewater, Park, Huang, and Wartella (2005) found that 67% of families had rules about the amount of time young children are allowed to watch television. Families with higher SES were more likely to have rules than those with lower SES. Children with time rules watched less television. Roberts *et al*. (1999), however, found only 38% of families with older children (8–18 years) with television had rules. Rules about media use can be predicted by the number of parents in the household as well as the level of parental education (Dorr & Rabin, 1995; Lin & Atkin, 1989). We predict that parental limit setting will be negatively related to children's media use, if parents have negative attitudes towards a particular medium.

Family conflict—Although not often examined, family conflict may have an impact on children's media use. From a family systems approach, the interactions among family members shape individual behaviour and attitudes. Conflict may cause children to use media as a means

of escape from the negative interactions around them (Bickham, *et al*., 2003). Vandewater and Bickham (2004) found that family conflict was negatively related to young children's educational media use as well as to young children's reading skills. 'Family conflict seems to be a particularly powerful stressor in children's lives, disrupting the quality of the home environment, educational media use, and reading skills alike' (Vandewater & Bickham, 2004, p. 725). Vandewater, Lee, and Shim (2005) similarly found support for this notion. Additionally, because there is a fairly large literature documenting the negative impact of family conflicton children's developmental outcomes (Amato & Keith, 1991; Vandewater & Lansford, 1998), we include this factor in order to examine the long-term effect of family conflict on children's media use. We predict that family conflict will be positively related to entertainment media use and negatively related to reading. Furthermore, we investigate whether the relationships hold longitudinally.

Number of adults in the household—Family composition might affect children's media exposure. Some studies have found that children in homes with a single mother or single parent watch more television than did children in homes with both parents (Brown, Childers, & Waszak, 1990; Medrich *et al*., 1982; Gentile & Walsh, 2002). This may be because the number of adults is positively related to time children spend interacting with adults, which may displace television viewing time. Thus, we predict the number of adults in the household will have a negative relationship to children's television viewing. We also seek to investigate whether such relationships hold for other media.

Developmental perspective

A developmental perspective assumes that children experience varied cognitive and social growth between birth and adolescence, while interacting with their environments. This perspective suggests that the impact of different forms of media and predictors influencing media use vary by a child's developmental stage. For younger children (especially up through 4–5 years of age), both exposure to various forms of media and television use increases with age. At around 5–7 years when children begin school, their exposure to media decreases, partly due to reduced discretionary time. Among pre-adolescents aged 8–11, television viewing and exposure to all forms of media increases once again (Roberts & Foehr, 2008).

A developmental perspective raises the question of why changes in patterns of media use occur with age. This may be explained by changes in individual motivations and preferences. However, given that individual motivations are also subject to influence by their social contexts including family and peers, contextual factors may explain the differences in media use by children's developmental stages. Another important consideration to be examined from this perspective is whether earlier media use shapes later media use. Use of a certain medium may influence later use of the same medium or other forms of media. For instance, the more young children watch television during preschool age, the more they may watch television and the less they may read books during their school age years.

The purpose of this study is to examine the predictors of children's media use in the USA, using both cross-sectional and longitudinal analyses. Although many predictors could be included in such an exploratory study, we have chosen to focus on predictors at Bronfenbrenner's micro system level. We focus on three age categories: preschoolers (ages 0–4), early school age (ages 5–8), and preadolescents (ages 9–12), as we expect children's media use will reflect various preferences and motivations associated with these age categories. Finally, we compare media use in the short and long term to determine if the predictors hold over time.

Method

Procedures and sample

Data for this study came from the first and second waves of the Child Development Supplement (CDS-I and II) to the Panel Study of Income Dynamics (PSID), a longitudinal study of a representative US sample of individuals and the families within which they reside. In 1997, the CDS was drawn primarily from the PSID core families, including a group of African-American families with children under age 13. Of the families in the PSID with children under 12, 2,380 participated, yielding a sample of 2,902 children who returned at least one time-use diary in Wave 1, and 2,569 children in Wave 2. Because of initial oversampling of low-income families and the addition of a sample of immigrant families, sampling weights were used in the CDS data so that the data provide nationally representative estimates (see University of Michigan, 2008, for a detailed discussion of PSID and CDS sampling procedures).

The current study utilized a subsample of the CDS (N = 1, 354 in which children completed time use diary data at Waves 1 and 2, and data on all variables and covariates of interest at wave 1. Sampling weights were recalibrated such that the subsample remained representative of the US population. The median income of families in CDS-I was $42,000, with 14.7% of families falling below the 1997 federal poverty level.[1] Seventeen per cent of heads of households had not graduated high school, 30.9% had a high school diploma, 22.4% had some college, and 30% had attained a bachelors degree or higher. Sixty-eight per cent of the samples were White, 14.4 Black, 10.6 Hispanic, and 6.7% were of other ethnicities.

Measures

Means and standard deviations for all variables of interest are presented in Table 1.

Media use—Time diaries in waves 1 and 2 provide the amount of time children spent viewing television, reading (or being read to), playing video games, and using a computer in 1997 and 2002. Children's time-use information was collected during the school year (September—May) using 24h time-use diaries on one randomly chosen weekday and one randomly chosen weekend day. The child's primary caregivers for the very young children, and older children and adolescents were expected to record all the activities that the children engaged in primarily and secondarily.[2] Caregivers were reminded to keep track of their child's activities with a phone-call the day before their randomly chosen diary day. On the diary, every minute of the two 24 h periods was accounted for with a primary activity and if applicable, a secondary activity. Also reported was who was doing the activity with the child, and who was there, but not directly participating in the activity with the child (i.e. if the parent was in the house, but not using media with the child).

All time-use variables were constructed by summing the total number of min spent in each activity on the weekday and the weekend. Duration totals included reports of activities as either primary or secondary. Time diaries in Wave 1 were used to examine short-term relationships of predictors with media use, and time diaries in Wave 2 were used to look at long-term relationships of predictors. Thus, dependent variables included time spent viewing television,

[1]The median income of US families was $44,568 in 1997. Families in poverty refer to those with below one family income-to-needs ratio (computed by dividing family income by the 1997 poverty threshold provided by the Census Bureau appropriate for family size, the number of persons in the family under age 18, and the age of the householder; mean: 3.04; SD: 3.50).

[2]Information about who completed the time diary: Weekday diary in Wave 1 (Primary caregiver alone: 67.77%; Primary caregiver and child: 11.36%; Child alone: 7.06%; Others: 8.33%; and Missing: 5.48%); weekend diary in Wave 1 (Primary caregiver alone: 67.42%; primary caregiver and child: 12.16%; child alone: 6.85%; others: 7.12%; and missing: 6.40%); weekday diary in Wave 2 (primary caregiver alone: 41.73%; primary caregiver and child: 20.096%; child alone: 35.62%; others: .66%; and missing: 1.91%); weekend diary in Wave 2 (primary caregiver alone: 42.86%; primary caregiver and child: 19.93%; child alone: 35.62%; Others: 0.78%; and missing: 0.82%).

time spent reading, time spent playing video games, and time spent using a computer for both waves 1 and 2. Time spent with each medium in wave 1 was entered as a predictor for the longitudinal analyses of media use.

Socio-demographic factors—Socio-demographic factors were assessed through family income to needs ratio, parental education, ethnicity, child age, and gender. *Family income to needs ratio* refers to family income divided by the family poverty threshold income; *parental education* was measured by the number of years of education the head of the household completed; and *ethnicity* was represented by three dummy variables. *Child age* was calculated in years. *Child gender* was coded into a dummy variable where girls were coded as zero and boys were coded as one.

Neighbourhood quality—*Neighbourhood quality* was measured by an index consisting of 11 items assessing parental perception of safety and neighbourhood cohesiveness. Primary caregivers were asked how they rate their neighbourhood as a place to raise children (1 = poor, 5 = excellent), how likely a neighbour would provide help if someone was breaking into their home, or if their kids were getting into trouble (1 = very unlikely, 4 = very likely), and how safe it is to walk around alone after dark (1 = extremely dangerous, 4 = completely safe). Standardized scores were used to create the neighbourhood quality index ($\alpha = .86$).

Family context—Family context was assessed by the number of adults in the household, parental limit setting, family conflict, and time spent with parents.

Number of adults in the household was calculated by subtracting the number of children in the home from the total number of family members.

Parental limit setting was measured by seven items assessing how parents set limits on children's time use. Items included 'set limits on how much time children can watch TV a day', 'set limits on how late children can stay up at night', 'try to control how children spend time after school or daycare', and 'set a time when children do homework'. The scale ranged from 1 (never) to 5 (very often), and the mean of the items was used as the final score ($\alpha = .76$).

Family conflict was measured by six items assessing how well family members got along and settled arguments. Items included 'we fight a lot in our family,' 'family members always calmly discuss problems,' and 'family members sometimes hit each other.' The scale ranged from 1 (completely agree) to 4 (completely disagree), and the mean of the items was used as the final score ($\alpha = .68$).

Time with parents was calculated by summing the total number of min parents were directly involved in their children's activities, which was collected by the time diaries.

Analysis plan

Analyses were conducted using Stata 8.0. Ordinary least squares (OLS) multiple regression was performed to predict time spent viewing television, time spent playing video games, time spent using a computer, and time spent reading. Cross-sectional analyses to examine concurrent effects of predictors on each type of media use used variables measured in Wave 1. Analyses to examine, longitudinal relationships between predictors and media use used variables measured in Wave 1 as the independent variables, and media use measured in Wave 2 as dependent variables. Analyses for each type of media were performed separately for children in three age categories: ages 0–4 ($N = 439$), ages 5–8 ($N = 454$), and ages 9–12 ($N = 446$).

For cross-section analyses, socio-economic factors (family income to needs ratio, parental education, and ethnicity), neighbourhood quality, parental factors (number of adults in the

household, parental limit setting, family conflict, and time with parents), individual factors (age and gender), and time spent with other media, measured in Wave 1, were entered as independent variables in the models. Time spentin each medium, measured in Wave 1, were the dependent variables. For longitudinal analyses, socio-economic factors (family income to needs ratio, parental education, and ethnicity), neighbourhood quality, parental factors (number of adults in the household, parental limit setting, family conflict, and time with parents), individual factors (age and gender), and time spent with each medium, measured in Wave 1, were entered as independent variables. Time spent in each medium, measured at Wave 2, were the dependent variables. All analyses were weighted using sampling weights to yield nationally representative coefficient estimates. The command of 'cluster' in Stata was used to correct standard errors for non-independence, because of the existence of sibling pairs in the data.

Results

Predictors of media use by age group

The zero-order correlations between media use and predictor variables are shown in Table 2. The results of the multiple regressions for television viewing, video game playing, computer use, and reading are presented in Tables 3–6, respectively.

Television viewing

Analyses predicting time spent viewing television within time and over time are presented in Table 3.

For children aged 0–4, cross-sectional analysis indicated that certain ethnicities (Asian), age, parental limit setting, and time spent with a computer were related to time spent viewing television. Longitudinal analysis show that age, the number of adults in the household, family conflict, and time watching television in Wave 1 predicted time spent viewing television in Wave 2. Asian children were less likely to spend time watching television than other ethnicities. The more parents set limits on children's time use, the less time children spent viewing television. However, parental limit setting did not have long-term effects on television viewing. In contrast, the number of adults in the household and level of family conflict predicted television viewing over time. That is, the number of adults in the family reduced, and family conflict increased, television viewing over time. Not surprisingly, the more time children spent watching television during infancy/toddlerhood, the more time they spent watching television during early school age (ages 5–9).

For children aged 5–8, cross-sectional analysis showed that gender, neighbourhood quality, and parental limit setting were significantly associated with time spent watching television. Longitudinal analysis showed that ethnicity (Black), family conflict, and time spent with television in Wave 1 were related to time spent viewing television in Wave 2. For children aged 9–12, while age and parental limit setting were related to time spent viewing television within time, there were no significant predictors of television viewing over time for this age group. As children increased in age, contextual factors became less important in predicting television use. However, regardless of children's age categories, parental limit setting on children's time use including television viewing, homework, and after-school time was negatively related to time spent viewing television within time. For children aged 0–4 and 5–8, family conflict was associated with an increase in television viewing over time.

Video games

Analyses predicting time spent playing video games within time and over time are presented in Table 4

For children aged 0–4, none of the variables except child age predicted video game playing within time. Longitudinal analysis indicated that family income to needs ratio, parental education, gender, time with television, and time with a computer during infancy/toddlerhood were related to time spent playing video games during early school age. The more children watched television and the more children used a computer in infancy/toddlerhood, the more they played video games at older ages.

For children aged 5–8, time spent reading was negatively related to time spent playing video games within time. Boys were once again more likely than girls to play video games both within and over time. For children aged 9–12, the more parents set limits on children's time use, the less time children spent playing video games. As was found for the younger age groups, boys were more likely than girls to play video games. Interestingly, the number of adults in the household during pre-adolescence was positively related to time spent playing video games during late adolescence.

Computer use

Analyses predicting time spent on the computer within and over time are presented in Table 5

For children aged 0–4, cross-sectional analysis indicated that family income to needs ratio, age, and time spent watching television were related to time spent using a computer. The regression model to predict computer use over time was not significant. For children aged 5–8, there were no significant predictors of computer use within time. Longitudinal analysis showed that family income to needs ratio, ethnicity (Black; Hispanic), age, and neighbourhood quality during early school age were related to time spent using a computer during early adolescence.

For children aged 9–12, ethnicity, age, gender, and time spent reading were related to time spent using a computer within time. White children, older children, boys, and children who spent more time reading spent more time using a computer. White children and children who spent more time reading also spent more time using a computer in the following 5 years. Parental limit setting on children's time during early adolescence was associated with spending less time using a computer during late adolescence.

Reading

Analyses predicting time spent reading within time and over time are presented in Table 6.

For children aged 0–4, ethnicity (Black and Hispanic) was related to time spent reading within time. That is, White children were more likely to spend more time readingthan Black and Hispanic children. Parental limit setting was also significantly associated with time spent reading. The more parents set limits on children's time use, the more children read. Parental limit setting, however, was not significant in predicting changes in reading over time. Longitudinal analysis showed that time watching TV and time reading in infancy/toddlerhood were related to time spent reading during early school age. The less time children spent viewing TV and the more time they spent reading, the more time they read 5 years later.

For children aged 5–8, cross-sectional analysis indicated that family income to needs ratio and time spent with parents were positively related to time spent reading. Longitudinal analysis showed that time watching television, time on a computer, time reading, parental education, neighbourhood quality, and family conflict during early school age were associated with time spent reading during early adolescence. The less time children spent watching TV and on a computer, and the more time they spent reading, the more they read when they were adolescents. Family conflict was related to a decrease in time spent reading over time.

For children aged 9–12, cross-sectional analysis showed that parental education and time on a computer were positively related to time spent reading. Longitudinal analysis indicated that time reading during early adolescence positively predicted time reading in later adolescence.

Discussion and conclusions

This study examined predictors of children's media use, using both cross-sectional and longitudinal research designs. The findings suggest that significant factors explaining children's media use vary by type of media and child's developmental age. Findings also differ by research design. Specifically, the predictors of media use vary depending on analyses of media use in the short or long-term. We summarize and discuss the findings by factors which were examined as predictors of children's media use, considering the characteristics of each medium and children's developmental age.

Socio-demographic factors

Family's economic status—Although earlier studies show a negative relationship between family income and children's time viewing television (Comstock, 1991; Truglio *et al*., 1996), this study did not find a significant relationship with children's television viewing. However, family income to needs ratio did significantly predict children's use of new media such as a computer. This may be due to the fact that families with higher incomes can afford to purchase new media equipment such as the latest video and computer games, and this in turn may affect children's choice of media to use during their leisure time (Bickham *et al*., 2003).

Parental education—The education level of the head of the household was positively related to reading 5 years later for children aged 5–8, and similarly for older children aged 9–12. Thus, for children in early adolescence, reading appears to be shaped by parental educational level, and this effect lasts over time. In contrast to our expectations, parental education level was not related the amount of time watching television and using a computer. It is possible that parental education may be related to the type of television program and online activities children choose. Assessing these relationships will be an important area of further inquiry.

Ethnicity—Black children tended to watch TV more than other ethnicities, while Asian children tended to watch less. Black and Hispanic adolescents were more likely to spend less time using a computer than White adolescents. For infants and preschool age children, Black and Hispanic children tended to spend less time reading than White children. This is consistent with prior studies indicating different patterns of use or preference towards certain types of media by race (Anand & Krosnick, 2005; Bickham, *et al*., 2003). Current studies indicate that Blacks (including adolescents) tend to use both the Internet and computersless and have less preferable attitudes towards them than White people (Jackson *et al*., 2003; Katz & Rice, 2002; Rideout, Roberts, & Foehr, 2005).

Child age—Within the three age categories assessed, age was positively related to time spent using television and computers, particularly for children aged 0–4 and 9–12. Media use of children aged 5–8 was not influenced by age, indicating that within this age range, use does not significantly vary by age. For all age groups, reading (or being read to) was not predicted by age. That is, regardless of age, the amount of time children spend reading was similar at around 30 min per day.

Child gender—Boys spend more time playing video games than girls, which is consistent with the findings of previous studies (Bickham *et al*., 2003; Cummings & Vandewater, 2007; Wright *et al*., 2001) except for very young children aged 0–4. The argument that boys spend

more time watching television than girls is true only for children aged 5–8. Gender differences in computer use are found among older children aged 9–12. However, unlike Van den Bulck and Van den Bergh's (2000) findings that boys read fewer books, we found no significant difference in reading between boys and girls. The amount of time in reading was not explained by child age and gender.

Neighbourhood context

Neighbourhood quality was a significant predictor of media use for children aged 5–8, who may begin to be active in outdoor play. The more parents perceived their neighbourhood as unsafe, the more children spent time with media at home. Parental perception of neighbourhood danger may cause them to keep their children inside at home rather than allowing them to play outside, thus causing increases in media use. Interestingly, children who have less safe and less cohesive neighbourhoods spend more time viewing television than children who have higher quality neighbourhoods. Over time, the children with lower quality neighbourhoods tend to spend more time with other media, such as computersand reading. Perception of danger and lack of facilities in neighbourhoods leads to media-rich homes to keep children inside, and as a result, children spend more time with media than playing out on the street (Bovill & Livingstone, 2001; Buckingham, 2000). However, Bickham *et al*. (2003), who analysed children ages 0–12, did not find a significant relationship between neighbourhood quality and television viewing. Our findings suggest that this gap may be explained by children's age. Among primary school aged children who start being active in outdoor play, neighbourhood quality may significantly affect the way they spend their leisure time, which in turn may influence their development.

An exception to the above notion that a negative relationship between neighbourhood quality and media use exists is with video game playing. This study found that the better the neighbourhood young adolescents had, the more time they spent playing video games. This may be partly due to the fact that playing electronic games is a type of socializing activity among adolescents, rather than a solitary activity (Durkin & Barber, 2002; Orleans & Laney, 2000; Suoninen, 2001). adolescents who have safe and cohesive neighbourhoods may have stronger ties with friends and less risky friends. Playing electronic games may be one of the activities shared with less risky friends. The possible links between good friendships and electronic games can be supported by the findings of Durkin and Barber (2002): Adolescents who never played computer games reported having more risky friends and being less attached to school than those who played either low or high levels of computer games. Playing electronic games can be a marker of having good friendships, and furthermore good friendships may be reinforced by playing electronic games together. This notion needs further examination.

Family context

Parental limit setting—Family context shapes children's media use, particularly media use at home. Parental limit setting on children's time use including television viewing, homework and after school activities was negatively related to time spent viewing television. This is consistent with findings from existing studies on parental guidance/restriction and media use (Van den Bulck & Van den Bergh, 2000; Vandewater *et al*., 2005). The negative relationship between parental limit setting and television viewing was true for all age groups from infants to preadolescents. Even though, it is assumed that parental influence is weakened during adolescents, parental control still holds for preadolescents' television viewing.

Meanwhile, this study found that the relationship between parental limit setting and other media use such as video games, computers, and reading were less obvious. This may be because the measure of parental limit setting included limits on television viewing, but did not include limits on video games and computer use. The concurrent relationship between parental limit

setting and children's television viewing suggests that parental limit setting, which refers to parental behaviour specifically intended to encourage or discourage children's behaviour in a certain way, tends to have immediate/instantaneous effects on children, but regulation through restriction does not have long-term effects in terms of parenting.

Family conflict—Family conflict was found to have along-term relationship, rather than a concurrent relationship, with children's media use. Children with higher levels of family conflict during infancy/toddlerhood were more likely to spend increased time viewing television during early school age than those with less family conflict. This is true for children aged 5–8 as well. Family conflict during early school age was positively associated with time watching television and negatively related to time reading during early adolescence. In a conflict-ridden family environment, children may spend more time alone than interacting with family members, and choose a solitary entertainment activity rather than family shared activities. Television viewing can be an appealing means for children to spend more time alone and avoid negative interaction with family members. Their preference for television viewing gradually increases, and as a result they spend more time viewing television than children with lower levels of family conflict. Thus, family conflicts may have cumulative effects on children's preference and behaviours, including television viewing.

Earlier media use as predictors of later media use

An important contribution of this study involves the longitudinal relationships among media use, given that few studies examine the influences of earlier media use on later media use with longitudinal data. For television viewing and reading, the total amount of time children spent viewing television and reading in Wave 1 was positively related to time spent in the respective mediums in Wave 2. These findings suggest that children's television viewing and reading habits are formed early in life, and those media habits are reinforced over time.

An interesting finding is the longitudinal relationship between television viewing and reading. According to the findings, reading time was reduced in later years by earlier television viewing, but television viewing was not influenced by earlier reading. Reading is a leisure activity that can be easily displaced by a more amusing activity, such as television viewing. Television viewing is not as easily displaced by other activities. This may be due to the fact that children's television viewing is a high priority entertainment activity, giving high levels of satisfaction with low cost. Over time, the more children are entertained by television, the less they may have need for or receive satisfaction from reading. Using 3-year panel data, Koolstra, van der Voort, and van der Kamp (1997) found that TV viewing has inhibitory effects on reading comprehension; specifically that television viewing reduced reading time and led to depreciative attitudes towards reading, which in turn was negatively related to reading comprehension.

For video game and computer use, the amount of time children spent playing video games and using a computer in Wave 1 was not related to time spent with the respective mediums in Wave 2. The amount of time spent viewing television during infant and preschool age positively predicted more video game play during early school age. For adolescents, reading seemed to stimulate computer use both within time and over time. The positive relationships between reading and computer use may be partially explained by a common characteristic of text-based media.

Limitations and future directions

Van den Bulck (2006) suggests that children's media use does not appear to be predicted by earlier media use and that longitudinal designs might not lead to much added value over cross-sectional approaches. This study, however, has found modest support for longitudinal

relationships between early and later media use. In addition, of the predictors assessed, early media use was found to be one of the strongest predictors of later media use. Rather than arguing that one method provides more valid findings than the other, we show that cross-sectional analyses indicate short-term relationships between predictors and media use, and longitudinal analyses present long-term relationships between earlier predictors and later media use, particularly between earlier media use and later media use. Most importantly, this study shows that the predictors of media use change when analysed using cross-sectional data compared to longitudinal data.

A second issue involves the use of parental reports versus child reports of media use. On one hand, young children are usually considered unreliable reporters because of a lack of understanding and different definitions/perceptions of measured phenomenon compared to adults. On the other hand, parents tend to report their behaviours/attitudes towards their child in a socially desirable way, and there is some limitation to their ability to report their child's behaviours because they are not the subject of those behaviours. Borzekowski and Robinson (1999), who compared mother's and child's global estimates of viewing time with observation by video equipment, found that the mother's estimate of viewing was closer to the video based measures than the child's estimate, but the child's report of their behaviours and actions while viewing was more accurate than the mother's report. Koolstra and Lucassen (2004) found that parents reported providing parental TV guidance more often than children reported receiving it. Interestingly, the mothers' estimation of their children's viewing time was lower than the children's estimation (83 vs. 125min/day).

The reliability of data reported by a child may depend on the child's developmental age. In Koolstra and Lucassen's (2004) study where the authors concluded that parents underestimated their child's viewing time, the mean age of the children was 11 years. Anderson, Field, Collins, Lorch, and Nathan (1985) examined, the accuracy of parental report of their young children's (age 5 on average) media use. The correlation between direct observation through video-recording and the viewing time diary was quite high (.84), indicating that time diaries filled out by parents provided fairly accurate representations of children's weekly viewing. Thus, it is argued that for children younger than 10 years, parental reports, particularly through time diaries are more valid than child reports, and older children's monitoring of their behaviours are closer to reality than parents' monitoring as a third party.

A third issue concerns, the use of multiple predictors in a regression model and the small effect sizes found (R^2 = .07 – .27). Effect size refers to the substantial strength of the relationship mong variables. Because statistical significance is influenced by sample size, it does not indicate substantial differences, particularly for data with a large sample size. Due to the large number of predictors and small effect sizes, there is the possibility that the relationships between significant predictors and media use may be false-positive relationships. While this issue might be addressed by setting more stringent significance levels, given the scarcity of longitudinal studies, we have chosen to report findings that indicate relationships. Future replications and related studies are required to confirm and extend the present findings.

This study emphasized neighbourhood and family factors as contexts influencing children's media use, given that the home is a primary place children use media. However, for adolescents, peer influence may be stronger than parental influence in choice and preference of media. In addition, while television viewing has been considered a family activity, video game playing is a socializing activity among friends. School environments encouraging computer use including educational games could shape the way children use computers. Thus, future research should examine peer and school contexts as factors influencing older children's use of media, particularly video games, computers, and the Internet.

Future research should also address the specific media content. This study examined the total amount of time spent viewing television, playing video games, using a computer, and reading print media. However, children not only show preference for a particular type of media, but also seek specific media content across a variety of media. That is, from television to the internet, children's media use may be motivated by their interests and preferences. Furthermore, any effects of media may depend on the content selected or on what children do with the media used. Consequently, different factors may explain children's use of a specific type of media content. For instance, while parental limit setting is negatively related to the total time of children's television viewing, it may be positively related to educational television viewing. Thus, future research should address differences in media content in identifying predictors of media use.

Conclusions

This study assessed both cross-sectional and longitudinal relationships of contextual factors on children's media use from ecological and developmental perspectives. Given that most studies use cross-sectional data, our study is among the first to provide empirical evidence for the effect of early contextual factors on the life course of children's media use. Particularly, by presenting both cross-sectional and longitudinal analyses, our study captures the effects of socio-demographic factors, neighbourhood quality, and family contexts on both short and long-term media use. Furthermore, our study shows how predictors vary by type of media and children's developmental age. Future research should address other potential predictors such as peer interaction, school context and consider differences in media content.

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Table 1

Means and deviations for all measures by age group

	Ages 0–4 to 5–9		Ages 5–8 to 10–13		Ages 9–12 to 14 +	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Income to needs ratio	2.95	2.37	3.06	2.81	3.75	5.29
Parental education	13.01	2.78	13.07	2.91	13.15	3.32
Ethnicity (Black)[a]	0.11	0.311	0.17	0.38	0.15	0.36
Ethnicity (Hispanic)[b]	0.14	0.34	0.08	0.27	0.10	0.30
Ethnicity (Asian/other)[c]	0.07	0.25	0.08	0.27	0.05	0.22
Child age	2.56	1.23	6.51	1.07	10.50	1.15
Child gender[d]	0.53	0.50	0.53	0.50	0.49	0.50
Neighborhood quality	0.02	0.62	0.05	0.63	0.00	0.64
Number of adults	1.99	0.62	1.86	0.61	1.95	0.64
Parental limits	3.84	0.72	4.02	0.59	3.78	0.69
Family conflict	1.95	0.45	1.99	0.42	2.06	0.45
Time with parents	688.79	285.02	505.61	250.35	416.25	253.38
Time watching TV (Wave 1)	240.41	171.38	290.17	168.73	294.71	208.27
Time playing video games (Wave 1)	12.41	59.30	30.20	95.98	39.54	90.04
Time on computer (Wave 1)	6.97	23.58	12.72	44.57	21.83	56.70
Time reading (Wave 1)	31.06	44.74	30.55	46.78	32.78	59.41
Time watching TV (Wave 2)	304.47	196.17	347.79	213.81	323.81	251.55
Time playing video games (Wave 2)	51.57	87.40	58.14	105.16	47.89	113.95
Time on computer (Wave 2)	22.96	49.19	61.24	109.25	115.69	188.67
Time reading (Wave 2)	38.01	62.43	36.48	69.66	22.61	59.08

[a] 1, Black

[b] 1, Hispanic

[c] 1, Asian/other

[d] 1, Boys

Table 2

Correlations among predictor and media-use variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.Income to needs ratio	1	.37**	-.21**	-.18**	-.02	.09*	-.03	.19**	.11*	.01	-.08*	.06	-.12**	-.02	.14**	.12**	-.08*	-.02	.13**	.03
2. Parental education		1	-.13**	-.41**	-.00	.04	-.01	.29**	-.10*	.09*	-.07	.14**	-.16**	-.01	.13**	.15**	-.08*	-.09*	.10*	.11*
3. Ethnicity (Black)[a]			1	-.14**	-.11*	.04	.09*	-.20**	-.25**	-.01	.03	-.18**	.17**	.13**	-.08*	-.12**	.15**	.10*	-.14**	-.08*
4. Ethnicity (Hispanic)[b]				1	-.09*	-.05	-.03	-.27**	.12**	-.11**	-.04	.03	.05	-.07*	-.08*	-.11**	.09*	-.03	-.11**	-.06*
5. Ethnicity (Asian/other)[c]					1	-.03	.00	-.04	.04	-.03	-.08*	.01	-.01	-.03	-.03	-.01	-.06*	-.04	.01	.06*
6. Child age						1	-.02	-.00	-.03	-.05	.11*	-.40**	.17**	.14**	.15**	.02	.03	.01	.28**	-.09*
7. Child gender [d]							1	.02	-.08*	.08*	-.00	-.06*	.04	.18**	.04	-.03	.04	.36**	-.01	-.07*
8. Neighborhood quality								1	.05	.18**	-.09*	.14**	-.19**	-.04	.08*	.08*	-.15**	-.01	.02	-.00
9. Number of adults									1	-.07*	-.08*	.09*	-.06*	-.04	.03	.01	-.12**	.01	.06*	.02
10. Parental limits										1	-.08*	.07*	-.21**	-.04	.03	.09*	-.11*	-.01	-.07*	.06*
11. Family conflict											1	-.14**	.08*	.02	-.04	-.02	.12**	.06	.01	-.11*
12. Time with parents												1	-.14**	-.13**	-.07*	.12**	-.12**	-.07*	-.06*	.11*
13. Time watching television (Wave 1)													1	.05	-.03	-.05	.22**	.12**	.09*	-.10*
14. Time playing video games (Wave 1)														1	.00	-.07*	.04	.11**	.03	-.07*
15. Time on computer (Wave 1)															1	.12**	-.03	-.00	.19**	-.05
16. Time reading (Wave 1)																1	-.09*	-.03	.11*	.21**
17. Time watching TV (Wave 2)																	1	.03	-.09*	-.13**
18. Time playing video (Wave 2)																		1	-.06*	-.06*
19. Time on computer (Wave 2)																			1	-.01
20. Time reading (Wave 2)																				1

[a] 1, Black

[b] 1, Hispanic

[c] 1, Asian/other

[d] 1, Boys

* $p \leq .05$;

** $p \leq .01$.

Table 3

Standardized coefficients to predict time spent viewing television

	Ages 0–4		Ages 5–8		Ages 9–12	
	Within time	**Over time**	**Within time**	**Over time**	**Within time**	**Over time**
Income to needs ratio	- .04	- .03	.01	.01	- .07	.01
Parental education	- .14	- .02	- .07	.07	- .07	.05
Ethnicity (Black)[a]	.10	.02	.11	.13*	.09	.08
Ethnicity (Hispanic)[b]	.02	.12	.01	- .00	- .05	.13
Ethnicity (Asian/other)[c]	- .09*	.00	.01	- .06	.09	- .04
Child age	.34**	- .12*	.01	- .01	.15**	- .01
Child gender[d]	- .01	.00	.15**	.03	- .02	.04
Neighborhood quality	- .05	- .11	- .16*	- .06	- .11	- .07
Number of adults	- .03	- .10*	.04	- .10	- .10	- .06
Parental limits	- .16**	- .10	- .26**	.00	- .16**	- .05
Family conflict	- .02	.17**	.00	.11*	.07	.01
Time with parents	- .03	- .06	.00	- .06	- .00	- .05
Time with television[e]	na	.26**	na	.24**	na	.08
Time with video games	.03	.02	- .06	.00	.00	- .01
Time with a computer	- .13**	- .01	.05	.06	- .03	- .03
Time in reading	.06	- .02	- .08	- .02	.00	- .08
R^2	.23**	.23**	.17**	.14**	.14**	.07*

[a] 1, Black.

[b] 1, Hispanic.

[c] 1, Asian/other.

[d] 1, Boys.

[e] 1, Not applicable.

* $p \leq .05$;

** $p \leq .01$.

Table 4

Standardized coefficients to predict time spent playing video games

	Ages 0–4 to 5–9		Ages 5–8 to 10–13		Ages 9–12 to 14 +	
	Within time	**Over time**	**Within time**	**Over time**	**Within time**	**Over time**
Income to needs ratio	- .02	.22**	.03	.06	- .04	- .03
Parental education	- .01	- .20**	.03	- .09	- .09	- .09
Ethnicity (Black)[a]	.17	.07	.08	.08	- .01	.01
Ethnicity (Hispanic)[b]	- .04	- .02	- .06	- .07	- .08	- .05
Ethnicity (Asian)[c]	- .01	.02	- .05	- .05	.00	- .10*
Child age	.21*	- .04	.03	.01	- .02	.06
Child gender[d]	- .02	.32**	.17**	.38**	.32**	.37**
Neighborhood quality	.12	- .03	- .05	.08	.10**	.03
Number of adults	.06	- .01	- .04	.04	.09	.14**
Parental limits	- .02	.01	- .05	- .08	- .11*	.05
Family conflict	.09	.08	- .04	.08	.08	.01
Time with parents	.09	.00	- .11	.01	- .11	- .09
Time with television	.04	.18**	- .07	.08	.00	.08
Time with video games[e]	na	.12	na	.03	na	- .03
Time with a computer	.03	.13*	- .04	- .02	- .02	- .05
Time in reading	.03	- .02	- .07*	- .00	- .05	.03
R^2	.20**	.16**	.11*	.25**	.21**	.27**

[a] 1, Black.

[b] 1, Hispanic.

[c] 1, Asian/other.

[d] 1, Boys.

[e] 1, Not applicable.

* $p \leq .05$;

** $p \leq .01$

Table 5

Standardized coefficients to predict time spent using a computer

	Ages 0–4 to 5–9		Ages 5–8 to 10–13		Ages 9–12 to 14 +	
	Within time	**Over time**	**Within time**	**Over time**	**Within time**	**Over time**
Income to needs ratio	.20**	.08	.06	.19**	.05	.01
Parental education	.02	.03	.04	- .01	.04	- .02
Ethnicity (Black)[a]	- .05	- .03	- .08	- .17**	- .08	- .20**
Ethnicity (Hispanic)[b]	- .03	- .04	- .02	- .11*	- .08*	- .19**
Ethnicity (Asian)[c]	- .08	- .06	- .07	- .03	.01	.06
Child age	.15*	.07	- .05	.18**	.11*	- .04
Child gender [d]	.03	.02	- .01	- .09	.14*	.08
Neighborhood quality	- .03	.02	.03	- .13**	.05	- .04
Number of adults	.01	.02	.01	.01	.03	.03
Parental limits	- .03	.04	.08	.02	.00	- .14*
Family conflict	.00	- .01	- .07	.06	- .04	- .06
Time with parents	- .12	.03	- .07	.06	- .07	- .00
Time with television	- .15*	.06	.06	.03	- .03	.15
Time with video games	.03	- .02	- .04	.00	- .03	- .01
Time with a computer[e]	na	.03	na	.14	na	.11
Time in reading	- .02	- .02	.05	- .04	.17**	.13*
R^2	.23**	.06	.15**	.16**	.07*	.10**

[a] 1, Black.

[b] 1, Hispanic.

[c] 1, Asian/other.

[d] 1, Boys.

[e] 1, Not applicable.

* $p \leq .05$;

** $p \leq .01$.

Table 6

Standardized coefficients to predict time spent reading

	Ages 0–4 to 5–9		Ages 5–8 to 10–13		Ages 9–12 to 14 +	
	Within time	**Over time**	**Within time**	**Over time**	**Within time**	**Over time**
Income to needs ratio	- .00	.00	.12*	- .09	.04	- .03
Parental education	- .05	.06	.10	.20**	.12*	- .01
Ethnicity (Black)[a]	- .16**	- .06	- .04	- .03	- .07	- .11**
Ethnicity (Hispanic)[b]	- .25**	- .04	- .00	.03	- .03	- .09
Ethnicity (Asian)[c]	- .04	- .02	.06	.05	- .05	.06
Child age	.01	.10	.04	- .01	.00	.04
Child gender[d]	.01	- .04	.03	- .04	- .08	- .01
Neighborhood quality	- .01	.02	- .06	- .16*	- .02	- .08
Number of adults	.07	- .02	- .02	- .01	- .04	.11
Parental limits	.15*	- .01	.07	.00	.04	.04
Family conflict	.02	- .00	.07	- .21**	- .07	- .04
Time with parents	.06	.00	.14*	.10	.11	- .05
Time with television	.10	- .11*	- .09	- .13**	.01	- .00
Time with videogames	.03	- .04	- .07	- .05	- .05	- .04
Time with a computer	- .02	- .06	.05	- .08**	.17**	- .09
Time in reading[e]	na	.25*	na	.11*	na	.26**
R^2	.11**	.11**	.10**	.16**	.10**	.12**

[a] 1, Black.

[b] 1, Hispanic.

[c] 1, Asian/other.

[d] 1, Boys.

[e] 1, not applicable.

* $p \leq .05$;

** $p \leq .01$.