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Abstract

This study examined the association between screen media use, media content, and language development among 119 Hispanic infants and toddlers. Children and their caregivers were recruited through an urban, Early Head Start program. Duration and content of screen media exposure was measured through a 24-hour recall questionnaire, and language development was measured at baseline and at 1-year follow up. Children in the sample spent an average of 3.29 hours engaged with screen media (median 2.5 hours per day). In both cross-sectional and longitudinal analyses, children who watched over 2 hours of television per day had increased odds of low communication scores. Whereas child-directed media was associated with low language scores, adult-directed media was not. Our findings support the mounting literature on the deleterious impacts of screen media in toddler's language development. Guidance and alternatives to screen media use should be available to families in pediatric practices and early childhood centers.

Keywords

screen time, television, language development, communication, infants, toddlers, Hispanic, Latino, minority

Introduction

Time in front of screen media is a daily occurrence in the lives of young children. Mounting evidence has documented that many children start using screen media in infancy and increase their media use through childhood.^{1,2} A nationally representative survey in the United States identified that 68% of children younger than 2 use screen media in a typical day.¹ The average use of media in this population is 2.05 hours per day.¹ Children may be exposed to additional time in front of the television in daycare (an additional hour per day) and home-based childcare settings.³

Studies suggest that media exposure for young children may be even higher for children from disadvantaged backgrounds. A study of young children participating in the New York State Women, Infants and Children program found that 82% of 1-year-old children and 95% of 2-year-olds watched television and videos regularly.⁴ Forty-three percent of 2-year-old children in this sample watched more than 2 hours of television per day. The amount of time spent watching television increased with age.⁴ About half of the Black and Hispanic children in

this sample had a TV set in their bedroom compared with 31% of white children.⁴ Children who had a television set in their bedroom spent an additional 4.6 hours per week watching television compared with those without a TV set in their room.⁴ Greater television watching in early childhood is a predictor of increased television watching later in childhood.²

The American Academy of Pediatrics has discouraged the use of television and media before the age of 2 years largely because of the unknown impact that television may have on the young developing brain.⁵ Several studies have been conducted to examine the relationship between screen media and child development. In infants

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and toddlers, television exposure has been frequently, although not consistently, associated with language delays.⁶⁻⁹ Sampling differences as well as measurement of screen time and language delays may account for these disparate findings.^{10,11}

Beyond language development, negative outcomes in other developmental areas have also been associated with high media exposure in young children; screen time use has been associated with delays in cognitive and social development.^{7,12-15} A study reported that children who watched at least 2 hours of television per day before the age of 3 years received lower scores on measures of cognitive development (short-term memory skills) and academic achievement, including reading and math, at age 3 to 5 years.¹² Similarly, a longitudinal study of 1314 children investigated the long-term risks associated with increased exposure to television at 29 and 53 months of age.¹⁶ Results showed that, at fourth grade follow-up, higher screen time predicted decrements in math and attention scores and higher chances of peer rejection experiences.¹⁶

In addition to the amount of exposure, research indicates that content is also an important factor to consider.^{7,14,17} In the longitudinal study of low-income infants/toddlers conducted by Tomopoulos et al,⁷ lower scores in language and cognitive measures were associated with overall media exposure in older child/adult-directed media but not educational or noneducational child-directed content. Adult-directed programming has also been associated with poorer executive functioning.¹⁴

Background television has also been proven to have negative effects in young children's development. Background television has been shown to reduce the amount and quality of interactions between parents and children and also reduce the number of utterances produced by the parent-child dyad.¹⁸⁻²¹

The main goal of this study was to assess the association between screen time use and young, Hispanic children's language development. This high-risk population is often identified as having a high incidence of television watching in the early years and a high risk of language delays.^{4,11,22} Our secondary aim was to explore whether the content of media exposure (child-directed vs adult-directed) is associated with children's language development.

Methods

Study Design

To address these aims, we conducted a cross-sectional and longitudinal study with Hispanic infants and toddlers participating in an urban Early Head Start (EHS)

program. The design and procedures for this study were approved by Columbia University's Institutional Review Board.

Sample

A total of 119 infants, toddlers and their caregivers were recruited from an urban EHS program. After signing necessary consents, families completed a questionnaire on screen time use, play, and leisure habits of the family, which included a 24-hour recall of screen time. Demographics for the sample are summarized in Table 1. Children in the sample were 38.1% male and mean age was 21.09 months (SD = 9.605). Adult respondents were mothers with a mean age of 29.9 years (SD = 6.3). About half of participants (52.9%) had less than a high school education and the vast majority defined themselves as Hispanic (96.5%). All families had incomes below the poverty line and met requirements for admission into EHS. Families with children with severe disabilities were excluded from the study.

In the longitudinal analysis, data were only available for those families that remained enrolled in the EHS program 9 to 12 months after initial data collection (n = 73). We did not have approval to follow up with children who graduated from EHS. Since data collection between Time 1 and Time 2 spanned an academic year, a large number of families aged out of EHS (children had turned 3 years old). There were no demographic or outcome differences between participants who left EHS and those who stayed except for age, 89% (n = 41) of those who left were in the older age category and had aged out of EHS (see Table 2).

Study Variables and Measures

The outcome variables for this study were infant/toddler language development assessed by the Ages and Stages Questionnaire: A Parent-Completed Child Monitoring System, Third Edition (ASQ3).²³ Our main predictor variable was screen time. We studied additional variables, such as sociodemographic characteristics, as confounders and explored their relationship to our main predictor (screen time).

Outcome Variable: Infant/Toddler Developmental Outcomes

The ASQ3 is a developmental screener completed by a parent or primary caregiver in an interview format for children aged 1 month to 5.5 years. The questionnaire consists of 30 developmental items organized into the

Table 1. Demographic Descriptive Statistics.

Variable	n (%)	Mean	SD
Number of children at home	101	1.96	0.94
Age of child (months)	119	21.09	9.61
<12	22 (18.5)		
12-24	41 (34.5)		
>24	56 (47.0)		
Parent's age (years)	109	29.87	6.30
<20	4 (3.7)		
20-29	43 (39.5)		
30-39	56 (51.4)		
≥40	6 (5.5)		
Gender	118		
Male	45 (38.1)		
Female	73 (61.9)		
Ethnicity	116		
Hispanic/Latino	112 (96.5)		
Non-Hispanic/Latino	4 (3.5)		
Language	116		
Spanish	105 (90.5)		
English	11 (9.5)		
Parent's education	102		
Less than high school	54 (52.9)		
High school/GED	22 (21.6)		
Associate degree/vocational	16 (15.7)		
BS/advanced degree	10 (9.8)		
Body mass index	118		
Underweight	7 (5.9)		
Normal	79 (67.0)		
Overweight	11 (9.3)		
Obese	21 (17.8)		
Living arrangements	97		
Family rents own apartment	42 (43.3)		
Family shares apartment with another family	55 (56.7)		

following 5 areas: communication, gross motor, fine motor, problem solving, and personal–social development. The ASQ3 has “good to acceptable” internal consistency for its 20 age intervals (Cronbach’s coefficient α ranged from .51 to .87) and strong test–retest and interobserver reliability.²³

Continuous scores of the ASQ3 are organized in 3 categories based on preestablished thresholds: (a) scores beneath thresholds indicate a need for further assessment, (b) scores near the thresholds call for monitoring, (c) scores above thresholds suggest that the child is on track developmentally. We dichotomized this outcome by grouping scores beneath and near the threshold into a “low” group, and scores above the threshold in the “high” group. The ASQ3 was administered in the language preferred by the parent (92% Spanish). We only report scores in the communication domain of the

ASQ3, which focuses on expressive and receptive language skills.

Predictor Variable: Screen Media Use

Screen Time Use. A 24-hour recall of screen media use by parent alone, child alone and parent and child together was conducted for each family at baseline (time 1). Families were presented with a list of names and pictures depicting the main characters of common children’s television shows (child-directed media) and were asked whether their child watched that show the previous day. Recall was assessed only when previous day was a typical weekday and included media accessed through television, cellphones, DVDs, or computers. In addition, parents could list other shows their child had watched that day. Parents reported whether the child

Table 2. Demographic and Baseline Characteristics of Those Enrolled Versus Nonenrolled in Longitudinal Study.

	Enrolled in Longitudinal Study (n = 73)	Not Enrolled in Longitudinal Study (n = 46)	P
Age (months)			.000 ^a
<12	20	2	
12-24	36	4	
>24	16	40	
Ethnicity			.299
Hispanic	69	43	
Other	1	3	
Language spoken at home			.525
Spanish	69	43	
Bilingual	1	3	
Gender			.833
Male	28	17	
Female	44	29	
Communication; mean (SD)	51.1 (12.97)	50.9 (14.31)	.936 ^b

^aSignificant at .0001.

^bAnalysis of variance test.

watched alone or with an adult. Participants also identified television shows they had watched (adult-directed media) and identified whether they watched alone or with their child. Each show was quantified in minutes based on information provided by the parent and using information available on the network's Web site and in the TV guide. We did not obtain information on content other than adult-directed or child-directed media. Screen time was quantified by adding child-directed and adult-directed screen time, and was then dichotomized as "under 2 hours" or "over 2 hours." Finally, a child-content ratio was calculated by dividing child-directed media by total amount of media.

Other Variables. We obtained sociodemographic information from families through a questionnaire administered at the same time as the 24-hour recall. Information was collected on maternal age, education, country of origin, language spoken in the home, number of children in the home and living arrangements of the family. The questionnaire also included information on children's sleep, media use, and leisure habits.

Statistical Analysis. Statistical analysis was conducted using SPSS 19 and SAS 9.1. Bivariate analyses were used to identify associations between screen time use and developmental outcomes. Pearson moment product correlations were used to assess the relationship between continuous variables. Pearson's χ^2 tests were used to assess association between categorical variables and analysis of variance test were used to assess differences in screen time use by categorical variables (e.g. gender,

ethnicity). Multivariable logistic regression with logit-link function was used to explore the relationship between screen time use and language development as categorical outcomes. Because of the non-normal distribution of the outcome variables, linear regressions were not conducted. A longitudinal data analysis for developmental outcome measured between 9 and 12 months was performed by generalized estimating equations.

Results

Media Exposure

On average, children in the sample spent 3.29 hours (SD = 2.63) watching television, 2.09 of which revolved around child-directed media and 1.29 hours around adult-directed media (see Table 3). The median total exposure was 2.5 hours per day.

The ratio of adult-directed media to child-directed media changed with age. Younger infants were exposed to more adult-directed media, and the ratio of total television viewing that was adult-directed remained consistent across ages. In contrast, there was a marked increase in child-directed media with age (see Figure 1). While exposure was predominantly through television, other media also played a role, such as watching shows through YouTube on cell phones or computers. Recall scores were based on reported shows, regardless of medium, and did not account for videogames, as reported use was rare.

The most popular shows were Dora the Explorer (42.9% of parents reported their child watched this

Table 3. Predictor and Outcomes Descriptive Statistics.

Variable	Time 1		Time 2	
	n (%)	Mean/SD	n (%)	Mean/SD
Parents' screen time	114	1.75/2.20		
High (>2 hours)	29 (25.4)			
Low (≤2 hours)	85 (74.6)			
Adult-directed screen time	114	1.29/1.92		
High (>2 hours)	19 (16.7)			
Low (≤2 hours)	95 (83.3)			
Child-directed screen time	114	2.09/1.62		
High (>2 hours)	43 (37.7)			
Low (≤2 hours)	71 (62.3)			
Total child screen time	117	3.29/2.63		
High (>2 hours)	65 (55.6)			
Low (≤2 hours)	52 (44.4)			
Communication (ASQ3)	118	51.02 (13.44)	73	49.79 (12.46)
High	104 (88.1)		62 (84.9)	
Low	14 (11.9)		11 (15.07)	

Abbreviation: ASQ3, Ages and Stages Questionnaire–3.

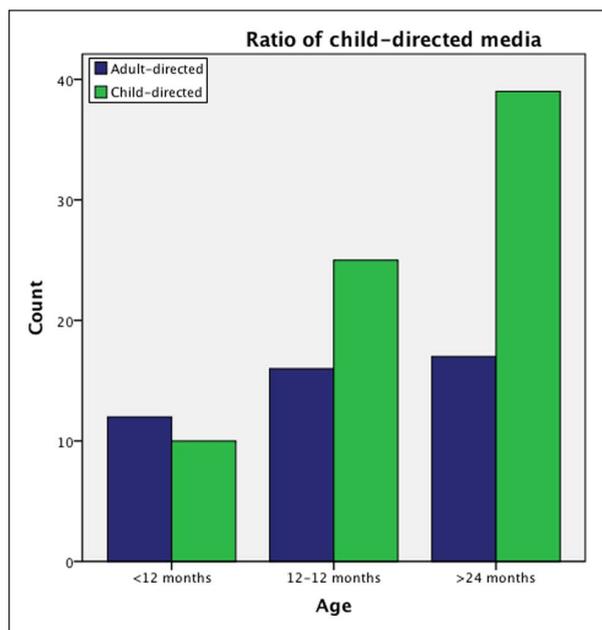


Figure 1. Ratio of child-directed media over total media exposure by age.

show), Go Diego Go (36.1%), and Sesame Street (32.8%). A myriad other shows were reported less consistently.

Participants reported that the television was turned on in the home for an average of 4.46 hours a day (SD = 2.92). Cell phones were the most common form of media used other than television (33.5%). Only 7.9% of

parents reported computer use during the previous day. Thirty-five percent of toddlers and 28% of infants were reported to use cell phones for 30 minutes the day prior, whereas 13.7% of toddlers and 12.5% of infants were reported to use cell phones between 31 minutes and 2 hours. Although 71% of families reported that their children sometimes watch baby DVDs (e.g. Brainy Baby, Baby Einstein), only 17.7% reported that their child watched a baby DVD the day prior. Eighty-four percent of families in this sample believed that baby DVDs and educational television shows have a positive effect on their children's learning. Forty-six percent of families reported frequently watching TV while breastfeeding, while 15.5% reported always watching TV while breastfeeding. Thirty-eight percent of children were reported to frequently watch TV during meals.

Language Outcomes

Data were obtained from the ASQ3 at 2 time points. The first time point was concurrent with the 24-hour TV recall and the second was approximately 1 year later. Table 3 summarizes scores at Time 1 and Time 2.

Media Exposure and Language Outcomes. In cross-sectional analysis, watching more than 2 hours of television per day was associated with low scores in the communication domain of the ASQ3 ($\beta = -1.71, P = .03$). On average, infants and toddlers exposed to 2 or more hours of television a day had 5.5 times the odds of low scores in the communication domain than infants/

Table 4. Simple and Multiple Logistic Regression Models With Categorical Outcome.

Parameter	Communication		Adjusted Model	
	Estimate	P	Estimate	P
Total screen time				
Intercept	3.12	<.0001	1.99	.35
Screen time (high)	-1.71	.03*	-1.65	.04*
Gender (male)			-0.68	.28
Parent education (<high school)			-1.40	.19
Child-directed media				
Intercept	2.80	<.0001	2.37	.0003
Screen time (high)	-1.61	.01**	-1.81	.009**
Gender (male)			0.89	.19
Parent education (<high school)			-0.20	.76
Adult-directed media				
Intercept	1.92	<.0001		
Screen time (high)	0.22	.79		

*Significant at .05. **Significant at .01.

toddlers exposed to less than 2 hours of television (see Table 4). The results were consistent in the adjusted model, controlling for child's gender and parent education ($\beta = -1.65$, $P = .04$). This was a homogenous sample in terms of ethnicity and socioeconomic status (see Table 4 for the adjusted model). Many other covariates were tested in the model for significance such as living arrangements, language, body mass index, and parent age, but none were significant predictors of language development.

In the longitudinal analysis, high television exposure (>2 hours) was associated with lower communication scores ($\beta = -1.49$, $P = .008$); results remained significant in the adjusted model (see Table 5).

Media Exposure and Language Development by Type of Media

Cross-sectionally, children who watched more than 2 hours of child-directed television had 6.25 times the odds of having low scores in the communication domain of the ASQ3 ($\beta = -1.61$, $P = .01$) than children who watched less than 2 hours of child-directed television. The results remained significant after controlling for gender and parent education ($\beta = -1.81$, $P = .009$). However, watching more than 2 hours of adult-directed television did not increase the odds of low scores in the communication domain ($\beta = 0.22$, $P = .79$).

Longitudinally, watching child-directed television for more than 2 hours was associated with lower scores in the ASQ3 communication domain ($\beta = -1.15$, $P = .02$) after adjusting for gender and parent education (see

Table 5). As in the cross-sectional study, watching more than 2 hours of adult-directed television was not associated with lower scores in the communication domain of the ASQ3 after 1 year ($\beta = -0.37$, $P = .55$).

Watching baby DVDs the day prior was not associated with lower scores in the communication domain of the ASQ3 (with DVD watching as a continuous [$P = .924$] or categorical variable [Fisher's exact test, $P = .711$]). However, data were only available for the 17.7% of children whose parents reported that they watched DVDs the day prior.

Discussion

This study aimed to examine the association between early television watching in Hispanic infants/toddlers and their language outcomes at 2 time points (cross-sectionally and at 1 year follow-up). In particular, we examined language development outcomes based on the communication domain of the ASQ3. Our sample was homogeneous, consisting of Hispanic families with young children participating in an urban EHS program. While the mean screen time reported in this study was 3.5 hours per day, the median of 2.5 hours closely approximates rates reported by other studies.^{1,4,7} Most media exposure revolved around watching television shows; still, about one-third of children watched shows through YouTube on parents' cell phones.

We found that children who watched more than 2 hours of television a day had increased odds of low communication scores concurrently and longitudinally, even after controlling for gender and maternal education. However,

Table 5. Generalized Estimating Equation With Categorical Outcome (Longitudinal Models).

Parameter	Communication		Adjusted Model	
	Estimate	P	Estimate	P
Total screen time				
Intercept	4.73	<.0001	2.62	.002
Time	-0.22	.59	-0.13	.78
Screen time (High)	-1.49	.008**	-1.51	.007**
Gender (male)			0.59	.23
Parent education (<high school)			0.16	.73
Child-directed media				
Intercept	2.69	<.000	2.21	.007
Time	-0.16	.70	-0.04	.94
Screen time (high)	-1.17	.02*	-1.15	.02*
Gender (male)			0.55	.27
Parent education (<high school)			-0.19	.72
Adult-directed media				
Intercept	2.12	.000	1.78	.03
Time	-0.14	.73	0.02	.96
Screen time (high)	-0.13	.82	-0.37	.55
Gender (male)			0.30	.56
Parent education (<high school)			-0.08	.86

*Significant at .05. **Significant at .01.

because of the small sample size in our longitudinal analysis and the small number of children with delayed communication, the longitudinal results are considered exploratory. In addition, child-directed media exposure was more frequently associated with low communication scores than time spent watching adult-directed media. This finding differs from those reported by some studies of infant/toddler television exposure and developmental outcomes^{7,14,19} but supports existing literature on the association between exposure to some child-directed programming and decreased language skills in very young children.^{17,24}

The results of this study are consistent with existing literature that has examined cross-sectional and longitudinal impacts of early media exposure and language development.⁶⁻⁹ In particular, Tomopoulos et al.⁷ identified longitudinal associations between media exposure at 6 months and lower cognitive and language development at 14 months in a similar population of low-income families with young children. Other studies have identified language and cognitive delays associated with early media exposure in more diverse samples.^{6,8,9,12} Our study adds to the literature of the potential effects of media exposure in young, Hispanic children from disadvantaged backgrounds. This high-risk population is often reported to have a high incidence of television watching and a high risk of language delays in the early years.^{4,11,22}

With regard to content of television shows, our finding that child-directed media most contributed to lower scores in language development is consistent with some studies^{17,24} and inconsistent with others.^{7,14,19} Tomopoulos et al.⁷ identified older child/adult-directed media as a predictor of lower language scores but, consistent with our findings, also identified a nonsignificant trend ($P = .06$) for exposure to young child-directed content.

Consistent with the study by Barr et al.,²⁴ child-directed media use increased significantly with age, whereas exposure to adult-directed media remained stable (see Figure 1), resulting in a lower proportion of exposure to adult-directed media at the same time that communication deficits became apparent in our sample (child-directed mean 2.09 hours vs adult-directed mean 1.29 hours at age 12 months). The proportion of adult-oriented media use was even lower at 18 months, the point at which variability within communication scores was greatest in our sample (see Figure 1). Thus, our finding that adult-directed media was not associated with communication delays may be a result of the small sample size and lack of power to detect differences, and the low variability of communication scores at the time when exposure to adult-oriented media was highest. It is possible that our outcome measure, the ASQ3, despite having good psychometric properties²³ was not as sensitive to identifying communication delays in children younger than 12 months, further contributing to the

reduced number of children with low communication scores in that age group. In addition, families in this study were participating in a high-quality, university-affiliated EHS program, which might have affected the numbers of children with low communication scores in the overall sample.

Language barriers may also contribute to our findings related to adult-oriented media. Almost all households in the present study were Spanish speaking (92%). All child-directed media reported by families was in English, whereas 95% of adult-directed media was in Spanish. Although parents may have chosen English programming to increase children's exposure to English, it is likely that they were not able to interact with their children around this media. Parent-child interaction is an essential component in communication development; thus, any decrease in interaction that resulted from language barriers may have exacerbated the negative impacts of child-directed media but not those of adult-oriented media.

A number of hypotheses exist regarding the possible mechanisms through which media exposure in young children may affect language development. Some evidence suggests that television watching or just background television, has a negative impact on the quality of the parent-child relationship.^{8,19-21} Mendelsohn et al²⁵ studied adult verbal interactions during media exposure and found that media verbal interactions moderated the adverse impacts of media exposure found on language development. In addition, background television may affect the quality and quantity of children's play activities.¹⁹ Evidence also suggests that young children are not adept at learning words from watching television/DVDs, making increased exposure a detriment to their language acquisition.^{26,27}

The families in this sample overwhelmingly believed (84%) that baby DVDs and educational television shows have a positive effect on their children's learning. Despite mounting evidence on the lack of benefits and potentially negative impact of media exposure in young children, families continue to believe in the positive value of media for young children's development. Qualitative findings with the same families in this study identified a series of cultural factors that affect their decisions about screen time use for their children.²⁸ Issues of safety, neighboring and renting relationships, immigration status, social isolation, language-culture preservation, and/or assimilation, all play an important role in families' decision making on how to use media at home.²⁸

Significant limitations to this study must be considered. First, the sample is homogeneously low-income, urban, Hispanic families; thus, generalizability to other groups is not possible. Additionally, the 24-hour recall

was only completed one time for each family, and all recall was based on exposure during a typical weekday. It is possible that families' screen media habits vary between the weekdays and weekends. It is also feasible that families underreported their media use because of social desirability and that recall bias was present. Finally, because of our small sample size in the longitudinal analysis, our results should be considered exploratory. The sample size also prevented us from conducting more comprehensive content analysis than dichotomizing media into child- and adult-directed content, and may have prevented us from determining the impact of adult-directed media. Despite these limitations, the study has significant strengths. We examined infant and toddler language outcomes in a high-risk population. Our results further contribute to a mounting literature on the negative effects of media exposure in infants and toddlers, particularly those from disadvantaged backgrounds. Furthermore, our findings also elucidate the important role of language and culture in understanding the impact of child- versus adult-directed media in young children's language development. Finally, we explored the association between screen time and language outcomes concurrently and longitudinally after a year, and surveyed several types of media, including the use of cell phones.

Conclusion

Screen media continues to be an important part of young children's lives. Parents believe in its positive impact and complex sociocultural considerations influence families' decisions about how to use media at home.²⁸ Our study supports the literature on the possible deleterious impacts of media exposure in young children's language development, particularly in this group of low-income, Hispanic families. More research is necessary on the mechanisms by which media interacts with child outcomes, particularly for bilingual children, and the types of interventions that can mitigate the possible effects of media exposure in young children's development. Anticipatory guidance should be provided to all families on the literature that associates media exposure in infancy and toddlerhood with negative developmental outcomes. Finally, beyond guidance, alternatives to media use in families' lives, such as parent-child play activities, that support positive development should be made available to families in pediatric practices and early childhood centers.

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