Critical Review:

What is the impact of screen media use on language development of infants and toddlers?*

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This critical review examines the impact of screen media use on language development of infants and toddlers. Seven studies were included in this review. Study designs included: one case-control study, four prospective longitudinal cohort studies, one cross-sectional survey and one prospective longitudinal and cross-sectional study. Overall, the results of this review provide suggestive evidence that screen media use in infants and toddlers is negatively associated with language development. The evidence indicates that this association depends on both amount and content of the children's exposure. Recommendations for clinical practice and future research are discussed.

Introduction

The American Academy of Pediatrics (AAP) recommend that children under two years of age should have minimal or no screen media exposure (American Academy of Pediatrics, 2014). The AAP (2014) supports this recommendation with evidence about the negative impact of screen media (e.g. television, videos, computers, cell phones, tablets) on early brain development. Despite this recommendation, Wartella, Vandewater, & Rideout (2005) report that the majority of children under two years of age use screen media for more than two hours a day on average. A significant proportion of parents believe that screen media is important and beneficial for their children's intellectual development (Wartella, Vandewater, & Rideout, 2005).

Considering the number of children under two who are exposed to screen media regularly and the duration of this exposure, it is important to understand the impact this is having on their language development. Additionally, recommendations about screen media use should be based on strong evidence. Parents and caregivers of young children should have accurate information about the potential harms or benefits of allowing infants and toddlers to be exposed to screen media. This information should include how the amount of exposure and the content of exposure specifically impact language development.

It is important for speech-language pathologists to have an understanding of the association between language development and screen media use in infants and toddlers because speech-language pathologists have an important role to play in the prevention of language disorders and delays. Speech-language pathologists can use this evidence to support and guide parents about best practice for encouraging child language development starting at birth. This information will also be important clinically for speech-language pathologists, as they are required to counsel parents of children with language disorders. If speech-language pathologists understand the association between screen media use and language development they can make recommendations about screen media usage for infants and toddlers.

Objectives

The primary objective of this review is to critically evaluate existing literature on the impact of screen media use on language development in infants and toddlers. The secondary objective of this paper is to provide evidence-based recommendations for clinical practice and future research.

Methods

Search Strategy

The computerized databases PubMed, PsycINFO, Scopus, CINAHL and Google Scholar were searched using the following keywords: [((screen media) OR (screen time) OR (television)) AND ((language development) OR (language delay)) AND ((infant*) OR (toddler*) OR (child*))]. The search was specific to articles written in English. Reference lists of previously searched articles were used to obtain additional related studies.

Selection Criteria

Studies selected for inclusion in this critical review were required to investigate the impact of screen media use on language development in infants and toddlers. No limits were set on the study design, outcome measures or date of publication.

* This paper was created as a required assignment for the CSD9639 Evidence Based Practice for Clinicians course at Western. While it has been evaluated by course instructors for elements of accuracy and style, it has not undergone formal peer-review.

Data Collection

Results of this literature search yielded 7 articles fitting with the aforementioned selection criteria. These include the following study designs: case-control study [1], prospective longitudinal cohort study [4], cross-sectional survey [1], and prospective longitudinal and cross-sectional study [1].

Results

Study #1: Linebarger & Walker (2005) conducted a longitudinal study of 51 infants and toddlers from Midwestern American families and examined the correlation between television viewing and content on language development. Data were collected every six months over a two-year period. Demographic information was collected via parent interviews and viewing logs were used to record program names and the number of hours of television viewed per week. The MacArthur Bates Communicative Development Inventory (CDI) which measures word production, was administered every 6 months starting when children were 12 months of age. The Early Childhood Indicator was used to measure expressive communication of the children between 3 and 36 months of age. Analysis of the relationships between television content and language development revealed that language development can be negatively or positively associated depending on the television content. For example, programs such as *Blue's Clues* and *Dora the Explorer*, where onscreen characters speak directly to the child and actively elicit participation were positively related to expressive language production and vocabulary. Alternatively shows such as *Teletubbies* with loose narrative structure and poor language models, were negatively associated with vocabulary acquisition and expressive language use.

Strengths of this study include the use of both vocabulary and expressive language measures to determine outcomes. It may be important to examine these outcomes separately as the impact from television viewing may vary. Another strength of this study was the use of a viewing log that provided data every 3 months, which provides data that is more representative than a one-time sample. The log was also beneficial as this study was able to examine the associations between language development and specific types of television shows. A limitation in this study is that the specific programs have been categorized based on assumed characteristics and not using a formal analysis of the program content. Another limitation noted by the authors is that the viewing logs identify foreground exposure to television but not background exposure. As a result the amount of total exposure may be underestimated in this study.

Based on these strengths and limitations, this study provides Level II evidence that is suggestive that television viewing is positively or negatively associated with language development in infants and toddlers based on the content of the program.

Study #2: Zimmerman, Christakis, & Meltzoff (2007) used a cross-sectional research design to test the association of media exposure with language development in children under 2 years of age. In February 2006 a telephone survey was conducted with 1008 parents of children aged 2 to 24 months as identified by birth certificates from Washington and Minnesota. Parents who consented were asked questions about children's time use and a series of demographic questions. This study used the short form of the MacArthur Bates CDI, which is a reliable, valid and broadly adopted measure of communicative development. Zimmerman, Christakis, & Meltzoff (2007) looked at media viewing of the following content types: children's educational, children's noneducational, baby DVDs/videos, and grownup TV. Demographic control variables and parental interaction variables were also included. An appropriate linear regression to test the association between media time and language development was performed. The analysis revealed a large negative association between language development and viewing of baby DVDs/videos in infants. However, no associations were found between the other content categories or in toddlers.

Strengths of this study include the analysis of specific media content types and several forms of parent-child interactions. This study uses a valid and reliable outcome measure for language development in this population and the effect size is large. Despite these strengths, these results should be interpreted with caution. This study designs allows for predictions to be made however causal inferences cannot be drawn. The associations between baby DVDs/videos and language development in infants may be a result of a residual variable not measured in the data. It is also important to note that the sample used in the study is not representative of the general population. The sample had relatively higher incomes and education than the overall population. Parent income and education may impact a child's language development and thus the findings of this study should only be applied to groups with similar education and income.

Based on these limitations, this study provides level II evidence that is suggestive of a negative association between viewing baby DVDs/videos and language development in infants.

Study #3: Chonchaiya & Pruksananonda (2008) conducted a case-control study that examined the impact of frequency and onset of television viewing on language development in children aged 15 to 48 months. The study included 100 normal children and 56 children with language delay as diagnosed by language milestones and the Denver-II. A developmental pediatrician collected information about the child, home environment and television viewing via parent interviews. This study included several risk factors for language delay including child characteristics, parental and family characteristics, and television and time use characteristics. To determine the likelihood that children with and without language delay had been exposed to these various risk factors, an odds ratio analysis was performed. Additionally, a multivariate logistic regression model was used to examine the relationship between identified risk factors and language development. Analysis revealed that children with language delay usually started watching television earlier and spent more time watching television than the control group. Children who started watching television at less than 12 months of age and who watched more than two hours per day were six times more likely to have a language delay.

Strengths of this study include the use of a control group that was similar at initiation of the study to the clinical group based on several important characteristics. Exclusion criteria were defined for each group and confounding factors were identified and addressed in the statistical analysis. Potential limitations of the study include interviewer bias as there is no report of blinding of the assessors. The measure of parent report for television viewing is a subjective measure and human recall can be inconsistent. Other limitations of this study that were acknowledged by the authors include the use of the Denver-II as a screening tool for language delay. The Denver-II has relatively low-to-moderate sensitivity and specificity meaning that it may fail to identify some children with expressive language problems. The study originally recruited 110 participants for the case and control group but only 56 of the case group completed the study.

Based on these limitations, this study provides equivocal evidence that is classified as level II evidence in support of a negative association between television viewing and language development.

Study #4: Schmidt, Rich, Rifas-Shiman, Oken, & Taveras (2009) examined the extent that television viewing in infancy is associated with language and visual motor skills at the age of 3. A prospective longitudinal study design was used to follow 872 children over a 3-year period. Information was collected via interview and self-administered questionnaires regarding television viewing at 6 months, 1 year and 2 years following delivery. Trained research assistants administered the Peabody Picture Vocabulary Test III (PPVT-III) and the Wide-Range Assessment of Visual Motor Abilities (WRAVMA) to children at 3 years of age. Multiple linear regression models were used to analyze the effects of television viewing on PPVT-III and WRAVMA scores. An analysis adjusted for the child's age and gender revealed that average daily hours of television viewing were associated with lower PPVT-III scores at age 3. However, in a model adjusted for maternal characteristics (e.g., maternal age, income, education, maternal PPVT-III scores, etc.) this association was not present. This suggests that maternal characteristics had a strong effect on the observed relationship with the greatest impact from maternal education and maternal PPVT-III scores.

The design of this study is considered a strength as it provides prospective data on television viewing in children from birth to 2 years. This study uses the PPVT-III as the outcome measure for vocabulary, which is a valid and reliable measure. Another strength of this study is that the analysis controlled for a large variety of sociodemographic and environmental predictors of language outcomes. Limitations of this study as noted by the authors include that the study did not measure the content of television/video viewing by the infants which has been suggested by previous research to be an important mediator on effects of television viewing in infants. It is important to note that this study had a sample that may not be representative of the general population based on maternal education and household income levels. In this study, the majority of household incomes were over $70, 000 and 76% of mothers had a college degree or higher. It is possible that maternal education and household income are moderating factors in child language development. Of the children in this sample only 16% watched more than 2 hours per day of television, thus it is possible that negative effects were not seen due to the lower levels of viewing.

Based on these strengths and limitations, this study provides level II evidence that is suggestive that TV

viewing in infancy is not associated with receptive vocabulary development at age 3.

Study #5: Ruangdaraganon et al. (2009) investigated the association between time spent watching television and language development in Thai children under the age of 2. The authors also explored parental perceptions about children's television viewing on their development. Data were collected about the child's television viewing, demographic information and parental perceptions of television viewing through face-to-face and telephone interviews of 260 parents. The interviews were conducted when the child was 6 months, 1 year and 2 years old. Children's language was assessed at the age of 2 by qualified developmental and behavioural paediatricians using a modified version of the Clinical Linguistic Auditory Milestone Scale (CLAMS). This screening tool was translated from English to Thai and modified to fit Thai cultures. Appropriate multivariate logistic regression models were used to analyze the association between delayed language development and time spent watching television. Analysis revealed that gender was the only variable significantly associated with delayed language development and that there was no association between delayed language development and time spent on television viewing.

A strength of this study is that it explored the parental perceptions about television viewing in relation to child development. This study had several limitations in its design. One limitation in this study is the use of the modified CLAMS as the outcome measure for language delay. Since this screening tool was modified to fit the Thai culture it is no longer being used in the standardized manner that was intended. The screening tool may no longer have the specificity and sensitivity as it would in the standard administration. As a result children in this study may not have accurately been identified as having a language delay or not. A final limitation of this study is the relatively small number of children with language delay that were included. Since there were only 16 children in this sample with language delay, this study may not have adequate power to identify any association. It is important to note that the sample used was recruited from two institutes in a single geographical area of Thailand. The authors indicate that the sample is not likely representative based on maternal education or family income and therefore the findings may not generalize well to the overall Thai population. These findings should be applied to samples with similar education and income characteristics.

Based on these limitations, this study presents equivocal level II evidence that there is no association between amount of time spent viewing television and delayed language development at the age of 2.

Study #6: Tomopoulos et al. (2010) conducted a longitudinal cohort study examining association between media use and the cognitive and language development of 259 infants. The duration and content of media use (i.e., television, videos/DVDs, movies and games) of the infants were recorded via a 24-hour recall diary based on an interview with the mother of the child at 6 months of age. Cognitive and language development were assessed at 14-months of age using the Bayley Scales of Infant and Toddler Development, 3rd Edition (Bayley-III) and the Preschool Language Scale-4 (PLS-4). Additionally, sociodemographic data was collected via maternal interviews. Statistical analysis included unadjusted analyses using Pearson correlations and adjusted analyses using multiple linear regressions that controlled for variables such as maternal education level, age, primary language spoken, child's sex and position in birth order. In adjusted and unadjusted analysis, the data revealed that longer daily duration of media use at 6 months predicted lower cognitive and language development at 14 months of age. Further analysis of media content revealed that exposure to older child/adult-oriented content at age 6 months predicted lower cognitive and language scores at 14 months of age.

Strengths of this study include the use of a standardized assessment tool as the language outcome. The PLS-4 has good validity and reliability as a tool to measure receptive and expressive language in the target population. Another strength of this study is that the sample population is infants from families of low socioeconomic status, a population that has not been examined in previous studies. This population may be at increased risk of language delays and therefore it is particularly important to understand the role of media use for this group. Limitations of this study include the method of data collection for media use. Through interviewing the parents it is possible to have recall bias, which could impact the accuracy of duration and content of media use reported. Additionally, this data was only collected for one day and it is possible that it is not representative of the infants overall media use. Another limitation in this study is the limited exposure to young child-oriented noneducational media. The limited data about this content type means that conclusions about its impact should be interpreted with caution. Finally, the results

of this study can be applied to families with low socioeconomic status, primarily from a Latino immigrant background but may not generalize to other groups.

Based on these strengths and limitations, this study provides level II evidence that is suggestive that media use at 6 months of age predicts language development at 14 months of age.

Study #7: Duch et al. (2013) conducted a cross-sectional and longitudinal study that examined the associations between screen media use, media content and language development of 119 Hispanic infants and toddlers. Parents of the children completed a questionnaire about the child's screen time use and play and leisure habits of the family. Screen time data was collected from parents through a 24-hour recall about the child's use. Screen media exposure was recorded as child-directed or adult-directed and included the use of television, cell phones, computers and YouTube videos. The Ages and Stages Questionnaire, Third Edition (ASQ3), which was used as the language outcome, was completed with the initial interview and approximately one year later. Cross-sectional and longitudinal data analysis revealed that watching more than 2 hours of television per day was associated with low scores on the communication domain of the ASQ3. These findings were consistent when models were adjusted for gender and parent education. Further analysis revealed that child-directed media increased the odds of low communication scores but adult-directed media did not.

Strengths of this study include the examination of the association between media use and language development in a high-risk population. Another strength in the design of this study is the use of cross-sectional and longitudinal analysis as this allows examination of the association between groups at one point in time and over time. A final strength of this study is the inclusion of several types of media exposure other than television alone. Despite these strengths, this study had several limitations. One limitation is the use of the 24-hour recall for media use. This was only completed once and didn't account for changes in media use that might occur on weekends versus weekdays. The use of parent report also means that parents may underreport media use because of social desirability or recall bias. This study had a relatively homogeneous sample and results should be applied to predominantly low-income urban Hispanic families.

Based on these limitations, this study presents level II evidence that is suggestive that infants and toddlers who watch more than two hours of television per day are more likely to have low language scores.

Discussion

Of the seven studies included in this review, five provided evidence to support a negative association between television viewing and language development in infants and toddlers and two of the studies found no association. For the studies that did not find a negative association, it is possible that the language outcome measure influenced the findings of those studies. The language outcome measure used by Schmidt, Rich, Rifas-Shiman, Oken, & Taveras (2009) was the PPVT-III, which measures the child's receptive vocabulary. This was the only study to use a specific measure of receptive vocabulary instead of an overall language measure. It is possible that the association does not exist between media viewing and receptive vocabulary and that some other aspect of developing language is causing the overall negative association. It is also possible that because this study had a relatively low amount of children watching more than two hours each day that the association was not evident.

Ruangdaraganon et al. (2009) also found that there was no association between media viewing and language development under the age of two. It is possible that an association was not seen because of the use of the CLAMS as the language outcome measure. Ruangdaraganon et al. (2009) used a modified version of the CLAMS, which may mean that it no longer had the specificity and sensitivity of the standard administration. This could have impacted the children identified with language delay and thus affected the overall findings of the study.

It is important to note that a variety of methodologies are used across the seven studies. All studies used some form of parent report to gather data on media exposure but no single methodology was used. Some studies had parents report on a single day and others included several days of use. Some included the types of content that children viewed and other reported just the amount of exposure. Finally some studies included only television use and others included multiple media formats. This variety makes it more difficult to directly compare the studies included.

Another consideration that impacts the ability to directly compare these studies is the variety of measures used for language development. Measures included the MacArthur CDI (Linebarger & Walker,

2005; Zimmerman, Christakis, & Meltzoff, 2007), the Denver II (Chonchaiya & Pruksananonda, 2008), the PPVT-III (Schmidt, Rich, Rifas-Shiman, Oken, & Taveras, 2009), the CLAMS (Ruangdaraganon et al., 2009), the PLS-4 (Tomopoulos et al., 2010) and the ASQ-3 (Duch et al., 2013). It is possible that media viewing only impacts certain aspects of language development in infants and toddlers. It may be beneficial for studies to use measures of specific areas of language rather than an overall language development tool. However, this is difficult considering the population being studied and therefore it would be beneficial to study the outcomes in children from birth up to five or six years old. This would allow more specific measures of different aspects of language and may allow for more specific recommendations to be made.

Although there is some variability in the results of the studies reviewed, overall, the results provide suggestive evidence that screen media use in infants and toddlers is negatively associated with language development. The evidence indicates that this association depends on both amount and content of children's exposure. Finally, it is important to note that all the studies included in this review provide correlational data that allow for predictions to be made about language development but that current research does not allow for causal statements to be made.

Clinical Implications

As speech-language pathologists, it is crucial to understand how early experience and exposure to screen media can impact a child's language development. Ruangdaraganon et al. (2009) found that 65-75% of parents believed that television viewing had a positive impact on their child's language, cognitive and social development. This data and the data on amount of media viewing in infants and toddlers emphasize the importance of speech-language pathologists' role in the education of families. It is the role of the speech-language pathologist providing early intervention services to prevent or reduce the effects of risk factors on a child's language development (American Speech-Language-Hearing Association, 2008). With knowledge about the risk associated with increased media viewing in infants and toddlers, speech-language pathologists can collaborate and consult with families about strategies to limit this exposure. Speech-language pathologists have unique knowledge to share with caregivers about activities and strategies to use as alternatives to screen media use for promoting language development in young children. Additionally, speech-language pathologists may provide strategies for caregivers to incorporate interaction with their child during periods of screen media use to make it a positive opportunity for language development.

Current research can be applied in a clinical setting for education and counseling but further research would allow speech-language pathologists to make more specific recommendations.

Recommendations for Future Research

It is recommended that future research be conducted and incorporate:

1. A longitudinal study of screen media use and language development that follows children from birth to beyond age three.
2. A randomized control trial with a control group and a group of children not viewing any screen media.
3. A study that examines the impact of parent interaction during screen media use on language development.
4. A study examining effects of different types of screen media (e.g., computer, television, tablet, etc.) on language development.

References

American Academy of Pediatrics. (2014). Where we stand: TV viewing time. Retrieved from: http://www.healthychildren.org/English/family-life/Media/pages/Where-We-Stand-TV-Viewing-Time.aspx?nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3a+No+local+token.

American Speech-Language-Hearing Association. (2008). *Roles and responsibilities of speech-language pathologists in early intervention: guidelines* [Guidelines]. Available from www.asha.org/policy. doi:10.1044/policy.GL2008-00293

Chonchaiya, W., & Pruksananonda, C. (2008). Television viewing associates with delayed language development. *Acta Paediatrica*, *97*(7), 977-982. doi:10.1111/j.1651-2227.2008.00831.x

Duch, H., Fisher, E. M., Ensari, I., Font, M., Harrington, A., Taromino, C., ... &

Rodriguez, C. (2013). Association of Screen Time Use and Language Development in Hispanic Toddlers A Cross-Sectional and Longitudinal Study. *Clinical pediatrics*, *52*(9), 857-865. doi:10.1177/0009922813492881

Linebarger, D. L., & Walker, D. (2005). Infants' and toddlers' television viewing and language outcomes. *American Behavioral Scientist*, *48*(5), 624-645. doi:10.1177/0002764204271505

Ruangdaraganon, N., Chuthapisith, J., Mo-suwan, L., Kriweradechachai, S., Udomsubpayakul, U., & Choprapawon, C. (2009). Television viewing in Thai infants and toddlers: impacts to language development and parental perceptions. *BMC pediatrics*, *9*(1), 34. doi:10.1186/1471-2431-9-34

Schmidt, M. E., Rich, M., Rifas-Shiman, S. L., Oken, E., & Taveras, E. M. (2009). Television viewing in infancy and child cognition at 3 years of age in a US cohort. *Pediatrics*, *123*(3), e370-e375. doi:10.1542/peds.2008-3221

Tomopoulos, S., Dreyer, B. P., Berkule, S., Fierman, A. H., Brockmeyer, C., & Mendelsohn, A. L. (2010). Infant media exposure and toddler development. *Archives of pediatrics & adolescent medicine*, *164*(12), 1105-1111. doi:10.1001/archpediatrics.2010.235

Wartella, E.A., Vandewater, E.A., & Rideout, V.J. (2005) Introduction: electronic media use in the lives of infants, toddlers, and preschoolers. *Am Behav Sci.* 48(5):501–504.

Zimmerman, F. J., Christakis, D. A., & Meltzoff, A. N. (2007). Associations between media viewing and language development in children under age 2 years. *The Journal of pediatrics*, *151*(4), 364-368. doi:10.1016/j.jpeds.2007.04.071