

ELECTRONIC MEDIA EXPOSURE AND EARLY
VOCABULARY ACQUISITION IN SPANISH-SPEAKING
HOMES

by

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The purpose of this study is to describe the electronic media exposure of young children from Mexican immigrant backgrounds in their home and to investigate the association between media exposure and children's vocabulary development. Thirty children between the ages of 15 and 24 months participated. Audio recordings of children's home environment were completed and information on children's productive vocabulary was collected. The electronic media captured on the audio recordings was categorized by frequency (i.e., percentage of total minutes of recording time), type of programming (i.e., child directed versus adult directed, cartoons, or educational child-directed media), and language (i.e., Spanish or English). These characteristics of children's media exposure were described. Then, the association of these characteristics to children's English and Spanish productive vocabulary was examined through nonparametric, rank order correlation analyses. The findings indicated that children were more likely to be exposed to adult directed electronic media rather than child directed media and were more likely to be exposed to programs in Spanish than English. No significant associations were found between children's vocabulary and any characteristic of electronic media exposure for toddlers from these backgrounds.

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Table of Contents

A Growing Population at Risk	1
Electronic Media and Language Outcomes	3
Research with Monolingual Children	5
Frequency of exposure to electronic media.	6
Type of television and other media programming.	7
Other Media Exposure.	10
Research with Bilingual Children	11
Limitations of Current Research	13
Purpose of This Study	16
Participants	18
Procedures and Measures	19
Child language.	19
Electronic media exposure	20
Analysis	22
Child vocabulary.	22
Television and electronic media.	22
Media exposure and vocabulary.	24
Results	26
Vocabulary	26
Television and Electronic Media	26
Media Exposure and Vocabulary Knowledge	28
Discussion and Implications	30
Variability in Media Exposure	30
Media Exposure and Child Vocabulary Development	32
Implications	35
Limitations and Future Research	37
Conclusion	40
References	41

List of Tables

Table 1. Demographic Characteristics of Children's Mothers and Fathers (N = 30)	19
Table 2. Descriptive Statistics of Child Vocabulary	26
Table 3. Descriptive Statistics of Television and Electronic Media Environment.....	28
Table 4. Spearman's rank order correlation coefficients among total expressive vocabulary and child directed television exposure, type, and language.....	29
Table 5. Spearman's rank order correlation coefficients among expressive vocabulary (English separate from Spanish) and Spanish television exposure, type, and language.	29

A Growing Population at Risk

According to Murphey, Guzman, and Torres (2014), the Latino population makes up almost 24% of the total population of the United States. Individuals of Latino ethnicity are also the fastest-growing population in the United States. Latino families in the US represent a variety of ethnicities, including Mexican, other Central American, and South American. As of 2015, 25% of all children were from Latino backgrounds (“Racial and ethnic composition”, 2016). Children from Mexican families in particular represent the largest proportion of the Latino population under age 5, accounting for around 70% of young children from Latino backgrounds in the US. Many of these children’s parents speak Spanish in the home, immigrated from Mexico, and live with incomes below the poverty line (Murphey, Guzman, & Torres, 2014).

Children from Mexican backgrounds unfortunately enter school with lower language and academic readiness skills than their monolingual, White peers. This difference in performance has been identified for early language, mathematics, and literacy (e.g., Guerrero et al., 2013). Oral language skills are important to children’s academic success because language abilities create a foundation for learning to read and for understanding more complex language eventually required in the classroom. The development of oral language abilities in the early years, prior to formal school entry, is known to be especially important. Many studies have demonstrated the link between child vocabulary size prior to age 2 and children’s later language and academic skills (e.g., Lee, 2009; McGregor, Sheng, & Smith, 2004; Morgan et al., 2015; Moyle, Weismer, Evans, & Lindstrom, 2007; Walker, Greenwood, Hart, & Carta, 1994). Children with larger vocabularies in the early years outperform their peers with lower

vocabularies in the areas of lexical composition, literacy, and syntax. Therefore, it is critical to understand the factors that influence the vocabulary development of young children from Spanish-speaking, Mexican backgrounds in the years before school entry. Previous studies have examined various factors that influence children's early language acquisition, such as the quantity and quality of home language environment, parent education, and socioeconomic status. This study focuses on the influence of television and electronic media exposure.

Electronic Media and Language Outcomes

One factor that may influence the early language development of children from Spanish-speaking, Mexican backgrounds is exposure to electronic media. Most studies that have examined the relation between language and media classify digital media as all forms of electronic devices that emit visual and/or auditory stimuli, including, but not limited to, cell phones, tablets, computers, televisions, and video games (Biedinger, Becker, & Klein, 2015; Bittman, Rutherford, Brown, & Unsworth, 2012; Liebeskind, Piotrowski, Lapierre, & Linebarger, 2014; Linebarger & Vaala, 2010; Vaala et al., 2010; Zimmerman, Christakis, & Meltzoff, 2007). The availability of electronic media is common for children in the United States. For example, more than 96% of families from varied backgrounds have television sets in their households. Moreover, half of children from minority and lower-income backgrounds have their own television sets by age 4 (Kabali et al., 2015; Lauricella, Wartella, & Rideout, 2015).

The American Academy of Pediatrics (AAP) has provided recommendations regarding media exposure that varies by child age and encourages adult participation (Brown, 2011; Cowan, 2018; Radesky & Christakis, 2016). Children younger than 24 months are highly discouraged from exposure to television and screen media. Between 2 and 5 years of age, children should be exposed to no more than 1 to 2 hours of quality television per day. These recommendations are based on the premise that television has negative effects on child development due to displaced time participating in critical conversation, physical activity, and exploration. The reduced time children spend in interactions when their attention is occupied by television and other media use is of particular importance to language development.

According to the social interactionist theory of development (Vygotsky, 1962), children develop language from social interaction with other human beings who scaffold their language skills in conversational contexts. Electronic media may limit the opportunities for this critical interaction. Television programs, tablet exposure, and radio programs also cannot respond to the child naturally and in real time to provide conversational scaffolding. Importantly, in acknowledgement that interactions are critical to child language development, the AAP also recommends that the child should co-view media programs with their caregivers. When caregivers are present during their child's media exposure, it is possible that the opportunities for interactions increase.

Unfortunately, many children in the United States, including those of Mexican descent, may not be receiving the critical language interactions needed as a result of frequent television and other media use. Almost 70% of children under the age of 2 are exposed to about 2 hours of electronic media every day (Duch et al., 2013). Not only is media exposure not recommended at this age, it well exceeds the daily recommended amount of television by AAP for children who are older than age 2. In addition, 50% of two-year-old children from Latino backgrounds have a television in their bedrooms, as compared to only 31% of children from White backgrounds (Duch et al., 2013). Children with televisions in their rooms are more likely to watch around 5 hours of additional television than children without bedroom television sets (Duch et al., 2013), suggesting that children from Latino background may be exposed to more electronic media than their peers. This possibility is strengthened in light of the fact that children from Mexican immigrant homes often live in poverty. Studies have also indicated that children from low socioeconomic backgrounds (below 185% of the poverty threshold)

have more frequent television exposure than children from working class families (above 185% of the poverty threshold; Brown, 2011; Linebarger, Liebeskind, & Mcmenamin, 2013). Therefore, understanding the characteristics of television and media use that may influence language learning from early ages in Mexican immigrant populations is important due to the frequency with which media use may occur.

Previous research has explored two specific characteristics of media exposure that may be important to young children's language acquisition. These characteristics include the frequency of their media exposure and the type of television programming watched by children. Importantly, this research has primarily been completed with monolingual, English-speaking populations to date. There has been limited research regarding media and its potential influence on the language acquisition of children from Spanish-speaking homes, who are at risk for unfavorable language outcomes and whose language-learning experience may be different due to the need to develop both Spanish and English rather than one language. In addition, little research exists to describe the language of media exposure for children from bilingual backgrounds despite the fact that children from Latino homes may be exposed to media more often than their peers from other backgrounds. In the following section, the existing research on electronic media and child language development will be reviewed, first for monolingual populations and then for bilingual populations.

Research with Monolingual Children

Most of the current research related to this topic has examined the influence of television, specifically, on children's language development. The frequency of programming and type of television programming have often been measured in studies

on television exposure and its influence on language development for monolingual, English-speaking populations. There are also a few studies that have looked at electronic media more generally in association with vocabulary learning for this population. Although there have been similarities in how exposure to television and other electronic media have been studied, the findings regarding how media and child language development are associated have not been consistent to date.

Frequency of exposure to electronic media.

Exposure to electronic media is the amount of television or other media that children experience in their homes on a regular basis. Regarding frequency of television exposure, existing studies have looked at parent report data that have documented the number of hours or minutes per day the child was exposed to television in the homes (Alloway, Williams, Jones, & Cochrane, 2013; Linebarger & Walker, 2005; Patterson, 2002; Van Horn & Kan, 2016) or all-day recordings of children's exposure to human and electronic sound (Christakis, 2009; Zimmerman et al., 2009). However, one study examined children's exposure to preselected 15-minute television segments and their receptive vocabulary (Rice & Woodsmall, 1988).

As previously mentioned, the findings on frequency of television and language development have been mixed. Two studies that have investigated children's frequency of television exposure found negative associations with child vocabulary, meaning that as exposure to television in hours per day increased for each child, their expressive and receptive vocabulary knowledge decreased. For example, Zimmerman et al. (2009) used all-day recordings in the homes of monolingual, English speaking children ages 2 to 48 months to study the effect of various types of media exposure on children's receptive

vocabulary. This study revealed that television and media exposure were negatively associated with the frequency with which children were speaking. Nelson (1973) found that maternal reports of television frequency in hours per day of viewing *Sesame Street* was associated with poor expressive and receptive vocabulary acquisition for monolingual, English speaking children between 1 and 2 years old.

Other studies have found different results when examining the association between television exposure and child language skills. Rice and Woodsmall (1988) found positive associations between receptive and expressive language learning and exposure to television. These researchers studied the effect of pre-selected 15-minute educational television on receptive vocabulary with children from 3 and 5 years of age from predominantly White, English-speaking backgrounds. There was a positive association between the exposure to the short segments of pre-selected television and the child's ability to identify researcher-selected vocabulary items corresponding to the selected programming for the categories of objects, actions, and attributes. However, due to the overall inconsistency in findings in the few studies that have examined media and vocabulary, the relationship between frequency of exposure to television and other media and vocabulary acquisition has not yet been fully determined.

Type of television and other media programming.

The media programming to which children are exposed can be defined either as child directed (i.e., programming specifically designed for children) or adult directed (i.e., programming specifically designed for adults). Child directed and adult directed categories of programming can be further categorized by the specific type of program (e.g., cartoons, news, sitcoms). In general, most previous studies have focused on child

directed programming specifically and its influence on expressive and receptive language learning. Type of television is usually categorized by the title of the show and the genre of the show, such as educational or entertainment television (Alloway, Williams, Jones, & Cochrane, 2013; Christakis, 2009; Linebarger & Walker, 2005). One study has also measured the effects of specific types of child directed television programs on child language acquisition (Rice & Woodsmall, 1988).

Two studies that have examined media type and children's vocabulary have found that specific types of television can have a positive impact on children's receptive and/or expressive vocabulary. Linebarger and Walker (2005) completed a study with monolingual children beginning when they were 6 months of age with data collection every 3 months until age 30 months. This study examined the relationship between different television programs, and receptive and expressive vocabulary. Although they found that frequent exposure to some types of child directed programming led to decreased or no word learning, other types had positive effects on vocabulary. Television programs such as *Arthur* and *Dora the Explorer* were related with a larger number of expressive and receptive vocabulary words (increase from 8.60 to 13.30 words). However, children who frequently watched shows called *Barney & Friends* and *Timetables* learned 10.93 fewer expressive words on average than children who did not watch these shows, while the vocabulary of children who viewed *Dragon Tales*, *Sesame Street*, and Disney movies was not impacted. The researchers hypothesized the increase in children's vocabulary knowledge stemmed from a repetition of vocabulary words in certain programs embedded in curriculum based educational television (Linebarger & Walker, 2005). Similarly, Rice and Woodsmall (1988) found positive associations

between television and language learning when monolingual, English speaking children aged 3 and 5 years old watched a preselected 15-minute educational program that was created by the researchers. Results indicated that children who viewed these programs performed better in identifying the meaning of the 20 target words that the researchers had embedded in the programming.

In contrast to the findings of a positive association between certain types of television and overall vocabulary learning, two studies found that the impact of specific types of child directed programming was negative. Christakis (2009) researched the relation between the vocabulary of monolingual, English speaking children under age 2 and DVDs that claim to improve children's language skills (e.g., *Baby Einstein 'language nursery'*). Christakis found that children with more hours of exposure to these programs had poorer expressive and receptive vocabulary. Alloway, Williams, Jones, and Cochrane (2013) utilized a standardized child receptive vocabulary test in relation to parent reported data on 3-year-old, English-speaking children's type of television viewing. These authors categorized television by the genres of educational, cartoons, baby DVDs, and adult entertainment. Similar to the findings of the previously presented studies, Alloway and colleagues (2013) found a negative correlation between hours spent watching educational television programming and children's receptive vocabulary. Given the mixed results for studies examining the impact of child-directed programming, no conclusions can be reached about the relation between type of programming and children's vocabulary development.

Other Media Exposure.

Although most research to date has mainly examined television, many other forms of media are currently available to children. These include cell phones, electronic books, tablets, radio programs, and computers. Given that exposure to other types of media may also reduce children's engagement in language-supporting interactions with other humans, children's early language development may also be affected. Bittman, Rutherford, Brown, and Unsworth (2012) and Zimmerman, Christakis, and Meltzoff (2007) researched the influence of television and other types of media (DVD, reading, social networking, video, and animation) on young children's language development. In these studies, information was collected on the receptive and expressive vocabulary and frequency of media exposure of children between 0 and 4 years of age who were from monolingual, English-speaking backgrounds. In both studies, children's acquisition of language was negatively correlated with the frequency of exposure to all types of electronic media: children who were exposed to electronic media more frequently had lower receptive and expressive vocabulary.

In addition to studying the frequency with which children are exposed to other media, measuring the number of electronic devices in children's homes may offer insight into children's language development. Liebeskind, Piotrowski, Lapierre, & Linebarger (2014) surveyed the homes of 500 monolingual, English-speaking children between the ages of 8 months and 7 years for the number of televisions, computers, radios, and video game consoles. The researchers also measured the expressive vocabulary of these children. They found no direct association between number of electronic media devices and children's vocabulary, suggesting that child's accessibility

to electronic media is not as critical to language learning as the frequency with which children are actually exposed to these devices.

Research with Bilingual Children

A few studies have provided information about the influence of television on the vocabulary acquisition of children from language backgrounds other than English or who may be in the process of acquiring two languages, as is often the case for children from Mexican immigrant backgrounds. These include studies within and outside the United States the findings of which have been inconsistent, similar to the research with monolingual, English-speaking populations. For example, Van Horn and Kan (2016) and Patterson (2002) examined parent reported frequency of media exposure (including television and books) and its impact on expressive vocabulary acquisition for Latino children from Spanish-speaking backgrounds in the United States. Patterson studied children between 21 and 27 months of age, while Van Horn and Kan included children with an average age of 4 years who acquired English after they acquired Spanish. Neither study found an association between frequency of media exposure and children's vocabulary. Importantly, these researchers also looked at bilingual children's television viewing versus storybooks and found no difference in children's language outcomes when these types of media were compared.

One additional study with diverse populations in the US has found a negative association between the frequency and type of media exposure and child language outcomes. Duch and colleagues (2013) used parent survey to investigate frequency in hours of media use and content on the language development of children from minority backgrounds ages 9 to 24 months. Over 95% of participants were described as Latino in

Spanish-speaking homes. Parents were asked to recall their child's daily use of television, cellphones, DVDs, and computers. Researchers found that children who watched more than 2 hours of child directed television were more likely to have lower expressive communication skills (including vocabulary). Other forms of adult directed television and media were not associated with children's language development.

In contrast, one study outside the US identified the positive influence of media exposure for early language development of bilingual children. Biedinger, Becker, and Klein (2015) examined the relationship between expressive language learning and media exposure, defined as television and books, for children between 3 and 6 years of age from Turkish-speaking backgrounds living in Germany. In this study, frequency of media exposure in Turkish resulted in a more advanced Turkish-language ability for the children. Although this study did not take place with bilingual English-Spanish language acquisition, the findings might be translatable to this population.

Finally, in addition to direct observations of child media use and language outcomes, a theoretical study by Webb (2010) examined the potential for learning low-frequency English words from English-language television programming in older populations of bilingual children. This study did not have human participants to measure vocabulary learning directly. Instead, Webb investigated the range of words that might be heard while watching specific types of television programs like *CNN* and *Seinfeld*. Webb concluded that television watching can be utilized as vocabulary exposure to a non-native language which may result in vocabulary acquisition for older children from other language backgrounds. However, this unique study implied television viewing might be beneficial for English-language acquisition without having

empirical data to support the claim. Thus, based on the research to date, it is not yet known how English language learning for young children from predominantly Spanish-speaking homes may be influenced by television viewing.

Limitations of Current Research

The previous studies on this topic have advanced the field's knowledge regarding television and language acquisition of primarily White, monolingual English-speaking children. These studies have generally found a negative correlation or no correlation between children's language acquisition and type and/or frequency of media exposure, including television and other forms. These inconsistent findings have been replicated in the few studies to date that included children from bilingual backgrounds. However, the past research has some important limitations that must be acknowledged.

First, most of the studies relied on parent report data to determine the amount of television exposure children experience. Although some studies directly recorded television in the homes (Christakis et al., 2009; Zimmerman et al., 2009), the majority of studies on this topic asked parents to report on media use in the home without observations to confirm their report (Alloway, Williams, Jones, & Cochrane, 2013; Biedinger, Becker, & Klein 2015; Bittman, Rutherford, Brown, & Unsworth, 2012; Liebeskind, Piotrowski, Lapierre, & Linebarger, 2014; Linebarger and Walker, 2005; Patterson, 2002; Zimmerman, Christakis, & Meltzoff, 2007). This method may not be completely accurate. According to Anderson, Field, Collins, Lorch, and Nathan (1985), parent-kept logs commonly contain discrepancies between the amount of television time video recorded objectively by the researcher and the amount of television viewing parents logged. More specifically, these researchers found that parents underreported

television exposure, which they hypothesized was due to a biased report based on the recommendations related to media viewing the parents had learned from the American Academy of Pediatrics and/or their child's pediatrician. Because frequency of television is an important aspect of many of these studies, incorrect parent reported data affect the validity of the results of a given study and the conclusions that can be drawn regarding language development.

In addition, some studies did not measure children's experience within their daily routine of media exposure, and instead took them out of their naturalistic viewing environments to see the effects of media exposure on their language. Linebarger and Piotrowski (2009) and Rice and Woodsmall (1988) preselected the television show to be watched by children whose language abilities were under study. Although this was necessary to examine how different types of programming might differentially impact language development, this method creates an inorganic environment to study the child's language-learning, as compared to studies that examined the media exposure of a child's typical home environment within their typical routines (Linebarger & Piotrowski, 2009). The ability to measure a child's routine exposure to television and electronic sound, chosen by the child or family members rather than the researcher, allows for more empirically accurate data.

Lastly, most of the children that have been involved in the existing research were from White backgrounds and spoke English as their only language. Few studies have included children from Latino, Spanish-speaking backgrounds specifically (Duch et al., 2013; Patterson, 2002; Van Horn & Kan, 2016). Thus, research on television and early vocabulary has not taken cultural and linguistic differences of language learning

into consideration to date. Children who grow up with exposure to two languages have different developmental trajectories from children exposed to one language only, which can influence the course of vocabulary acquisition (Guerrero et al., 2013). Therefore, it is currently unknown how television impacts English vocabulary learning for children from Spanish-speaking homes who are likely to hear English as well. Similarly, it is not currently known how the language of television (i.e., Spanish or English) watched by children exposed to two languages impacts language learning in each language. Moreover, parents from Mexican backgrounds, may possess different views regarding television exposure than parents from the populations typically studied, which could result in different outcomes. For example, parents from Spanish-speaking, Mexican backgrounds have been found to associate television exposure to their children's vocabulary learning in English and school readiness (Thompson et al., 2015). Therefore, media exposure may be supported in these homes differently than in White, monolingual homes. The current study will address these limitations.

Purpose of This Study

Presently, it is not yet known how electronic media frequency, type, and language influence the dual language development of English and Spanish for young children from Latino backgrounds. It is important to gather this information for children from Mexican backgrounds, specifically, due to the increase in this population in the United States and our limited understanding of the multiple influences on early language development that contribute to the later academic outcomes of children from these backgrounds. In addition, it is important to study children's exposure to electronic media in their everyday routines using observational methods that limit the potential for bias in parent report. Therefore, this study asks: how does frequency, type, and language of electronic media in everyday routines impact the bilingual language development of young children from Spanish-speaking, Mexican backgrounds? Specifically, children's expressive vocabulary was examined. The findings from this study may benefit various professionals, including speech-language pathologists, in learning on how to best advise Spanish-speaking children and their families on the topic of early dual language development and electronic media use.

It is hypothesized that there will be variability in the frequency, language, and type of television exposure children from Mexican immigrant backgrounds experience. Moreover, it is hypothesized that each of these characteristics of media exposure will be associated with the early expressive vocabulary of children from these backgrounds. More specifically, it is likely that higher frequencies of media exposure will be associated with smaller expressive vocabulary size. Additionally, child directed educational programming will be associated with more expressive vocabulary

knowledge than child directed cartoon television programming. Lastly, it is hypothesized that exposure to English television and media exposure will be associated with English vocabulary knowledge, while Spanish exposure will be associated with Spanish vocabulary acquisition. Additionally, because Spanish is the primary language spoken in the home, most electronic media and television will be categorized as Spanish.

Methods

Data collection for the current study was completed in 2015 by the advisor to this project, Dr. Lauren Ccyk, as part of a larger study designed to better understand contextual influences on the early language development of young children from lower-income, Mexican immigrant backgrounds. This study was approved by the Institutional Review Boards (IRB) of two universities in the United States, including the University of Oregon.

Participants

Thirty typically-developing children from Mexican immigrant households participated. The children averaged 19.73 months of age (range = 15-27 months). Half were female. All children were born in the United States, and all of their parents were born in Mexico. All families had at least two parents living in the home. Fifty-six percent of the children's mothers and 73% of the children's fathers did not receive high school diplomas. The primary language spoken in all homes was Spanish. Sixty percent of mothers, and 60% of fathers used only Spanish with their child. Only 3.3% of mothers used English and Spanish an equal amount of time when speaking with their child. Every home had a television. Additional demographic information on children's mothers and fathers is described in Table 1.

Table 1. Demographic Characteristics of Children's Mothers and Fathers (N = 30)

Characteristics	Mothers			Fathers		
	<i>M</i>	<i>SD</i>	%	<i>M</i>	<i>SD</i>	%
Age (years)	29.17	4.61		30.70	4.94	
Employed			36.70			96.70
Education level						
Some schooling			53.30			76.70
High school diploma			36.70			13.30
Vocational training			3.30			6.70
Some College but no degree			-			3.30
Associate's degree			3.30			-
Bachelor's degree			3.30			-
Language to child						
All Spanish			60.00			56.70
More Spanish			33.30			43.30
Equal amounts of English and Spanish			6.70			-

Procedures and Measures

Child language.

In order to document children's productive vocabulary, their mothers completed the parallel Spanish and English versions of the MacArthur Communicative Development Inventories, *MacArthur Communicative Development Inventory* (CDI): *Words and sentences* (Fenson et al., 2007) being the English version, and the Spanish version of the document *MacArthur Inventarios del Desarrollo de Habilidades Comunicativas* (IDHC) (Jackson-Maldonado, Bates, & Thal, 2003). These standardized measures are comprised of checklists of 396 words common for the age and developmental range of the child. The vocabulary checklist includes categories such as *animals (real or toy)* or the Spanish paralleled *animales (de verdad y de juguete)*. The toddler version is valid for use with children between the ages of 16 and 30 months. The caregivers were asked to complete the checklist by indicating if each word is part of the child's expressive vocabulary (i.e., a word that is consistently said by the child and

recognized as related to a particular person, place, object, or concept). The mothers were administered the form verbally to avoid any potential difficulties with literacy given their generally low educational levels.

These measures have been successfully utilized by researchers to measure the vocabulary of young children from both Spanish- and English-speaking populations. Some studies examining media exposure and language development have utilized the English version, for analysis of English language acquisition with children who only spoke English (e.g., Linebarger & Walker, 2005). No studies to date on the topic of media exposure and language development have used the Spanish version; however, the CDI and IDHC are commonly used in conjunction to assess the dual language acquisition of children exposed to both Spanish and English (e.g., Grüter, Marchman, & Fernald, 2013; Hoff et al., 2011; Pearson, Fernandez, Lewedeg, & Oller, 1997; Place & Hoff, 2011; Song et al., 2011).

Electronic media exposure.

In order to capture children's television and other electronic media exposure, recordings of the home environment were completed by the families using the Language ENvironment Analysis Digital Language Processor (LENA DLP; <https://www.lena.org/>). The LENA DLP is a 2-ounce recorder with a highly-sensitive microphone that children wear in specially made vests with front pockets. It records the audio environment surrounding the child and provides automated data on a variety of features of the child's environmental input.

Families were instructed to complete three recordings on typical days for their child, across weekdays and weekends, when the researcher was not present. Instructions

were given to record 4 hours on two weekdays and 8 hours on one weekend day (in order to capture variability in children's home environments). Families made between 2 and 13 different recordings on days and at times they preferred. These individual recordings were an average of 3 hours and 58 minutes in length, with approximately 14 hours of total recording time. Variance in exact number of days and times occurred due to differences in family lives.

Once families returned the LENA DLPs with the recordings to the researcher, the audio data were transferred to the computer to be processed by the LENA Advanced Data Extractor software (<https://www.lena.org>). This software automatically sorts the audio by recording and by audio input, and has been found to be reliable for studying the audio environment in both Spanish (Weisleder & Fernald, 2013) and English (Xu, Yapanel, & Gray, 2009). The audio data were categorized by the date on which the audio was recorded and further distinguished by 5 minute increments. The audio data were also split into the following categories: *meaningful* (language that occurs less than 6 feet away from the child), *distant* (language that occurs more than 6 feet away), *TV & ES* (television and electronic sound exposure), *noise* (any noise that is not categorized as speech or electronic noise), and lastly, *silence & background*. The software also provides information on total minutes of each input category and the proportion of these categories by total recording time in comparison to other auditory input. The TV & ES data are the main focuses of the study, as represented by the percentage of television and electronic sound as compared to other auditory input heard by the child across the length of the recording.

Analysis

Child vocabulary.

The number of English and Spanish words reported were separately counted in order to record the sum of expressive vocabulary words for each child in each language. In addition, the sum of Spanish and English expressive vocabulary words was calculated to determine the child's total productive vocabulary. Means and standard deviations of child vocabulary were then calculated using SPSS Version 22. The child vocabulary data were visually inspected for normal distribution and checked for outliers. The data were normally distributed and no outliers were found.

Television and electronic media.

Analysis took place to assess frequency, language, and type of television and electronic sound heard by children. The measure of frequency was provided via automated data created by LENA Advanced Data Extractor software (<https://www.lena.org>), as previously described. Frequency of exposure was represented as the percentage of television and electronic sounds recorded by the LENA out of the child's total recording time. The number of minutes to which children were exposed to media across the length of the recording was also provided by the software.

Additional analyses were required to determine the type of television programming and the language of television. To do so, each five-minute increment in which television and/or electronic sounds represented 50% or greater of the recording were selected for further analyses. Fifty percent television and electronic sound was chosen due to the assumption that if the child was exposed to this amount of electronic

media, their attention was on the audio in question (rather than the possibility of the child simply passing through a room where the television was on). Then, the author and bilingual research assistants listened to each of these 5-minute segments in their entirety and recorded the language (Spanish or English) and type of television programming heard (child directed or adult directed; and further categorization of child directed).

Segments were labeled as “Spanish” or “English”. If the media program switched languages half way through, the audio file was categorized as 50% English and 50% Spanish. The language of media and electronic sounds was calculated then as a percentage of English compared to the percentage of Spanish, then an average was found across all participants.

The determination of the type of programming was made by attending to key aspects of language, music, and context of the recorded audio. Audio files with complex language usually indicated a program directed towards an older audience, as opposed to less complex, slower language, which was geared towards children. Audio files of television programs that were directed towards children had very distinct background music that supported the topics on screen. Also, the events and story line of the program usually allowed the listener to identify the intended age group. The type of programming was then calculated as the percentage of child directed as compared to the percentage of adult programming and then averages were calculated across all participants.

Once a child directed segment was identified, the programming was further assigned a programming category. Possible categories for child directed television programming included cartoon (including shows like *SpongeBob*, *Chowder*, *Pororo*),

educational (including shows like *Daniel Tiger's Neighborhood*, *Clifford*, and *Curious George*), other (including music, Disney Movies, or child directed sitcoms like *iCarly*, or *Kickin' It*) or unknown (when the category could not be reliably determined).

Network websites often assisted in identifying programs as educational or cartoon.

Commercials were categorized as “other”, and usually only occurred for half of each 5-minute segment; therefore, if a commercial occurred the audio file was categorized as 50% commercial and 50% of the identified program. Adult-directed media was not broken into further categories. The percentage of each type of child directed programming was compared to total amount of child directed programming across all possible categories, then it was averaged across all participants.

To summarize, the final independent variables in this study included percentage of media exposure of the full recording (i.e., frequency of exposure), percentage of media exposure in Spanish and English (i.e., language of media), percentage of child directed media (i.e., type of media), and percentage of each category of child directed media (i.e., type of media). Due to variability in exposure to television, variables were examined as percentages of total recording time to have a consistent metric of comparison. Using SPSS Version 22, means and standard deviations of all variables were calculated. Data were reviewed for normal distribution and outliers. The data were considered appropriate for analysis.

Media exposure and vocabulary.

Correlational analyses were then completed to determine the association between productive vocabulary and the characteristics of television and electronic media exposure (i.e., frequency, type, language). Nonparametric Spearman's rank order

correlations were utilized due to the small sample size. Variables representing frequency and type of media were analyzed in association with children's total productive vocabulary (in both English and Spanish). Analyses were not run comparing language learning acquired from educational verses cartoon television due to a small amount of data categorized as cartoon television programming. Moreover, the percentage of Spanish language programming was analyzed in association with children's Spanish vocabulary only. Due to the low number of English words that had been acquired by the children in this study, it was not possible to analyze the influence of the percentage of English television on their English vocabulary.

Additionally, analyses were completed to determine the influence of child sex and age on any of the television characteristics or vocabulary outcomes. Both child sex and age are relevant to vocabulary development in the early years, as girls tend to outperform boys and vocabulary increases with age.

Results

Vocabulary

Children had an average productive vocabulary of 114 words in Spanish and English combined (range = 2–561 words). On average, children knew more Spanish vocabulary words than English (See table 2).

Table 2. Descriptive Statistics of Child Vocabulary

Variable	Mean	Range	SD
Vocabulary words			
Spanish Total Vocabulary	99.97	2.00-371.00	112.03
English Total Vocabulary	15.10	0-190.00	36.44
Spanish-English Total Vocabulary	114.17	2.00-561.00	137.52

Television and Electronic Media

The full descriptive statistics of children’s television and electronic media environment are reported in Table 3. Television and electronic media comprised between 42.35% and 0.44% ($M = 14\%$) of children’s total recording time. The total number of minutes across the entire recording for which children were exposed to television ranged from 0 to 595 minutes ($M = 127$ minutes). As a reminder, families’ total recording time was approximately 14 hours on average (840 minutes).

The types of programming to which children were exposed was an average of 91 minutes of adult directed television, comprising 72% of children’s total exposure to media. On average, children heard 51 minutes of child directed television, making up 41% of the total exposure to media. In other words, children in this study were mostly exposed to adult directed programming.

Of the small amount of child directed programming identified, an average of 37 minutes of child directed television were categorized as cartoon programs (25% of total child directed television), while 17 minutes were educational programs (11% of child directed television). Adult directed accounted for more of children's exposure than child directed television, but this type of television was not categorized further for the current study.

In relation to the language of programming, an average of 100 minutes were categorized as Spanish television, which was 79% of the total amount of television segments. Children watched 51 minutes of English programming on average, which was 40% of the total amount of television programming. Although children heard a fair amount of programming in English, Spanish was the dominant language of their media exposure.

Table 3. Descriptive Statistics of Television and Electronic Media Environment

Variable	Mean	Range	SD
Total TV minutes	126.85	0-595.00	143.62
AD ^a TV minutes	91.15	0-430.00	99.10
CD ^b TV minutes	51.65	0-255.00	66.87
Unknown TV minutes	3.45	0-65.00	13.18
TV to total recording %	13.91	0-42.35	11.82
CD TV to total TV %	29.61	0-100.00	28.09
CD TV minutes			
CD Cartoon	37.10	0-315.00	74.21
CD Educational	16.65	0-95.00	26.60
CD Other	9.40	0-60.00	16.90
Educational TV to total CD TV %	30.48	0-100.00	38.51
Language of TV minutes			
Spanish	100.00	0-380.00	109.78
English	50.95	0-470.00	97.79
Unknown	3.15	0-60.00	12.02

^aadult directed television; ^bchild directed television

Media Exposure and Vocabulary Knowledge

There was no significant correlation between children's total expressive vocabulary and television exposure as represented by percentage of total recording time ($r_s = .079, p = .679$). In addition, there was no significant correlation between children's percentage of exposure to child directed programming (as opposed to adult directed programming) and their total expressive vocabulary ($r_s = .243, p = .232$). No further analyses were completed to determine the association between specific categories of child directed programming (i.e., cartoons, educational) due to lack of significant association found between total child directed television and expressive vocabulary knowledge. Additionally, no association was found between the percentage with which children were exposed to media in Spanish and their Spanish vocabulary ($r_s = .051, p = .803$). There was an association found between child sex and vocabulary in that

female children had larger expressive vocabularies than males ($r_s = -.420, p = .021$).

Children who were male also had more frequent exposure to child directed television than adult directed television ($r_s = -.412, p = .037$).

A full report of the results from the correlational analysis examining total vocabulary and language exposure characteristics is provided in Table 4. This is followed by Table 5, which presents the findings for the analyses of Spanish-language programming, total vocabulary, and Spanish vocabulary only.

Table 4. Spearman's rank order correlation coefficients among total expressive vocabulary and child directed television exposure, type, and language.

Variable	1	2	3	4
1. Total vocabulary (Spanish + English)	-			
2. Percentage of total TV & ES ^a	0.08	-		
3. Percentage of CD ^b TV of all TV	0.24	0.26	-	
4. Percentage of CD Educational TV	0.05	0.12	0.38	-
5. Child Sex	-0.42*	-0.12	-0.41*	-0.14

^a television and electronic sound; ^bchild directed; * $p < .05$

Table 5. Spearman's rank order correlation coefficients among expressive vocabulary (English separate from Spanish) and Spanish television exposure, type, and language.

Variable	1	2	3
1. Total vocabulary (Spanish + English)	-		
2. Spanish vocabulary	0.97**	-	
3. Percentage of TV in Spanish	-0.04	0.05	-

** $p < .001$

Discussion and Implications

This is the first study, to date, that has examined young children's electronic media exposure in a naturalistic environment in bilingual households and how this exposure may relate to child vocabulary development. The findings are discussed.

Variability in Media Exposure

It was initially hypothesized that there would be variability in the frequency, language, and type of television exposure experienced by children from Mexican immigrant backgrounds. The findings confirm this hypothesis. It was found that some children heard television and electronic media for almost 50% of their typical days, while other children participants were exposed to less than 1% of television and electronic sound. This amount of variability in children's frequency of exposure to electronic media in their home environments aligns with findings from Christakis and colleagues (2009) and Zimmerman and colleagues (2009), who also found wide ranges of television and electronic media exposure among children studied while utilizing the LENA technology. There was also variability in types of programming to which children were exposed, aligning with the variability in type of programming found by Alloway and colleagues (2013). Importantly, variability in children's exposure to Spanish and English-language media was noted; however, language of programming has not previously been studied for bilingual Spanish-English speakers in their naturalistic environments. Therefore, it is not possible to compare these findings to those of previous research.

This variability in frequency, type, and language of children's media exposure is important because it suggests that children from similar Mexican immigrant

backgrounds have very different experiences with television and other media in their homes. It is possible that the variability noted in this study was a result of multiple factors. For example, this study gave flexible recommendations for when each parent should use the LENA technology. Parents were advised to record 2 weekdays and 1 weekend but the exact days and times for recording were not provided. As a result, parents recorded at different times of the day when media exposure may have been more or less likely in comparison to the routines of other families. Moreover, the time in which children were exposed to electronic media might have differed due to increased or decreased hours the child spent at home versus outside the household while the recording was underway. Additionally, parental knowledge regarding the possible negative effects of television and electronic media may have influenced the times in which the parents utilized the LENA technology, only recording times in which television and electronic media were not present. This might have caused further variability, due to the varied amount of parent education regarding television.

Generally, children in this study exceeded the amount of television recommended by the American Academy of Pediatrics, averaging 2.11 hours per day of television exposure. Many previous studies also found that children, on average, were watching more than the recommended daily amount of television (e.g., Anderson, Field, Collins, Lorch, and Nathan, 1985; Christakis, 2009; Duch et al., 2013; Linebarger & Walker, 2005; Linebarger, Liebeskind, & Mcmenamin, 2013). Although the vocabulary size of the children in this study was not affected by the amount of television exposure in children's homes, this amount of exposure still might implicate language learning for the general population of children from these backgrounds. Children were in the early

stages of language learning, in which the effect of television and media may not have yet been evident. Alternatively, children's expressive vocabulary skills might not be affected by television and media exposure, specifically, but other communication skills not examined in the current study may be affected instead (e.g., receptive language).

Moreover, the American Academy of Pediatrics specifically recommends that children older than 2 years of age are exposed to "quality" television and media (i.e., programs that have educational benefits; Brown, 2011), to which participants from this study were not generally exposed. The children in this study were mainly exposed to adult directed television (averaging 39.85 more minutes than child directed), which is not categorized as "quality" television as defined by the American Academy of Pediatrics. Experts have concluded that adult directed television may not be beneficial for children under the age of 2 because the content and vocabulary is too confusing (Brown, 2011). Thus, it is possible that if children from Mexican immigrant backgrounds were exposed to more quality, educational child directed television than adult directed television, there may have been an association between vocabulary and electronic media exposure due to prompting and pauses, similar to scaffolding, from characters in the show (Linebarger & Walker, 2005; Rice and Woodsmall, 1988).

Media Exposure and Child Vocabulary Development

In addition, it was hypothesized that higher frequencies of media exposure would be associated with smaller expressive vocabulary size, which was not confirmed with the findings from this study. Contrary to the initial hypotheses, findings indicated that there was no significant association between vocabulary acquisition and electronic media frequency, type, or language. Some previous studies have similarly found no

association between media exposure and young children's vocabulary (Liebeskind, Pitrowski, Lapierre, & Linebarger, 2014; Patterson, 2002; Van Horn & Kan, 2016), while others have shown these factors to be negatively associated (Alloway, Williams, Jones, & Cochrane, 2013; Bittman, Rutherford, Brown, & Unsworth, 2012; Christakis, 2009; Duch et al., 2013; Nelson, 1973; Zimmerman, Christakis, & Meltzoff, 2007; Zimmerman et al., 2009). Importantly, past research with bilingual Spanish-English population has also found no association between media exposure and language learning for children between 21 months and 4 years of age (Patterson, 2002; Van Horn & Kan, 2016).

The lack of association between media and vocabulary in this study could be explained by three factors. First, it is possible that the lack of association is due to the children's low amount of vocabulary knowledge. Perhaps a negative effect would be noted as children developed their vocabulary skills. Second, the lack of association may result from the lack of child attention to the television programs and other media recorded by the LENA. Finally, the findings could be due to children's exposure to possibly frequent and high quality language from family members in their daily lives, offsetting the potential negative effects of television programming. Regardless, the lack of association between media and language found in this study may be beneficial news for parents from bilingual Latino backgrounds, who believe television viewing helps children's English-language learning (Thompson et al., 2015). Mothers from this background may continue encouraging television watching due to this belief, and this study shows that they may not be harming their child's expressive vocabulary development in the earliest stages in doing so.

However, even though children's productive vocabulary may not be limited as a result of television and other media exposure, there may be additional consequences to their early language development for professionals and families to consider. Specifically, while engaged with television and media, children's meaningful interactions with parents and others that support features of language acquisition are likely to be reduced. For example, previous research has shown that when adult directed television is present as background noise for children under age 3 from Latino backgrounds, the quality of language input children receive from their parents is decreased (Pempek et al., 2014). Specifically, children hear utterances that are shorter and less complex and the frequency of input is significantly reduced. Given that these features of input quality are strongly connected to children's later language outcomes (Zauche et al., 2016), reductions in input related to television and media exposure might have long term, negative effects for children from Mexican immigrant backgrounds that were not identified in the current study.

Additionally, it was hypothesized that exposure to English television and media would be associated with English vocabulary knowledge, while Spanish exposure would be associated with Spanish vocabulary acquisition. Although it was not possible to analyze the influence of English language exposure on children's English vocabulary, the findings revealed that the amount of Spanish language television did not impact Spanish vocabulary acquisition. Despite the lack of association, this study provided information for the first time on the language of television to which some children from Spanish-speaking backgrounds in the US are exposed. In this sample, children were mostly exposed to Spanish television (averaging 78.83% Spanish television as

compared to 40.17% English television). This is likely due to Spanish being the primary language of Mexican immigrant homes. However, most children also had some exposure to English media (range = 0-470 minutes). There are two possible reasons why some children may have been exposed to more English electronic media as opposed to their peers. First, children with higher amounts of English-language media exposure may have been interacting with older siblings who were selecting programming in English (due to changes in their language proficiency related to attending school). Second, parents may believe in a positive association between English-language learning and English media exposure (Thompson et al., 2015). Furthermore, Children from Mexican backgrounds are receiving language input in both Spanish and English, so it is important to consider both languages when studying the language acquisition of children from these backgrounds.

Implications

Although research regarding early language acquisition in Spanish-speaking households has grown, the understanding of early dual language development of children from these backgrounds continues to be limited. This study was an effort to better understand one aspect of Spanish-speaking children's language and learning contexts that may influence their language-learning trajectories: television and electronic media exposure. Despite the fact that this factor did not appear to impact the language development of children from Mexican immigrant backgrounds, it provides helpful information that may inform future studies and practice in the field of speech-language pathology. More specifically, speech-language pathologists working with Mexican immigrant populations can make appropriate recommendations to families

regarding media exposure with this information on the average media exposure in children's homes. For example, speech-language pathologists may wish to guide families to select programming considered to be of high quality for their children. Additionally, families should be informed on the importance of co-viewing and talking about content in television programming to encourage interactions that are known to support language development. However, more consistent results regarding expressive vocabulary acquisition and television and electronic media exposure, type, and language are needed to determine the kinds of recommendations that may be appropriate. Still, this information can be utilized to make recommendations for appropriate exposure to television programs and media for children, particularly as we continue to increase our reliance on technology in the 21st century.

Limitations and Future Research

Despite the fact that this study adds to the understanding of media exposure and language development in the growing population of children from Mexican immigrant backgrounds, this study contains a few limitations that must be addressed. These include the small sample size, lack of visual data on electronic media use, small amount of English vocabulary, and variability in sampling. Each of these four limitations will be discussed in this section.

First, this study had a small sample size of 30 participants, who were all from Mexican immigrant backgrounds. As a result, it is not possible to assume that the electronic media will never have a negative effect on the language development of bilingual children, regardless of Latino backgrounds. The small number of participants only gives us a slight look into the effect of electronic media on a child's bilingual Spanish-English language acquisition. Additionally, it is important not to generalize the results from this study to children from other bilingual Spanish-English backgrounds, as populations might differ in their home characteristics and approaches to electronic media for young children. For future research, it is recommended that the sample size is increased and participants from different Latino backgrounds are included.

Next, there may be limitations associated with the process in which the data were collected for this study. Importantly, audio recordings of children's media exposure were made to overcome the limitations of previous research that mainly relied on parent report. However, use of audio recording only created some difficulty. Because the data in this study was compiled only through audio recordings rather than with video recordings, the ability to easily distinguish between different forms of media was

not possible. Additionally, it was sometimes difficult to differentiate the type of programming to which the child was exposed. Even when the television program was easily recognized through listening to the audio file, there was not a definitive way of ensuring that the child was indeed attending to the program. If the child was not attending to the program, the lack of impact on children's vocabulary makes sense. In addition, without video footage it was not possible to confirm on which device the child was engaging with electronic media (e.g., television set, tablet, radio, or cell phone). This is relevant because a child's attention might be more focused if they are physically holding a device, rather than listening to television as background noise. For future research, video recording is recommended alongside audio recording.

Additionally, researchers were not able to determine the relation between English vocabulary acquisition and English-language television programming. This was attributed to a lack of English word knowledge for the participants, who were in the very early stages of learning English as their second language. Spanish was the dominant language for all of the families, which resulted in less English language exposure. In other bilingual households, English might be a more predominant language, which would possibly allow for larger expressive English inventories for children from these ages. Future research might take these contexts into consideration when looking at the impact of English television on English vocabulary acquisition, particularly because mothers from Spanish-speaking backgrounds perceive English-language television as an important source of their children's English language learning.

Lastly, variability in sampling poses a limitation for this study. Not all families recorded the same amount of audio on the same days of the week, so samples varied on

many characteristics for each participant. This variability is problematic because inconsistencies limit the methodological control of this study. Because the families also chose when they utilized the recording device, there was a possibility of self-report bias. Families might have picked to record on specific days or times of the day in which their children were not exposed to large amounts of television, possibly due to previous information they learned about the negative impact of too much television and media. Future research should specify times and hours each day that families should begin and finish utilizing the recording devices. This may decrease the variability in length of recordings for each participant and make for more reliable and valid comparisons across children and families.

Conclusion

Although no correlation was found between features of electronic media exposure and child language development for the Mexican immigrant children participating in this study, speech-language pathologists should continue to be cognizant of the possibility of an effect of television and electronic media on vocabulary acquisition. Speech-language pathologists should be aware of the possible negative or positive effects of television and electronic media exposure for this population on subsequent language learning. Parent education is an important next step in recommending the appropriate amount and type of electronic media to which children from these age groups and background should be exposed. Due to previous research, it is recommended that children are exposed to more child directed television than adult, due to the positive associations. Parent education should include information about the importance of scaffolding and parent interaction on language development. Moreover, speech-language pathologists should always be aware of both languages in assessment and intervention as well as upholding cultural competence. The population of children from Mexican background is growing, Spanish continues to be a dominant language in the United States, and therefore, should continuously be studied in order to best serve this population.

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