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HOW HEARING LOSS AFFECTS BILINGUAL CHILDREN

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ABSTRACT

Hearing loss is a disability that affects not only the person, but also the family. This is especially true for children who have hearing loss. Parents of bilingual children who have a hearing loss can receive conflicting views on what language input they should be giving their child. Some healthcare professionals recommend no second language exposure, as it can be detrimental to their first (Bunta & Douglas, 2013). Research studies demonstrate that children with a hearing loss can learn a second language without hindering the other language, which challenges those saying that learning a second language can be detrimental to the first. When children receive a cochlear implant and are given the proper supports, such as early intervention and a supportive environment, they are able to perform in many cases with a slight difference or equal difference compared to the language skills of their normal hearing peers. Given these findings and the sociocultural importance of acquiring a second language in bilingual communities, I recommend that these children should not be discouraged from learning more than one language.

Keywords: hearing loss, children, bilingual, cochlear implants

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Chapter 1

Introduction

Hearing loss is an impairment that can affect people of all ages, genders, and races. In the United States alone, there are 30 million people aged 12 or older who have hearing loss in both ears (National Institute on Deafness and Other Communication Disorders, 2018). Hearing loss is defined as a partial or total inability to hear in one or both ears. There is compelling evidence that hearing loss can have consequences on children and adults throughout their lifetime. The statistics from the National Institute on Deafness and Other Communication Disorders state that about 2 to 3 children out of every 1,000 are born with a detectable hearing loss in either one or both ears (NIDCD, 2018). Hearing loss can hinder a child's language development if not properly addressed. For many parents, if the hearing loss is mild, they might have their child fitted with hearing aids. This ensures that they do not miss out on any valuable language input. If the hearing loss of the child is profound, the parents of the child might choose for their child to have surgery for a cochlear implant (NIDCD, 2017). In this review, I will examine studies about children with hearing loss, children with cochlear implants, and bilingual children with cochlear implants. I will do this because there are common misconceptions about children with hearing loss learning a second language. Finally, I will conclude by examining the key points reviewed, discuss limitations of these studies, and examine how these studies can help bilingual children with cochlear implants.

A cochlear implant, according to the American Association of Speech Language and Hearing (n.d), is a device that can help someone who has a severe sensorineural hearing loss.

This type of hearing loss occurs when the hair cells in the inner ear are damaged. The cochlear implant skips the hair cells and sends sound directly to the auditory nerve while a hearing aid only amplifies the sound. Each device consists of an external and an internal component, with the external component having the capability to be removed by the user for sleeping, bathing, etc., and the internal component being surgically implanted (Peterson, Pisoni, & Miyamoto, 2010). This device allows the person to be able to perceive sound, who otherwise would not be able to hear without it. However, cochlear implants do not replace normal hearing. Users will need to train themselves how to hear and on how to use this device. They will need to learn what these sounds are that they are hearing for the first time. Because the brain needs to learn a different way of hearing, many studies support that the earlier the implantation, the better chances of success for oral language proficiency. Because of this, infants have the best chances for success in their language development.

According to the United States Census Bureau, there are at least 350 languages spoken throughout the United States (US Census Bureau, 2015).While English may be considered the primary language of the United States and the language spoken by nearly all citizens, one can hear and see the presence of other languages in day to day life. When someone is bilingual, it means that a person is able to speak in two different languages effectively in everyday life (Montrul, 2013). Per the statistics of the United States Census Bureau, throughout the United States, children are surrounded by multiple languages other than English. These children are likely to hear more than one language at home.

How does this all relate to hearing and cochlear implants? If hearing loss is something that affects all people, then there is a good chance that there are children growing up in bilingual homes who have some degree of hearing loss. With any degree of hearing loss, there is a stigma

associated that these children will never be able to learn a second language (Grosjean, 2016). However, there is a lot of research that has been done to demonstrate that this assumption is not supported by data. Learning a second language does not hinder their development of their native language. There is significant research done on the benefits of being bilingual, and these children should be encouraged to do so just as children with normal hearing are. The aspects of hearing loss, bilingualism, and cochlear implants are all important to examine before looking into the topic of bilingual children with cochlear implants. Understanding more on each of these aspects is important in the process of identifying and promoting the language usage of the child. Professionals will need to understand the existing literature and advance their own knowledge on this topic to provide high quality services and improve bilingual proficiency for these potential clients in the future.

Chapter 2

Language Development of Children with Hearing Loss

Every year in the United States alone, 2 to 3 out of every 1,000 children born have some degree of hearing loss and about 90% of all deaf children are born to hearing parents as stated by the National Institute on Deafness and Other Communication Disorders (2018).This often affects the child's language development and interferes with communication between the child and their caregiver (National Association of the Deaf, n.d.). Based on research, a deaf child's development of language will differ compared to a hearing child. It centers on the importance of early identification and involves the use of various assistive technologies or the acquisition of sign language (National Association of the Deaf, n.d.).

The development of language in a child with typical hearing occurs in the first years of life. This short span is called the critical period for language development (see Berk and Meyers, 2016; for a discussion). The first sign of communication is usually when the baby cries to signal a need that they have, such as being fed. Due to the constant exposure of the sounds of their native language, by six months a baby can distinguish sounds of the language. While all children have a unique progression for their language skills, there is a universal pattern that occurs in mastering language. This typical language development sequence starts as crying and cooing. This then turns into babbling, where the baby will repeat syllables. This is followed by holophrastic word phrases. The child recognizes the meaning that the syllables have and says one word to communicate. Lastly is the telegraphic stage, which is when a baby uses two words to communicate (Berk and Meyers, 2016). The authors discuss the language development in

children with normal hearing such that it serves as a basis for knowledge for the rest of this text. The authors summarize that language development and increasing vocabulary begins with little need for intervention with the children. Unfortunately, this is not always the case. If a child is born with a hearing problem, they experience major delays in their language development.

Bilateral permanent hearing loss is hearing loss that occurs in both ears and this loss is present in about 1.2 to 5.7 per 1000 births. With increasing severity of the hearing loss, delays in language development and academic achievement can increase in children (Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). Yoshinaga-Itano, Sedey, Coulter, and Mehl (1998) compared the language abilities of earlier and later identified deaf and hard of hearing children. The purpose of this study was to investigate and compare the language skills of children who were identified by six months of age with a hearing loss and those who were identified after six months of age. The participants were deaf and hard of hearing children who were all between the ages of 1 year to 3 years old. Most of the children, after identification, received at least one hearing aid about 2 months after being diagnosed. Nearly all of the children were enrolled in a home intervention program as well. The children were split into two groups of early identified or later identified. Each primary caregiver completed the *Minnesota Child Development Inventory,* or MCDI, as a comprehensive developmental evaluation that includes language abilities. The other test measure used to assess the language abilities of the participants were language quotients, also known simply as LQ, and the total LQ was obtained by averaging each participant's receptive and expressive LQ scores. Both the LQ and the MCDI scores were used to compare the results between the early and the later identified groups. The results showed a significantly higher LQ for children with earlier identified hearing loss compared to those children in the later identified group (Yoshinaga -Itano, et al.,1998). This study shows that children with normal cognitive

ability and who are earlier identified have notably better language development than those children who are later identified.

In a follow up study completed by Yoshinaga-Itano, she and her colleagues further examined the effects of hearing loss on speech and language development in children (Yoshinaga-Itano, Coulter, &Thomson, 2000). The objective of this study was to compare the speech and language development of children with bilateral hearing loss. The children who were born in hospitals with a newborn hearing screening had normal cognition. This study consisted of fifty children who were anywhere between the ages of 9 to 36 months old who had parents within the normal hearing range. The participants were divided into four groups on the basis of having a hospital screening or not. There was also a third group of probably screened, where the parents reported that the child was screened, but the hospital reported no record of it. The last group was probably not screened where the parents reported that the child was probably not screened and there was no record of it. The tools used for assessment were the *Minnesota Child Development Inventory, the MacArthur Communicative Development Inventory (*CDI), and a 25-minute videotape of an interaction between the parent and child. This study used the MCDI by deriving language quotients to examine the participants' language development. They found that 68% of children in the not screened group had delays, compared to only 24% in the screened group. The CDI measured the expressive vocabulary of the children. They found that the screened group had a larger expressive vocabulary than the non-screened group. The results for speech and language showed that children who were screened had significantly more consonant types and produced more words than the non-screened group. Overall results showed a positive relationship for expressive, receptive, and vocabulary productions for children who received

newborn screenings compared to the children in the other groups (Yoshinaga-Itano, Coulter, and Thomson, 2000).

Early identification is an important factor for children with hearing loss when it comes to their language development. Early identification occurred with both of these studies done by Yoshinaga-Itano, and colleagues (1998; 2000) and they provide support for these findings about early identification. A newborn hearing screening is one way to identify if a child could have a hearing loss and lead that child to further testing. This research shows the importance of early identification, as the children who were screened were able to receive early prevention intervention, which helped when it came to the children's language development as a whole. A child born with a hearing loss will benefit greatly from the newborn hearing screenings and going through follow checkups.

Once a child is identified as having a hearing loss, many parents receive information on early intervention programs and services. Programs, such as early intervention programs, have also proved successful for these children (Yoshinaga-Itano, et al., 1998). It also seems that for optimal results, the children should be diagnosed on or before six months of age, as these children receive the most success according to this study.

However, in participants from previous studies, not all children are identified as having a hearing loss as an infant. For children who are later identified as having a hearing loss, these children may not be able to regain valuable language input. To answer this, Delage and Tuller (2007), researched adolescents with mild to moderate hearing loss to see if their language impairment will normalize with age. French-speaking adolescents with a moderate or mild sensorineural hearing loss participated in this study, between the ages of 11 and 15. A set of 7 standardized tests were used to examine their spoken and literacy skills. The battery of these 7

tests revealed that more than half of the participants had relatively severe long-term language impairments in phonology and grammar (Delage & Tuller, 2007). These results show that the language development of these children did not normalize with their age. This could be because linguistic development is thought to be mostly complete by adolescence (Delage & Tuller, 2007).

This information demonstrates that for children with hearing loss, language development will not normalize with age. This means that as the child grows up, their language development will need intervention for them to be at what is expected of their age. The children who did not have language impairments were both identified and fitted with hearing aids earlier than those who did have language impairments. These children were identified and fitted around the age of 6 or 7. These children might have missed the critical period for language development, which is between the ages of birth to 5, and did not receive full input for language access (Berks & Meyers, 2016).

All of the research in this review indicates that for children with hearing loss, there is a greater risk for complications in their language development. Key factors to prevent complications in language development are early identification, a supportive family, and an enriching environment. The factor of early identification also shows that later identification could be detrimental for these children, as their language development will not normalize with age and these language impairments will last their whole life. Once that critical period is passed, it is much harder for that child to learn language. While this research only discussed children with hearing loss who are monolingual, it can be applied to those children who are from bilingual homes as well. If early identification is important for monolingual children, then that suggests it is equally important for those children who come from a bilingual home. It is

important for these children to be screened and given the proper care to help them with one of the most basic human rights, which is being able to communicate.

Chapter 3
Children with Cochlear Implants

As established, the age of diagnosis plays a key role in how successful a child with a hearing loss will be when it comes to their language development (Yoshinaga-Itano, Coulter, & Thomson, 2000). However, this is not the only factor for success. There is an array of different circumstances that can increase this likelihood for language development success, such as if the child has cochlear implants and age of implantation if they have one. (Peterson, Pisoni, & Miyamoto, 2010). More than 324,200 people use this type of device to aid in their hearing and everyday communication, with 96,000 of those people being in the United States (National Institutes on Deafness and Other Communication Disorders, 2017). This number is ever growing though, and cochlear implants are becoming more used and seen in the modern world.

Several studies demonstrate that the age of implantation in children has a significant impact on their spoken language development. For instance, Nicholas and Geers (2007) examined the benefits of implanting children at an early age. To do so, they examined the benefits of younger children being implanted from the ages of 3.5 and 4.5 years of age. They do so by researching neural organization and structure of the perception of speech that is affected by auditory deprivation. It is known that children who received a cochlear implant before the age of 6 tend to do better with language than those who are implanted after. The explanation for this is that these children are still in the period of relative plasticity in the auditory system. The authors hypothesized that children implanted at the youngest ages would show the most language advantage. The authors wanted to determine whether it is realistic for children with severe to profound hearing loss who have two cochlear implants to use an oral language method for their education. A group of monolingual children with severe to profound hearing loss who had

cochlear implants participated. Another group was used as a reference group of children from a previous study who underwent the same procedures and protocols as the first. Both groups were implanted between the ages of 1 and 3 years old and were enrolled in oral education programs since then. Language samples were collected from videotaped sessions of each child during play. Findings show that language scores do increase with an earlier age of implantation, even when these scores were compared with the same frequency of the use of the implant.

This study is important as it discusses research that early implantation can help children develop their language skills. Just as early intervention and diagnosis are important, the same trend can be seen when it comes to cochlear implantation in monolingual children. It is also important to note that children implanted after 36 months had more trouble with certain language concepts, such as bound morphemes, compared to those who were implanted earlier. Receiving a cochlear implant and intervention services later increases the possibility of delayed language skills. For these children to have proficiency in spoken language, early implantation and intervention is one factor that will make it easier for them to fully understand language.

It is critical to examine the differences of a bilateral cochlear implant versus a unilateral one in order to understand how they differ**.** According to Sarant, Harris, Bennet, and Bant (2014), a bilateral cochlear implant does offer more speech perception and localization benefits for its user, but to how much of an extent is not truly known. There are children with adequate speech perception who only have a cochlear implant on one side; however, these samples are taken in a quiet testing room where a researcher or clinician can control the conditions. This is not representative of the real world, as there are many adverse conditions that occur that make it difficult for even people with normal ranged hearing to hear, such as eating in a noisy restaurant

or a loud air conditioner in a classroom. Sarant et al. (2014) researched unilateral and bilateral cochlear implants in children and compares their language comprehension. This study used children between the ages of 5 to 8 years of age and were grouped into bilateral and unilateral. The main tests that were used in this study were the Peabody Vocabulary Test and the Preschool Language Scales or the Clinical Evaluation of Language Fundamentals. They also tested their cognitive abilities by assessing how involved the parents were with the children, such as by parenting styles. Ultimately, children with bilateral implants achieved significantly better vocabulary and language compared to those who were unilaterally implanted. Some other interesting factors that were also noted for this was if the child was female, as they tend to score better, and the birth order of the children with older siblings, as they tended to have lower scores. (Sarent et al., 2014).

Additionally, on children with cochlear implants, there have been research and literature reviews that examine even more important factors than those previously mentioned for success in language development, such as age of implantation and mode of communication. Peterson, Pisoni and Miyamoto (2010), examine the previous literature that has been published on the topic. They focused their examination on age of implantation and mode of communication. This study also examines the neural plasticity of the brain and how it is a factor that contributes to the success of cochlear implantation in deaf children. The studies first examined the recipients where the primary goal for cochlear implantation is that the recipient be able to understand auditory speech input in everyday listening environments. Based on accumulating evidence that early implantation shows a positive correlation with language outcomes, some researchers have focused their investigations on children who were profoundly deaf, less than 12 months old and who had received cochlear implants. Miyamoto reports on his own research on the topic in this

literature review. For instance, Miyamoto, Houston, Kirk, Perdew, and Svirsky (2003) reported on one infant who was implanted at 6 months, and the child demonstrated through the Reynell Developmental Language Scales to have achieved close age appropriate language abilities by the age of two. Miyamoto, Houston, and Bergeson (2005) then did a follow up study two years later where outcomes were measured with the Categories of Auditory Performance (CAP) scale. The results showed children implanted between the ages of 12 and 36 months for approximately 1 year and compared those results to the children who were implanted before their first birthday (Peterson, et al., 2010). Another study, Holt and Svirsky (2008), addressed the question on early implantation. Specifically, they examined children who were implanted before their 4th birthday. The authors also found that almost all children had some delay with speech and language abilities when compared to normal hearing, typical-developing children, no matter the age they had received their cochlear implant, but the delays were not significant (Peterson, et al., 2010). The Holt and Svirsky (2008) study also found that between the ages of 6 and 12 months of age there was little difference compared to children implanted between 13 and 24 months.

Furthermore, the review of previous literature mentioned also examined the neural plasticity of individuals who are deaf. The authors ask whether there existed a sensitive period in prelingually deaf children for when they should be implanted (Peterson, et al., 2010). This is a question that is significant to the field of audiology and cochlear implants as it could directly relate to the field's potential clientele. Peterson et al. (2010) investigated whether there was an effect of age or duration of deafness where receiving a cochlear implant produces the least favorable results. Previous studies have concluded that a sensitive period is highly likely to exist between the ages of 4 and 12. A sensitive period in this case was defined similar to that of a critical period; regardless, the sensitive period had a less precise and precipitous cut off.

Research also demonstrates that the prolonged deafness affects the ultrastructural organization of the auditory brainstem. Two of the changes that occur are a smaller synaptic vesicle density and decreased terminal branches of the neurons. One interesting study that the authors discussed was one that studied the auditory evoked potentials in children with cochlear implants. The cochlear implants were directly stimulated, and the findings showed that the waves were delayed by an amount equivalent to their time of sound deprivation. The authors concluded that the auditory cortex does not develop without stimulation and the plasticity of the cortical auditory system is maintained during sensory deprivation (Peterson, et al., 2010.)

All the information presented in these studies indicate there are many factors that determine how to best use these devices for positive outcomes for its users. However, hearing loss can affect various populations, regardless of age or race. Given this, it is imperative to discuss how bilingualism and hearing loss relate. One cannot assume that research and methods of helping bilinguals will be the same as it is for those who are monolinguals. The process of learning more than one language varies when compared to monolingual children. Therefore, it is just as important to talk about hearing loss, which can affect language development, and how it relates to children who are bilingual.

Chapter 4

Bilingual Children with Cochlear Implants

So far, I have focused only on studies examining monolingual children with hearing loss. However, it is important to evaluate work on bilingual children because this population is growing (US Census Bureau, 2015). Families who have children with a profound hearing loss have continually been faced with difficult decisions regarding their child's communication needs, especially when both parents have normal hearing. This becomes even more complicated when there is more than one language that is spoken at home (Thomas, El-Kashlan, & Zwolan, 2008). Current recommendations for these parents can be rather confusing. Some professionals recommend using both languages with the child to avoid social, cultural, and personal restrictions due to deprivations of a second language. Others advise using only one language to avoid further communication problems as a result of learning a second language (Bunta & Douglas, 2013). It needed to be addressed if learning a second language is an obtainable goal for a child who has received a cochlear implant (Thomas, et al., 2008). McConkey, Robbins, Green, and Waltzman (2004) researched this question by studying oral language proficiency in prelingually deaf bilingual children with cochlear implants. The participants were all profoundly deaf children who received cochlear implants before 3 years of age. Only children exposed to more than one language (other than English) and that communicated solely through oral language were tested. To assess the English language abilities and evaluate language comprehension and expression, the Reynell Developmental Language Scales (RDLS) was given to those 3 and younger. The Oral and Written Language Scales (OWLS) measures the comprehension and use of connected language and was given to those who were 4 and older. From these tests, the raw scores were given and converted into standard scores with norms.

These tests were completed to compare the participant's language skills to those of children with normal hearing. To assess the second language, the Student Oral Language Observation Matrix (SOLOM) was used. This test assesses the child's proficiency in a second language. The scores of these children showed that they have exceptional first language proficiency. The scores from the SOLOM suggest that it is possible for some degree of proficiency in a second oral language for children with cochlear implants. The SOLOM scores revealed that the children fell along a continuum that was due to two factors, which were the amount and intensity of second language exposure. The children most proficient were those who were exposed to the second language the most (McConkey Robbins, Green, & Waltzman, 2004). Because these children demonstrated exceptional levels of proficiency in English and continuing the use of a second language, it implies that it is possible for children with cochlear implants to learn more than one language. The process of learning a second language was not detrimental to their first language's skills.

Many researchers have also asked if exposure to a second language impacts the ability of children with cochlear implants in developing their first spoken language skills. Thomas et al. (2008) studied whether a second language would impede the development of spoken language for children with cochlear implants. Their study consisted of children who received a unilateral cochlear implant before the age of 6 years old. The participants were divided into sections of those who resided in a monolingual home and those who resided in a bilingual home. The battery of tests used on the participants included the Infant-Toddler Meaningful Integration Scale (IT-MAIS), the MacArthur-Bates Communicative Development Inventory: Words and Gestures , the Peabody Picture Vocabulary Test (PPVT), the Listening Comprehension and Oral Expression portions of the Oral and Written Language Scales, and the Student Oral Language Observation Matrix (SOLOM). All tests were used to measure speech perception and speech language skills.

For the children who were bilingual, this test was completed twice in each language. These tests were used to acquire scores at months 12- and 24-months post activation of the cochlear implant. At 12 months, the bilingual children had relatively the same average scores of the tests as the monolingual children. At 24 months, there was also no significant difference between the two groups. All the scores obtained in this study for bilingual children were similar to those of the monolingual children. The results indicate that children with cochlear implants can acquire more than one language and it does not seem to impede their development of English. If the child receives a cochlear implant early and is able to access the speech signal, this child can benefit from the sensitive period and learn more than one language (Thomas, et al., 2008).

An additional study that discusses how exposure to a second language on children with hearing loss is that of Bunta and Douglas (2013). Their findings further support the use of both languages for children with cochlear implants who come from bilingual homes by investigating the effects of dual language support. This study investigated the language abilities of bilingual children with hearing loss to those of their monolingual peers. In addition, this study investigated Spanish versus English language scores of the children who were bilingual. The researchers conducted a multivariate analysis of variance (MANOVA) with language statuses as the independent variable. The dependent variables were the raw scores from the Preschool Language Scale, Fourth Edition (PLS-4), which consisted of a total language score in English, an English Auditory Comprehension subscale score, and an English Expressive Communication subscale score. The participants were children who had received their cochlear implants or hearing aids before their 5th birthday and were part of an oral communication program for at least a year. The children were divided into two groups depending on whether they were monolingual or bilingual. For the bilingual group, the language test, PLS-4, was administered twice, once in Spanish and

once in English. The result of the total language scores of this test showed no significant difference between the two groups indicating that learning more than one language does not hinder proficiency in English. The MANOVA demonstrated the same type of results. The results of this test, PLS-4, showed that the Spanish and English language skills of the bilingual participants would be commensurated, as the total language scores were not different from each other. This study showed a positive correlation between the English and Spanish scores on the PLS-4 indicating that children can become proficient in more than one language with a cochlear implant. This study gave further insight into children with cochlear implants by expanding the understanding of language skills in monolingual and bilingual children with hearing loss. This data demonstrated that bilingual children with hearing loss who receive support in both languages can perform the same, if not better, than their monolingual peers.

A follow up study done by Bunta, Douglas, Dickson, Cantu, Wickesberg, and Gifford (2016) examines and investigates whether supporting Spanish as the home language, alongside English, benefits Spanish and English bilingual children with hearing loss and cochlear implants. Their main interest was if it would yield different results than when only English is supported. This study reviewed the results of a previous research study, done by Bunta and Douglas, (2013). Their retrospective analysis supports the previous research by comparing the effects of dual-language support to English-only support of bilingual children who have cochlear implants or hearing aids. The researchers' study included children who receive cochlear implants or hearing aids before the age of 5 years old. The participants were then divided into two groups of bilingual children with cochlear implants and hearing aids who received English-only support (English-only support group) and bilingual children with cochlear implants and hearing aids who received support in both languages (dual language support group). All the participants used

spoken language and had at least 1 year of speech and language intervention. Each participant had their language skills gauged with the PLS-4. The tests assess how well a child understands language and evaluates the spoken language skills of the child. The present study (Bunta et al., 2016) analyzed the data collected by using raw scores and then converting those scores into language age. This allowed for tracking the rate of language development and for comparisons to other children to be made. Using the raw scores of the participants from the PLS-4, the results show that the dual language support group outperformed their bilingual peers who received English-only support. These raw score findings show that bilingual children with dual language support outperformed their English only support peers on total and expressive language. When the raw scores were converted into language age, the results were consistent with those of the raw scores. These findings further support that bilingual children with cochlear implants and hearing aids with dual language support perform as well or better than their peers with English-only support on English language measures (Bunta et al., 2016)

While these studies all agree that children with a cochlear implants can learn a second language, they raise the question of what phonological areas these children may struggle in. For bilingual children with cochlear implants, the situation is more complex due to the fact that they are learning two phonological systems despite having access to an impoverished signal. This could affect their segmental accuracy and whole word variability. Sosa and Bunta (2019) look into segmental accuracy and whole word variability that could potentially offer new insight on the topic. Whole word variability is defined as differences in phonemic realization of a word when produced multiple times. This is also known as *token-to-token inconsistency.* This decreases with age in the typical development of a child. The researchers address two questions. First, is if there a difference in accuracy and whole word variability for children with cochlear

implants who are bilingual, or monolingual compared to children who have normal hearing. Second, they asked how accuracy and whole word variability compare across the two different languages in the bilingual children. To answer this, Sosa and Bunta (2019) had participants be divided into four groups. They used a group of bilingual children with cochlear implants and another group of monolingual children with cochlear implants. For each group, there were sets of bilingual or monolingual children with normal hearing for comparison. Only children with a cochlear implant, who had received the implant before the age of 3 and had at least 2 and a half years of experience using the implant participated. All cochlear implant users only used oral communication and bilinguals were encouraged to use both languages. For the material and procedures used during this experiment, a naming task of a list of words was used. To elicit the response, black and white line drawings were shown to the child along with a prompt, such as "What's this?" from the clinician. The target words for assessment included 20 Spanish and 20 English words. For each bilingual child, they received the test twice with one being in English and the second being in Spanish. Variability was also calculated separately for the English and Spanish word lists of the bilingual children. Means and standard deviations for English variability in each group were created for English whole-word variability. Children with cochlear implants had significantly higher variability scores than children with normal hearing. For the within-subject effect of language, there was a higher variability in English than in Spanish. The results from this study show that for both monolingual and bilingual children who use cochlear implants, their speech production differs compared to children with normal hearing. Children with cochlear implants showed lower accuracy and higher whole word variability (Sosa & Bunta, 2019). Based on the results of this study, exposure to a second language does not negatively impact the first language when it comes to phonological development of children with cochlear

implants. Therefore, this leads to the idea that children should not be discouraged from being raised in a bilingual home.

Detriments can be found in the phonological development in bilingual children with cochlear implants because they have to learn two phonological systems rather than one and be able to discriminate between the sounds of one language versus the other. Li, Bunta, and Tomblin (2017), look into phonological development by investigating the production of voiceless alveolar and postalveolar fricatives and affricates of bilingual and monolingual children who use cochlear implants. Children who use cochlear implants tend to find the fricatives and affricates in the English languages challenging to produce and decipher (Serry & Blamey, 1999). The current study addresses the question of how the use of cochlear implant affect bilingual language acquisition. To address this question, this study focuses on speech production and whether or not children are able to acquire separate phonological systems of alveolar and postalveolar fricatives and affricates in the speech production domain. To test this, they used sounds from English (/s/, /ʃ/, and /tʃ/) and Spanish (/s/ and /tʃ/). Children with cochlear implants who participated in this study received implants before 4 years of age and were in oral-aural programs with spoken languages as the primary mode of communication. During the experiment, each child was given a single-word picture elicitation task. Each child received a prompt to produce the desired word. The results indicated that children with cochlear implants who are bilingual Spanish-English speakers or monolingual English speakers could differentiate the target phonemes. This was done by assessing duration, rise time, and frequency in each language, with duration and rise time being the most dependable. These findings suggest that cochlear implants provide its user sufficient access to the speech signal that children are able to distinguish two separate phonological systems (Li, Bunta, & Tomblin, 2017).

There is much research to suggest that cochlear implants can help children with hearing loss acquire more than one language. However, there needs to be made known the factors and what is an efficient treatment procedure for these children. Yim (2012), discussed possible factors for language development success that influence Spanish-English bilingual children. The purpose of this study was to determine if age and duration of implantation influenced English language competency in Spanish-English bilinguals, if the amount of Spanish used by the family influenced Spanish use, and if communication mode affected articulation. Children in this study were profoundly deaf with a sensorineural hearing loss and received a cochlear implant before the age of 36 months and came from dual speaking Spanish and English homes. A battery of standardized tests was administered to all participants to determine speech, language, hearing, and nonverbal IQ skills. These included the Preschool Language Scale-IV (PLS-IV) English and Spanish versions, the PPVT-IV, the Test de Vocabulario en Imagenes Peabody (TVIP), and the Goldman-Fristoe Test of Articulation-2 (GFTA-2). Once these tests were completed, the findings showed that age and duration of implantation does have an effect on English language scores. There was a strong correlation between duration of implantation and English language performance. In addition, the children who used Spanish more at home showed higher Spanish language scores. If the family used oral communication mode in a Spanish-speaking home, then the child had strong Spanish language development. The communication mode had a positive impact on speech accuracy on the word level (Yim, 2012). This study adds to the previous literature on oral language performance with its findings. Variables such as duration of implantation, age, and communication mode are able to influence the outcome of speech and language skills in bilingual children with cochlear implants.

These studies shed light on how to advise bilingual parents who have a child with a cochlear implant, who in the past may have recommended that these children only focus on learning one language rather than two. To put these findings into practice can help those children who are from bilingual homes be able to communicate effectively in more than one language. It is clear that the acquisition of a second language does not hinder their development of their primary language and can even surpass their bilingual peers with normal hearing (Bunta et al., 2016). These children who come from bilingual homes have the capability to learn and distinguish two separate phonological systems as well (Li, Bunta, & Tomblin, 2017). This research challenges the assumption that exposure to a second language impedes the development of their first spoken language for those with cochlear implants

Chapter 5

Discussion

Each of these studies show that hearing loss does not automatically hinder the development of language, whether it is one or two languages that the child is learning. The significance of the studies reviewed above is that they bring us closer to understanding how cochlear implants and hearing aids can assist in the language development of children, both bilingual and monolingual. This is important to answering the question of whether or not children from bilingual homes can learn more than one language without hindering the use of their primary language. In these studies, with appropriate supports such as cochlear implants, bilingual children with hearing loss were either on par or sometimes even outperformed their monolingual peers (Bunta et al., 2016). This suggests that children with hearing loss can learn a second language with a cochlear implant. Children from bilingual homes should not be discouraged from learning a second language.

This literature review suggests many applications when it comes to recommendations and intervention for bilingual children with cochlear implants. One of the most significant ones is that this review can help inform healthcare providers who come in contact with these children and their parents. Healthcare providers can give accurate information to the parents of these children, because in the past many parents were told that learning a second language could hinder the child's first language.

A clinical implication that can be derived with this information is to integrate appropriate teaching methods for bilingual children with cochlear implants to ensure the approaches are

culturally and linguistically diverse. Items to consider for these children are the family's involvement with the child, how connected the family and child are and the amount of input the child is receiving in both languages. Another clinical application is one that relates to children's speech development. As demonstrated in Li, et al. (2017), there is a complex interplay between bilingualism and phonological acquisition. Children with cochlear implants tend to have difficulty with fricatives and affricates. In bilingual children, who are learning two phonological systems, to sound native-like in the future they need to be able to differentiate between two phonemes that can occur in the same language, but that are slightly different. This is important information to clinicians, such as speech language pathologists, who will be working with these children and their speech production. By knowing this, they can adjust therapy sessions to make sure that they are catering to needs such as this. This information indicates the need to hire appropriate employees to serve these children and for clinicians and practitioners to be able to manage the outcomes for bilingual children with cochlear implants.

While these studies all tell us about the possibilities, there are limitations to this literature review as well. First of all, one thing is that each study does not offer guidance on if and how bilingual intervention is different compared to that of a monolingual child with a cochlear implant. This is something that can be researched more, as intervention was a factor that was consistent when the researchers choose participants for each study. Moreover, the studies were not longitudinal studies. In the future, if these types of studies are done, it can provide valuable information that is more precise and comprehensive in the children's speech and language development, as noted in Bunta, et al. (2016). With the addition of these longitudinal studies, along with the ones reviewed in this paper, it will lead to more well-rounded information about

these bilingual children and can further improve the knowledge on how to best use resources to help them.

Overall, hearing loss in children, both monolingual and bilingual, does not automatically hinder the development of language skills. They are able to become proficient in one or more languages when given the proper tools necessary, such as by receiving early intervention services and hearing aids or cochlear implants. Children from bilingual homes should not be discouraged to learn another language, as there is no demonstrated impediment on the other language if they do so. If a child is discouraged from learning another language, it may come with unexpected cost later to their social and cultural well-being. Many healthcare professionals working with bilingual children with hearing loss need to advance their knowledge on the topic, as to be able to provide the best care they can to their clients. This will help ensure the success of language development in bilingual children who have a hearing loss.

Chapter 6

Conclusion

This literature review contributes to the field of communication sciences and disorders by researching information on bilingual children with cochlear implants. Hearing loss can affect language development in children and that is why many children use devices, such as hearing aids and cochlear implants, to improve their language development skills. Children with cochlear implants from bilingual homes should not be discouraged from learning a second language because of their hearing loss. This literature review shows and supports this statement with research that the learning of a second language does not impede the development of the first language. This is important, as in the past there has been much mixed information on the best type of input for children with cochlear implants. Healthcare providers can provide accurate information to these families as well as providing another option to them which is to have their child with a hearing loss be bilingual. Helping children with hearing loss become fluent in language is a necessity for these children throughout their life, such as social and cultural aspects. It is important to conduct further research to fully address this topic of language development in bilingual children with cochlear implants to be able to improve this group of children's overall language abilities.

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ACADEMIC VITA
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EDUCATION

The Pennsylvania State University, State College, PA **Graduation:** May 2020
Major: Communication Sciences and Disorders
Minor: Spanish
Honors: Schreyer Honors College

RESEARCH AND TEACHING ASSISTANT EXPERIENCE

Schreyer Honors College Thesis: **2019-2020**

- Writing a systematic review on children who have cochlear implants and how they can achieve bilingual proficiency
- Cultivating data analysis skills
- Working closely with my thesis supervisor, Dr. Navin Viswanathan, and other faculty

Undergraduate Teaching Assistant: **Spring, 2019**

CSD 146: Introduction to Communication Sciences & Disorders

- Answered student's questions that they had about the class material
- Hosted weekly office hours to answer students' questions.
- Assisted the professor in monitoring tests, handing back papers, etc.

Abington College Undergraduate Research Activities: **2016-2017**

- Worked yearlong with Professor Oren Gur at the Pennsylvania State University: Abington campus about ways to prevent bike theft with the new dorms
- Hypothesized on ways to help prevent bike theft by reading research and implementing theft prevention strategies around campus
- Presented research and earned Honorable Mention for Information Literacy at a research fair

AWARDS AND ACHIEVEMENTS

Dean's List

- Given to students who achieve a semester grade point average of 3.5 or above.
- Received multiple times as an undergraduate student.

Campus 4-Year Provost Award

- Given to students based on their academic achievements in high school.
- Must maintain a 3.0 GPA or higher throughout undergraduate career.

Information Literacy Award: Honorable Mention **April 26, 2017**

- Given to undergraduate students who have participated in undergraduate research at the Pennsylvania State University: Abington Campus for scholarly work with a foundation of careful background research and literacy review.

The Freshman Award **April 24, 2017**

- Given to students who have achieved a 4.0 cumulative grade point average during their first semester at the Pennsylvania State University.

STUDY ABROAD

Contemporary Colombia **May 2019**

- Embedded course taken at the Pennsylvania State University with a travel component to Colombia for a month.
- Learned about the economic, social, and political change in the country and how it has affected its current state.
- Given an abundance of opportunities to practice the Spanish language among native Spanish speakers

Exploring the Visual Arts in Ireland **Spring Break, March 2017**

- Embedded course taken at the Pennsylvania State University: Abington Campus with a travel component to Ireland for a week.
- Discovered how art relates to the culture and history of the Irish people

WORK EXPERIENCE

West End Space and Open Park Commission, Brodheadsville, PA **Summers of 2018 & 2019**

Camp Counselor

- Ensured proper supervision, safety and security of children
- Collaborated with other camp counselors to create an atmosphere of fun and learning
- Developed strong working relationships with campers, and parents or guardians through effective communication and active listening skills
- Provided first aid for accidents and injuries or during an emergency situation

Law Office of David A. Martino, Brodheadsville, PA **Summers of 2014,2015, 2016 & 2017**

Legal Secretary

- Assisted clients in various legal matters, such as divorces, power of attorney, etc.
- Prepared legal paperwork
- Answered telephones and interacted with clients and lawyers
- Organized and purged files

VOLUNTEER EXPERIENCE

Canine Companions for Independence **November 2014- Present**

Puppy Raiser

- Raise puppies to become full-fledged service dogs for people with various needs
- Socialize and train puppies to various settings, such as going to the movies or the mall
- Groom, feed, and take care of the puppies

EXTRACURRICULAR ACTIVITIES

Audiology Club: **2018-2020**
- Executive Board for 2019-2020 school year

National Student Speech Language Hearing Association **2018-2020**
National Black Association for Speech Language and Hearing **2019-2020**
Sign Language Organization **2018-2020**