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Dual language versus English only support for bilingual children with hearing loss who use cochlear implants and hearing aids

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Abstract

Background—There is a critical need to better understand speech and language development in bilingual children learning two spoken languages who use cochlear implants (CIs) and hearing aids (HAs). The paucity of knowledge in this area poses a significant barrier to providing maximal communicative outcomes to a growing number of children who have a hearing loss and are learning multiple spoken languages. In fact, the number of bilingual individuals receiving CIs and HAs is rapidly increasing, and Hispanic children display a higher prevalence of hearing loss than the general population of the United States (e.g., Mehra, Eavey, & Keamy, 2009). In order to better serve bilingual children with CIs and HAs, appropriate and effective therapy approaches need to be designed and tested, based on research findings.

Aims—This study investigated the effects of supporting both the home language (Spanish) and the language of the majority culture (English) on language outcomes in bilingual children with hearing loss (HL) who use CIs and HAs as compared to their bilingual peers who receive English only support.

Methods and Procedures—Retrospective analyses of language measures were completed for two groups of Spanish-and English-speaking bilingual children with HL who use CIs and HAs matched on a range of demographic and socio-economic variables: those with dual language support versus their peers with English only support. Dependent variables included scores from the English version of the Preschool Language Scales, 4th edition.

Results—Bilingual children who received dual language support outperformed their peers who received English only support at statistically significant levels as measured by Total Language and Expressive Communication as raw and language age scores. No statistically significant group differences were found on Auditory Comprehension scores.

Conclusions—In addition to providing support in English, encouraging home language use and providing treatment support in the first language may help rather than hinder development of

both English and the home language in bilingual children with hearing loss who use CIs and HAs. In fact, dual language support may yield better overall and expressive English language outcomes than English only support for this population.

Keywords

bilingual Spanish-English; cochlear implants; hearing aids; therapy

Introduction

There is clear consensus in the literature regarding the need to provide speech and language services supporting spoken language development in monolingual children with hearing loss (HL) who use cochlear implants (CIs) and hearing aids (HAs). There is ample evidence for the benefits of such support (e.g., Dettman et al., 2013; Geers et al., 2011; Hayes, Geers, Treiman, & Moog, 2009; Jackson & Schatschneider, 2014; Moog & Geers, 2010; O'Brien et al., 2012); further there are no published reports in which researchers or clinicians working with this population have argued for withholding speech or language services due to a concern of overwhelming children with too much speech or language. However, there is considerably less agreement both in the research literature and clinically regarding best practices when it comes to **which** spoken language to support in bilingual children with HL who use CIs and HAs (cf. Bunta & Douglas, 2013; Deriaz, Pelizzone, & Pérez Fornos, 2014; Guiberson, 2014; Rhoades & Chisolm, 2001; Teschendorf, Janeschik, Bagus, Lang, & Arweiler-Harbeck, 2011; Waltzman, McConkey Robbins, Green, & Cohen, 2003).

Some researchers have found evidence for supporting both spoken languages in bilingual children who have HL and use CIs and HAs (e.g., Bunta & Douglas, 2013; Guiberson, 2014) while other sources are more cautious or even refrain from recommending supporting the home language for this population (e.g., Teschendorf et al., 2011; Deriaz et al., 2014). In fact, when it comes to clinical practice, it is not uncommon to encounter “fear that bilingualism may splinter linguistic resources or result in linguistic confusion” in bilingual children with HL, as noted by Guiberson (2014, p. 87). Despite being faced with this dilemma, the goal is still to provide the best care for children (monolingual and bilingual) with HL who use CIs and HAs; thus, a systematic analysis of the speech and language outcomes of this population is needed comparing the effects of dual language support versus support in the language of the majority culture only. The purpose of the current study was to provide a first step in addressing this gap by using a retrospective analysis comparing the language outcomes of Spanish-and English-speaking bilingual children with HL who use CIs and HAs with 1) dual language (Spanish and English) support versus 2) matched peers receiving support in the language of the majority culture only (English). Throughout this paper, bilingualism is referenced in the context of two spoken languages and our study focuses specifically on Spanish and English.

The timeliness of this research is reinforced by the fact that there is an increasing number of individuals with HL who use CIs and HAs who speak two languages. Moreover, there is a higher prevalence of HL among the Hispanic population as compared to the general population of the United States (e.g., Mehra, Eavey, & Keamy, 2009). Despite the large and

growing population of bilinguals in the United States (US), there is a paucity of research on the best practices to help bilingual children with HL who use CIs and HAs. The lack of agreement regarding best practices coupled with the limited amount of research on speech and language skills of bilingual children with HL who use CIs and HAs have prompted studies addressing the issue of whether or not supporting the home language can have beneficial results not only for the language spoken at home but even for the language of the majority culture (e.g., Bunta & Douglas, 2013; Guiberson, 2014).

Bunta and Douglas (2013) conducted a study comparing the language skills of bilingual Spanish-and English-speaking children ($n = 20$, mean chronological age: 4;4) to those of their monolingual English-speaking peers ($n = 20$, mean chronological age: 4;0), all of whom had HL and used CIs and/or HAs. The bilingual children in the Bunta and Douglas study all received dual language support, and the authors found that the language skills of the bilingual and the monolingual participants were commensurate. Furthermore, when comparing the Spanish and English language skills of the bilingual participants, the skills were found to be not only comparable, but also highly correlated. The authors concluded that supporting the language spoken at home (in this case, Spanish) for bilingual children with HL who used CIs and/or HAs did not hinder the children's ability to acquire English.

Guiberson (2014) had similar conclusions, suggesting that children with HL "can acquire an L2 [second language], and that it is not at the expense of the child's L1 development" (p. 91). In his study, Guiberson used the Student Oral Language Observation Matrix (SOLOM, provided by the Montebello Unified School District) to gauge the language skills of monolingual Spanish-speaking children from Spain ($n = 26$) and their bilingual peers ($n = 25$), all of whom were deaf or hard of hearing with a wide age range from 3 to 18 years. The bilingual participants spoke Spanish and another language (the second languages varied from minority languages of Spain such as Basque to foreign languages such as English, German, or Dutch). The author found considerable variability in the second language skills of the bilingual participants, but overall, the parents of the bilingual participants reported that their children had good second language skills. Guiberson (2014) recognized two major study limitations such that 1) the amount of exposure to each language was unknown and, 2) no direct behavioral measures were collected from the participants.

Earlier works conducted in the US on the language abilities of bilingual children with HL also reported no inherent problems with supporting the home language, provided that the environment was conducive to maintaining both languages. In a retrospective study, Waltzman, et al. (2003) found that bilingual children with HL ($n = 18$, mean hearing age: 4;6) did display expressive and receptive language abilities appropriate for their age in the stronger language, relative to their monolingual peers. One of their conclusions was that learning two languages did not have negative consequences for language development in the stronger language; thus, limiting linguistic experiences for bilingual children with hearing loss may not be the best clinical approach for this population. In fact, the more language exposure a bilingual child has, the better the speech and language outcomes may be. In a study with 12 bilingual children between the ages of 1 year 8 months and 15 years implanted before 3 years of age, McConkey Robbins, Green, and Waltzman (2004) found further

evidence for advantages of supporting the home language, especially in the case of bilingual children whose home language environment was predominantly non-English.

Thomas, El-Kashlan, and Zwolan (2008) compared the language skills of bilingual ($n = 12$) and monolingual CI users ($n = 12$) who had implantation ages ranging from 0;11 to 5;8, and the children were tested at 6, 12, 24, and 36 months post-implant. The authors found that bilingual children with HL who used CIs matched the performance of their monolingual peers with HL who also use CIs. Moreover, some of the bilingual participants outperformed their monolingual English-speaking peers on the Peabody Picture Vocabulary Test III (Dunn & Dunn, 1997). The authors also noted that in spite of receiving support in the home language, their bilingual participants still displayed more advanced English language skills relative to language skills in their home language. Taken together, these findings reinforce that (1) supporting the home language does not necessarily represent an added burden that would slow the acquisition of the other language; (2) on the contrary, encouraging bilingual children to use their home language appears to promote the acquisition of the other language, and (3) despite supporting the home language, over time, the language of the majority culture becomes the stronger language of bilingual children with HL who use CIs. Nonetheless, there are studies whose results differ from the ones reviewed above.

Teschendorf et al. (2011) studied 41 monolingual German-speaking children with CIs (mean age of implantation: 3;4) and 52 bilingual children with CIs speaking German as a second language and having a variety of first languages (mean age of implantation: 3;1). They found that bilingual children speaking German and another language who had HL and used CIs did not perform as well as their monolingual German-speaking peers with HL and CIs on measures of spoken language. According to the results of the study, only some of the children from bilingual homes showed advanced spoken language skills in German. The authors concluded that “[a]dvanced language skills including the learning of a second spoken language are possible for children with cochlear implant living in a bilingual home, but that is the exception rather than the rule” (Teschendorf et al. 2011, p. 229). The authors also claimed that factors such as how well the family integrated into the majority culture, parental education, how closely the habilitation program was being followed, and how well family members of the client spoke German all contributed to the spoken language performance of bilingual child participants with HL who used CIs. A critical point to make is that differences among the Teschedorf et al. and other studies may be due to differences in sampling and analysis. The former study was conducted in Germany while previously cited works were conducted in the US or Spain. Furthermore, Teschedorf et al. noted that variables for which they did not account – such as differences among the monolingual and bilingual group members on socio-economic status – might have had various effects on the findings. Naturally, the problem of lack of experimental control is an issue that is not unique to this study, so more research is needed to help disentangle the factors that contribute to speech and language development in bilingual children with HL who use CIs and HAs.

Deriaz et al. (2014) reported that bilingual children with CIs implanted before 5;6 who spoke French and another language ($n = 7$) did not perform as well as their monolingual French-speaking peers with CIs ($n = 7$) on measures of spoken language. The authors concluded that bilingual children with CIs needed greater exposure to the culturally

dominant language and that families should consider enrolling children in a childcare facility upon CI activation to support mainstream language development. It has to be noted that the age of implantation was considerably higher for members of the bilingual group than for those of the monolingual one — a factor that is unequivocally correlated with poorer speech and language outcomes for all children, even those with a coordinated language in the home and majority culture. Furthermore, as noted with the Teschedorf et al. (2011) study, there was no control for potential disparity in socio-economic status across the monolingual and bilingual groups, and bilingual children came from various first language backgrounds. Nonetheless, Deriaz et al. (2014) emphasized that bilingual children needed intensive and good quality input in both languages and also encouraged parental involvement in rehabilitation efforts.

To date, the majority of studies on speech and language development in bilingual children with HL who use CIs and HAs have typically included children from various first language backgrounds, used wide age ranges, and had limited control for variables such as maternal education. It must be noted that finding a homogeneous group of bilingual children with HL who use CIs and HAs poses significant challenges due to the specific nature of the population. In the present study, a conscious effort was made to control for background variables such as languages spoken, maternal education across the groups, narrowly defined age range, and so on (please see the method section below).

Furthermore, the lack of consensus regarding best practices for supporting one or both languages of bilingual children with HL who use CIs and HAs necessitates the investigation of the effects of supporting both the home language and the language of the majority culture versus supporting only the latter. Previous studies may have taken into consideration home language use, but they did not consider the effects of intentional home language support as part of the children's speech and language therapy including parental involvement in supporting the home language. The purpose of the present study was to fill this gap and investigate whether providing therapy in both English and Spanish and encouraging the use of both languages would accelerate language learning as compared to English only support in bilingual children with HL who used CIs and HAs. Understanding how bilingual children with HL learn language is important, because it has implications not only for bilingual language acquisition, but also for informing practicing audiologists, speech-language pathologists (SLPs), Auditory-Verbal Therapists, educators, and teachers of the deaf about how to maximize the benefit these children could receive from early intervention practices in both languages.

Research Question and Hypothesis

The primary research question was whether supporting the home language (Spanish) as well as English for Spanish-and English-speaking bilingual children with HL who used CIs and HAs would yield different results from supporting English only. The hypothesis was that bilingual children with HL who used CIs and HAs and received speech and language support in both languages would derive greater benefit in English from dual language support than their peers who received support in English only, as measured by their language skills.

Method

This study presents the results of an investigation that builds on previous work that compared the language skills of bilingual Spanish-and English-speaking and monolingual English-speaking children with hearing loss who used listening devices (Bunta & Douglas, 2013). Similarly to the Bunta and Douglas study, retrospective analyses of existing data are presented in this research with the relevant details described below. Building on the Bunta and Douglas study, the present work extends the analyses to comparing the effects of dual language support to English only support for bilingual children with HL who use CIs and HAs. Approval for this study was obtained from the Institutional Review Boards of the University of Houston and Vanderbilt University.

Participants

This study included 20 Spanish-and English-speaking bilingual children ($n = 10$ per group as described below) from the US with HL who used CIs, HAs, or both. All 20 children in this study were from the US, received their devices (CIs, HAs, or both) before 5 years of age, had corrected pure-tone averages of 40 dB hearing level (HL) or better in the implanted ear(s), and participated in oral communication programs for a minimum of one year. None of the participants selected for this study had any oral motor issues or co-occurring disorders other than one participant who had a mild sensory processing disorder so as to minimize the possibility of co-occurring disorders affecting the results of the investigation.

There were two groups of participants: (Group 1) bilingual children with HL who used CIs, HAs, or both and received English only support ($n = 10$; mean chronological age = 4;8; mean hearing age = 3;1) versus (Group 2) bilingual children with HL who used CIs, HAs, or both and received support in both their home language (Spanish) and English ($n = 10$; mean chronological age = 4;7; mean hearing age = 3;2). Participants in the second group (with bilingual Spanish-English support) represented a sub-group of a previous study that compared the English skills of bilingual children with hearing loss to those of their monolingual peers with hearing loss who used listening devices (cf. Bunta & Douglas, 2013). The socio-economic status of the children who participated in this study was comparable across the two groups, and a conscious effort was made to match the participants in the two groups on background variables as closely as possible. Statistical analyses comparing the two groups on background variables revealed that there were no significant group differences on hearing age [$\chi^2(1) = 0.208$ at $p = 0.649$], chronological age [$\chi^2(1) = 0.001$ at $p = 0.970$], age at initial device activation [$\chi^2(1) = 0.418$ at $p = 0.518$], or maternal education [$\chi^2(1) = 0.508$ at $p = 0.476$]. The distribution of the children's gender was identical across the two groups – 5 female and 5 male speakers in each group (see also Table 1 with the participants' background information).

Speech and language support for the participants—All of the participants (in both Groups 1 and 2) used spoken language and had at least one full year of speech and language intervention. Children in the English only group (Group 1) had somewhat longer exposure to intervention (mean duration of intervention: 37.2 months) than children in Group 2 with dual language intervention (mean duration of intervention: 29.8 months).

Participants of Group 1 (bilingual children with English only support) received instruction in either regular education settings or a preschool program for children with disabilities in their school district or regional day school program for the deaf. In addition, each child received small group and/or individual pull out speech and language services in English only at least one hour per week (two or three 25-minute sessions, weekly). There was no reported support or assessment provided for the children's home language (Spanish) other than translated case history forms for the parents and provision of a translator for parent-teacher/therapist conference meetings. The English language support provided to the children in Group 1 was commensurate with the support provided in the same language to the children in the other (dual language support) group in that the habilitation philosophy across the two groups was the same. That is, the support for both groups emphasized the development of spoken language, provided individualized, objective-driven instruction, assured maximum access to sound through HAs and CIs, and encouraged parents to be partners in their child's learning. Children in Group 1 did not receive support in the language of the home (Spanish) in a systematic fashion, but their English education was commensurate with that of their peers in Group 2 in that certified listening and spoken language specialists worked with children in both groups providing individual therapy as well as having certified educators of the deaf at school.

As indicated above, children in Group 2 (bilingual children with support in both Spanish and English) constituted a sub-group participants from a previous study that compared the English skills of bilingual children with hearing loss to those of their monolingual peers with hearing loss who used listening devices (cf. Bunta & Douglas, 2013). Children in both groups attended preschool in a listening and spoken language program in which the main language of instruction was English, having English pull-out sessions in small groups three times daily by certified teachers of the deaf. Children in Group 2 also received auditory-based therapy in Spanish once a week led by a native speaker of the language who was also a certified listening and spoken language specialist (LSLS). Participants in Group 2 also received professional interpreter services for all audiology related appointments in Spanish. Thus, all families had a thorough understanding of the information provided regarding device use, wear time, troubleshooting, and need for intensive audiologic management. As part of the dual language support protocol, the parents or caregivers actively participated during the Auditory-Verbal Therapy sessions in Spanish. The purpose of parental involvement was to teach linguistic goals and strategies that they could implement with their children during regular daily activities. Each subsequent session started with a reflection of the effectiveness of the assigned strategy, which prompted either repeat practice or the learning of a new strategy.

As indicated above and illustrated in Table 1, a conscious effort was made to match the participants across the two groups on a range of background variables such as chronological age, hearing age, type of prosthesis, gender, maternal education, et cetera. The main difference between the two groups was that children in Group 1 received English-only support while children in Group 2 received support in both English and Spanish.

Materials and Procedure

The materials and the procedure were largely the same as the ones reported in Bunta and Douglas (2013). Data collection for all but two of the children took place at the Center for Hearing and Speech in Houston, TX where the participants had their hearing screened the day they were sampled by a certified pediatric audiologist. Two participants who received support in English only were tested at Vanderbilt University. Before language testing took place, all of the children had their HA settings verified and CI aided hearing evaluated on the day of the test. Language testing sessions were conducted either by a licensed and certified SLP or by a bilingual speech-language pathologist assistant (SLP-A) trained in test administration and directly supervised by a licensed and certified SLP. The second author, a licensed and certified SLP and LSLS with over a decade of experience in working with children with hearing loss, supervised the process.

The measure used to gauge the language skills of the participants was the Preschool Language Scales – 4th Edition (PLS-4 by Zimmerman, Steiner, & Pond, 2002). The PLS-4 has an Auditory Comprehension subscale that assesses how well a child understands language, and the test also has an Expressive Communication subscale that evaluates the spoken language skills of the child. In the present paper, we only report the English language scores of our participants, because the children who received English only support did not have sufficient Spanish skills for the clinician to be able to administer the test in Spanish. In fact, one of the negative effects of not supporting or discouraging home language use is diminished or even non-existent skills in the non-English language. Lack of support for the home language typically results in lack of functional use of that language to the point where the child may be unable to speak or even comprehend their mother tongue. Bilingual children in Group 2 who had dual language support did provide a Spanish sample, but those data are not reported in this study, because participants of Group 1 with English only support were unable to provide a comparable Spanish sample. For reference, Bunta and Douglas (2013) report data on the Spanish language skills of bilingual children with dual language support.

Raw scores and language age—In the present study, data were analyzed from two perspectives: **raw scores** as well as scores converted to **language age**. Both of these metrics have been used by previous research in the field (e.g., Bunta & Douglas, 2013; Dornan, Hickson, Murdoch, & Houston, 2007; 2009; Svirsky, Chute, Green, Bollard, & Miyamoto, 2002, and others). One of the reasons for opting to use raw scores rather than standard scores is that the bilingual group was not considered to be representative of the standard sample, because the English version of the measure used in our study was normed on a sample of monolingual English-speaking children (see Bedore, 2004 and Peña & Kester, 2004 for further details regarding the assessment of bilingual children's language using raw versus standard scores). In the discussion, we revisit the issue of standard scores and discuss in the context of the study.

Converting PLS-4 raw test scores to language ages allowed for tracking the rate of language development and also made comparisons to other children with HL possible; something that could not be easily accomplished by using other scores (cf. Dornan et al., 2007; 2009;

Svirsky, Chute, Green, Bollard, & Miyamoto, 2002). It is important to note that language age cannot be used as a substitute for standard scores; for example, a child with a CI with a language age of 31 may not have the equivalent language of a 31-month-old. Nevertheless, using language age allows for tracking progress in a way other scores could not, and language age scores do allow for comparing the performance of one child to another, even if it is an imperfect way of establishing language ability. In the current study, language age was used as it has been in the literature investigating the language skills of children with hearing loss, based on raw scores on the PLS-4, similarly to existing studies (Dornan et al., 2007; 2009). Using the raw score-based language ages enables tracking language development in children with listening devices, and practicing clinicians often use language age to track children's progress with language by gauging the time it takes to reach language milestones relative to their peers. Consequently, presenting both raw scores and language age scores provides a more complete picture that both researchers and clinicians can use when investigating and evaluating the language skills of bilingual children with HL who use CIs and HAs.

Statistical analyses

Due to the retrospective nature of this study and the relatively limited number of participants, non-parametric tests were used to compare independent samples based on the two groups of participants (bilingual children with Spanish and English support versus bilingual children with English only support). The other concern that prompted the use of non-parametric tests was the considerable variability that characterizes the language performance of children with hearing loss – an issue that has been discussed extensively in the relevant literature (e.g., Geers, 2006; Niparko et al., 2010; Tobey et al., 2013).

Kruskal-Wallis tests were used to investigate group differences because this measure is a non-parametric alternative designed to compare two or more groups of independent samples. The independent variable was group (Group 1: English only support versus Group 2: dual language support for bilingual children with HL who used CIs and HAs). The dependent variables were the scores the participants received on the PLS-4 (Total Language, Auditory Comprehension, and Expressive Communication) both as raw scores and as language age equivalent scores.

Results

Raw Scores

Using the raw scores from the PLS-4, participants in Group 2 – receiving dual language support – outperformed their bilingual peers who received English only support. Specifically, children in Group 2 significantly outperformed children in Group 1 on the Total Language measure [$\chi^2(1) = 6.06$ at $p = 0.014$ with a mean rank score of 7.25 for English only support, 13.75 for dual language support, and an effect size of $\eta^2 = 0.32$] and the Expressive Communication subscale [$\chi^2(1) = 8.07$ at $p = 0.004$ with a mean rank score of 6.75 for English only support, 14.25 for dual language support, and an effect size of $\eta^2 = 0.42$]. However, there was no significant difference between the two groups on the Auditory Comprehension subscale despite of a relatively large effect size [$\chi^2(1) = 3.59$ at $p = 0.058$].

with a mean rank score of 8.00 for English only support, 13.00 for dual language support, and an effect size of $\eta^2 = 0.19$. Overall, the findings based on the raw PLS-4 scores indicated that bilingual children with dual-language support outperformed their peers with English only support on total and expressive language. Figures 1, 2, and 3 illustrate the group mean differences (including standard errors).

Scores Converted to Language Age

A perspective favored by clinicians in gauging the language skills of children with HL is using raw scores converted to language age (Douglas, 2011a). This approach allows for more immediate comparisons to other children as well as for tracking progress in a meaningful and easily interpretable fashion (e.g., comparing language age to intervention age). For example, if a child has a language age of 31 months and an intervention age of 31 months, one can reasonably assume that the child has achieved the minimal expectations of 1 month of progress for 1 month of intervention. Similarly, if a child has a language age of 48 months and an intervention age of 26 months, clinicians can reasonably assume the child is responding quite well for the time she or he has been in intervention, progressing faster than typically expected. Clinicians are prompted to provide deeper assessment if the language age is persistently less than the intervention age. Thus, language age scores along with raw scores provide more context for and interpretability of the data, which is why the current study reports both scores.

The current results using language age scores were consistent with the results obtained using raw scores. Statistically significant group differences were found for Total Language scores converted to language age [$\chi^2(1) = 3.88$ at $p = 0.049$ with a mean rank score of 7.90 for English only support, 13.10 for dual language support, and an effect size of $\eta^2 = 0.20$] and Expressive Communication language age scores [$\chi^2(1) = 6.24$ at $p = 0.012$ with a mean rank score of 7.20 for English only support, 13.80 for dual language support, and an effect size of $\eta^2 = 0.33$]. As observed with the raw score, there was not a statistically significant group difference for Auditory Comprehension language age scores [$\chi^2(1) = 2.53$ at $p = 0.112$ with a mean rank score of 8.40 for English only support, and 12.60 for dual language support and an effect size of $\eta^2 = 0.13$].

As in the case of the raw scores, the analysis of language age scores indicated that bilingual children with dual language support outperformed their peers with English only support on total language as well as expressive communication. Figures 4, 5, and 6 illustrate the group differences, and in the next section, differences between the groups with English only support versus dual language support are discussed, along with interpretation of the results and directions for future research.

Overall, the current findings are generally supportive of the hypothesis that bilingual children with HL who use CIs and HAs and Spanish and English language support perform as well as or better than their peers with English only support on English language measures. Both the Total Language scores and the Expressive Communication scores (raw and converted to language age) indicated that the group with dual language support outperformed their peers with English only support. The Auditory Comprehension scores

(raw and language age) did not display such a difference despite the dual language support group having more advanced scores, an issue further explored in the discussion.

Discussion

In the present study, the effects of dual language support versus English only support were compared for bilingual children who had HL and used CIs and HAs. The main findings were that bilingual children with HL who used CIs and HAs who received support in both of their languages outperformed their bilingual peers who received English only support on English Total Language and Expressive Communication. No differences were found on Auditory Comprehension, despite the fact that the scores of the children in the dual language support group exceeded those of their peers' who received English only support. This difference should be further investigated by future studies.

The primary analyses in the current results focused on raw and language age scores, because the children who participated in the study were bilingual, and the English version of the PLS-4 was normed on monolingual English-speaking children in the US. Nonetheless, providing information about the participants' standard scores is informative and therefore, standard scores are presented as part of the discussion here. Post-hoc analyses using a Bonferroni alpha of 0.017 revealed no significant differences on standard scores between bilingual children with dual language support versus English only support. Specifically, there were no statistically significant differences between the groups on Total Language [$\chi^2(1) = 2.07$, not significant with an effect size of $\eta^2 = 0.11$], Expressive Communication [$\chi^2(1) = 2.55$, not significant with an effect size of $\eta^2 = 0.13$], or Auditory Comprehension standard scores [$\chi^2(1) = 1.68$, not significant with an effect size of $\eta^2 = 0.08$]. Nevertheless, it is worth noting that despite the lack of statistically significant group differences, children with dual language support tended to have higher standard scores than their peers with English only support on all language measures (see also Figures 7, 8, and 9). The effect sizes for the Total Language and Expressive Communication contrasts were in the medium range.

Overall, these findings are important because they suggest that quality language support in both languages is not detrimental to language development in bilingual children with HL who use CIs and HAs. On the contrary, dual language support for bilingual children may accelerate expressive and total language skills because children with HL learning spoken languages need more rather than less language input.

These findings also add valuable insight into speech and language development by bilingual children with HL who use CIs and HAs by highlighting that dual language support may actually promote the acquisition of both languages more effectively than providing support in English only. The unique contribution of this study to the field is that English only support may not yield as impressive results as supporting both languages on the English language skills of bilingual children. As Bunta and Douglas (2013) suggested, encouraging home language use typically yields more quality and quantity language input for bilingual children with HL. Additionally, as McConkey Robbins (2007) reported, parent involvement in supporting the child's language development is important for achieving positive speech and language outcomes in bilingual children with HL who use CIs and HAs. To be clear, the

current study is in agreement with McConkey Robbins (2007) as the current results do not suggest introducing bilingualism indiscriminately to all children with HL who use CIs and HAs. Rather, the current findings support the supposition that for children growing up in a bilingual environment, having more language at home does result in more advanced language outcomes in not only the home language but also in the other language (usually the language of the majority culture). Simply put, higher quantity and quality language input at home yields better speech and language outcomes in both languages for children with HL. Based on the current findings and those of others, it is clear that a large-scale assessment of language support and intervention on speech and language outcomes is warranted for this population of bilingual children with hearing loss.

Limitations

The findings of this study move the field forward and provide critical information for both researchers investigating speech and language development of bilingual children with HL and clinicians who provide services for this population, but this study is not without limitations. The number of participants per group was relatively small, so a larger study is needed to obtain a more comprehensive representation of the population. Furthermore, the current study was retrospective in nature, so future works may build on this research and include prospective longitudinal studies to verify these findings. Finally, as language measures are beginning to be standardized on bilingual populations, it will become possible to analyze the standard scores in their appropriate context, so future replication studies should verify the accuracy of these findings.

Clinical Issues and Implications

LSLS professionals who provide a nurturing linguistic environment in which bilingual children with hearing loss learn to communicate are also likely to promote and accelerate learning. Moreover, encouraging communication in a nurturing environment also engenders other social or personal benefits such as the ability to maintain a sense of belonging at home, make numerous friends, and perform well at school (Bunta & Douglas, 2013). LSLS professionals as well as their administrators must have resources and strategies to adequately prepare for and effectively serve this growing US population (Gildersleeve-Neumann, Kester, Davis, & Peña, 2008).

A proposal that is consistent with the current findings would be to integrate appropriate teaching methods for children with hearing loss in LSLS programs with approaches for children who are culturally and linguistically diverse (cf. Austin et al., 2005; Douglas, 2011b; Douglas, 2012; Douglas, 2014; Kohnert & Derr, 2012; Langdon, Quintanar-Sarellana, Helm-Estabrooks, Rainer, & Whitmire, 2003; Mattes & Garcia-Easterly, 2007; McConkey Robbins, 2007; Rhoades, 2008). For instance, a continuum of services implemented in a manner that effectively supports the development of the primary home language could meet the needs of children with hearing loss from non-English-speaking homes and need to develop bilingualism simultaneously (Douglas, 2011b). Initially, the bond between parent and child and the development of a listening function could begin in the child's home language with the parent present. A bilingual SLP-A, fluent in the targeted language, could implement the lesson under the direction of a monolingual SLP and/or a

certified LSLS who is trained in issues involving working with clinically and linguistically diverse populations such as typical bilingual development and strategies that facilitate success (Mattes & Garcia-Easterly, 2007).

As the child prepares for enrollment in the preschool for second language immersion, a coordinated service model could be implemented (Austin et al, 2005). Here, the monolingual deaf educator would work with the child in English and a bilingual SLP or SLP-A would work with the child on parallel lesson plans in the home language with the parent during individual sessions. For example, if the target theme in Spanish with the family is centered on domestic animals, the English sessions with the deaf educator would cover the same topic.

As the child's language needs increase in complexity, an integrated bilingual model could be employed (Kohnert & Derr, 2012). In this situation, the bilingual SLP or SLP-A would provide parallel services in both languages and help the child transfer skills and learn differences between the languages. For example, the therapist may explicitly teach and have the child practice the change in word order when using adjective + noun in English and noun + adjective in Spanish.

As the child's speech and language skills progress, a combination of bilingual support and coordinated models could be utilized (Austin et al., 2005). For example, the monolingual SLP may provide individual instruction in English, the deaf educator may provide small group therapy in English, and the bilingual SLP-A may provide individual and/or group services in the home language. All three professionals may consult with the support of a more experienced bilingual SLP who can provide input during the design of the treatment plans (Douglas, 2011a).

For parents who are proficient bilinguals and have chosen to develop both languages simultaneously with their young child who has hearing loss, a parent-centered integrated bilingual model could be implemented. Here, individual, parent-centered therapy is provided with the help of a monolingual SLP in English. The parent would be enlisted to practice the strategies learned in the weekly therapy sessions with their child at home in either the minority language or both languages. Strategies for establishing linguistic boundaries could be encouraged while English immersion through a LSLS option or regular preschool with small student-teacher ratios could be recommended.

For families who need services from low-incidence languages in the US such as Estonian or Finnish, every effort should be made to find interpreters, train them on policies for sequential interpreting and brief them on the lesson prior to the interaction. During the interaction, the therapist would take care to make eye contact with the client while assuring learning of the home language and respecting the limits of the translator's memory for sentences. After the interaction, the therapist should take time to debrief with the interpreter and to identify any issues about the session that need to be discussed and to make arrangements for the next appointment (Langdon, et al., 2003). In these cases, immersion in an auditory-oral preschool with small student-teacher ratios would be recommended.

If interpreters are not feasible, the “tag-team approach” can be implemented as described in McConkey Robbins (2007), or lessons from professional and parent resources in various languages can be used to serve as the interpreter and facilitate communication with the family and progress in the home language (Douglas, 2014). As the children progress in both languages, some parents may be able to consider a heritage language program to help develop and preserve the home language (Douglas, 2014). There are several heritage language programs in the US and a directory can be found on the National Heritage Language Resource Center website (<http://www.nhlrc.ucla.edu/nhlrcwww>).

This continuum of support will certainly not be appropriate for all children with HL from non-English-speaking homes, or solve all of the problems clinicians face when working with this population. Bilingual children will come to intervention with a range of cultural and linguistic experiences and no one strategy will work perfectly for all children with diverse language or cultural backgrounds (Patterson & Pearson, 2012). Overall, professionals, in consultation with the family, will be responsible for proposing the most appropriate approach that can facilitate gains in both spoken languages as determined during baseline, formative, and summative assessment practices (Douglas, 2012). One goal of this study would be stimulation of discussion prompting professionals to realign current practices in a way that will improve the outcomes for the majority of these children.

Future Directions and Conclusion

The present study filled a gap by demonstrating that dual language support for bilingual children with HL who use CIs and HAs was **not** detrimental to the development of the language of the majority (in our case, English); moreover, supporting home language use provides benefits for the development of the other language. Future research should employ planned experimental rather than retrospective studies as well as include a larger number of participants so as to allow for stronger predictions and generalization. Having planned experimental research on the topic will also allow for accounting for more client factors than it was possible in the present study to gain a more accurate picture of the variables that contribute to the participants’ performance (such as amount of language input and output, other scores from test batteries, etc.).

Future research will also include more specific investigations focusing on clearly defined aspects of speech and language in bilingual and monolingual children with HL who use CIs and HAs. To this end, research in our laboratories is underway investigating specific and more well-defined aspects of speech and language development such as phonological development in bilingual and monolingual children with HL who use CIs and HAs.

Furthermore, it is necessary to collect longitudinal data from monolingual and bilingual children, because only through following speech and language development of an individual child will we gain a more precise and comprehensive understanding of speech and language acquisition in children with HL who use CIs and HAs.

As Guiberson (2014) noted, bilingualism does not appear to pose an insurmountable challenge to children with HL and the enhanced language input may, in fact, provide advantages for children acquiring two languages. The results of the present study echo

Guiberson's (2014) findings in that when both languages are supported for bilingual children with HL who use CIs and HAs, the language gains accelerate as compared to bilingual children who only receive monolingual support. The results of the current study do not suggest that bilingualism is the answer to successful speech and language development in children with HL; however, it is certainly possible that without proper speech and language support, bilingual children with HL who use CIs and HAs may not reach their full potential. That means if the language in the home is other than the language of the majority culture, supporting both the home language and the language of the majority culture will yield results that are superior to providing support only in the latter. Simply put, more quality language support in both languages is better than withholding such support due to a concern over creating undue burden for the child. The take-home message of our findings is very positive for clinicians and educators, because it underscores the importance of working with parents and families to support speech and language development in bilingual children with HL who use CIs and HAs. Based on these findings, the concern that supporting both languages for children with HL will somehow "overburden" the child appears to be unfounded. In fact, providing quality support for both languages can have positive effects for not only the home language but the language of the majority culture.

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References

- AUSTIN, L.; GLOVER, G.; AOYAMA, K.; STUBBE KESTER, E.; CÁRDENAS, N.; VALLES, B.; FERNANDEZ, MR.; FERNANDES, B.; LIMON-ORDOÑEZ, M.; LOPEZ, J. [accessed 15 August 2015] Linguistically diverse populations: Considerations and resources for assessment and intervention. 2005. http://www.txsha.org/cultural_and_linguistic_diversity
- BEDORE, LM. Morpho-syntactic development. In: Goldstein, B., editor. Bilingual Language Development and Disorders in Spanish-English Speakers. Baltimore, MD: Paul H. Brookes; 2004. p. 163-186.
- BUNTA F, DOUGLAS M. The effects of dual language support on the English language skills of bilingual children with cochlear implants and hearing aids as compared to monolingual peers. *Language, Speech and Hearing Services in Schools*. 2013; 44:281–290. DOI: 10.1044/0161-1461(2013/12-0073)
- DERIAZ M, PELIZZONE M, PÉREZ FORNOS A. Simultaneous development of 2 oral languages by child cochlear implant recipients. *Otology and Neurotology*. 2014; 35(9):1541–1544. DOI: 10.1097/MAO.0000000000000497 [PubMed: 25226264]
- DETTMAN S, WALL E, CONSTANTINESCU G, DOWELL R. Communication outcomes for groups of children using cochlear implants enrolled in auditory-verbal, aural-oral, and bilingual-bicultural early intervention programs. *Otology & Neuro-otology*. 2013; 34(3):451–9.
- DORNAN D, HICKSON L, MURDOCH B, HOUSTON T. Outcomes of an auditory-verbal program for children with hearing loss: A comparative study with a matched group of children with normal hearing. *The Volta Review*. 2007; 107(1):37–54.

- DORNAN D, HICKSON L, MURDOCH B, HOUSTON T. Longitudinal study of speech perception, speech, and language for children with hearing loss in an auditory-verbal therapy program. *The Volta Review*. 2009; 109(2–3):61–85.
- DOUGLAS M. Teaching children with hearing impairment to listen and speak when the home language is not English. *Perspectives on Childhood Hearing and Hearing Disorders*. 2011a; 21:20–30.
- DOUGLAS M. Spoken language assessment considerations for children with hearing impairment when the home language is not English. *Perspectives on Childhood Hearing and Hearing Disorders*. 2011b; 21:4–19.
- DOUGLAS M. The Center for Hearing and Speech: Bilingual support services through video-conferencing technology. *The Volta Review*. 2012; 112(3):345–356.
- DOUGLAS, M. Dual Language Learning for Children with Hearing Loss: Assessment, Intervention and Program Development. MED-EL; Innsbruck: 2014.
- DUNN, L.; DUNN, LM. Peabody Picture Vocabulary Test. 3. Circle Pines, MN: American Guidance Service; 1997.
- GEERS A. Factors influencing spoken language outcomes in children following early cochlear implantation. *Advances in Otorhinolaryngology*. 2006; (64):50–65.
- GEERS AE, STRUBE MJ, TOBEY EA, PISONI DB, MOOG JS. Epilogue: Factors contributing to long-term outcomes of cochlear implantation in early childhood. *Ear and Hearing*. 2011; 2(1 Suppl):84S–92S. [PubMed: 21832892]
- GILDERSLEEVE-NEUMANN CE, KESTER ES, DAVIS BL, PEÑA ED. English speech sound development in preschool-aged children from bilingual English-Spanish environments. *Language, Speech, and Hearing Services in Schools*. 2008; 39:314–328.
- GUIBERSON M. A bilingual skills of deaf/hard of hearing children from Spain. *Cochlear Implants International*. 2014; 15:87–92. [PubMed: 24144114]
- HAYES H, GEERS AE, TREIMAN R, MOOG JS. Receptive vocabulary development in deaf children with cochlear implants: Achievement in an intensive auditory-oral educational setting. *Ear and Hearing*. 2009; 30:128–135. [PubMed: 19125035]
- JACKSON CW, SCHATSCHEIDER C. Rate of language growth in children with hearing loss in an auditory-verbal early intervention program. *American Annals of the Deaf*. 2014; 158(5):539–54. [PubMed: 24745108]
- KOHNERT, K.; DERR, A. Language intervention with bilingual children. In: Goldstein, B., editor. *Bilingual Language Development and Disorders in Spanish-English Speakers*. 2. Baltimore, MD: Paul Brookes; 2012. p. 311–338.
- LANGDON H, QUINTANAR-SARELLANA R, HELM-ESTABROOKS N, RAINER NB, WHITMIRE K. Roles and Responsibilities of the interpreter with speech-language pathologists, parents, and students. *Seminars in Speech & Language*. 2003; 24(3):235–244. [PubMed: 14533055]
- MATTES, LJ.; GARCIA-EASTERLY, I. Bilingual speech and language intervention resource: Lists, forms, and instructional aides for Hispanic student. Oceanside, CA: Academic Communication Associates, Inc; 2007.
- MCCONKEY ROBBINS A, GREEN JE, WALTZMAN SB. Bilingual oral proficiency in children with cochlear implants. *Archives of Otolaryngology-Head and Neck Surgery*. 2004; 130(5):644–7. [PubMed: 15148191]
- MCCONKEY ROBBINS, A. Loud and Clear. Valencia, Calif: Advanced Bionics Corp; 2007. Clinical management of bilingual families and children with Cochlear implants; p. 1 www.BionicEar.com [accessed 14 May 2015]
- MEHRA S, EAVEY RD, KEAMY DG. The epidemiology of hearing impairment in the United States: Newborns, children, and adolescents. *Otolaryngology – Head and Neck Surgery*. 2009; 140:461–472. [PubMed: 19328331]
- MOOG JS, GEERS AE. Early educational placement and later language outcomes for children with cochlear implants. *Otology & Neuro-otology*. 2010; 31(8):1315–9.

- NIPARKO JK, TOBEY EA, THAL DJ, EISENBERG LS, WANG NY, QUITTNER AL, FINK NE. CDaCI Investigative Team. Spoken language development in children following cochlear implantation. *JAMA*. 2010; 303(15):1498–1506. [PubMed: 20407059]
- O'BRIEN LC, VALIM C, NEAULT M, KAMMERER B, CLARK T, JOHNSTON J, CULVER S, ZHOU J, KENNA MA, LICAMELI GR. Prognosis tool based on a modified children's implant profile for use in pediatric cochlear implant candidacy evaluation. *Annals of Otolaryngology and Laryngology*. 2012; 121(2):73–84.
- PATTERSON, JL.; PEARSON, B. Bilingual lexical development: Assessment and Intervention. In: Goldstein, B., editor. *Bilingual Language Development and Disorders in Spanish-English Speakers*. 2. Baltimore, MD: Paul Brookes; 2012. p. 113-130.
- PEÑA, ED.; KESTER, ES. Semantic development in Spanish-English bilinguals: Theory, assessment, and intervention. In: Goldstein, B., editor. *Bilingual Language Development and Disorders in Spanish-English Speakers*. Baltimore, MD: Paul H. Brookes; 2004. p. 105-130.
- RHOADES, EA. Working with multicultural and multilingual families of young children. In: Madell, JR.; Flexer, C., editors. *Pediatric Audiology: Diagnosis, Technology, and Management*. NY: Thieme; 2008. p. 262-268.
- RHOADES EA, CHISOLM TH. Global language progress with an auditory-verbal approach for children who are deaf or hard of hearing. *The Volta Review*. 2001; 102(1):5–24.
- Student Oral Language Observation Matrix (SOLOM). Provided by Montebello Unified School District. Instructional Division; Montebello, CA:
- SVIRSKY MA, CHUTE PM, GREEN J, BOLLARD P, MIYAMOTO RT. Language development in children who are prelingually deaf who have used the SPEAK or CIS stimulation strategies since initial stimulation. *The Volta Review*. 2002; 102:199–213.
- TESCHENDORF M, JANESCHIK S, BAGUS H, LANG S, ARWEILER-HARBECK D. Speech development after cochlear implantation in children from bilingual homes. *Otology and Neurotology*. 2011; 32:229–235. [PubMed: 21178802]
- THOMAS E, EI-KASHLAN H, ZWOLAN TA. Children with cochlear implants who live in monolingual and bilingual homes. *Otology and Neurotology*. 2008; 29:230–234. [PubMed: 18223450]
- TOBEY EA, THAL D, NIPARKO JK, EISENBERG LS, QUITTNER AL, WANG NY. CDaCI Investigative Team. Influence of implantation age on school-age language performance in pediatric cochlear implant users. *International Journal of Audiology*. 2013; 52(4):219–29. [PubMed: 23448124]
- WALTZMAN SB, MCCONKEY ROBBINS A, GREEN J, COHEN N. Second oral language capabilities in children with cochlear implants. *Otology and Neurotology*. 2003; 24(5):757–763. [PubMed: 14501453]
- ZIMMERMAN, I.; STEINER, V.; POND, R. *Preschool language scale-4*. San Antonio, TX: Harcourt Assessment; 2002. Spanish edition

What this paper adds to the literature

Section 1: Previous research

Prior to this study, some researchers found evidence for the benefits of supporting both spoken languages for bilingual children with HL (e.g., Bunta & Douglas, 2013; Guiberson, 2014), but other studies came to different conclusions in that focusing on the language of the majority and limiting home language input may be needed for children with HL exposed to two languages (e.g., Deriaz et al., 2014; Teschendorf et al., 2011). As Guiberson (2014) notes, when it comes to bilingual children with HL, it is not unusual to encounter “fear that bilingualism may splinter linguistic resources or result in linguistic confusion” (p. 87). The ultimate goal is providing bilingual children with HL with the best care and evidence-based clinical practice, making it necessary to investigate the effects of dual language support versus support in the language of the majority culture only; something that was not done systematically in previous studies.

Section 2: Contributions of the present study

The present study fills a gap by demonstrating that dual language support for bilingual children with HL who use CIs and HAs is **not** detrimental to the development of the language of the majority (in our case, English). In fact, supporting home language use provides benefits for the development of the language of the majority above and beyond what can be accomplished with English only support.

Figure 1. Mean total language raw scores in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 2. Mean expressive communication raw scores in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 3. Mean auditory comprehension raw scores in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 4. Mean total language scores converted to language age in month equivalents in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 5. Mean expressive communication scores converted to language age in month equivalents in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 6. Mean auditory comprehension scores converted to language age in month equivalents in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 7. Mean total language standard scores in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 8. Mean expressive communication standard scores in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Figure 9. Mean auditory comprehension standard scores in English (with standard error bars) of bilingual children with HL who use CIs and HAs with English only versus dual language support.

Table 1**Participant Background Information for Bilingual Children with Hearing Loss**

Group	Type of Amplification	Unaided Hearing Loss	Gender	Mean Age in Months (Standard Deviation)	Maternal Education
Group 1 (English only support) (n = 10)	3 bilateral hearing aid (HA)	1 mild	5 male	Chronological: 55.6 (20.4)	3 no high school
	0 unilateral HA	0 moderate	5 female	Hearing: 36.5 (15.5)	6 high school
	2 bilateral cochlear implant (CI)	0 moderate to severe		Fitting: 14.0 (11.0)	1 some college
	0 unilateral CI	2 severe		Intervention: 37.2 (18.8)	0 college degree
	5 bimodal CI + HA	0 severe to profound 7 profound			
Group 2 (Bilingual support) (n = 10)	3 bilateral hearing aid (HA)	0 mild	5 male	Chronological: 55.3 (13.2)	5 no high school
	0 unilateral HA	1 moderate	5 female	Hearing: 38.2 (14.1)	4 high school
	2 bilateral cochlear implant (CI)	2 moderate to severe		Fitting: 14.0 (15.0)	0 some college
	0 unilateral CI	1 severe		Intervention: 29.8 (12.5)	1 college degree
	5 bimodal CI + HA	1 severe to profound 5 profound			