



Published in final edited form as:

*Child Lang Teach Ther.* 2013 February ; 29(1): 111–129. doi:10.1177/0265659012467640.

## Multilingual children with hearing loss: Factors contributing to language use at home and in early education

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### Abstract

Understanding the relationship between children's cultural and linguistic diversity and child, caregiver, and environmental characteristics is important to ensure appropriate educational expectations and provisions. As part of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study, children's caregivers and educators completed questionnaires on demographic characteristics, including the communication mode (oral, manual, or mixed) and languages used in home and early educational environments. This article reports an exploratory analysis to examine factors associated with language use and communication mode of children at 3 years of age. A Chi Square Automatic Interaction Detector (CHAID) analysis was performed on data from 406 children to examine factors influencing communication mode and oral language use. The factor that most influenced children's communication mode at home was the communication mode used by their female caregiver. Children's communication mode in their early education environment was most related to the communication mode they used at home, and then related to the presence of additional needs in the children, female caregivers' level of education and the male caregivers' use of languages other than English (LOTEs). A second exploratory CHAID analysis of data for children from multilingual families ( $n = 106$ ) indicated that female caregivers' use of English at home significantly influenced whether children used a LOTE at home. Finally, the use of a LOTE at home was associated with the use of a LOTE in the early education environment. These findings serve as an initial description of the factors that were associated with the communication mode and language use of children with hearing loss.

### Keywords

Communication; hearing; multilingualism; early education; sign language

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## I Introduction

Throughout the world, many people communicate with more than one language. Spoken and written languages are the most common types of communication used; however, signed languages, sign systems, and augmentative and alternative communication systems (AAC) are also important means of communication. Definitions of multilingualism vary in the way they consider age of acquisition, order of acquisition, context of acquisition, language fluency, language modality and domains of language use (Genesee et al., 2004; Grech and McLeod, 2012; Romaine, 1989; Valdés and Figueroa, 1994). In this article, the Grech and McLeod (2012) definition of multilingualism is applied, where a person is multilingual if they are 'able to comprehend or produce two or more languages in oral, manual or written form regardless of the level of proficiency, use, and the age at which the languages were learned' (Grech and McLeod, 2012: 121).

Communication mode can be classified as oral, manual or mixed. Children using an oral communication mode use a spoken language (e.g. English or Arabic). Children using a manual communication mode use a natural signed language (e.g. Australian Sign Language [Auslan] or British Sign Language [BSL]) or an artificial sign system (i.e. not a natural language) without the simultaneous use of speech. Children using a mixed communication mode simultaneously use a spoken language and another method of communication. These other methods of communication include artificial sign systems (e.g. Signed English, Makaton, Cued Speech, Auslan signs in English word order), pictures and symbols (e.g. picture communication boards) and electronic voice output communication systems (Australian Hearing, 2005; Beukelman and Mirenda, 1998).

### 1 Hearing loss

Hearing loss may occur in people of all language backgrounds, with the global prevalence of moderate or greater hearing loss estimated to be approximately 278 million people in 2005 (World Health Organization, 2010a). Children with hearing loss may learn to communicate using an oral, manual or mixed communication mode, and the communication mode they use may vary according to their communication partner, environment and age. Children with hearing loss may be monolingual or multilingual with regards to oral language use. Factors influencing the communication mode and language use of children with hearing loss will be discussed.

### 2 Factors affecting communication mode

Hearing loss can disrupt the typical transmission of languages between generations. The communication mode primarily used by a child with a hearing loss depends on many demographic factors related to both the family and the child (Gravel and O'Gara, 2003) and is subject to change over time (Watson et al., 2008). Caregivers make decisions about the communication mode they would like their child to use very early in their child's development. However, the way this goal is achieved 'is pragmatic and involves the choice of whichever communication option is the most effective at a particular time' (Wheeler et al., 2009: 58). There is very little high quality evidence to advise professionals as to which communication options are best for individual children (Kumar et al., 2009).

**a Family factors**—The majority of children with congenital hearing loss are born into families without a history of hearing loss where an oral communication mode is used (Mitchell and Karchmer, 2004a). Children born into families where a signed language is used may use manual communication, but they may also use oral or mixed communication modes in different situations (Mitchell and Karchmer, 2004b). Family socioeconomic status and caregiver education may impact on the caregivers' ability to access information and

services to inform and support decisions about communication (Wheeler et al., 2009; Young et al., 2005). The preference of the family as to the child's communication mode and caregiver beliefs and aspirations for their child could influence how children with hearing loss learn to communicate (Li et al., 2003).

**b Child factors**—Factors that may influence choice of primary communication mode for a child include degree of hearing loss, age of hearing loss identification, age of intervention, type of amplification (hearing aid or cochlear implant), age of implant and presence of additional needs (Gallaudet Research Institute, 1994; Gravel and O'Gara, 2003; Mitchell and Karchmer, 2005; Reamy and Brackett, 1999; Watson et al., 2006, 2008).

### 3 Factors influencing the use of oral languages other than English

The home communication environment of children with hearing loss may include languages other than the majority community language, or the use of multiple spoken languages. As the children described in this article live in a country where English is the majority language, the term 'languages other than English' (LOTE) will be used to describe non-majority spoken languages. When a family uses a LOTE, a variety of factors may influence whether the child with hearing loss will acquire the LOTE. Family factors may include the LOTE used, the country of birth of the caregivers, whether the caregivers use English, socioeconomic status, level of education, cultural identity and preference (Okita, 2002; Schwartz et al., 2010). Child factors may include use of English in the home, degree of hearing loss, age of hearing loss identification and intervention, and presence of additional needs (Crowe et al., 2012). Professional factors may include advice regarding the use of LOTES; for example, McConkey Robbins et al. (2004) stated that some multilingual caregivers of children with cochlear implants in their study had been advised to speak only English with their children to increase the possibility of optimal spoken language development.

Despite the special needs of oral multilingual children with hearing loss being documented as early as 1921, studies of these children are scarce (Fischgrund, 1982). There is very little research examining the demographic characteristics of children with hearing loss and their families who use non-dominant languages or are multilingual. A number of studies have examined the development of one language in children exposed to oral multilingual environments. Thomas et al. (2008) found children with cochlear implants who lived in oral mono- and multilingual homes had similar levels of English language proficiency. Contrary to this, Teschendorf et al. (2011) found that children with hearing loss from multilingual home environments showed less proficiency in the dominant community language than their peers from monolingual home environments. However, some multilingual children did excel in their acquisition of both languages.

A number of studies have examined children's competency in both of the spoken languages that they use. Waltzman and colleagues reviewed the language skills of 18 multilingual children with hearing loss using cochlear implants, finding that the acquisition of multiple languages was possible for children with hearing loss (Waltzman et al., 2003). Proficiency was impacted by the use of LOTES in early education, the age exposure to the LOTE begins, and the amount of LOTE exposure children received. McConkey Robbins and colleagues (McConkey Robbins et al., 2004) studied a similar cohort of children with cochlear implants, and found that their participants experienced either stability or gains in language proficiency at later assessments. Yim (2012) examined the Spanish and English performance of 12 orally multilingual children with cochlear implants aged between four and eight years. Age of implantation, home language use and communication mode all impacted on overall skills in both languages. Uziel et al. (2007) examined an older cohort of children living in

France, exploring the outcomes of 82 children who had received cochlear implants at least 10 years prior to the investigation. Ratings of English (second language) proficiency were not provided for many of the children, but some children showed skills in acquiring a second language.

#### **4 Home and early education language environments**

Within the home environment, children with hearing loss may be exposed to oral, manual and/or mixed communication through caregivers, siblings and extended family. There may also be one or more spoken languages used by other family members, or used directly with the child with hearing loss. In an early education environment children may experience communication in modes and languages that are not supported in their home environment. Understanding the factors that contribute to communication modality and language choice in children with hearing loss will help to equip those working with these children with information and resources to respond sensitively to the needs of these children and their families in both home and early education environments. Similarly, identifying mismatches between child, caregiver and educator communication mode and languages use, and the reasons this may occur, assist in better understanding the environments in which children with hearing loss acquire language.

#### **5 Importance of communication mode and language use**

Communication mode has been associated with differences in the speech and language outcomes of children with hearing loss in many studies (Geers and Sedey, 2011; Jiménez et al., 2009; Percy-Smith et al., 2010; Rinaldi and Caselli, 2009; Yim, 2012). As it is known that the communication mode used by children with hearing loss may change during the early years of development (Hyde and Punch, 2011; Watson et al., 2008; Wheeler et al., 2009), it is important to increase understanding of the child and family characteristics associated with children who use different communication modes and those from different cultural and linguistic backgrounds. Examining these issues in preschool-aged children is particularly important for three reasons. First, caregivers may be re-evaluating previous decisions about communication mode and language use given the communication competency that their child has developed over the first three years of life. Second, clinicians and educators working in early education environments make recommendations about communication mode and language use to plan for suitable school-aged education options. Third, to better understand communication mode and language use in young children with regards to their potential impact on children's later speech and language outcomes.

#### **6 Research questions**

This research aimed to examine the relationship between child and family demographic factors and the communication mode and language use of young children with hearing loss. This research addressed two questions:

- Which demographic factors most influence the communication mode used by 3-year-old children with hearing loss in their home and early education environments?
- Which demographic factors most influence the use of a language other than English by 3-year-old children with hearing loss in their home and early education environments?

## II Context of the current study

This article reports an exploratory analysis of demographic data collected as part of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study. The aim was to examine the factors that influence the communication mode and language use of children with hearing loss at 3 years of age. The LOCHI study is a prospective, population-based study designed to determine the speech, language, academic and functional outcomes of children with hearing loss, and to investigate the effects of a range of demographic and intervention-related factors on children's outcomes (Ching et al., 2010). Children who were born between 2002 and 2007 in New South Wales, Queensland and Victoria who were diagnosed with hearing loss and accessed paediatric hearing centres before 3 years of age were invited to participate in the study. Data were solicited from caregivers and teachers via written questionnaires custom-designed for the LOCHI study. As described in Crowe et al. (2012), the children participating in the LOCHI study had higher rates of oral monolingualism than their caregivers. One quarter of the children used manual communication at home and/or in their early education environment. The current article analysed the data to increase understanding of factors that influence communication mode and language use, both at home and during early education. Data for 22 variables were available for examining children's communication mode and data for 24 variables were available for examining children's use of LOTEs (see Table 1).

## III Method

Participant data were examined in two ways. First, communication mode in the home and early education environment was examined for all participants. Second, all participants with a caregiver who used a LOTE were identified, and the factors relating to their use of a LOTE at home and in early education environments were examined ( $n = 106$ ).

### 1 Participants

**a Child participants**—Demographic data was obtained for 406 3-year-old children participating in the LOCHI study. Participants were included from the entire LOCHI 3 year dataset if they had complete or near-complete data in the fields being investigated. All children had a congenital bilateral hearing loss and were fitted with an amplification device before 3 years of age. There were more boys ( $n = 225$ , 55.4%) than girls ( $n = 181$ , 44.6%).

The severity of hearing loss for children using hearing aids was calculated from their average loss at 0.5kHz, 1kHz, 2kHz and 4kHz in the better ear, and categorized using the World Health Organization's grades of hearing impairment (World Health Organization, 2010b). For children with hearing aids at 3 years of age 25 (8.5%) had a profound impairment (81dB loss), 57 (19.4%) had a severe impairment (61dB–80dB loss), 132 (44.9%) had a moderate impairment (41dB–60dB loss), 66 (27.2%) had a slight impairment (26dB–40dB loss), and 14 (4.8%) had no impairment (25dB loss). Those children listed as having no impairment were diagnosed with a hearing impairment early in their development; however, by 3 years of age hearing thresholds in their better ear had improved to 25dB. Threshold information was unavailable for one child. Hearing aids were used by 295 (72.8%) children, 58 (14.3%) children used a unilateral cochlear implant, and 51 (12.6%) children used bilateral cochlear implants. One (0.2%) child was unaided. The mean age of diagnosis of hearing loss was 6.0 months (range 0.1 to 34.4 months) and mean age at initial hearing aid fitting was 9.1 months (range 0.1 to 34.8 months). The mean age of cochlear implant switch-on for children's first implant was 17.4 months (range 5.4 to 42.8 months).

Socioeconomic status was determined using the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD; Australian Bureau of Statistics, 2006). The IRSAD is a measure of socioeconomic status based on geographical area where higher IRSAD deciles indicate areas with relatively more financial, educational and infrastructure resources, and lower deciles indicated the opposite. Children's reported socioeconomic status was negatively skewed (mean 7.1, median 7.0, mode 10.0). Seventy-six children (18.7%) lived in tenth decile areas, making the least disadvantaged decile the most frequently reported.

Of the 406 children in this sample, 127 (31.6%) children were reported to have a disability or additional need, which were grouped into cognitive ( $n = 87$ , 21.6%), physical ( $n = 52$ , 12.9%), additional sensory ( $n = 39$ , 9.7%), communication unrelated to hearing loss ( $n = 30$ , 7.5%) (e.g. cleft palate) and behavioural ( $n = 20$ , 5.0%) impairments, and medical needs ( $n = 32$ , 8.0%).

**b Child participants from families that used a language other than English—**A subgroup of 106 participants was identified for analysis of factors that relate to the use of LOTE. Inclusion in this group was based on caregiver report that either of the child's primary caregivers use a LOTE at home (information on which languages were used directly with their children was not available). There were 27 languages reported to be used by children in this group. The most common were: Arabic ( $n = 18$ , 4.5%), Cantonese ( $n = 9$ , 2.3%), Vietnamese ( $n = 6$ , 1.5%), and Spanish ( $n = 4$ , 1.0%). Caregivers reported the language used by themselves and their child. They were not asked to specify whether language use was in a receptive and/or expressive capacity, and no measures of language competence were elicited.

This subgroup of children whose families used LOTEs was composed nearly equally of boys ( $n = 54$ , 50.9%) and girls ( $n = 52$ , 49.1%). Socioeconomic status, as measured by the IRSAD, was negatively skewed for this subgroup (mean 6.8, median 7.0, mode 7.0) with more participants residing in relatively less disadvantaged areas.

The mean age at which this subgroup of children was diagnosed with a hearing loss was 6.4 months (range 1.7 to 31.2 months). The mean age at which hearing aids were first fitted was 10.3 months (range 1.0 to 32.8 months). For children who had cochlear implants, the mean age of switch-on for the first implant was 18.2 months (range 7.3 to 35.6 months). Children's average hearing loss (0.5, 1, 2 and 4kHz thresholds in the better) were categorized using the World Health Organization grades of hearing impairment (World Health Organization, 2010b). For the 80 (75.5%) children using hearing aids the distribution of hearing loss was: 10 (12.5%) with a profound impairment, 12 (15.0%) with a severe impairment, 36 (45.0%) with a moderate impairment, 16 (20.0%) with a slight impairment and five (6.3%) with no impairment. Thresholds were unavailable for one child. In addition to this, 14 (13.2%) children used unilateral cochlear implants, and 12 (11.3%) children used bilateral cochlear implants.

Of the 106 children who were from households where a language other than English was used, 29 (27.4%) were reported to have a disability or additional need, which were grouped into cognitive ( $n = 14$ , 48.3%), physical ( $n = 10$ , 34.5%), additional sensory ( $n = 7$ , 24.1%), communication unrelated to hearing loss ( $n = 5$ , 17.2%), and behavioural impairments ( $n = 5$ , 17.2%) and medical needs ( $n = 9$ , 31.0%).

**c Caregivers—**For the purpose of this article children's primary caregivers were categorized as female caregivers or male caregivers. Caregivers may have been the child's parent, step-parent, parent's partner, grandparent or foster parent. For the total sample all children ( $n = 406$ , 100%) were cared for by a female caregiver, and 386 (95.1%) were also

cared for by a male caregiver. No child had two primary caregivers of the same gender and a maximum of two primary caregivers could be reported. The majority of children (375, 92.4%) lived with two primary caregivers, 22 (5.4%) lived with one caregiver, and information was unavailable for nine (2.2%) children. The majority of caregivers had a university education ( $n = 293$ , 37.6%), or had received further education to diploma or certificate level ( $n = 216$ , 27.8%) or had completed other post-secondary education ( $n = 46$ , 5.8%). Secondary education only was reported by 216 (27.8%) caregivers and primary education only was reported by eight (1.0%) caregivers.

**d Caregivers from families that use a language other than English**—For the children who came from households where a LOTE was used by one or more caregivers, all children had a female caregiver ( $n = 106$ , 100%), and 104 (98.1%) also had a male caregiver. There were 41 languages spoken by the caregivers. The most common spoken by the female caregivers were: Arabic ( $n = 25$ , 6.2%), Cantonese ( $n = 9$ , 2.2%), Vietnamese ( $n = 9$ , 2.2%), and Italian ( $n = 8$ , 2.0%). Similarly, the most common spoken by the male caregivers were: Arabic ( $n = 25$ , 6.5%), Cantonese ( $n = 12$ , 3.1%), Vietnamese ( $n = 8$ , 2.1%), and Italian ( $n = 7$ , 1.8%). Reports of caregiver education levels indicated that 76 (37.1%) had a university education, 50 (24.4%) had a post-secondary diploma or certificate, and 14 (6.8%) had other post-secondary education. Secondary education only was reported by 58 caregivers (28.3%), and primary education only was reported by seven (3.4%) caregivers. Information was unavailable for five caregivers.

## 2 Procedure

Reports of children's and caregivers' communication mode, language use and demographic information were collected via questionnaire from children's caregivers and educators shortly after each child's third birthday. Where a caregiver was not confident to complete questionnaires in written English, questionnaires were administered orally in English or in a language of the caregiver's choice (through a qualified interpreter). Data describing the following variables were extracted for analysis in this article: socioeconomic status, communication mode, language use, education level, country of birth, additional needs, degree of hearing loss, age of hearing loss diagnosis, device type and usage, age of first hearing aid fitting and age of cochlear implant switch-on (see Table 1).

The amount of valid data for each variable varied due to both the structure of the LOCHI study and the nature of each variable. The amount of valid data available for analysis was maximized by retrospective collection of missing information for all children. The caregivers of children with missing data at 3 years were contacted, and this information was obtained through interview, by phone, email or in person. Reliability of caregiver and educator reported data was not specifically examined. The caregiver data reported here was collected independently of children's early education and habitation providers. Caregiver communication mode was classified based on the languages caregivers reported using at home. If caregivers reported only using English then they were classified as using oral communication only at home. A mixed/manual communication mode was only recorded if the caregiver reported they used sign or alternative/augmentative communication such as Auslan, Makaton or picture/symbols when asked to report the languages they used at home.

Ethical approval was obtained through the Human Research Ethics Committees of Australian Hearing and Charles Sturt University. Ethical standards were met in the collection and reporting of this data.

### 3 Data analysis

Data were analysed using Statistical Program for the Social Sciences (SPSS) Version 19 computer program (IBM, 2010) and CHAID (Chi Square Automatic Interaction Detector; Kass, 1980). CHAID analyses allow for large quantities of categorical data to be examined, and the output can provide hierarchical tree diagrams of the interactions between variables of interest for further analysis. Analysis was conducted in line with the methods used by McLeod and McKinnon (2010). For each CHAID analysis a dependent variable was selected, followed by a group of independent variables. CHAID then computed all possible cross-tabulations and Chi-squares for each branch of the tree until the number of cases within each group is too small for further analysis (less than or equal to 10 cases), or no further significant Chi-square results were generated. The CHAID analysis was set to generate 10 levels of analysis, or where no further partitions of the data generated significant Chi-square results, with the significance level for the Chi-square set at 0.05 (with full Bonferroni protection). The four analyses undertaken were:

1. factors related to the choice of communication mode used at home by the child;
2. factors related to the choice of communication mode used in early education by the child;
3. factors related to the use of a LOTE at home by the child; and
4. factors related to the use of a LOTE in early education by the child.

The factors included in each analysis were determined in two ways. First, only data that had been collected through the LOCHI study was available for analysis. Second, of all the data collected through the LOCHI study, factors identified as potentially influencing children's communication mode and language use identified in the literature were selected. The factors included in each CHAID analysis are specified in Table 1. The maximum number of relevant variables available from the LOCHI data was included for each of the four analyses. Communication mode was treated as two categories, oral only and mixed/manual for two reasons. First, caregiver and teacher reliability in accurately reporting communication mode was maximized by asking them to report on broad categories. Second, as CHAID analysis sets minimum cell values beyond which it will no longer look for relationships between variable, the inclusion of a communication mode category used by few children would preclude meaningful analysis of the data. These reasons meant that treatment of mixed and manual communication as a single communication mode category would allow for more meaningful analysis of these data.

## IV Results

### 1 Communication mode in the home environment

Information describing home communication mode was available for 401 children. Exclusive use of oral communication was reported for 302 (75.3%) children and manual or mixed communication was reported for 99 (24.7%) children. A total of 22 variables describing caregiver and child characteristics (Table 1) were entered into the analysis. Of these, the communication mode used by the child's female caregiver was the variable that best partitioned the data. Figure 1 is the CHAID tree of the variables that were most associated with the dependent variable, communication mode used at home by the children. The factors associated with children's home communication mode were:

1. Female caregiver reported using oral communication only at home ( $n = 362$ ). Of this group there were 298 (82.3%) children who were reported to use oral communication only at home, and 64 (17.7%) children who were reported to use manual or mixed communication at home.



2. Female caregiver reported using oral communication only at home + child had additional needs ( $n = 109$ ). There were 74 (67.9%) children who were reported to use oral communication only at home, and 35 (32.1%) children who were reported to use manual or mixed communication at home. No more significant splits were obtained by CHAID.
3. Female caregiver reported using oral communication only at home + child had no additional needs ( $n = 253$ ). There were 224 (88.5%) children who were reported to use oral communication only at home, and 29 (11.5%) children who were reported to use manual or mixed communication at home.
4. Female caregiver reported using oral communication only at home + child had no additional needs + female caregiver had a university education ( $n = 102$ ). There were 100 (98.0%) children who were reported to use oral communication only at home and two (2.0%) children who were reported to use manual or mixed communication at home. No more significant splits were obtained by CHAID.
5. Female caregiver reported using oral communication only at home + child had no additional needs + female caregiver does not have a university education ( $n = 151$ ). There were 124 (82.1%) children who were reported to use oral communication only at home, and 27 (17.8%) children who were reported to use manual or mixed communication at home. No more significant splits were obtained by CHAID.
6. Female caregiver reported using manual or mixed communication at home ( $n = 35$ ). There was one (2.9%) child who was reported to use oral communication only at home, and 34 (97.1%) children who were reported to use manual or mixed communication at home. No more significant splits were obtained by CHAID.

Almost all children ( $n = 100$ , 98.0%) whose female caregiver reported using oral communication only at home, who had no additional needs, and who had a university educated female caregiver were reported to use oral communication only at home. Children in the same situation but with female caregivers who did not have a university education were mostly reported to use oral communication only at home ( $n = 120$ , 82.1%), but a greater proportion were reported to use manual or mixed communication at home ( $n = 26$ , 17.8%). There was incomplete matching between female caregivers' and their children's reported communication mode at home, with 64 (17.7%) children using non-oral communication while their female caregivers reported using oral communication exclusively. In contrast, one child was reported to use oral communication exclusively while at home while their female caregiver reported using manual or mixed communication.

## 2 Communication mode in the early education environment

Caregiver and/or educator reported information describing children's communication mode in their early education environment was available for 390 children. Oral communication only was reported for 299 (76.7%) children, and 91 (23.3%) children were reported to use manual or mixed communication in their early education environment. Twenty-two variables describing caregiver and child demographic characteristics (Table 1) were entered into the analysis. Of these, the communication mode reported to be used by the child at home best partitioned the data. Figure 2 is the CHAID tree of the best associations for the dependent variable, children's communication mode in their early education environment. The pattern of factors associated with children's communication mode in their early education environment were:

1. Child was reported to use oral communication only at home ( $n = 272$ ). There were 292 (93.2%) children who were reported to use oral communication only in early

education, and 20 (6.8%) children who used manual or mixed communication in early education. No more significant splits were obtained by CHAID.

2. Child was reported to use manual or mixed communication at home ( $n = 94$ ). There were 24 (25.5%) children who were reported to use oral communication only in early education, and 70 (74.5%) children who were reported to use manual or mixed communication in early education.
3. Child was reported to use manual or mixed communication at home + male caregiver reported using a LOTE at home ( $n = 11$ ). No (0.0%) children were reported to use oral communication only in early education, and 11 (100.0%) children were reported to use manual or mixed communication in early education. No more significant splits were obtained by CHAID.
4. Child was reported to use manual or mixed communication at home, and male caregiver did not report using a LOTE at home ( $n = 74$ ). There were 21 (28.4%) children who were reported to use oral communication only in early education, and 53 (71.6%) children who were reported to use manual or mixed communication in early education. No more significant splits were obtained by CHAID.

There was incomplete matching between the communication mode children used at home and in their early education environment. There were 20 children who were reported to use oral communication only at home and manual or mixed communication in their early education environment. Conversely there were 24 children who were reported to use manual or mixed communication at home but used oral communication only in their early education environment.

### 3 Language use in the home environment

Caregiver report describing the language their children use to communicate in their home environment was available for 104 children. These children all came from home environments where one or two caregivers reported using a LOTE at home. There were 66 (63.5%) children who were reported to use a LOTE at home, and 38 (36.5%) children who were not reported to communicate using a LOTE at home. A total of 24 factors describing caregiver and child characteristics (Table 1) were entered into the analysis. Of these, the factor that best partitioned the data was whether children's female caregivers reported using English at home. Figure 3 is the CHAID tree of the best associations for reported use of a LOTE by children at home. Factors associated with children's language use at home were:

1. Female caregiver reported using English at home ( $n = 83$ ). There were 45 (54.2%) children who were reported to communicate using a LOTE at home, and 38 (45.8%) children who were not reported to communicate using a LOTE at home.
2. Female caregiver reported using English at home + child was reported to use oral communication only at home ( $n = 75$ ). There were 44 (58.7%) children who were reported to communicate using a LOTE at home, and 31 (41.3%) children who were not reported to communicate using a LOTE at home.
3. Female caregiver reported using English at home + child was reported to use oral communication only at home + child was reported to communicate using English at home ( $n = 70$ ). There were 39 (55.7%) children who were reported to communicate using a LOTE at home, and 31 (44.3%) children who were not reported to communicate using a LOTE at home. No more significant splits were obtained by CHAID.
4. Female caregiver reported using English at home + child was reported to use oral communication only at home + child was not reported to communicate using

English at home ( $n = 5$ ). All five (100.0%) children were reported to communicate using a LOTE at home. No more significant splits were obtained by CHAID.

5. Female caregiver reported using English at home + child was reported to use a manual or mixed communication mode at home ( $n = 8$ ). There was one (12.5%) child who was reported to communicate using a LOTE at home, and seven (87.5%) children who were not reported to communicate using a LOTE at home. No more significant splits were obtained by CHAID.
6. Female caregiver did not report use of English at home ( $n = 20$ ). All 20 children were reported to communicate using a LOTE at home (100.0%). No more significant splits were obtained by CHAID.

There were five children who were reported to communicate using only a LOTE at home despite being in home environments where the female caregiver reported using English. The languages reported to be used by the children to communicate were Arabic ( $n = 2$ ), Cantonese ( $n = 1$ ), Farsi/Persian ( $n = 1$ ), and Japanese ( $n = 1$ ).

#### 4 Language use in the early education environment

Caregiver and or educator reported information describing children's use of a LOTE in their early education environment was available for 98 children. These children all came from home environments where one or two caregivers reported using a LOTE at home. A LOTE was used to communicate in the early education environments of nine (9.2%) of the children but not by the other 89 (90.8%) children. There were 24 factors describing caregiver and child demographic characteristics (Table 1) that were entered into the analysis. Of these, the use of a LOTE to communicate at home was the factor that best partitioned the data. The factors associated with children's use of a LOTE to communicate in their early education environment were:

1. Child was reported to use a LOTE to communicate at home ( $n = 62$ ). There were eight (12.9%) children who were reported to use a LOTE to communicate in their early education environment, and 52 (83.9%) children were not reported to use a LOTE to communicate in their early education. No more significant splits were obtained by CHAID.
2. Child was not reported to use a LOTE to communicate at home ( $n = 36$ ). All 36 (100.0%) children were reported not to use a LOTE to communicate in their early education environment. No more significant splits were obtained by CHAID.

The LOTES that were reported to be used by children in their early education environment to communicate were Arabic ( $n = 6$ ), Cantonese ( $n = 1$ ), Korean ( $n = 1$ ) and Spanish ( $n = 1$ ). English was reported to be used by caregivers in the home environment of seven for these nine children.

## V Discussion

This exploratory article examined the relationship between child and caregiver demographic factors with the communication mode and language use of 3-year-old children with hearing loss. Overall, the majority of children (81.5%) were reported to be monolingual users of spoken English; however, there were a number of children who were reported to use manual or mixed communication modes in both home and early education environments.

### 1 Communication mode in the home environment

The factor that most strongly related to the communication mode the child was reported to use at home was the communication mode the female caregiver reported using in the home

environment. However, there were a number of children for whom this relationship was not straightforward. For 64 children, their female caregivers reported using oral communication themselves but reported that the children used a combination of oral and manual communication at home. The female caregiver of one of these children reported that her child only ever used oral communication, but she did not. There are two possible explanations for this mismatch in communication mode at home. First, for some of the children with additional needs, differences between their expressive and receptive communication abilities may lead to situations where they were able to comprehend oral language, but required sign or alternative communication for expressive communication. For example, one of the children had a mild hearing loss, poor speech intelligibility and Down Syndrome. He was able to comprehend the spoken English used by his caregivers and siblings, but used Makaton to supplement his spoken English when communicating with his family. Second, caregiver communication mode at home was inferred from reports of the languages caregivers used at home (as described in the method). This may have led to an over-representation of caregivers reporting exclusive use of oral communication at home, a limitation of this finding.

The relationship between female caregivers' level of education and the home communication mode of children without additional needs showed that nearly all of the children of university educated mothers exclusively used oral communication. For the children of female caregivers with less educational experience there were relatively fewer children using oral communication exclusively.

## 2 Communication mode in the early education environment

There were 20 children who were reported to use only oral communication at home but not in their early education environment. Conversely, 24 children were reported to use only oral communication in their early education environment, but not at home. Difference in reports of the communication mode used in home and education environments could mean that children are using sign or alternative communication in unsupportive environments. That is, they may use sign at home because that is how they communicate in early education, but their caregivers may not recognize or acknowledge the child's use of sign at home. To date, consistency between communication modes used in the home and early educational environments has not fully been explored and this article provides evidence that inconsistencies may exist.

## 3 Use of languages other than English

Children's use of a LOTE to communicate at home was most strongly related to whether their female caregiver used English at home. When the children's female caregiver did not report using English at home children were always reported to use a LOTE to communicate at home. The majority of children who were reported to communicate using a LOTE at home and whose female caregiver reported using English at home were bilingual, using English and a LOTE to communicate at home. From this analysis, an interesting finding was that five children were reported to communicate only using a LOTE at 3 years of age, even though their female caregivers were bilingual, reporting use of English and a LOTE at home. The languages used to communicate by these children at home were Arabic, Cantonese, Farsi/Persian and Japanese. Four of the five male caregivers of these children also reported they were bilingual using English and a LOTE at home. One male caregiver was a monolingual user of a LOTE at home.

The choices multilingual caregivers make about the languages used in their child's environment and development may be multifaceted. There is also currently no research indicating the rates of heritage language attrition for typically developing children in

Australia. Comparison of the attrition of heritage languages for children with hearing loss and typically developing children, and similarities and differences in the reasons for language attrition in each situation would be of use to clinicians and educators working with children with hearing loss from culturally and linguistically diverse backgrounds.

#### 4 Limitations and future research

The present article is a first step in exploring factors that potentially relate to communication mode and language use of children with hearing loss through secondary analysis of existing data. The findings illustrate some aspects of communication that occur in families who used more than one language and/or different modes of communication, including heritage language attrition. The factors identified as being important here, and their interactions, will be further examined to validate the relationships found in this exploratory analysis. The present CHAID analysis found that degree of hearing loss and ages of hearing loss identification and intervention were not identified as being influential in explaining communication mode or language use in this cohort of children. These variables are essentially continuous in nature, but were necessarily treated as ordinal variables in the analysis. Consequently, statistical power was reduced and potential non-linear relationships that might have existed cannot be detected. It will be necessary to validate the relationships identified in the present analysis in future studies. Future analysis will also probe any potential nonlinear relationships within the data.

Further investigations into this area would also need to include information about the specific languages and communication modes used by the caregivers with the child, compared with those used with and by other family members. It would also be necessary to examine usage in relation to language proficiency, fluency and domains of use. Future research is also needed into the factors caregivers consider when making decisions about communication mode and language use for children with hearing loss and how these factors influence choices over time. Factors that might be analysed include language proficiency, fluency, preference, cultural identity and birth order. Furthermore, as caregiver choices may be influenced by advice from professionals, research into this will also be necessary to increase understanding of what underlie professional recommendations for communication mode and language use for children with hearing loss.

#### VI Conclusions

This exploratory analysis of demographic factors influencing communication mode and language use for 3-year-old children with hearing loss showed that female caregivers' communication mode and language use were the factors that most influenced children's communication in the home environment. Communication mode and language use in children's early education environments was most associated with home communication mode and language use. Secondary factors were the presence of additional needs (disabilities) in the children, the female caregivers' educational attainments and the male caregivers' use of LOTEs. The importance of examining a cohort of young children enrolled in early education assists in planning appropriate intervention services for these children and their families. This analysis also serves as a basis for further investigation of the factors that influence caregiver decisions about the communication mode and language/s that their young child with a hearing loss will use. Future research will explore questions related to choices made based on caregiver preference, experiences, and professional advice regarding communication mode and language use.

## Acknowledgments

We gratefully thank all the children and their families and educators for participating in this study. Data support was provided by Vivienne Marnane. Conception and design of the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study was contributed to by Linda Cupples, Henrik Dahl, Harvey Dillon, and Greg Leigh. Data collection and management was supported by LOCHI staff. The HEARing CRC partners that collaborated with NAL on the LOCHI study include The Catherine Sullivan Centre, Cochlear Implant Clinic of the Royal Victorian Eye and Ear Hospital, Hear and Say Centre, Matilda Rose Early Intervention Centre, Royal Institute for Deaf and Blind Children, St Gabriel's School for Hearing Impaired Children, The Shepherd Centre, and Sydney Cochlear Implant Centre.

### Funding

The LOCHI study is supported by the National Institutes of Health (grant number R01DC008080) awarded to the fourth author. Funding support for the study was also received from the Office of Hearing Services in Australia, Department of Health in Australia, Australian Hearing, New South Wales Department of Health, Phonak Ltd and Oticon Foundation. The first and fourth authors acknowledge the financial support of the HEARing CRC, established and supported under the Cooperative Research Centers Program, an initiative of the Australian Government. The third author acknowledges support from the Australian Research Council Future Fellowship (FT0990588).

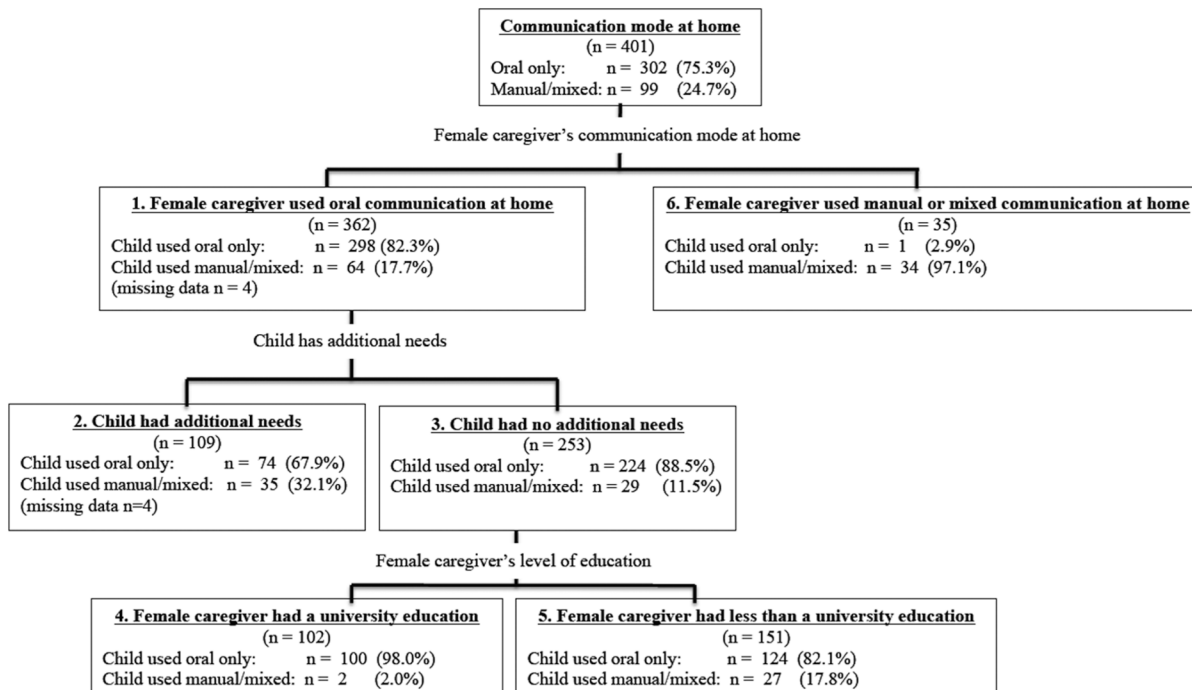
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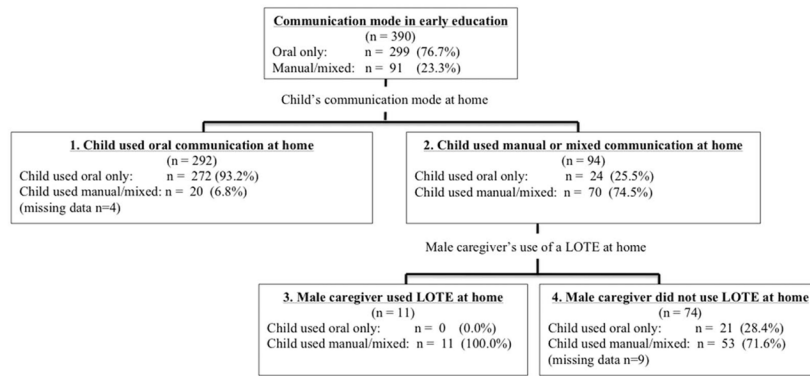
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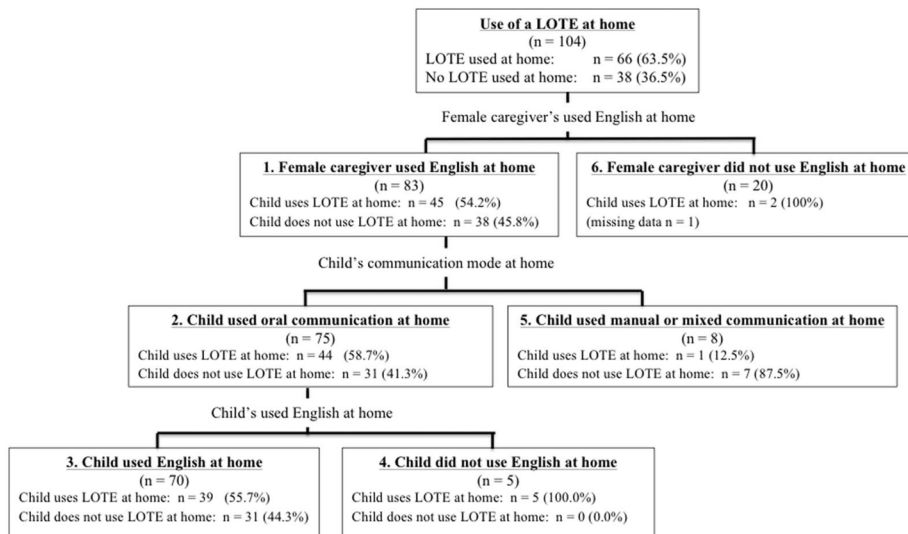




**Figure 1.**  
CHAID tree of factors related to children’s communication mode at home.



**Figure 2.**  
CHAID tree of factors related to children’s communication mode in their early education environment.  
*Note:* LOTE = Language other than English



**Figure 3.** CHAID tree of factors related to children’s use of a language other than English (LOTE) at home.

Table 1

Variables included in the analysis of factors impacting on use of communication mode and languages other than English (LOTE).

Factor	Number of variables	Type of variable	Variables	Communication mode analyses (1 dependant variable, 22 independent variables)				LOTE analyses (1 dependant variable, 24 independent variables)					
				Female caregiver	Male caregiver	Child	Female caregiver	Male caregiver	Child				
1	Socioeconomic status	10	nominal	10 deciles	×	×	×	×	×	×	×	×	×
2	Level of education	5	nominal	University, diploma/certificate, >13 years education <sup>*</sup> , 7–13 years schooling, 6 or less years schooling	×	×	×	×	×	×	×	×	×
3	Use of a LOTE at home	2	nominal	Yes, no	×	×	×	×	×	×	×	×	×
4	Use of a LOTE in early education	2	nominal	Yes, no									×
5	Region LOTE originates from <sup>^</sup>	9	nominal	No LOTE; northern European, southern European, eastern European, southwest and central Asian, southern Asian, southeast Asian, eastern Asian, other regions, multiple regions								×	×
6	Use of English at home	2	nominal	Yes, no	×	×	×	×	×	×	×	×	×
7	Communication at home	2	nominal	Yes, no	×	×	×	×	×	×	×	×	×
8	Communication in early education	2	nominal	Yes, no						×			
9	Presence of additional needs	2	nominal	Yes, no						×			×
10a	Caregiver severity of hearing loss	3	nominal	No hearing loss, mild/moderate loss,	×	×	×	×	×	×	×	×	×

Factor	Number of variables	Type of variable	Variables	Communication mode analyses (1 dependant variable, 22 independent variables)		LOTE analyses (1 dependant variable, 24 independent variables)			
				Female caregiver	Male caregiver	Child	Female caregiver	Male caregiver	Child
10b	6	nominal	severe/profound loss No loss, slight loss, moderate loss, severe loss, profound loss, cochlear implant			×			×
11	7	ordinal	0-5.9, 6.0-11.9, 12.0-17.9, 18.0-23.9, 24.0-29.9, 30.0-35.9, 36.0-41.9			×			×
12	7	ordinal	0-5.9, 6.0-11.9, 12.0-17.9, 18.0-23.9, 24.0-29.9, 30.0-35.9, 36.0-41.9			×			×
13	7	ordinal	0-5.9, 6.0-11.9, 12.0-17.9, 18.0-23.9, 24.0-29.9, 30.0-35.9, 36.0-41.9			×			×
14a	3	nominal	No hearing loss, no amplification used, amplification used		×				
14b	3	nominal	Hearing aid, cochlear implant, no amplification			×			×
15	2	nominal	Yes, no				×		×

Note:

\* Information about the type of post-secondary education was not available.

<sup>1</sup> Region LOTE originates from 'categorized' using The Australian Standard Classification of Languages (ASCL; Australian Bureau of Statistics, 2005).