

# The Cultural and Linguistic Diversity of 3-Year-Old Children with Hearing Loss

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Received December 21, 2011; revisions received May 14, 2012; accepted June 24, 2012

Understanding the cultural and linguistic diversity of young children with hearing loss informs the provision of assessment, habilitation, and education services to both children and their families. Data describing communication mode, oral language use, and demographic characteristics were collected for 406 children with hearing loss and their caregivers when children were 3 years old. The data were from the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study, a prospective, population-based study of children with hearing loss in Australia. The majority of the 406 children used spoken English at home; however, 28 other languages also were spoken. Compared with their caregivers, the children in this study used fewer spoken languages and had higher rates of oral monolingualism. Few children used a spoken language other than English in their early education environment. One quarter of the children used sign to communicate at home and/or in their early education environment. No associations between caregiver hearing status and children's communication mode were identified. This exploratory investigation of the communication modes and languages used by young children with hearing loss and their caregivers provides an initial examination of the cultural and linguistic diversity and heritage language attrition of this population. The findings of this study have implications for the development of resources and the provision of early education services to the families of children with hearing loss, especially where the caregivers use a language that is not the lingua franca of their country of residence.

Hearing loss occurs in people of all nationalities, all cultural heritages, and from all language backgrounds. Approximately 278 million people worldwide are estimated to have a moderate or greater hearing loss (World

Health Organization, 2010a). The conceptualization of multilingualism in the context of people with hearing loss is complex. People with hearing loss may be multimodal, communicating through a number of communication modes: spoken language, sign language, written language, and/or alternative communication. The possibility of the use of multiple languages, multilingualism, within any of these communication modes increases the potential complexity of the communication system.

Approximately 7,000 primary languages are recognized as being spoken throughout the world, and many people speak more than one language (Harding-Esch & Riley, 2003; Lewis, 2009). Multilingualism, even aside from multimodalism, is difficult to define. Definitions of multilingualism differ in how they consider the age and sequence of language acquisition, the linguistic proficiency attained, and the purposes for which the languages are used (Grech & McLeod, 2012). For example, Genesee, Paradis, and Crago (2004) use the term bilingualism to refer to exclusively children who learn two or more languages simultaneously from birth, whereas Valdés and Figueroa (1994) view bilingualism as a continuum on which individuals may be a little bilingual or very bilingual. Grech and McLeod (2012, p. 121) define multilingualism as the ability 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.” This definition is employed here but will be restricted to describing spoken languages only.

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In this paper, communication will be categorized into three modes: oral, manual, and mixed. Oral communication is the use of spoken language (e.g., English). Manual communication uses the hands, face, and body to create linguistic information that is perceived through vision such as in signed languages (e.g., American Sign Language) and sign systems (e.g., Signed English). Mixed communication uses oral and another communication mode simultaneously, including Signed English, Makaton, Cued Speech, and/or pictures/symbols. Communication will be considered in two environments important to young children with hearing loss: home and early education. In relation to children's linguistic development, the home linguistic environment consists of the communication modes and languages used by a child's primary caregivers. The early education linguistic environment is described by the communication mode and languages used by the child in habilitation sessions, early intervention, and/or at preschool.

### **The Cultural and Linguistic Diversity of Children with Hearing Loss**

Rich cultural and linguistic diversity exists even in societies that are believed to be predominantly monolingual, such as the United States, England, and Australia (Department of Education, 2010; Federal Interagency Forum on Child and Family Statistics, 2010; State Government of Victoria, 2009). A few studies have described the cultural and linguistic diversity of children with hearing loss. The Annual Surveys of Deaf and Hard-of-Hearing Children and Youth found that English Language Learners constituted 24% (6,868 of 22,388) of the children surveyed in the United States (Gallaudet Research Institute, 2008). The languages other than English (LOTEs) that were used in children's homes were Spanish, Arabic, Filipino/Tagalog, Chinese, Vietnamese, Korean, Russian, and Hmong/Miao. Some children lived in families where more than one language was used. Information about the children's use of spoken LOTEs at home was not elicited and there was no stratification of results based on age. It was therefore not possible to determine how many of the children were orally multilingual or the language profiles of preschool-aged children in this cohort.

A survey of school-aged deaf and hard-of-hearing children in Puerto Rico captured data for approximately 30% ( $n = 336$ ) of children with hearing loss (Albertorio, Holden-Pitt, & Rawlings, 1999). The majority of children were monolingual (73%), whereas fewer used two (26%) or three languages (<1%). The Puerto Rican sample of children was biased toward those with more significant hearing losses and those attending private education institutions, which may have affected the representativeness of this sample. The results presented did not allow examination of the cultural and linguistic diversity of only the youngest children.

The cultural and linguistic diversity of children with hearing loss may also be related to the community that they live in. Census data indicated that the rates of use of a LOTE at home for the total population are similar in the United States (20%) and Australia (22%) (Australian Bureau of Statistics, 2006b; Shin & Kominski, 2010). Although the overall rates are similar, there were differences in the languages used. In the United States, the majority of people who used a LOTE spoke Spanish (62%), followed by significantly less speakers of other languages, including 19% Indo-European languages, 15% Asian and Pacific Island languages and 4% other languages (Shin & Kominski, 2010). In Australia, there was no dominant LOTE. Italian was the most frequently used LOTE (7%) followed by Greek (6%), Cantonese (6%), Arabic (6%), and Mandarin (5%) (Australian Bureau of Statistics, 2006b).

Reports of languages spoken at home by adults are not necessarily representative of the languages their children will use (e.g., McLeod, 2011). Attrition of heritage language use among the children of recent immigrants has been reported. Parents who are speakers of minority languages face dilemmas about language maintenance and cultural identity with their children (Rohani, Choi, Amjad, Burnett, & Colahan, 2006). The process of acculturation and assimilation, and pressure to develop competence in the dominant community language means that language loss, and even language death, may occur in these families (Wu, 2005). Multilingual parents decide whether to use one or more languages with their child, and if they decide to use more than one language they need to

consider who will use which languages with the child and when. Oral multilingualism for young children with hearing loss has been reported to have been discouraged by professionals (McConkey Robbins, Green, & Waltzman, 2004). Children may be confused when confronted with degraded auditory input from two languages, and this may impact on the rate and quality of their language acquisition (McConkey et al., 2004). Therefore, a question exists as to whether the caregivers of children with hearing loss choose to maintain heritage languages with their children.

Reports from the United States and Puerto Rico suggest both that some children with hearing loss come from multilingual homes and that some children with hearing loss are themselves multilingual (Albertorio et al., 1999; Gallaudet Research Institute, 2008). To date, there have been no population-based investigations of oral language usage, multilingualism, or heritage language attrition for young children with hearing loss, either at home or in their early education environment. Information about the language landscape of a region is necessary for planning services, resources, and intervention in appropriate languages for the families of children with hearing loss. Winter (2001, pp. 489–490) stated that “service providers can easily turn a blind eye to the specific needs of people from linguistic minorities as . . . they often seem silent. It is therefore all the more vital to search out data about the language status of the population which are as current as possible and as specific as possible to the age-range and geographical area served.” It is for this reason that population-based data on the cultural and linguistic diversity of young children with hearing loss and their families is important.

### **Communication Mode Usage by Children with Hearing Loss**

The communication mode used by a child with hearing loss depends on many factors, including the communication mode and choice of the family, the age at which the hearing loss was identified, the degree and progression of the hearing loss, the child’s language development, caregiver preferences, and the presence of additional disabilities (Gravel & O’Gara, 2003). Children with hearing loss born into families who use a

spoken language may learn to use oral communication but may also learn to use manual or mixed communication. Children with hearing loss born into families who use a sign language may learn to use manual communication and may also learn to use oral or mixed communication (Mitchell & Karchmer, 2004b). Children with hearing loss and additional disabilities may use an augmentative or alternative communication (AAC) system with or without the use of spoken and/or signed communication (Malandraki & Okalidou, 2007).

Population-based data describing the use of different communication modes by children with hearing loss is a relatively unreported area. The Annual Survey of Deaf and Hard-of-Hearing Children and Youth examined the communication mode children used at home (Gallaudet Research Institute, 2008). Sign was regularly used in the homes of 24% (8,485 of 35,443) of children. A study by Arnesen et al. (2008) in Norway examined the frequency with which different communication modes were used with, and by, children with hearing loss aged 8 to 16 years. Norwegian Sign Language (NSL) was used at home by 45% of children, 33% used spoken Norwegian, and the remaining 22% used a combination of speech and sign, or another language. However, most parents communicated with their child using spoken Norwegian (74%), with few using NSL (<7%). Parents also reported that spoken Norwegian was most likely to be used with their child in a group environment and NSL or a mix of spoken and signed Norwegian was more likely to be used in one-to-one communication environments. Arnesen et al. (2008) investigation captures the complexities associated with the communication across environments and partners.

The use of different communication modes in education environments has been investigated in a number of studies. The Annual Survey of Deaf and Hard-of-Hearing Children and Youth reported that 52% (18,975 of 36,481) of children exclusively used oral communication in the classroom and 11% (4,160) exclusively used manual communication (Gallaudet Research Institute, 2008). A mixed communication mode was used by 35% (12,719), whereas 2% (627) communicated by other means. Grimes, Thoutenhoofd, and Byrne (2007) described longitudinal, population-based data on the classroom communication of Scottish children with

bilateral hearing loss. The majority of children used spoken and written English exclusively in their education environment (74%,  $n = 2,441$ ), followed by total communication (18%,  $n = 579$ ), then English/BSL bilingual (6%,  $n = 186$ ). AAC or simplified signing systems (e.g., Makaton) were reported to be used by 64 children (2%) and four pupils were “exposed to other languages/modes at school”: Gaelic, Swedish, Danish Sign Language, and Punjabi (Grimes et al., 2007, p. 537). Arnesen et al. (2008) investigated Norwegian children’s bilingualism (use of NSL and Norwegian for learning) in their education environment. Parents and teachers indicated that the majority of children were bilingual (63% reported by parents, 69% reported by teachers).

Communication mode in the early education environment may also be influenced by familial experiences of hearing loss (Allen & Anderson, 2010; Mitchell & Karchmer, 2004b). Data describing families in the United States indicated that less than 5% of deaf and hard-of-hearing students receiving special education services had a deaf parent and approximately 13% of children with a hearing loss also had a sibling with a hearing loss (Gallaudet Research Institute, 2008; Mitchell & Karchmer, 2004a, 2005). Mitchell and Karchmer (2004b) demonstrated the relationship between parental hearing status, child sign usage, and school placement, finding that having at least one deaf parent meant the child was highly likely to use sign to communicate at home and attend a classroom where sign was the medium of instruction. Conversely, if at least one parent was hard-of-hearing, the child was highly likely to use speech at home and attend a classroom where speech was the medium of instruction (Mitchell & Karchmer, 2005). As parental and child degree of hearing loss may be related (Marazita et al., 1993; Mitchell & Karchmer, 2004b), these factors should be considered when examining patterns of language use.

### Gaps in Current Knowledge

To date, there have been no population-based investigations of the cultural and linguistic diversity or communication modes used by children prior to commencing formal education. Previous studies (e.g., the Gallaudet Annual Surveys) have relied on reports

from educators. However, information from children’s caregivers is particularly important to gather accurate reports of a family’s home communication mode and languages, and also the communication modes and languages used in education, especially where children receive services from more than one early education provider. The present study gathered reports from caregivers and educators. Knowledge of communication mode and language use is essential for organizations providing services to the families of children with hearing loss in order to ensure full access to, and engagement with, audiological and educational services. This knowledge is also beneficial for the development of speech, language, and audiological assessments, habilitation, and information resources in languages that match the linguistic needs of this population. Additionally, this knowledge will enhance understanding of the influence of policy, attitudes, research and other factors on cultural and linguistic diversity of young children with hearing loss. With this knowledge, it will be possible to look not only at cross-sectional changes in trends as children get older but also to look at individual children’s changes in communication modes and language use over time.

### Research Questions and Relevance

The current paper investigated the communication mode and language use of a population sample of 3-year-old children with hearing loss and their caregivers. The following questions were addressed:

1. What are the cultural and linguistic backgrounds of these children and their caregivers?
2. What communication modes and languages are used in the home environment?
  - a. Are there differences between the oral language use of these children and their caregivers compared with the Australian population?
  - b. Is the pattern of oral monolingualism and oral multilingualism similar between these children and their caregivers?
3. What communication modes and languages are used by these children in their early education environment?

**Table 1** Valid data for each variable for children at three years of age

	Child ( <i>n</i> = 406)	Female caregiver ( <i>n</i> = 406)	Male caregiver ( <i>n</i> = 386)
Country of birth	405	405	382
Home language/communication	401	402	382
Education language/communication	390	Not applicable	Not applicable
Caregiver education	Not applicable	404	375
Socioeconomic status	378	378	253
Familial hearing loss	406	Not applicable	Not applicable
Additional disabilities	402	Not applicable	Not applicable

*Note.* Values are not equal across all fields as some static information (e.g., country of birth and gender) were able to be obtained from information provided at other assessment intervals.

4. Is there a relationship between caregivers having a hearing loss themselves and the communication mode used by their children?

## Method

### Context of the Current Research

The data analyzed in this paper were collected through the LOCHI study (Ching et al., 2010). The LOCHI study is a prospective, longitudinal, population-based study of the audiological, speech, language, academic, and psychosocial outcomes of children with hearing loss in the three eastern mainland states of Australia (New South Wales, Queensland, and Victoria). The caregivers of all children meeting the following recruitment criteria were invited to participate in the LOCHI study. Children must have been (a) born between April 2002 and August 2007; (b) be diagnosed with a congenital, bilateral hearing loss, (c) first fitted with hearing aids or a cochlear implant prior to 3 years of age; (d) eligible to receive services from Australian Hearing; and (e) attend an Australian Hearing pediatric centre in New South Wales, Queensland, or Victoria. In addition to this, the caregivers of children born in New South Wales between December 2002 and December 2007, whose hearing loss was identified through universal newborn hearing screening, were invited to participate. Australian Hearing is an Australian government-funded organization that is responsible for the audiological management of all children with hearing loss who are Australian citizens or permanent residents. All audiological services and devices are provided for a small annual contribution from children's caregivers and provision of services is not based on

family income or health insurance coverage. The caregivers of all children were approached regardless of the family's language background, hearing status, education, socioeconomic status, additional needs, or geographic location. The inclusive recruitment of participants to the LOCHI study provides an ideal context for considering the cultural and linguistic diversity of children with hearing loss. The current paper reports the linguistic background, language use, and communication mode of 406 participants at age 3.

### Participants

Demographic data were analyzed for 406 children and their caregivers. These children were either current or withdrawn participants in the LOCHI study with complete, or near complete, data in the fields being analyzed. The amount of valid data for each key variable is presented in Table 1. Not all of these children completed speech and language testing at age 3, meaning the data analyzed in here is based on a slightly different cohort of children than those included in other analyses of LOCHI data (e.g., Ching et al., 2010). The present group contained 225 boys (55.4%) and 181 girls (44.6%). Hearing aids were used by 295 (72.8%) children, 58 (14.3%) used unilateral cochlear implants, 51 (12.6%) used bilateral cochlear implants, and one child was unaided (0.2%). Children displayed hearing losses of a range of severity based on averaging thresholds at 0.5, 1, 2, and 4 kHz in the better ear. Using the World Health Organization classification of grades of hearing impairment, the degree of hearing loss of these children at 3 years (based on their better ear) was as follows: 14 (4.8%) had no impairment ( $\leq 25$  dB loss), 66 (27.2%) had a

slight impairment (26–40 dB loss), 132 (44.9%) had a moderate impairment (41–60 dB loss), 57 (19.4%) had a severe impairment (61–80 dB loss), and 25 (8.5%) had a profound impairment ( $\geq 81$  dB loss) (World Health Organization, 2010b). Thresholds for children using unilateral cochlear implants showed 12 (21.4%) children had a severe impairment and 44 (78.6%) had a profound impairment in their unimplanted ear. The mean age of diagnosis of hearing loss was 6 months (range 0.1–34.4 months) and the mean age of initial hearing aid fitting was 9.1 months (range 0.1–34.8 months). The mean age of switch-on for children using cochlear implants was 17.4 months (range 5.4–42.8 months) for their first implant.

### Procedure

Data describing caregivers' and children's communication mode and language use were collected from children's caregivers and educators who completed a written questionnaire shortly after a child's third birthday. The custom-designed questionnaire collected information about caregiver, child, and environmental variables that have been suggested to impact on the outcomes of children with hearing loss. Data from questions describing country of birth, caregiver languages, child communication mode and language use at home and in early education, and caregiver hearing characteristics were extracted for analysis in this paper. Appendix presents the questions used for eliciting descriptions of the children's communication mode and language use. In cases where the caregivers were not comfortable responding in written English, questionnaires were completed orally, either in English or in the language of the caregiver's choice (through a qualified interpreter).

Data for all LOCHI study participants at age 3 were not available due to some children being recruited after they turned three, and questionnaires not being returned for all children. Consequently, data cleaning was undertaken to identify data missing for each child. To maximize the data available for analysis, retrospective data collection was attempted for all children (which also included information not analyzed in this paper). The caregivers of children with missing data were contacted and missing information was obtained

through interview, by phone, email, or in person by LOCHI researchers.

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

### Data Analysis

Data were entered into Microsoft Excel. Percentages describing partitioning of the data, frequencies, cross-tabs, and measures of central tendency were calculated using *Statistical Program for the Social Sciences* (SPSS, release 19.0.0). Chi-square statistics were calculated for the purpose of examining associations in the data and t-tests were performed in SPSS to examine similarities between the LOCHI data set and other data sets. As there were only small amounts of missing data for each variable, no steps were taken to statistically account for missing data. Imputations were not performed on this data set.

## Results

### Child Characteristics

The caregivers of 127 (31.6%) children reported that their children had a disability or condition in addition to hearing loss. The additional needs that were reported were grouped according to the domains they impacted rather than diagnosis. Cognitive impairment was the most frequently reported additional need ( $n = 87$ , 21.6%), followed by physical impairment ( $n = 52$ , 12.9%), an additional sensory impairment ( $n = 39$ , 9.7%) (e.g., vision impairment), medical needs ( $n = 32$ , 8.0%) (e.g., CHARGE syndrome), communication impairment unrelated to hearing loss ( $n = 30$ , 7.5%) (e.g., apraxia of speech), and behavioral impairment ( $n = 20$ , 5.0%) (e.g., Autism spectrum disorder). Percentages total more than 100% as some children were reported to have more than one additional need.

Children's socioeconomic status was determined using the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) from the Socio-Economic Index For Areas created by the Australian Bureau of Statistics (Australian Bureau of Statistics, 2006a).

**Table 2** Communication mode: Children and caregivers

	Oral communication	Manual communication	Mixed communication
Children in home environment ( $n = 401$ )	302 (75.3%)	3 (0.7%)	96 (23.9%)
Children in early education environment ( $n = 390$ )	299 (76.7%)	1 (0.3%)	90 (23.1%)
Female caregiver in home environment ( $n = 402$ )	367 (91.3%)	5 (1.2%)	30 (7.5%)
Male caregiver in home environment ( $n = 382$ )	356 (93.2%)	7 (1.8%)	19 (4.7%)

IRSAD is a measure of socioeconomic status based on geographic location. Lower IRSAD scores indicate an area with relatively less financial, educational, and other resources, whereas a higher score indicates the opposite. Children's reported socioeconomic status was negatively skewed (mean 7.1, median 7.0, mode 10.0) with more children tending to live in less disadvantaged areas.

#### Caregiver Characteristics

Children's primary caregivers in this paper are categorized as female caregivers and male caregivers. The caregiver completing the questionnaire provided information about a maximum of two of the child's primary caregivers. These caregivers were parents, stepparents, parent's partners, grandparents, and foster parents. All (100%) participants had one female caregiver and 386 (95.1%) had a male caregiver. No child had two primary caregivers of the same gender. Caregiver education was described through reports of the highest level of education attended, using five levels: university education ( $n = 286$ , 37.6%), diploma/certificate ( $n = 209$ , 27.5%), unspecified postsecondary education ( $n = 45$ , 5.9%), 7–12 years of secondary education ( $n = 213$ , 28.0%), and six or less years of primary education ( $n = 8$ , 1.1%).

#### Cultural and Linguistic Background

The recruitment criteria for the LOCHI study, which required participants to be eligible to receive services from Australian Hearing, and the fact that many children were very young at the time they were recruited to the study meant that the majority of children were born in Australia ( $n = 399$ , 98.5%). However, six children were born in other countries: New Zealand ( $n = 3$ , 0.7%), China ( $n = 1$ , 0.2%), Japan ( $n = 1$ , 0.2%), and Papua New Guinea ( $n = 1$ , 0.2%). Reports of cultural heritage were not obtained; however, eight (2.0%) children were of Aboriginal and/or Torres Strait Islander

descent. Children's caregivers were born in 57 countries. The majority of caregivers were born in Australia ( $n = 536$ , 67.9%), followed by New Zealand ( $n = 29$ , 3.7%), Viet Nam ( $n = 23$ , 2.9%), China ( $n = 20$ , 2.5%), and Lebanon ( $n = 20$ , 2.5%). By region, the majority of caregivers were born in Oceania ( $n = 578$ , 73.3%), followed by North–West Europe ( $n = 43$ , 5.4%), North Africa, and the Middle East ( $n = 39$ , 4.9%) (classified using the Australian Standard Classification of Cultural and Ethnic Groups, Australian Bureau of Statistics, 2005).

#### Communication Mode and Language Use: Home Environment

The majority of children used oral communication at home, with fewer children using mixed and manual communication (see Table 2). Nonspoken communication formed part or all of the home communication system of 99 children (24.8%). The most common method of sign communication was Auslan ( $n = 47$ , 11.8%), followed by Makaton ( $n = 39$ , 9.8%), and then Signed English ( $n = 17$ , 4.3%). AAC was used by 10 (2.5%) children and one child used tactile communication (0.3%). The majority of children used oral communication only, regardless of whether then used a hearing aid ( $n = 228$ , 78.1%) or a cochlear implant ( $n = 73$ , 68.2%).

English was the dominant spoken language used in the home environment, although 16.7% of children used a LOTE at home (see Table 3). A small number of children did not use English but only used a LOTE in their home environment. The majority of children were monolingual; however, 51 (12.7%) children used more than one spoken language at home. Oral multilingual children used two spoken languages at home, except for one child who was reported to use three: English, Cantonese, and Japanese. There were 27 different languages spoken by the children. The most common spoken LOTEs were Arabic ( $n = 18$ , 4.5%), Cantonese

**Table 3** Language use: Children and caregivers

	Use English only (%)	Use LOTE only (%)	Use English (%)	Use LOTE (%)	Monolingual (%)	Multilingual (%)
Children in home environment ( $n = 401$ )	326 (81.5)	17 (4.3)	377 (94.3)	68 (16.7)	343 (85.5)	51 (12.7)
Children in early education environment ( $n = 390$ )	363 (96.8)	2 (0.5)	371 (98.9)	10 (2.7)	365 (97.3)	8 (2.1)
Female caregiver in home environment ( $n = 402$ )	297 (73.9)	20 (5.0)	377 (93.8)	100 (24.9)	317 (78.1)	80 (19.9)
Male caregiver in home environment ( $n = 382$ )	276 (72.3)	18 (4.7)	356 (93.2)	98 (25.7)	293 (76.7)	81 (21.2)

Note. LOTE = language other than English. Monolingual and multilingual columns add to less than 100% as all groups contained a number of participants who did not use a spoken language.

( $n = 9$ , 2.3%), Vietnamese ( $n = 6$ , 1.5%), and Spanish ( $n = 4$ , 1.0%). Italian and Mandarin were each spoken by three children (0.8% each), and Turkish, Telugu, Urdu, and Japanese were each spoken by two children (0.5% each). Each of the following languages were spoken by one child (0.3% each): Assyrian, Dutch, Farsi, French, German, Greek, Hindi, Kannada, Maltese, Maori, Nuer, Oromo, Polish, Samoan, Sri Lankan, Tagalog, and Thai. There was a higher proportion of children reported to be orally multilingual who were hearing aid users ( $n = 42$ , 14.4%) than cochlear implant users ( $n = 9$ , 8.4%). Similarly, the children using hearing aids ( $n = 56$ , 19.2%) were more frequently reported to use a LOTE at home than children using cochlear implants ( $n = 12$ , 11.2%).

Table 4 contains information on the languages used at home by 3-year-old children participating in the LOCHI study and compares this to data on children language use collected by the Longitudinal Study of Australian Children (LSAC). Language data from LSAC are based on a nationally representative sample of 4,983 Australian 4- to 5-year-old children and has been described previously in (McLeod, 2011). A paired sample  $t$ -test of proportions of the incidence of language used at home revealed no significant difference between the LOCHI and LSAC data ( $t(37) = -0.139$ ,  $p = .891$ ).

The majority of female caregivers used oral communication at home, with less using mixed and manual communication (see Table 2). The most common method of sign communication was Auslan ( $n = 31$ , 7.7%), followed by Makaton ( $n = 2$ , 0.5%), and then Signed English ( $n = 1$ , 0.2%). AAC was reported to be used by two (0.5%) female caregivers. English

was the dominant spoken language used in the home environment, although 19.9% of female caregivers used a LOTE at home (see Table 3). A small number of female caregivers used a LOTE and not English in the home environment. The majority of female caregivers were monolingual; however, 80 (19.9%) used more than one spoken language at home. Two languages were spoken by 77 (19.2%) female caregivers and three languages were spoken by three (0.7%). In total, 37 different spoken languages were used by female caregivers with the most common LOTEs being Arabic ( $n = 25$ , 6.2%), Cantonese ( $n = 9$ , 2.2%), Vietnamese ( $n = 9$ , 2.2%), and Italian ( $n = 8$ , 2.0%). Table 5 lists all languages used by female caregivers and compares this to census data (Australian Bureau of Statistics, 2006b) on adult language use by female adults in Australia. A paired sample  $t$ -test of proportions of the rates use of different languages revealed no significant difference between the LOCHI and ABS data ( $t(39) = 1.538$ ,  $p = .132$ ).

The majority of male caregivers used oral communication at home, with less using mixed and manual communication (see Table 2). The most common method of sign communication was Auslan ( $n = 22$ , 5.8%), followed by Makaton ( $n = 2$ , 0.5%), and then Signed English ( $n = 1$ , 0.3%). AAC was reported to be used by one (0.3%) male caregiver. English was the dominant spoken language used in the home environment, although 25.7% of male caregivers used a LOTE at home (see Table 3). A small number of male caregivers used a LOTE and not English in the home environment. The majority of male caregivers were monolingual; however, 81 (21.2%) used more than one spoken language at home. Two languages



**Table 4** Language used at home by Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) children and the primary language used by children participating in Longitudinal Study of Australian Children (LSAC)

Communication type	Languages used at home	LOCHI children at		LSAC children at	
		3 years ( $n = 406$ )		4 to 5 years ( $n = 4,983$ )*	
Spoken language	African language (nfd)	2	0.6%	7	0.1%
	Arabic	18	4.5%	108	3.6%
	Australian Aboriginal (nfd)	0	0.0%	22	0.4%
	Assyrian	1	0.3%	22	0.4%
	Bengali	0	0.0%	11	0.2%
	Cantonese	9	2.3%	133	2.7%
	Croatian	0	0.0%	6	0.1%
	Dutch	1	0.3%	-	-
	English	377	94.3%	4285	86.0%
	French	1	0.3%	18	0.4%
	German	0	0.0%	12	0.2%
	Greek	1	0.3%	109	2.2%
	Hakka	0	0.0%	8	0.2%
	Hindi	0	0.0%	21	0.4%
	Indonesian	0	0.0%	8	0.2%
	Italian	3	0.8%	179	3.6%
	Japanese	3	0.5%	32	0.7%
	Kannada	1	0.3%	-	-
	Khmer	0	0.0%	2	0%
	Korean	0	0.0%	6	0.1%
	Macedonian	0	0.0%	6	0.1%
	Maltese	1	0.3%	-	-
	Mandarin	3	0.8%	112	2.2%
	Maori	1	0.3%	5	0.1%
	Persian	1	0.3%	1	0%
	Polish	1	0.3%	9	0.2%
	Portuguese	0	0.0%	9	0.2%
	Punjabi	0	0.0%	6	0.1%
	Russian	0	0.0%	4	0.1%
	Samoan	1	0.3%	23	0.5%
	Serbian	0	0.0%	28	0.5%
	Sinhalese	0	0.0%	8	0.2%
	Somali	0	0.0%	11	0.2%
	Spanish	4	1.0%	73	1.5%
	Tagalog	1	0.3%	13	0.3%
	Tamil	0	0.0%	15	0.3%
Telugu	1	0.3%	-	-	
Thai	1	0.3%	8	0.2%	
Tongan	0	0.0%	5	0.1%	
Turkish	2	0.5%	39	0.7%	
Urdu	2	0.5%	7	0.1%	
Vietnamese	6	1.5%	108	2.2%	
Other	0	0.0%	488	9.8%	
Sign language	Auslan	47	11.8%	-	-
Sign system	Signed English	17	4.3%	-	-
	Makaton	39	9.8%	-	-
	Sign (nfd)	-	-	-	-
Alternative and Augmentative	AAC	10	2.5%	-	-
Missing or confidentialized data		6	1.5%	90	1.8%

*Note.* For LOCHI data, these figures total more than the number of participants as some participants spoke two or more languages. “nfd” refers to no further definition, e.g., “sign” was reported but the type was not specified. Dashes indicate that this language may not have been used by anyone or may have been used by a few participants. These data may have been amalgamated under “other.” \*Data analyzed in McLeod (2011).

were used at home by 74 (19.4%) male caregivers and three languages were used at home by seven (1.8%). Thirty-five different spoken languages were used by male caregivers with the most common LOTEs being Arabic ( $n = 25$ , 6.5%), Cantonese ( $n = 12$ , 3.1%), Vietnamese ( $n = 8$ , 2.1%), and Italian ( $n = 7$ , 1.8%). Table 5 lists all languages used by male caregivers and compares this to census data (Australian Bureau of Statistics, 2006b) on male adult language use in Australia. A paired sample  $t$ -test of proportions in the use of different languages revealed no significant difference between the LOCHI and census data ( $t(39) = -1.541$ ,  $p = .131$ ).

#### Comparison Between Children's and Caregivers' Home Languages

The number of languages spoken by children and their caregivers was also compared. Table 6 presents a matrix of the number and combination of oral languages used by children and caregivers participating in the LOCHI study when children were 3 years old. Many more female caregivers ( $n = 81$ , 20.1%) and male caregivers ( $n = 82$ , 21.5%) reported that they were orally multilingual at home than their children ( $n = 51$ , 12.8%). There were 87 (21.5%) households that were oral multilingual (i.e., one caregiver reported using more than one language at home or both caregivers reported using a different language at home). Only 45 (50.6%) children from these multilingual households were oral multilingual. Two (0.5%) children were reported to be orally multilingual although their parents were not. In both cases, the LOTE was spoken with the children by their grandparents.

A  $2 \times 2$  contingency table was constructed from Table 6 where caregivers were paired and the total number of languages spoken in the child's household was determined. Caregiver pairs and children were grouped according to whether they were monolingual (i.e., used English only or a LOTE only) or multilingual (i.e., used English and one or more LOTEs, or used two or more LOTEs). The chi-square statistic for the contingency table revealed a significant association between caregiver and child language status (i.e., monolingual or multilingual) ( $\chi^2 = 138.70$ ,  $df = 1$ ,  $p < .0001$ ). This significant result can best be

explained by the fact that there were eight instances where children from a monolingual home were orally multilingual (2.0%). Six of these children were from homes where only a LOTE was spoken, although the child used a LOTE and English, whereas the other two lived with extended family, who used a LOTE with the child, although their primary caregivers did not. In addition, there were 40 instances where children from oral multilingual households were monolingual (10.1%). In all of these families, both caregivers reported using English at home. Only 7 of the 40 families had a monolingual caregiver, and there were only four families where the caregivers did not speak the same LOTE.

A second  $2 \times 2$  contingency table was constructed from Table 6 where caregivers and children were grouped according to whether English was the only language spoken at home or whether a LOTE was spoken. The chi-square statistic for the contingency table revealed a significant association between caregiver and child language use ( $\chi^2 = 216.06$ ,  $df = 1$ ,  $p < .0001$ ). The majority of children and caregivers were monolingual English users and 66 (17.0%) caregivers and children used a LOTE at home. Two children were reported to use a LOTE where their caregivers did not.

#### Communication Mode and Language Use: Educational Environment

The majority of children used oral communication in their early education environment, with less using mixed and manual communication (see Table 2). The most common method of sign communication was Auslan ( $n = 46$ , 12.3%), followed by Makaton ( $n = 30$ , 8.0%), and Signed English ( $n = 4$ , 1.1%). AAC was used by 12 children (3.2%). The majority of children used oral communication only, regardless of whether then used a hearing aid ( $n = 221$ , 77.8%) or a cochlear implant ( $n = 78$ , 74.3%).

English was the dominant spoken language used in the early education environment, although 2.1% of children used English and a LOTE and 0.5% of children exclusively used a LOTE (see Table 3). The majority of children were monolingual; however, eight children used more than one spoken language in their early education environment. No child used more than

**Table 5** Language used at home by LOCHI caregivers and the primary language used at home by Australian adults

	LOCHI caregivers		Australian census data*	
	Female caregiver	Male caregiver	Females	Males
	( <i>n</i> = 406)	( <i>n</i> = 386)	( <i>n</i> = 10,056,046)	( <i>n</i> = 9,799,242)
Afrikaans	3	3	8,447	8,359
Arabic	25	25	118,686	124,976
Assyrian	1	1	11,838	11,688
Auslan	31	22	3,061	2,477
Cantonese	9	12	128,845	115,708
Croatian	0	0	32,301	31,311
Dutch	1	1	19,937	16,246
English	377	356	7,909,832	7,671,501
French	1	2	22,669	20,547
German	1	0	40,908	34,726
Greek	3	2	127,971	124,255
Hindi	2	3	33,591	36,420
Hungarian	1	2	11,786	9,779
Italian	8	7	162,922	153,973
Japanese	3	2	20,750	14,361
Kannada	1	1	1,495	1,755
Korean	1	1	29,021	25,602
Kurdish	0	0	1,690	1,909
Lithuanian	0	0	1,183	822
Macedonian	1	1	33,785	34,050
Makaton	2	2	106	95
Maltese	1	1	18,745	17,769
Mandarin	3	4	117,285	103,315
Nuer	1	1	568	632
Oromo	1	1	488	510
Persian (excluding Dari)	2	2	11,193	11,648
Polish	2	1	29,574	23,815
Russian	1	0	20,587	15,915
Samoan	1	0	14,689	13,836
Slovak	1	0	2,413	2,164
Spanish	4	4	51,389	46,612
Tagalog	2	2	32,188	21,095
Telugu	3	3	3,286	4,990
Thai	1	0	15,048	8,597
Turkish	2	3	26,747	27,110
Ukrainian	0	1	5,130	3,887
Urdu	2	2	8,561	10,727
Vietnamese	9	8	100,526	94,328
Other	6	6	354,048	346,725
Cambodian	1	0	a	a
Chaldean	1	1	a	a
Creole (Mauritian)	0	1	a	a
Hula	0	1	a	a
Pidgin (Papua New Guinea)	1	0	a	a
Sri Lankan (nfd)	1	1	a	a
Twi	1	1	a	a
Signed English	1	1	a	a
Missing data/not stated	2	4	522,757	605,007

*Note.* For LOCHI data these figures total more than the number of participants as some participants spoke two or more languages. Languages present in census data but not in LOCHI data were amalgamated under “other.” “nfd” refers to no further definition, e.g., Chinese was reported but dialect was not specified. \*Data from Australian Bureau of Statistics (2006b). <sup>a</sup>These languages were not identified.

**Table 6** Comparison of spoken language status between children and their caregivers

	Child home language status							Total
	English only	1 LOTE only	English and 1 LOTE	2 LOTEs	English and 2 LOTEs	English and 3 LOTEs	No spoken language	
Combined caregiver home language status								
English only	283	0	2	0	0	0	3	288
1 LOTE only	3	12	6	0	0	0	0	21
English and 1 LOTE	26	5	39	0	0	0	0	70
2 LOTEs	0	0	1	0	0	0	0	1
English and 2 LOTEs	8	0	2	0	1	0	0	11
English and 3 LOTEs	1	0	0	0	0	0	0	1
No spoken language	3	0	0	0	0	0	3	6
Total	324	17	50	0	1	0	6	398

Note. LOTE = language other than English.

two spoken languages in their early education environment. A total of five different spoken languages were reported to be used in early education environments. Arabic was spoken by six children (1.6%) and Cantonese, Korean, Maori, and Spanish were each used by one child (0.2% each). The child who used Maori was attending an early education service in New Zealand when she was 3 years old. Similar rates of orally multilingual in the early education environment were reported for children using hearing aids ( $n = 6$ , 2.2%) and children using cochlear implants ( $n = 2$ , 2.0%). Similarly children using hearing aids ( $n = 8$ , 2.9%) or cochlear implants ( $n = 2$ , 2.0%) rarely used a LOTE in their early education environment.

#### Familial Hearing Loss

Information about the caregivers' hearing status in 406 households was available (100%). There were 51 children (12.6%) who had one caregiver with a hearing loss and eight children (2.0%) who had two caregivers with hearing loss. For the male caregivers who had a hearing loss, the majority had a mild or moderate hearing loss ( $n = 17$ , 4.4%), whereas less had a severe or profound hearing loss ( $n = 11$ , 2.9%). The trend was similar for female caregivers with most reporting a mild or moderate hearing loss ( $n = 21$ , 5.2%) and fewer reporting a severe or profound hearing loss ( $n = 16$ , 4.0%). Only six male caregivers (21.4%) reported using an amplification device compared with 26 female caregivers (70.3%).

Table 7 presents a comparison of the communication mode used by children participating in the LOCHI

study at age 3 and the hearing status of their caregivers. A  $2 \times 2$  contingency table was created by pairing children's caregivers and then grouping them according to whether any caregivers in the household had a hearing loss or not. Children's communication modes were grouped into oral only and manual/mixed. A chi-square statistic was computed to examine the association between caregiver hearing status and child communication mode. The chi-square statistic did not reveal a significant association between caregivers' hearing status and child's communication mode ( $\chi^2 = 0.262$ ,  $df = 1$ ,  $p = .608$ ). That is to say, there was no relationship between the presence or absence of hearing loss in the caregiver and the communication mode of the child.

#### Discussion

This exploratory study is the first to describe the communication mode and language use of a population-based sample of 3-year-old children with hearing loss and their caregivers at home and in early education environments. The sample of children with hearing loss was representative of both Australian children and children with hearing loss on several key demographic variables: gender, degree of hearing loss, presence of additional disabilities, and spoken languages used at home. There were slightly more male than female participants, reflecting trends for both Australian children of this birth cohort, and children with hearing loss (Australian Bureau of Statistics, 2011; Gallaudet Research Institute, 2008). The most frequently occurring degree of hearing loss was of moderate severity, reflecting a trend observed

**Table 7** Comparison of communication mode use in families where more than one person has a hearing loss

	Child's communication mode at home			Total
	Oral communication only	Manual communication only	Mixed communication modes	
Neither caregiver has a hearing loss	256	1	85	342
One caregiver has a hearing loss	44	0	7	51
Two caregivers have a hearing loss	2	2	4	8
Total	302	3	96	401

in Australia and other developed nations (Ching, Oong, & Van Wanrooy, 2006; Fortnum, Summerfield, Marshall, Davis, & Bamford, 2001; Maki-Torkko, Lindholm, Vayrynen, Leisti, & Sorri, 1998; Uus & Bamford, 2006). The frequency of the co-occurrence of hearing loss and an additional disability was similar to the frequency reported in the United Kingdom but lower than reported in the United States (Fortnum, Marshall, & Summerfield, 2002; Gallaudet Research Institute, 2008). The difference may be reflective of both sampling methods and the children reported on in the Annual Survey being older than the children in the present study. Comparison between the spoken languages used at home by caregivers and children in the current study and the Australian population (Australian Bureau of Statistics, 2006b; McLeod, 2011) indicated that there were no significant differences in the rates with which different languages were used.

Although the majority of children in this study were born in Australia, the country of birth of their caregivers and the languages used by their caregivers reveal rich cultural and linguistic diversity within this population. The most frequently reported LOTEs used in the home environment were similar between the children and the caregivers, with Arabic, Cantonese, and Vietnamese reported to be used frequently by all groups. Italian was spoken much more frequently by caregivers compared with children, a trend outlined by McLeod (2011) who compared Australian 4- to 5-year-olds with Australian adults. In terms of the communication mode used at home, the majority of participants used oral communication, with oral communication used most often by male caregiver, followed by female caregivers, and then children. The use of a mixed communication mode at home followed the reverse pattern, with mixed communication used

most frequently by children, then female caregiver, and then male caregivers. These results align well with the findings of Arnesen et al. (2008) that more mothers than fathers reported sign to be the most effective way of communicating with their child. However, these results differ from the rates of family use of sign reported in the Gallaudet Annual Survey (Gallaudet Research Institute, 2008). Based on 35,443 reports by teachers, 23.9% of their students had a family member who signed regularly. The higher rates in access to signed communication at home in the Gallaudet study may reflect the older age of the children in this sample and information about siblings' and extended family's use of sign being reported, which was not part of the current investigation.

The children with hearing loss in this study used fewer spoken languages overall and had higher rates of oral monolingualism than their caregivers. Although the majority of children and caregivers were from monolingual English speaking homes, over one quarter was not (28.9%). Multilingual caregivers spoke up to four languages and multilingual children spoke up to three languages. Only 61.6% of children with oral multilingual caregivers were reported to be oral multilingual language users at age 3. The decrease in the rate of oral multilingualism between caregivers and their children with hearing loss has not been previously described. Decreased rates of bilingualism and heritage language attrition in children compared with their caregivers have been reported in families without hearing loss, especially when the caregivers have immigrated to a country whose community does not support all of their languages (Okita, 2002; Schwartz, Moin, Leikin, & Breikopf, 2010). Schwartz et al. (2010) examined the family language policies of Russian immigrants to Israel, especially concerning caregiver's choices to enroll their children in Russian-Hebrew bilingual kindergartens.

They found that regardless of whether a bilingual education environment was selected, caregivers displayed a “willingness to sacrifice personal needs for the sake of their child’s education and development” (Schwartz et al., 2010, p. 119). Interestingly, eight children in the present study were reported to use a greater number of spoken languages than their caregivers. In these cases, the children’s extended family used a language with the child that the caregivers did not or children spoke English when their caregivers did not.

At 3 years, the children with hearing loss predominantly used English in their early education environment. The reported rate at which English only was used in early education was 96.8% compared with 81.5% at home. LOTEs were used much less frequently in education as compared with at home. Only eight children used more than one spoken language in their early education environment and in all cases the language combination was English and one other spoken language. In contrast, 51 children used more than one language in their home environment, with one child using three spoken languages. There were four children who did not use English in their early education environment. Two of these children did not use any spoken language. In the remaining two cases, the female caregiver did not speak English at home and one of the male caregivers did not speak English at home. However, in the home environment, there were 17 children who reported using only a LOTE. Despite the differences in spoken language use between home and early education environments, the reported use of different communication modes was similar across environments.

No relationship was found in this study between the caregivers’ hearing status and children’s communication mode, contrary to the findings of previous research (Mitchell & Karchmer, 2004b). A number of factors may explain the difference between current and previous findings: the small number of caregivers with hearing loss included in this sample, many caregivers in this sample having mild and moderate hearing loss, and few caregivers having a significant prelingual hearing loss. Interestingly, the use of amplification devices was much higher for female caregivers compared with male caregivers.

There was also a significant association between the presence of a disability or condition in addition

to hearing loss and the communication mode used by children at age 3. Children who were reported to have an additional need were more likely to use a communication mode that was not purely oral than children who were not reported to have an additional need.

### Clinical Application

Numerical data describing the communication mode and language use is essential for acknowledging the diversity of children with hearing loss, especially in countries with a single, dominant spoken language. Organizations that provide services to young children with hearing loss and their families require this information in order to ensure that families are able to access appropriate audiological, educational, and habilitation services (Winter, 2001). A significant number of caregivers in this study used a LOTE, some using a LOTE exclusively and not English. Collecting information about the language profiles of children’s families will enable organizations to plan for caregiver’s needs and provide services in languages accessible to families who do not use or do not confidently use the language services are typically provided in. The development of information packages in different languages, targeted development of staff who use languages considered priorities for the target demographic, and the development of culturally and linguistically appropriate resources for children of different backgrounds are possible outcomes of greater knowledge about cultural and linguistic diversity.

Research demonstrating the cultural and linguistic diversity of children with hearing loss will provide impetus for research into the developmental outcomes of these children by practitioners, early education providers, and academics. It is known that for typically developing multilingual children, early education programs that support development of the home language also provide the basis for successful acquisition of the community language (Kohnert, Yim, Nett, Kan, & Duran, 2005). Research from many angles is required to examine if this statement is true for children with hearing loss. Understanding multilingual language development in children with hearing loss would inform the development of speech, language,

and audiological assessments, habilitation goals and programs, and information resources in languages that match the linguistic needs of this population.

### Limitations

Although this study was based on data from a population sample of Australian children with hearing loss, there may be some limitations in the representativeness of the families who consented to participate in the study. Participants were representative of the Australian population in terms of their gender, state of residence, and languages used, and representative of children with hearing loss in terms of their degree of loss and the presence of additional needs. However, 19.9% of the children in this study lived in areas categorized as belonging to the least disadvantaged decile in Australia in terms of these areas “access to material and social resources, and their ability to participate in society” (Australian Bureau of Statistics, 2006a, p. 17). Children from less advantaged areas may have been harder to recruit to and maintain on the study or may reflect the areas in which children with hearing loss live in Australia. Further investigation of this issue is warranted.

Caregiver and educator reports concerning the type of sign communication used by children and caregivers were sometimes inconsistent and difficult to interpret. Reports of sign communication that was termed, for example, deaf language, deaf sign, and keyword signing were clarified, were possible, and categorized as Auslan, Makaton, or Signed English. As reports or measures of caregiver and child signing proficiency were not collected, it was very difficult for some families to distinguish if they were using Makaton (which utilizes signs from Auslan) or Auslan (with its own phonology, morphology, and syntax).

Data analysis for the current paper was based on a data set previously collected through the LOCHI study. The use of this existing data set meant that information regarding the children’s proficiency in the communication modes and languages they were reported to use could not be established. The absence of information describing children’s exposure to and proficiency using LOTEs means that the diversity of children’s language use could not be captured. This may also have led to caregivers over-

under-reporting children’s use of these languages. Caregivers determined whether the quantity of each language their children were exposed to, or used, warranted reporting. A child may or may not have been reported as using a LOTE if they only understood or used a few words, depending on the caregiver’s own definition of what constitutes use of a language. Similarly, a child who understands, but does not use, a LOTE may or may not have been reported as using a LOTE depending on the caregiver’s definition of language use. A richer analysis of young children’s language experiences would be possible with knowledge about the child’s competency, levels and timelines of exposure, and domains of use for each language.

### Future Research

Although the issue of children’s communication mode has been frequently addressed in the literature, there is a clear need for research addressing oral multilingualism in children with hearing loss. Kohnert and Goldstein (2005) described the difficulties in establishing an empirical, scientific basis for understanding the development of multilingual children without hearing loss. The heterogeneity of children with hearing loss adds a further layer of complexity to understanding this issue, which may be the reason for the under-representation of these children in previous research. Discussion of oral multilingualism in children with hearing loss may stimulate further research to provide professionals directly providing early education services to these children and their families with empirical research describing how services are provided to families that use LOTEs and how oral multilingualism may develop in children with hearing loss. What remains to be demonstrated is whether the provision of linguistically diverse services will lead to a qualitative or quantitative difference in the outcomes of these children.

A better understanding of the communication mode and language use of young children with hearing loss could be gained from deeper examination of the characteristics of groups of children and caregivers. Analysis is currently being undertaken to examine the characteristics associated with children using different communication modes and language combinations to increase understanding of these complex

relationships (Crowe, McKinnon, McLeod, & Ching, 2012). Further, analysis of children's communication mode and language use as they mature will increase our understanding of the developmental trajectories that follow from these early choices about communication mode and language use. A richer understanding of the factors that have led to children using particular communication modes of language combinations could be gained through investigation of the ways caregivers made decisions about these issues for their young children. Li, Bain, and Steinberg (2003) have previously investigated this question related to communication mode choices, but no investigation of caregiver decision making about multilingualism in children with hearing loss has been reported. As professional advice may influence the choices that caregivers make for their child, the factors professionals such as educators, speech-language pathologists, and audiologists consider when advising caregivers about communication mode and language use choices should also be considered.

This paper provides an initial investigation of the cultural and linguistic diversity of young children with hearing loss in Australia. Diversity was evident in terms of not only the communication modes and languages used by the children but also the communication modes and languages used by their caregivers.

## Notes

1. Throughout this paper the percentage values relate to the percentage of valid data available for each variable.

## Funding

National Institutes of Health (R01DC008080), Office of Hearing Services, Department of Health in Australia, Australian Hearing, New South Wales Department of Health, Phonak Ltd and Oticon Foundation; HEARING CRC, Cooperative Research Centers Program and initiative of the Australian Government to K.C. and T.Y.C.C.; Australian Research Council Future Fellowship (FT0990588) to S.M..

## Conflict of Interest

No conflicts of interest were reported.

## Acknowledgments

We gratefully thank all the children and their families and educators for participating in this study. Data support was provided by David McKinnon, Vivienne Marnane, and Mark Seeto. Conception and design of the 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.

## References

- Albertorio, J. R., Holden-Pitt, L., & Rawlings, B. (1999). Preliminary results of the annual survey of deaf and hard of hearing children and youth in Puerto Rico: The first wave. *American Annals of the Deaf, 144*(5), 386–394.
- Allen, T. E., & Anderson, M. L. (2010). Deaf students and their classroom communication: An evaluation of higher order categorical interactions among school and background characteristics. *Journal of Deaf Studies and Deaf Education, 15*(4), 334–347. doi:10.1093/deafed/enq034
- Arnesen, K., Enerstvedt, R. T., Engen, E. A., Engen, T., Hoie, G., & Vonen, A. M. (2008). The linguistic milieu of Norwegian children with hearing loss. *American Annals of the Deaf, 153*(1), 65–77. doi:10.1353/aad.0.0000
- Australian Bureau of Statistics. (2005). Australian Standard Classification of Cultural and Ethnic Groups (ASCCEG). Australian Bureau of Statistics.
- Australian Bureau of Statistics. (2006a). Information paper: An introduction to Socio-Economic Indexes for Areas (SEIFA). Australian Bureau of Statistics.
- Australian Bureau of Statistics. (2006b). Language spoken at home (full classification list) by sex, Australia, 2006. *Data cube: Excel spreadsheet*. Retrieved from <http://www.censusdata.abs.gov.au/ABSNavigation/prenav/ViewData?action=404&documentproductno=0&documenttype=Details&order=1&tabname=Details&areacode=0&issue=2006&producttype=Census Tables&javascript=true&textversion=false&navmapdisplayed=true&breadcrumb=POLTD&&collection=Census&period=2006&productlabel=Language Spoken at Home %28full classification list%29 by Sex&producttype=Census Tables&method=Place of Usual Residence&topic=Language&>
- Australian Bureau of Statistics. (2011). Table 9. Estimated resident population by single year of age, Australia. *Time Series Spreadsheets*. Retrieved from <http://www.abs.gov.au>



- gov.au/AUSSTATS/abs@.nsf/DetailsPage/3201.0Jun2010?OpenDocument
- Ching, T. Y. C., Crowe, K., Martin, V., Day, J., Mahler, N., Youn, S., . . . Orsini, J. (2010). Language development and everyday functioning of children with hearing loss assessed at 3 years of age. *International Journal of Speech-Language Pathology*, *12*(2), 124–131. doi:10.3109/17549500903577022
- Ching, T. Y. C., Oong, R., & Van Wanrooy, E. (2006). The ages of intervention in regions with and without universal newborn hearing screening and prevalence of childhood hearing impairment in Australia. *Australian and New Zealand Journal of Audiology*, *28*(2), 137–150. doi:10.1375/audi.28.2.137
- Crowe, K., McKinnon, D. H., McLeod, S., & Ching, T. Y. C. (2012). Multilingual children with hearing loss: Factors contributing to language use at home and in early education. Manuscript submitted for publication.
- Department of Education. (2010). *School, pupils and their characteristics*. London: Department of Education.
- Federal Interagency Forum on Child and Family Statistics. (2010). *America's children in brief: Key national indicators of well-being*. Washington, DC: US Government Printing Office.
- Fortnum, H. M., Marshall, D. H., & Summerfield, A. Q. (2002). Epidemiology of the UK population of hearing-impaired children, including characteristics of those with and without cochlear implants: Audiology, aetiology, comorbidity and affluence. *International Journal of Audiology*, *41*(3), 170. doi:10.3109/14992020209077181
- Fortnum, H. M., Summerfield, A. Q., Marshall, D. H., Davis, A. C., & Bamford, J. M. (2001). Prevalence of permanent childhood hearing impairment in the United Kingdom and implications for universal neonatal hearing screening: Questionnaire based ascertainment study. *British Medical Journal*, *323*, 536–540. doi:10.1136/bmj.323.7312.536
- Gallaudet Research Institute. (2008). *Regional and national summary report of data from the 2007-08 annual survey of deaf and hard of hearing children and youth*. Washington, DC: Gallaudet Research Institute, Gallaudet University.
- Genesee, F., Paradis, J., & Crago, M. B. (2004). *Dual language development and disorders. A handbook on bilingualism and second language learning*. Baltimore, MD: Paul H. Brookes Publishers.
- Gravel, J. S., & O'Gara, J. (2003). Communication options for children with hearing loss. *Mental Retardation and Developmental Disabilities Research Reviews*, *9*(4), 243–251. doi:10.1002/mrdd.10087
- Grech, H., & McLeod, S. (2012). Multilingual speech and language development and disorders. In D. Battle (Ed.), *Communication disorders in multicultural and international populations* (4th Ed., pp. 120–147). St Louis, MI: Elsevier.
- Grimes, M., Thoutenhoofd, E. D., & Byrne, D. (2007). Language approaches used with deaf pupils in Scottish Schools: 2001–2004. *Journal of Deaf Studies and Deaf Education*, *12*(4), 530–551. doi:10.1093/deafed/enm026
- Harding-Esch, E., & Riley, P. (2003). *The bilingual family: A handbook for parents* (2nd ed.). Cambridge, England: Cambridge University Press.
- Kohnert, K., & Goldstein, B. A. (2005). Speech, language, and hearing in developing bilingual children: From practice to research. *Language, Speech, and Hearing Services in Schools*, *36*(3), 169–171. doi:10.1044/0161-1461(2005/018)
- Kohnert, K., Yim, D., Nett, K., Kan, P. F., & Duran, L. (2005). Intervention with linguistically diverse preschool children: A focus on developing home language(s). *Language, Speech, and Hearing Services in Schools*, *36*(3), 251–263. doi:10.1044/0161-1461(2005/025)
- Lewis, P. M. (Ed.). (2009). *Ethnologue: Languages of the world* (16th ed.). Dallas, TX: SIL International.
- Li, Y., Bain, L., & Steinberg, A. G. (2003). Parental decision making and the choice of communication modality for the child who is deaf. *Archives of Pediatrics and Adolescent Medicine*, *157*(2), 162–168.
- Maki-Torkko, E. M., Lindholm, P. K., Vayrynen, M. R. H., Leisti, J. T., & Sorri, M. J. (1998). Epidemiology of moderate to profound childhood hearing impairments in northern Finland: Any changes in ten years? *Scandinavian Audiology*, *27*(2), 95–103. doi:10.1080/010503998420333
- Malandraki, G. A., & Okalidou, A. (2007). The application of PECS in a deaf child with autism: A case study. *Focus on Autism and Other Developmental Disabilities*, *22*(1), 23–32. doi:10.1177/10883576070220010301
- Marazita, M. L., Ploughman, L. M., Rawlings, B., Remington, E., Arnos, K. S., & Nance, W. E. (1993). Genetic epidemiological studies of early-onset deafness in the U.S. school-age population. *American Journal of Medical Genetics*, *46*(5), 486–491. doi:10.1002/ajmg.1320460504
- McConkey Robbins, A., Green, J. E., & Waltzman, S. B. (2004). Bilingual oral language proficiency in children with cochlear implants. *Archives Of Otolaryngology: Head and Neck Surgery*, *130*(5), 644–647.
- McLeod, S. (2011). Cultural and linguistic diversity of Australian 4- to 5-year-old children and their parents. *ACQuiring Knowledge in Speech, Language, and Hearing*, *13*(3), 112–119.
- Mitchell, R. E., & Karchmer, M. A. (2004a). Chasing the mythical ten percent: Parental hearing status of deaf and hard of hearing students in the United States. *Sign Language Studies*, *4*(2), 138–163. doi:10.1353/sls.2004.0005
- Mitchell, R. E., & Karchmer, M. A. (2004b). When parents are deaf versus hard of hearing: Patterns of sign use and school placement of deaf and hard-of-hearing children. *Journal of Deaf Studies and Deaf Education*, *9*(2), 133–152. doi:10.1093/deafed/enh017
- Mitchell, R. E., & Karchmer, M. A. (2005). Parental hearing status and signing among deaf and hard of hearing students. *Sign Language Studies*, *5*(2), 231–244. doi:10.1353/sls.2005.0004
- Okita, T. (2002). *Invisible Work: Bilingualism, language choice and childrearing in intermarried families*. Amsterdam, The Netherlands: John Benjamin B.V.
- Rohani, S., Choi, C., Amjad, R. N., Burnett, C., & Colahan, C. (2006). *Language maintenance and the role of the family amongst immigrant groups in the United States: Persian-speaking Bahais, Cantonese, Urdu, Spanish and Japanese: An exploratory study*. New York, NY: Center for Multiple Languages and Literacies (CMLL).
- Schwartz, M., Moin, V., Leikin, M., & Breitkopf, A. (2010). Immigrant parents' choice of a bilingual versus monolingual

- kindergarten for second-generation children: Motives, attitudes, and factors. *International Multilingual Research Journal*, 4(2), 107–124. doi:10.1080/19313152.2010.499038
- Shin, H. B., & Kominski, R. A. (2010). *Language use in the United States: 2007. American Community Survey Reports* (pp. 1–16). Washington, D.C.: US Census Bureau.
- State Government of Victoria. (2009). *ESL report 2009: English as a second language in Victorian government schools*. Melbourne, Australia: Department of Education and Early Childhood Development.
- Uus, K., & Bamford, J. (2006). Effectiveness of population-based newborn hearing screening in England: Ages of interventions and profile of cases. *Pediatrics*, 117(5), e887–893. doi:10.1542/peds.2005-1064
- Valdés, G., & Figueroa, R. A. (1994). *Bilingualism and testing: A special case of bias*. Norwood, NJ: Ablex.
- Winter, K. (2001). Numbers of bilingual children in speech and language therapy: Theory and practice of measuring their representation. *International Journal of Bilingualism*, 5(4), 465–495. doi:10.1177/13670069010050040401
- World Health Organization. (2010a). *Deafness and hearing impairment*. Geneva: World Health Organization.
- World Health Organization. (2010b). *Grades of hearing impairment*. Geneva, Switzerland: World Health Organization.
- Wu, C.-H. (2005). *Attitude and behavior towards bilingualism for Chinese parents and children*. Paper presented at the Attitude and Behavior toward Bilingualism for Chinese Parents and Children, Somerville, MA.

## Appendix

Questions used to elicit information about child and caregiver communication mode and language use

1. List all languages used at home by each caregiver
2. What spoken languages does the child use in their home environment?
3. What spoken language does the child use in their early education program?
4. What signed communication does the child use in their home environment?
5. What signed communication does the child use in their early education program?
6. What alternative/augmentative/other communication does the child use in their home environment?
7. What alternative/augmentative/other communication does the child use in their early education program?