The 2013

Libby Harricks Memorial Oration

Libby Harricks Memorial Oration number 15

Honouring the Deafness Forum's first president & profoundly deaf achiever

Elisabeth Ann Harricks AM 1945 – 1998

deafness forum of australia

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The Consequences of Being Born Deaf in the 21st Century
Laurie S Eisenberg

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Introduction to the 15th Libby Harricks Memorial Oration

Jenny Rosen AM MA PhD, Chair, Libby Harricks Memorial Oration Committee

Good evening

My name is Dr Jenny Rosen and I am the Chair of the Libby Harricks Memorial Oration Committee within Deafness Forum of Australia.

I would like to thank Professor Greeley and the Australian Hearing Hub Inaugural Conference committee for providing the support to present the 15th Libby Harricks Memorial Oration as a featured address at this auspicious launching of the new state-of-the-art Australian Hearing Hub, and also for programming the Oration at a time to facilitate attendance by interested people not registering for the full conference. Those of us able to be here in time were presented with the additional benefit of viewing the webcast of the Hearing Hub official opening.

As many of you know, Libby Harricks grew up with apparently normal hearing. As a young wife and mother, she developed a profound hearing loss, and quickly educated herself with skills to manage her own hearing difficulties. She soon became a committed advocate for hearing impaired people, a founding member and long term President of SHHH Australia Inc (Self Help for Hard of Hearing People), and amongst many other achievements was the inaugural Chair of Deafness Forum of Australia. In these purely voluntary roles, she worked tirelessly to raise awareness of the need for equal inclusion in life activities for hearing impaired people, travelling widely throughout Australia to lobby for this on their behalf. In 1990, Libby was made a Member of the Order of Australia in recognition of her advocacy work

Libby died in 1998. Subsequently, Deafness Forum of Australia, the national co-ordinating body for Deaf and hearing impaired issues, established the annual Libby Harricks Memorial Oration Series to honour her achievements and to continue her vision of working towards gaining appropriate recognition, awareness, and access for hearing impaired people. Over the years, the Oration Series has been presented across Australia and has developed a well-deserved reputation for carrying forward Libby's commitment to raising awareness of issues relating to hearing impairment, and for furthering the aims of Deafness Forum. This is undoubtedly due to the great contributions of our outstanding Orators who have presented on a wide range of relevant topics. In order to reach further than each Oration audience and indeed to make these important contributions available on an on-going basis, the Orations are published by Deafness Forum of Australia in a Monograph series. We are very gratified that it has been possible to provide the opportunity for audiences across Australia to hear the Orators, and to enable continuing availability of this valuable body of information via the on-going Monograph series.

I would like to acknowledge the support of the Libby Harricks Memorial Oration Committee and the Deafness Forum national secretariat. I am also pleased to acknowledge the generous support of the Australian Hearing Hub and our Oration sponsor for 2013 which once again is Cochlear Ltd. Without the help of all of these people and organisations, neither presentation of the Oration, nor preparation of the companion Monograph series would be possible.

This year, we are privileged to welcome as our 15th Orator, Laurie Eisenberg PhD of the House Research Institute (HRI) in Los Angeles. As a young audiologist in 1976 Dr Eisenberg was closely involved in the early stages of the cochlear implant project under William F House M.D. She in fact, worked with the very first young implant child. Since that time, she has developed a strong record both clinically and in research. Dr Eisenberg is now a principal investigator in the Division of Clinical and Translational Research at HRI, with projects focusing mainly on auditory sensory aids and communication outcomes in deaf and hard of hearing children. She has many publications in the peer reviewed literature and is a clinical professor in the Department of Otolaryngology at the USC Keck School of Medicine.

We are indeed fortunate that Laurie has been able to accept our invitation to come so far to speak to us today. She will be sharing her thoughts on the major innovations of the second half of the 20th century and the ways in which they currently influence the development of spoken language and literacy in children who are born deaf.

Copies of Dr Eisenberg's Oration in Monograph form will be available as you leave here this evening. A full list of previous Orators and their Oration titles is included in the Monograph. Copies of all Monographs are available from the Deafness Forum office in Canberra or can be accessed on the publications section of the Deafness Forum website (www.deafnessforum.org.au).

Would you please welcome Dr Laurie Eisenberg.

THE CONSEQUENCES OF BEING BORN DEAF IN THE 21ST CENTURY

Laurie S Eisenberg, PhD

It is with gratitude and humility that I deliver the Libby Harricks Memorial Oration at this inaugural event to launch the Australian Hearing Hub at Macquarie University. I wish to thank the Deafness Forum of Australia, Dr. Jenny Rosen, Professor Janet Greely, and Dr. Harvey Dillon for their kind invitations to present at this conference. In delivering this oration I honor the memories of Elisabeth Ann Harricks and Dr. William F. House.

A number of years ago I had the good fortune to visit Sydney on two occasions to present outcomes from early studies on the cochlear implant. Because these talks were specific to the single-electrode implant, it was intimidating to be presenting in the country that inspired development of the Nucleus multichannel cochlear implant—the technically advanced newcomer on the block. I pay tribute here to Professor Graeme Clark, the 2009 Libby Harricks Memorial Orator, for spearheading the development of the Nucleus multichannel implant. Professor Clark was one of those early surgeons with Dr. House to have gone bravely into the unknown territory of human cochlear implantation.

Those pioneers were often treated with disdain and even animosity by the scientific community for carrying out human trials with the first-generation auditory implants. Basic scientists weighed patient outcomes against the benchmark of normal hearing. From that perspective, the relatively low levels of auditory performance being reported did not excite their interest. Conversely, clinical scientists viewed results from the context of deafness, and even incremental improvements were clinically significant. Perhaps it was brazen to embark on human cochlear implantation before long-term safety trials were completed using animal models. However, those early human trials played an important role in advancing the field and contributing to the impressive results we see today with this ever evolving technology.

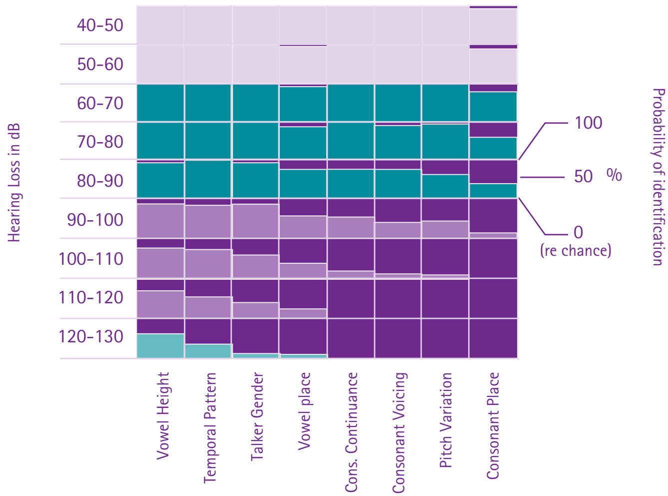
Looking back, I often think about those first pediatric trials with the single-channel implant. On average that early group of children was implanted around 8 years of age and the majority communicated by sign language (Berliner et al., 1985). Now adults, some of the early recipients have been able to upgrade to multichannel systems, develop spoken language, and graduate from college; others have stopped using their implants altogether and are firmly entrenched in the Deaf community. Still, it gives us pause that even the more successful users from that early group most likely retain the "deaf" label. In essence, those first recipients were born too early to benefit from multichannel technology because such devices were not yet available to them. They were equally disadvantaged by being implanted at too late an age to reverse the adverse effects of auditory deprivation.

During the past 33 years of pediatric cochlear implantation a vast amount of knowledge has been amassed to clarify the complex issues that underlie performance outcomes with the use of this sensory device. It is the new complexities we now consider and confront.

From where have we come?

To frame these considerations in the proper context, we turn back to a time when cochlear implants were not available and newborn hearing screening was either non-existent or limited to those infants at high risk for hearing loss. Severe to profound hearing loss was typically identified and confirmed in young children between the ages of 13 to 24 months (Elsmann et al, 1987; Harrison & Roush 1996), which would be delayed by today's standards. Evidence from large scale studies helped to define the far reaching consequences of early onset deafness for the acquisition of spoken language, psychosocial development, and academic achievement (e.g., Osberger, 1986; Levitt et al., 1987).

There was an assumption during that time that individuals with severe to profound hearing loss could not derive benefit from amplification because of the magnitude of the loss. Arthur Boothroyd proved this assumption to be incorrect as evidenced by his classic study on speech pattern contrast perception in adolescents with hearing loss (Boothroyd, 1984, 1985). In that study Boothroyd administered tests of speech pattern contrast perception to orally trained students with varying degrees of hearing loss. A summary of results is presented in Figure 1, displaying the mean scores for each contrast as a function of degree of hearing loss. Impressively, the children with pure-tone average thresholds of 70 dB HL or better had access to all the speech contrasts. Perception



Contrast perception as a Function of Degree of Hearing Loss

Figure 1. Speech pattern contrast perception in adolescents with differing degrees of hearing loss. This figure is adapted from Boothroyd (1985), from which the data were interpolated and extrapolated from Boothroyd (1984).

of consonant place, the contrast most susceptible to hearing loss, was compromised for thresholds of 75 dB HL and poorer. The order by which scores systematically dropped with increasing levels of hearing loss for the remaining contrasts were: initial consonant continuance, initial consonant voicing, vowel place, talker sex, syllabic pattern, and vowel height. Even for thresholds of 120 dB HL, time and intensity cues were accessible through detection of the most intensive peaks in the speech signal.

Because of the correspondence between perception and production, early onset deafness is detrimental to the development of speech production skills. Results from early investigations verified that articulation skills were delayed or even absent for the majority of deaf children (Hudgins & Numbers, 1942; Markides, 1970; Smith, 1975; Osberger & McGarr, 1982). Even with the emergence of babbling, delays were evident for the deaf infants (Oller et al., 1985; Eilers & Oller, 1994; Carney, 1996). The magnitude of deficits in articulation and speech intelligibility was related to the level of residual hearing (Smith, 1975; Monson, 1978; Ling & Milne, 1981; Boothroyd, 1984).

A finding of particular interest was that speech production skills surpassed speech perception skills in children with early onset deafness (Subtelny, 1983), suggesting that production was amenable to training. However, the quality of that speech was characteristically deviant, being marked by breathiness, wide pitch excursions, and abnormal nasalization (described in Stevens et al., 1983). Children who derived little to no benefit from hearing aids demonstrated numerous errors in articulation and voice quality (Hudgins & Numbers, 1942; Smith, 1975). Because of distortions in voice quality and numerous speech production errors, speech intelligibility was notably reduced. Smith (1975) reported a mean speech intelligibility rating of 18.7% for a group of congenitally deaf children, 10-15 years of age.

With assistance from hearing aids, access to low and/or mid-pitch speech frequencies reinforced the production of pitch, intonation, stress, and number of syllables. Access to mid-frequencies via amplification supported vowel production; however, consonant production was typically delayed. Those children reliant on lipreading were shown to produce front consonants more often than back consonants (Sykes, 1940; Carr, 1953; Lach et al., 1970), but continued to experience difficulty with voicing distinctions (Carr, 1953; Markides, 1970).

Acquisition of language is not solely an auditory-based skill. The majority of children with profound hearing loss were placed in programs that advocated some form of sign language (American Sign Language or Signed Exact English) (Conrad, 1979) or cued speech (Nicholls & Ling, 1982). In terms of spoken language, however, degree of hearing loss and use of hearing aids were factors that corresponded to language ability (Pressnel, 1973; Quigley et al., 1976a, b). Those children with aidable residual hearing and consistent hearing aid use were likely to succeed in programs that advocated a strong auditory-oral approach (Musselman & Kircaali-Iftar, 1996), but for many this process was arduous and frustrating.

Vocabulary development in this population paralleled that of hearing children but at a slower rate (Pressnell, 1973; Kretschmer & Kretschmer, 1978). By 12 months of age deaf children continued to use gestures when hearing children were producing first words (Grewel, 1963). By of age, deaf children reportedly knew less than 10 words (Schafer & Lynch, 1980) at an age when their hearing peers demonstrated vocabularies of 20 to 50 words. By 5 years of age, deaf children revealed a spoken vocabulary of 250 words when the typical vocabulary of hearing children was more than 2000 words (Dale, 1974).

Grammatical errors also were evident in children with early onset deafness. In a large-scale study of deaf children, 10 to 18 years of age, Quigley and associates documented grammatical errors at an age when hearing children (ages 8 to 10 years) were using adult-like sentence patterns (Quigley et al., 1976a, b). The grammatical errors were typical of much younger hearing children; however, unique error patterns also were apparent. The combination of language delay and reduced speech intelligibility further complicated the development of conversational skills of deaf children because it impacted the flow of conversion.

Reading is an auditory-based skill, and the inability to perceive the sounds of speech results in poor phonological awareness—a prerequisite for literacy skill development. It was therefore not surprising that most children with early onset deafness were unable to read beyond a third or fourth grade level (Furth, 1966; Krose et al., 1986).

Deficits in communication characterized the deaf population prior to the widespread practice of newborn hearing screening and cochlear implantation. The deaf individual who was firmly rooted in Deaf culture belonged to a thriving, albeit insular, community. The deaf individual not aligned to that protected community often was isolated from both hearing and deaf societies.

Where are we today?

Enter cochlear implants! Enter universal newborn hearing screening! Enter the public laws that mandate a child be educated in the least restrictive environment! These events converged during the second half of the 20th century to change the outlook for children with early onset deafness. Today children born deaf have the potential to develop spoken language and produce intelligible speech through training programs that emphasize auditory learning and spoken language development.

Early newborn hearing screenings morphed into widespread early hearing detection and intervention (EHDI) programs, spurred by research demonstrating that early identification facilitates language development (Yoshinaga-Itano et al., 1998; Kennedy et al., 2006). Moreover, early fitting of hearing aids has been successful in reducing the duration of auditory deprivation (Harrison et al., 2003; Sininger et al., 2009, 2010). For those children with early onset deafness, cochlear implantation at young ages has had a positive effect on maturation of the central auditory nervous system. That is, implantation by the age of 3½ years has been shown to produce age-appropriate cortical responses by six months post device activation (Sharma et al., 2002).

Another innovation relates to the legislation that favors individuals with disabilities. Public laws mandate that children with hearing loss be educated in the least restrictive environment. Federal and state funding supports the educational needs of children with disabilities from birth to 18 years of age.

Early and appropriate fitting of a sensory device plays a central role in auditory skill development by ensuring audibility across a broad range of frequencies. In general, children with severe to profound hearing loss are unable to extract mid and high frequencies from the speech stimulus even with well-fitted hearing aids. Hence, the cochlear implant has become the device of choice for children with this magnitude of loss. The implant enables deaf children, as a group, to function similarly to children with severe loss (Blamey et al., 2001b; Boothroyd & Boothroyd-Turner, 2002; Dettman et al., 2004; Eisenberg et al., 2004). Following is a summary on the current state of knowledge as it relates to the communication outcomes in children with cochlear implants.

Speech Perception

Before delving into auditory outcomes, discussion about new test development is germane to the topic of speech perception. Dr. Norman Erber is credited with spearheading this effort by creating two tests that helped define early efficacy with cochlear implants. By name, these tests are the Monosyllable, Trochee, Spondee (MTS) Test (Erber & Alencewicz, 1976) and the Glendonald Auditory Screening Procedure (GASP) (Erber, 1982). The MTS, in particular, was the precursor to the Early Speech Perception (ESP) Test (Moog & Geers, 1990), a measure that taps into the lower level skills of pattern perception and closed-set word identification. The ESP is widely used in pediatric cochlear implant clinics for tracking emergent perceptual abilities of young deaf children.

In terms of open-set test development, the Multisyllabic Lexical Neighborhood Test (MLNT) and Lexical Neighborhood Test (LNT) (Kirk et al., 1995) are two theoretically motivated word tests that tap into the higher level processes that underlie spoken word recognition in children. The MLNT and LNT have become standard measures used by researchers and clinicians to evaluate word recognition in the pediatric implant population.

Other recent tests have emphasized speech feature differentiation. They include the Speech Feature Test (Dawson et al., 1998) and the Auditory Speech Sounds Evaluation (A§E®) (Govaerts et al., 2006). Our group at the House Research Institute, in collaboration with Arthur Boothroyd, also has engaged in developing software-driven speech pattern contrast tests for use with infants and toddlers. These tests rely on the child's behavioral responses via visual reinforcement, conditioned play, and verbal imitation (Eisenberg et al., 2003, 2007, 2012; Martinez et al., 2008; Boothroyd, 2009; Boothroyd et al., 2010).

Displayed in Figure 2 are response profiles of four 9-month-old infants with differing degrees of hearing loss. Using the visual reinforcement, head-turn test paradigm, speech pattern contrast perception was assessed in the sound field with the infants' hearing aids activated. Accuracy was analyzed using an algorithm derived from probability theory that generated a percent-confidence value for each vowel and consonant

Figure 2. Speech pattern contrast results on four infants with different degrees of hearing loss. The filled blocks represent percent-confidence scores for the speech contrasts being assessed: vowel height (VH), vowel place (VP), consonant voicing (CV), consonant continuance (CC), front consonant place (CPf) and rear consonant place (CPr). (Reprinted from Eisenberg et al., 2010, with permission from Phonak AG).

contrast assessed. The gradations in shading in Figure 2 convey the likelihood that detection of difference (e.g., the vowel place contrast "oodoo vs eedee") was probable, possible, or unlikely.

The percent-confidence scores were high across most contrasts for the two children with mild and moderate hearing loss (top two profiles, respectively). That is, the vowel and consonant contrasts were perceived with relatively high probability that the detection of change was not random. The percent-confidence scores were reduced for the two children with severe and profound hearing loss (bottom two profiles, respectively), particularly for the one child with an average threshold of 115 dB HL. This child responded with certainty only to the vowel height contrast. It is worth noting that the response pattern of results across the four infants is consistent with the group data reported by Boothroyd on adolescents (refer back to Figure 1 for those results).

Commencing with the early implant trials, speech perception test batteries emerged as an effective way to track progress and also to account for the wide variability in performance. The first pediatric batteries were compiled by investigators from the Central Institute for the Deaf (Geers, 1994) and Indiana University School of Medicine (Kirk, 2000). Those first batteries took into consideration the age and skill level of young deaf children. Of more recent origin is the speech recognition test battery assembled for the Childhood Development after Cochlear Implantation (CDaCI) study (Fink et al., 2007; Niparko et al. 2010), a multicenter study presently ongoing in the United States. The CDaCI test battery is hierarchical, allowing each child to advance at his or her own pace (Eisenberg et al., 2006, 2012). A diagram of the clinical tests that comprise the CDaCI test battery is shown in Figure 3.

Wang et al. (2008) created an index to chart auditory skill development as children progress through the CDaCI hierarchy. Referred to as the Speech Recognition Index (SRI-Q), each of the six tests administered in quiet is assigned a range of values within a 100-point range and then stacked from easiest to most difficult to create an index of 0-600, as shown in Figure 3. Each child's highest level of performance is inserted into the SRI-Q at each test interval. The individual data points are subjected to curve fitting.

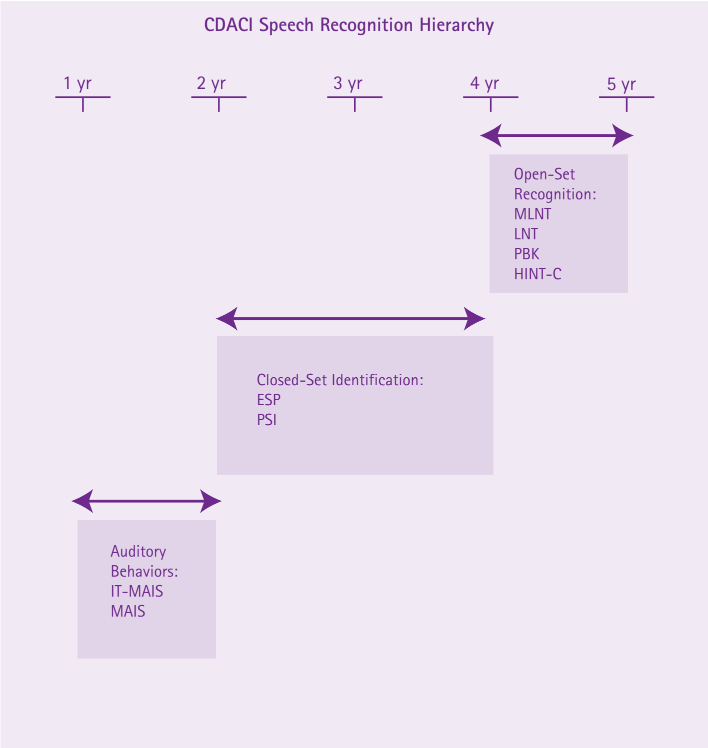


Figure 3. The CDaCI speech recognition test battery.
The specific tests are: the Meaningful Auditory Integration Scales (MAIS, Robbins, et al., 1991) and the Infant-Toddler version (Zimmerman, et al., 2000); Early Speech Perception (ESP) Test (Moog & Geers, 1990); Pediatric Speech Intelligibility (PSI) Test (Jerger et al., 1980); Lexical Neighborhood Test and Multisyllabic version (M/LNT) (Kirk et al., 1995); Phonetically Balanced Word Lists—Kindergarten (PBK; Haskins, 1949); and, Hearing In Noise Test for Children (HINT-C; Gelnett, et al., 1995). (Reprinted from Eisenberg et al., 2010, with permission from Phonak AG).

Figure 4 displays the median growth curve representing 50% of the sample (50th percentile represented by the black line) along with estimates of the 90th, 75th, 25th, and 10th percentiles (dashed lines). The time span on the x-axis ranges from baseline (pre-implant activation) to five years post implant follow-up. At baseline (0 on the x-axis) the lower 25% of the sample (25th and 10th percentile curves) were coded as 0 on the y-axis, indicating lack of speech awareness with hearing aids. The top half of the sample (50th, 75th, and 90th percentiles) detected speech at 65 dB HL (coded as 100 on the y-axis) or even better with use of hearing aids prior to cochlear implant surgery.

Following cochlear implantation, the rate of growth in speech recognition development was most rapid for the top 25% of the sample (75th and 90th percentile curves). With the exception of the lowest 10% of the sample, the majority of children achieved open-set speech recognition within approximately three and a half years of implant activation. A preliminary analysis of these data indicated that expressive language scores at baseline were predictive of the rate at which children transition from closed– to open-set recognition (Johnson et al., 2011).

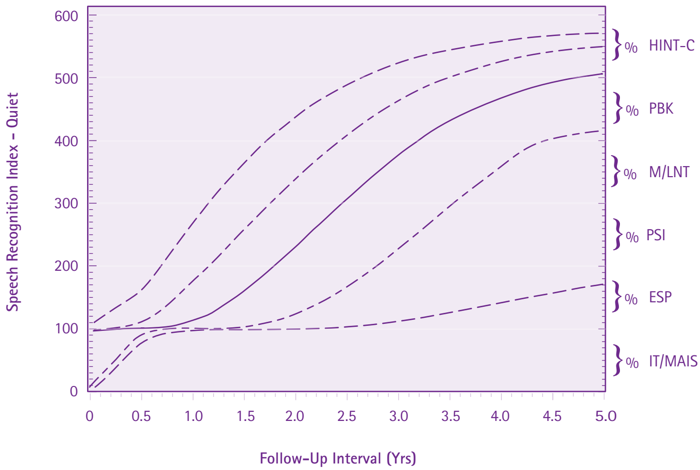


Figure 4. Speech recognition results ranging from baseline (pre cochlear implant) through five years experience with the cochlear implant for children enrolled in the Childhood Development after Cochlear Implantation (CDaCI) study. The growth curves are displayed in percentiles. The black line represents the median (50th percentile) and the dashed lines represent the 90th, 75th, 25th, and 10th percentiles from top to bottom, respectively.

The rate of growth for the lower 10% of the sample was disproportionately slower than that shown for the remaining children in the study. In other words, the lowest performing group did not reach open-set speech recognition even after five years of implant use. These findings were attributable in part to developmental delays, autism, and suspected cochlear nerve deficiency.

The SRI-Q has broad appeal for use with large datasets. However, it also has appeal for use with individual subjects, as illustrated in a case study of one child with an auditory brainstem implant. Ineligible for a cochlear implant due to auditory nerve deficiency, this child underwent surgery for an auditory brainstem implant at age 1 year, 11 months. We have been tracking this child's progress for four years on the CDaCI speech recognition test battery. Displayed in Figure 5, the test scores were converted to SRI-Q units and plotted alongside the CDaCI data. It will be seen that the child progressed at a rate on par with the median performance of the children with cochlear implants on closed-set tests.

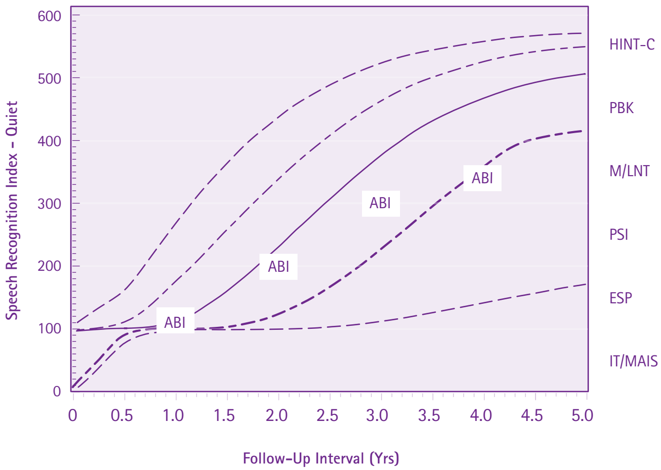


Figure 5. SRI-Q results of a child with an auditory brainstem implant (ABI) assessed annually over the course of four years. The data points are displayed in relation to the five-year growth curves of children with cochlear implants who are enrolled in the Childhood Development after Cochlear Implantation (CDaCI) study.

The rate slowed three years post-device activation at the emergence of open-set speech recognition. At this point in time the child's skill level became more closely aligned with 25% of the CDaCI sample. These findings demonstrate the value of large datasets for comparing rates of growth in single children or in groups of children using different types of sensory devices.

Speech Production

Hearing children produce intelligible speech by the age of 4 years (Flipsen, 2006) and articulate all the phonemes in their language by approximately 8 years of age (Goldman, 2000). Children with cochlear implants, as a group, have not achieved these same milestones, even when the factors of age and length of auditory experience are statistically controlled (Chin et al., 2003; Peng et al., 2004).

Despite these developmental lags, cochlear implantation has had a positive influence on the vocal development of young children with early onset deafness as evidenced by the emergence of babbling between one to six months following cochlear implant activation (Ertmer & Mellon, 2001; Ertmer et al., 2002; Moore & Bass-Ringdahl, 2002; Schauwers et al., 2004; Kishon-Rabin et al., 2005; Ertmer, Young, & Nathani, 2007; Moeller et al., 2007). These findings are of particular interest because they indicate that young children with implants are attaining vocal milestones with fewer months of auditory experience than hearing children.

Tomblin et al. (2008) examined the speech production skills of children implanted at an average age of 4.5 years who had been using cochlear implants for at least 8 years. Improvements in articulation were evident during the first five years of implant use, but reached a plateau after six years of use. In an earlier study from this same group, Peng et al. (2004) reported speech intelligibility rates near 72%. The finding of intelligible speech in deaf children with cochlear implants has been corroborated by others (Blamey et al., 2001a; Svirsky et al., 2002; Tobey et al., 2003). However, it is important to acknowledge that not all implant recipients are intelligible even after many years of device use (Beadle et al., 2005; Uziel et al., 2007).

It remains for future studies to determine whether age-appropriate mastery is possible for children with cochlear implants. Even though there is room for improvement, it is impressive that the speech production and intelligibility skills of pediatric implant recipients far surpass skills of those children for whom implants were not an option in the past.

Spoken Language

The first investigations into the spoken language skills of children with cochlear implants involved comparisons with hearing aids and vibrotactile devices. Significantly better outcomes and more rapid rates of growth were shown with the implant relative to the other devices (Geers & Moog, 1994; Robbins et al., 1999; Svirsky et al., 2000). Today there is less interest in this type of comparison as investigators have come to gauge language outcomes exclusively to those of children with normal hearing,

This comparison was first made in a study by Geers et al. (2003) on the language abilities of 8 – and 9-year-old children implanted under the age of 5 years. More than half the children with implants demonstrated receptive and expressive spoken language results on par with their hearing peers. Similar findings were reported by Schorr et al. (2008), who evaluated receptive and expressive vocabulary in addition to morphology and syntax in children with cochlear implants between the ages of 5 and 14 years. Those results were further corroborated in a study of 153 young children with implants with a mean age of 5 years, 10 months (Geers et al., 2009). Geers and colleagues reported that 39% to 59% of children with implants attained scores equivalent to their hearing peers on measures of receptive and expressive vocabulary and general language.

Age at cochlear implantation has proven to be a robust predictor of spoken language acquisition in children with early onset deafness. Simply put, earlier is better (Tomblin et al., 2005; Dettman et al., 2007; Nicholas & Geers, 2006, 2007; Holt & Svirsky, 2008; Niparko et al., 2010). Three-year language results reported on children in the aforementioned CDaCI study indicated that children implanted under 18 months of age demonstrated more rapid rates of receptive and expressive language learning in comparison to children implanted at older ages (up to 5 years of age). However, as a whole the children did not achieve age-appropriate language levels. In addition to the age variable, improvements in language scores were related to greater pre-implant residual hearing, higher ratings of parent-child interactions, and higher socioeconomic status (SES) (Niparko et al., 2010). Children implanted before the age of 12 months have been shown to attain even higher levels of performance on language measures (Svirsky et al., 2004; Colletti et al., 2005; Miyamoto et al., 2005; Dettman et al., 2007).

The relationship between early age at implantation and improved rates of spoken language acquisition is consistent with the notion of a sensitive period for speech and language learning (Tomblin et al., 2007). The second year of life, in particular, is a period of general maturation accompanied by a large spurt in vocabulary growth and grammatical development (Bates & Goodman, 1997), with marked changes in brain organization (Mills et al., 1993, 1997, 2004).

Literacy

Awareness of the phonemic units of speech is enhanced by cochlear implantation. Those children enrolled in oral communication programs are at a particular advantage in establishing robust phonological representations of the speech sounds in their language (Pisoni & Geers, 2000). These advantages translate into improved phonological awareness abilities (James et al., 2005). Phonological awareness is the knowledge of sound structure and systematic patterns of spoken language; it is a precursor to the acquisition of reading skills. Thus, cochlear implantation offers deaf children the prospect of improved reading proficiency in addition to the acquisition of an auditory-based language. On tasks that measured phonological awareness skills, scores by children with cochlear implants were found to be within one standard deviation of the mean of hearing peers, although significant between-group differences suggested lags by the children with implants (DesJardin et al., 2009a; Ambrose et al., 2012).

Despite the between-group gaps in phonological awareness abilities, improvements in literacy skills are evident in the pediatric implant population. As early as 1997, Spencer and colleagues reported that 54% of 28 school-age children demonstrated reading abilities above the fourth grade level (Spencer et al., 1997). Placing these results in perspective, only 8% to 14% of children without implants exceeded fourth grade reading levels (Furth, 1966; Krose et al., 1986). Spencer et al. (2003) subsequently investigated reading comprehension and writing skills of children with implants and their age-matched hearing peers. The children with implants performed within 1 standard deviation of the mean of hearing children.

These impressive results are upheld as children with cochlear implants mature. Geers and Hayes (2011) investigated reading aptitude in high school students with 10 years or more cochlear implant use. The results yielded an impressive 47% to 66% of children performing within or above the average range of their hearing peers on reading tests. Continued delays, however, were evident on tasks that evaluated writing and phonological processing skills.

Cochlear implantation is an evolving field. Technology continues to improve as selection criteria become less rigid. The age at which children are eligible for a cochlear implant has decreased through the years. Children with significant amounts of residual hearing are receiving cochlear implants, including those devices that combine electrical and acoustic stimulation. Present goals for improved performance include better understanding of speech in noise and more accurate music perception.

Perspectives in Research Design

Many early researchers in pediatric hearing loss adopted a univariate approach to understanding outcomes in one developmental domain, such as speech perception or language. Today, longitudinal research designs incorporate a multivariate strategy, as evidenced by the study on Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) being carried out in Australia (Ching et al., in press) and the CDaCI study ongoing in the United States (Fink et al., 2007; Niparko et al., 2010). These contemporary frameworks are advantageous for exploring the complex interactions between child, family, culture, intervention, as well as other contributing factors for predicting outcomes (Bronfenbrenner, 1986; Sameroff & Fiese, 1990; Lerner, 1998). They also address important questions about how skills emerge developmentally, change over time, and interact to promote and support optimal development. Lastly, these designs foster multicenter and interdisciplinary collaborations.

Remaining Challenges and New Directions

The year is 2013 and we can state with some confidence that the well-being of deaf children, as a group, is much improved from earlier conditions. The innovations of the second half of the 20th century have had a positive impact on reducing the societal burden and costs of educating children with early onset deafness (Francis et al., 1999; Mohr et al., 2000). Many of these children today are mainstreamed in neighborhood schools.

Despite remarkable gains, not all of these children achieve high levels of speech recognition, develop spoken language, or produce intelligible speech. Wide variability in outcomes still exists and developmental lags remain. Significant unaccounted variance necessitates exploration of other potential correlates. Even with cochlear implants, there are those deaf children who encounter challenges that prevent them from becoming successful, productive members of society. Today we face ever changing population demographics, multiple languages, increasing poverty, and widening health disparities (Kirkham et al., 2009; Suskind & Gehlert, 2009; Knoors & Marschark, 2012).

It is well established that low SES has a negative impact on outcomes in the pediatric implant population (Geers, 2003; Connor & Zwolan, 2004; Niparko et al., 2010). Because early intervention and preschool programs may not have adequate resources or experienced personnel to serve this population, professionals are often unable to meet the diverse needs of these children. Moreover, public educational programs aren't always equipped to provide individualized curricula for children in need of specialized hearing and related services. Consequently, these children may not acquire the requisite skills for academic success as they enter their elementary educational years. Another drawback is that parents may be unaware of services available to their child through federal and state funding. Limited parental involvement contributes to the widening disparities observed with implanted children of low SES (Kirkham et al., 2009). There is a pressing need to intervene early with these families by developing specialized parent-child training programs.

Investigation into the role of the family and home environment has become a contemporary topic of enquiry, with relevance for children with early onset deafness (Holt et al., 2012, in press). Holt and colleagues recently examined the effects of family environment on language and cognitive development in deaf children with cochlear implants (Holt et al., 2012). They found that high levels of control exerted by families (i.e., number of rules imposed in the home) had a negative effect on the vocabulary growth of these children. In contrast, the importance placed on achievement was related to fewer deficits in children's executive function and working memory. Based on these findings, the investigators concluded that examination of family factors and the home environment has potential for improving communication skills in children with implants because family dynamics are amenable to therapeutic intervention.

With the widespread practice of newborn hearing screening, parents are in the best position to provide ongoing linguistic input to their young children in their natural environment. Indeed, the availability of the Language ENvironment Analysis (LENA) system (the Digital Language

Figure 6. LENA Digital Language Processor (DLP; LENA Foundation, Boulder, CO.). The LENA DLP weighs 2 ounces and 1x5x8 cm. and is worn by the child in a chest pocket of a specially designed outfit. The system captures up to 16 hours of audio (retrieved from the LENA website with permission).

Processor is shown in Figure 6) now provides a means to quantify the communicative content and interactions that occur between parent and child in the home setting. The LENA system has become an important tool for investigating language delay, bilingualism, and autism spectrum disorders, and recently is finding utility in the investigation of pediatric hearing loss (Aragon & Yoshinaga-Itano, 2012; VanDam et al., 2012). It is my understanding that the LENA system is being utilized at Macquarie University through the Institute of Early Childhood and at select centers within the Hearing Hub. The use of this technology and the outcomes generated are expected to play a prominent role in the study and management of children with hearing loss.

The role of parental contributions is another topical area of investigation. It has been demonstrated that parents' competence and confidence in their own abilities has a positive impact on children's auditory, language, and early literacy development (Calderon, 2000; Moeller, 2000; McWilliam & Scott, 2001; DesJardin, 2009; DesJardin et al., 2009a, b). As mentioned earlier, ratings of increased parent-child interactions are significantly associated with faster rates of spoken language learning in children with cochlear implants (Niparko et al., 2010). Maternal sensitivity also is positively related to language acquisition in children with hearing loss (Pressman et al., 1999; Quittner et al., 2013).

The specific contributions of parental involvement and self-efficacy to children's outcomes have been explored in a number of studies on pediatric hearing loss (Calderon et al., 1998; DesJardin, 2003, 2009; DesJardin & Eisenberg, 2007; Zaidman-Zait & Young, 2008). Parental involvement refers to the active involvement of parents in their child's early intervention program (Calderon et al., 1998). Self-efficacy pertains to the belief in one's ability to perform a particular task successfully (Bandura, 1989. 1997).

DesJardin and colleagues focused their research endeavors on the ways in which perceived parental involvement and self-efficacy contribute to language and literacy development in children with cochlear implants (DesJardin, 2003; DesJardin et al., 2009a, b; DesJardin & Eisenberg, 2007). In one study, DesJardin & Eisenberg (2007) investigated the mothers' role in supporting the language abilities of their children by analyzing associations between child language, mothers' perceived involvement and self-efficacy, mothers' quantitative linguistic input (mean length of utterances, number of words, word types), and mothers' qualitative linguistic input (facilitative language techniques, see Table 1 for descriptions).

The results demonstrated that perceived involvement and self-efficacy were positively related to the mothers' linguistic input, which, in turn, was positively associated with higher language skills in their children (see Table 2). The specific higher level facilitative language techniques of recast and open-ended question were significantly related to improved language skills in the children. It was reasoned that these two higher-level facilitative techniques encourage conversation by expanding grammatical and syntactical linguistic structures (Fey et al., 1999; Lilly & Green, 2004). Conversely, the use of several lower-level techniques by mothers, specifically linguistic mapping, labels, and directives, were associated with poorer language skills in the children.

The techniques of recast and open-ended questions also have significance for the development of literacy skills in children with cochlear implants. DesJardin et al. (2009a) found that mothers' use of these two higher level techniques was positively related to later phonological awareness and reading skills in school-age children with implants. More specifically, the use of open-ended questions during early book reading was associated with improved phonological awareness, letter-word

Table 1. Descriptions of higher and lower level facilitative language techniques (adapted from DesJardin et al., 2009a).

HIGHER LEVEL TECHNIQUES	DESCRIPTIONS
Parallel Talk	Caregiver provides a description about what the child is directly looking at in the storybook.
Open-ended question	Caregiver provides a question in which the child can answer using more than one word.
Expansion	Caregiver repeats child's utterance by maintaining the child's word order with or without adding new information or words.
Recast	Caregiver restates the child's utterance into a question format.
LOWER LEVEL TECHNIQUES	**DESCRIPTIONS**
Imitation	Caregiver repeats a child's preceding utterance.
Label	Caregiver provides a label for a picture in the storybook.
Closed-ended question	Caregiver asks a question in which the child can only answer with one word.
Linguistic mapping	Caregiver interprets the child's intended message by using the context as a clue. Child uses a preceding utterance that is not recognizable as an approximation of a word.
Directive	Caregiver tells the child to do something or commands a behavior.
Comment	Caregiver states a comment to keep the conversation going or to positively reinforce the child.

Table 2. Pearson product correlations between: 1) facilitative language techniques used by the mothers and perceived self-efficacy and involvement, and 2) facilitative language techniques used by the mothers and child language.
The hashed line divides the higher level from the lower level techniques (Adapted from DesJardin & Eisenberg, 2007).

FACILITATIVE LANGUAGE TECHNIQUES	MATERNAL SELF-EFFICACY SPEECH-LANGUAGE	MATERNAL INVOLVEMENT SPEECH-LANGUAGE	CHILD RECEPTIVE LANGUAGE	CHILD EXPRESSIVE LANGUAGE
Parallel Talk	0.45[a]	0.56[b]	0.27	0.13
Expansion	0.22	0.39[a]	0.33	0.21
Recast	0.08	-0.31	0.47[b]	0.27
Open-ended question	0.10	0.30	0.34	0.51[b]
— — —	— — —	— — —	— — —	— — —
Linguistic mapping	-0.63[b]	-0.37	-0.50[b]	-0.42[a]
Closed-ended question	0.12	-0.05	0.17	0.11
Imitation	-0.63[a]	-0.56[a]	-0.27	-0.23
Label	-0.29	-0.51a	-0.44[a]	-0.45[a]
Directive	-0.52[a]	-0.53[a]	-0.58[b]	-0.49[a]
Comment	-0.39	-0.40[a]	0.15	0.07

[a]$p < 0.05$; [b]$p < 0.01$

identification, and passage comprehension. The use of recast was related to improved spoken and reading vocabulary. In another study on literacy, DesJardin et al. (2009b) found that mothers' perception of their own activities to teach reading was positively related to the literacy skills of their children.

To summarize, research findings have substantiated the important role parents play in facilitating their deaf children's language and literacy development. Parental involvement, self-efficacy, and the way in which parents communicate with their young child are essential targets for instruction in any early intervention program. The LENA system is ideally suited to quantify parent-child interactions in the home environment. Parental contributions may have particular relevance for families of low SES. In fact, parent-directed educational intervention programs are being developed for families of disadvantaged backgrounds; they are *30 million words* and *Project Aspire* (Suskind & Gehlert, 2009). The design and utilization of new intervention programs may one day reduce the unaccounted variability in performance outcomes that remains the hallmark of pediatric cochlear implantation.

Concluding Remarks

In the introductory remarks, it was suggested that the first group of children to receive cochlear implants was born too early to benefit from future advances in technology, a finding complicated by implantation at older ages. Although one of these two factors has been remedied with early implantation, the fact remains that children born deaf today likely will not benefit from major scientific and technological advances in the future.

At the present time, we can't foresee what the future may hold in an era of drug therapies and biotechnology. There has been experimentation into hair cell regeneration for decades, broaching the question whether this type of treatment will become an imminent reality. Other innovations, such as genetic engineering, may have potential in the distant future for intervening in cases of inherited hearing loss. These ultramodern solutions could one day eradicate deafness, rendering sensory device technology obsolete. Alternatively, auditory implantable devices designed in the future may promise restoration of hearing to normal levels. Should any or all of these innovations become a reality, there will always be a group of forward thinking parents who bravely enroll their children into the first pediatric clinical trials. Despite inevitable difficulties, the knowledge gained from these first trials will benefit children participating in subsequent studies. And so the cycle continues. As with the extenuating circumstances of the last century, a new set of complexities will determine the consequences of being born deaf in the 21st century.

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References

Ambrose, S. E., Fey, M. E., & Eisenberg, L. S. (2012). Phonological awareness and print knowledge of preschool children with cochlear implants. *Journal of Speech, Language, and Hearing Research, 55*, 811-823.

Aragon, M., & Yoshinaga-Itano, C. (2012). Using Language Environment Analysis to improve outcomes for children who are deaf or hard of hearing. S*eminars in Speech and Language, 33*, 340-353.

Bandura, A. (1989). Regulation of cognitive processes through perceived self-efficacy. *Developmental Psychology, 25*, 729-735.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: W. H. Freeman.

Bates, E., & Goodman, J. (1997). On the inseparability of grammar and the lexicon: Evidence from acquisition, aphasia, and real-time processing. In G. Altmann (Ed.), Special issue on the lexicon. *Language and cognitive processes, 12*, 507-586.

Beadle, E. A. R., McKinley, D. J., Nikolopoulos, T. P., Brough, J., O'Donoghue, G. M., & Archbold, S. M. (2005). Long-term functional outcomes and academic-occupational status in implanted children after 10 to 14 years of cochlear implant use. *Otology and Neurotology, 26*, 1152-1160.

Berliner, K. I., Eisenberg, L. S., & House, W. F. (Eds.) (1985). The cochlear implant: An auditory prosthesis for the profoundly deaf child. *Ear and Hearing, 6*(Suppl.), 1S-69S.

Blamey, P. J., Barry, J. G., Bow, C. P., Sarant, J. Z., Paatsch, L. E., & Wales, R. J. (2001a). The development of speech production following cochlear implantation. *Clinical Linguistics and Phonetics,15*, 363-382.

Blamey, P. J., Sarant, J. Z., Paatsch, L. E., Barry, J. G., Bow, C. P., Wales, R J. Wright, M., Psarros, C., & Rattigan, K. (2001b). Relationships among speech perception, production, language, hearing loss, and age in children with impaired hearing. *Journal of Speech, Language, and Hearing Research, 44*, 264-285.

Boothroyd, A. (1984). Auditory perception of speech contrasts by subjects with sensorineural hearing loss. *Journal of Speech and Hearing Research, 27*, 134-144.

Boothroyd, A. (1985). Residual hearing and the problem of carry-over in the speech of the deaf. In J. Lauter (ed.), *Speech planning and production in normal and hearing-impaired children. ASHA Report #15* (pp. 8-14). Rockville, MD: American Speech-Language-Hearing Association.

Boothroyd, A. (2009). Assessment of Auditory Speech-Perception Capacity. In L. S. Eisenberg (Ed.), *Clinical management of children with cochlear implants* (Chapter 9, pp. 189-216). San Diego, CA: Plural Publishing.

Boothroyd, A., & Boothroyd-Turner, D. (2002). Postimplantation audition and educational attainment in children with prelingually acquired profound deafness. *Annals of Otology, Rhinology, and Laryngology, 111*(Suppl. 189), 79-84.

Boothroyd, A., Eisenberg, L. S., & Martinez, A. S. (2010). An on-line imitative test of speech pattern contrast perception (OlimSpac): Developmental effects in normally hearing children. *Journal of Speech, Language, and Hearing Research, 53*, 531-542.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22*, 723-742.

Calderon, R. (2000). Parental involvement in deaf children's education programs as a predictor of child's language, early reading, and social-emotion development. *Journal of Deaf Studies and Deaf Education, 5*, 140-156.

Calderon, R., Bargones, J. & Sidman, S. (1998). Characteristics of hearing families and their young deaf and hard of hearing children: Early intervention follow-up. *American Annals of the Deaf, 143*, 347-362.

Carney, A. E. (1996). Audition and the development of oral communication competency. In F. E., Bess, J. S. Gravel, & A. M. Tharpe (Eds.), *Amplification for children with auditory deficits* (pp. 29-53). Nashville, TN: Bill Wilkerson Press.

Carr, J. (1953). An investigation of the spontaneous speech sounds of five-year-old deafborn children. *Journal of Speech and Hearing Disorders, 18*, 22-29.

Chin, S. B., Tsai, P. L., & Gao, S. (2003). Connected speech intelligibility of children with cochlear implants and children with normal hearing. *American Journal of Speech-Language Pathology, 12*, 440-451.

Ching, T. Y. C., Dillon, H., Marnane, V., Hou, S., Day, J., Seeto, M. et al. (in press). Outcomes of early – and late-identified children at 3 years of age: Findings from a prospective population-based study. *Ear and Hearing*.

Colletti, V., Carner, M., Miorelli, V., Guida, M., Colletti, L., & Fiorino, F. G. (2005). Cochlear implantation at under 12 months: Report on 10 patients. *Laryngoscope, 115*, 445-449

Connor, C. M., & Zwolan, T. A. (2004). Examining multiple sources of influence on the reading comprehension skills of children who use cochlear implants. Journal of Speech, *Language, and Hearing Research, 47*, 509-526.

Conrad, R. (1979). *The deaf school child.* London: Harper Row.

Dale, D. M. C. (1974). *Language development in deaf and partially hearing children.* Springfield, IL: Charles C. Thomas.

Dawson, P. W., Nott, P. E., Clark, G. M., & Cowan, R. S. C. (1998). A modification of play audiometry to assess speech discrimination ability in severe-profoundly deaf 2-to-4 year old children. *Ear and Hearing, 19*, 371-384.

DesJardin, J. L. (2003). Assessing parental perceptions of self-efficacy and involvement in families of young children with hearing loss. *Volta Review, 103*, 391-409.

DesJardin, J. L. (2009). Empowering families of children with cochlear implants: Implications for early intervention and language development. In L. S. Eisenberg (Ed.), *Clinical management of children with cochlear implants* (Chapter 17, pp. 513-553). San Diego, CA: Plural Publishing.

DesJardin, J. L., Ambrose, S. E., & Eisenberg, L. S. (2009a). Maternal involvement in the home literacy environment: Supporting literacy skills in children with cochlear implants. *Communication Disorders Quarterly, 322*, 135-150.

DesJardin, J. L., Ambrose, S. E., & Eisenberg, L. S. (2009b). Literacy skills in children with cochlear implants: The importance of early oral language and joint storybook reading. *Journal of Deaf Studies and Deaf Education, 14*, 22-43.

DesJardin, J. L., & Eisenberg, L. S. (2007). Maternal contributions: Supporting language development in young children with cochlear implants. *Ear and Hearing, 28*, 456-469.

Dettman S. J., D'Costa, W. A., Dowell, R. C., Winton, E. J., Hill, K. L., & Williams, S. S. (2004). Cochlear implants in children with significant residual hearing. *Archives of Otolaryngology—Head and Neck Surgery, 130*, 612-618.

Dettman, S. J., Pinder, D., Briggs, R. J., Dowell, R. C., & Leigh, J. R. (2007). Communication development in children who receive the cochlear implant younger than 12 months. *Ear and Hearing, 28*(Suppl.), 11S-18S.

Eilers, R. E., & Oller, D. K. (1994). Infant vocalizations and the early diagnosis of severe hearing impairment. *Journal of Pediatrics, 12*, 199-203.

Eisenberg, L. S., Johnson, K. C., & Martinez, A. S. (2010). Measuring auditory performance of pediatric cochlear implant users: What can be learned for children who use hearing instruments? In R. C. Seewald & J. M. Bamford (Eds.). *A Sound foundation through early amplification 2010: Proceedings of the fifth international conference* (Chapter 20, pp.261-271). Phonak AG.

Eisenberg, L. S., Johnson, K. J., Martinez, A. S., Cokely, C. G., Tobey, E. A., Quittner, A. L., Fink, N. E., Wang, N-Y., Niparko, J. K, & the CDaCI Investigative Team. (2006). Speech recognition at 1-year follow-up in the Childhood Development after Cochlear Implantation Study: Methods and preliminary findings. *Audiology and Neurotology, 11*, 259-268.

Eisenberg, L. S., Johnson, K. J., Martinez, A. S., Visser-Dumont, L., Ganguly, D. H., & Still, J. F. (2012). Studies in Pediatric Hearing Loss at the House Research Institute. *Journal of the American Academy of Audiology, 23*, 412-421.

Eisenberg, L. S., Kirk, K. I., Martinez, A. S., Ying, E. A., & Miyamoto, R. T. (2004). Communication abilities of children with aided residual hearing: Comparison with cochlear implant users. *Archives of Otolaryngology—Head and Neck Surgery, 130*, 563-569.

Eisenberg, L. S., Martinez, A. S., & Boothroyd, A. (2003). Auditory-visual and auditory-only perception of phonetic contrasts in children. *Volta Review, 103*, 327-346.

Eisenberg, L. S., Martinez, A. S., & Boothroyd, A. (2007). Assessing auditory capabilities in young children. *International Journal of Pediatric Otorhinolaryngology, 71*, 1339-1350.

Elsmann, S. F., Matkin, N. D., & Sabo, M. P. (1987). Early identification of congenital sensorineural hearing impairment. *The Hearing Journal, 40*, 13-17.

Erber, N. (1982). *Auditory training*. Washington, DC: Alexander Graham Bell Association for the Deaf.

Erber, N., & Alencewicz, C. (1976). Audiologic evaluation of the deaf children. *Journal of Speech and Hearing Disorders, 41*, 256-267.

Ertmer, D. J., & Mellon, J. A. (2001). Beginning to talk at 20 months: Early vocal development in a young cochlear implant recipient. *Journal of Speech, Language and Hearing Research, 44*, 192-206.

Ertmer, D. J., Young, N., Grohne, K., Mellon, J., Johnson, C., Corbett, K., & Saindon, K. (2002). Vocal development in young children with cochlear implants; Assessment and implications for intervention. *Language, Speech, and Hearing Services in the Schools, 33*, 184-195.

Ertmer, D. J., Young, N., & Nathani, S. (2007). Profiles of vocal development in young cochlear implant recipients. *Journal of Speech, Language, and Hearing Research, 50*, 393-407.

Fey, M., Krulik, T., Loeb, D., & Proctor-Williams, K. (1999). Sentence recast use by parents of children with typical language and children with specific language impairment. *American Journal of Speech-Language Pathology, 8*, 273-286.

Fink, N. E., Wang, N-Y., Visaya, J., Niparko, J. K., Quittner, A. L., Eisenberg, L. S., Tobey, E. A., & the CDaCI Investigative Team. (2007). Childhood development after cochlear implantation (CDaCI): Design and baseline characteristics. *Cochlear Implants International, 8*, 92-116.

Flipsen, P. (2006). Measuring the intelligibility of conversational speech in children. *Clinical Linguistics and Phonetics*, 20(4), 303-312.

Flipsen, P., & Colvard, L. G. (2006). Inteligibility of conversational speech produced by children with cochlear implants. *Journal of Communication Disorders, 39*, 93-108.

Francis, H. W., Koch, M. E., Wyatt, J. R., & Niparko, J. K. (1999). Trends in educational placement and cost-benefit considerations in children with cochlear implants. *Archives of Otolaryngology—Head and Neck Surgery, 125*, 499-505.

Furth, H. G. (1966). A comparison of reading test norms of deaf and hearing children. *American Annals of the Deaf, 111*, 461-462.

Geers, A. E. (1994). Techniques for assessing auditory speech perception and lipreading enhancement in young deaf children. In Geers, A. E., & Moog, J. S. (Eds.), Effectiveness of Cochlear Implants and Tactile Aids for Deaf Children: The Sensory Aids Study at Central Institute for the Deaf. *Volta Review, 96,* 85-96.

Geers, A. E. (2003). Predictors of reading skill development in children with early cochlear implantation. *Ear and Hearing, 24*(1 Suppl.), 59S-68S.

Geers, A. E., & Hayes, J. (2011). Reading, writing, and phonological processing skills of adolescents with 10 or more years of cochlear implant experience. *Ear and Hearing, 32*, 49-59.

Geers, A. E., & Moog, J. S. (1994). Spoken language results: vocabulary, syntax, and communication. In Geers, A. E., & Moog, J. S. (Eds.), Effectiveness of Cochlear Implants and Tactile Aids for Deaf Children: The Sensory Aids Study at Central Institute for the Deaf. *Volta Review, 96*, 131-148.

Geers, A. E., Moog, J. S., Biedenstein, J., Brenner, C., & Hayes, H. (2009). Spoken language scores of children using cochlear implants compared to hearing age-mates at school entry. *Journal of Deaf Studies and Deaf Education, 14*, 371-385.

Geers, A. E., Nicholas, J., & Sedey, A. L. (2003). Language skills of children with early cochlear implantation. *Ear and Hearing, 24*(1 Suppl.), 46S-58S.

Gelnett, D., Sumida, A., Nilsson, M., & Soli, S. D. (1995). Development of the Hearing in Noise Test for Children (HINT-C). Presented at the Annual Meeting of the American Academy of Audiology, Dallas, TX.

Goldman, R. (2000). *Goldman-Fristoe Test of Articulation-2*. Circle Pines, MN: American Guidance Service.

Govaerts, P., Daemers, K., Yperman, M., De Beukelaer, C., De Saegher, G., & De Ceulaer, G. (2006). Auditory speech sounds evaluation (A§E®): A new test to assess detection, discrimination and identification in hearing impairment. *Cochlear Implants International, 7*, 92-106.

Grewel, F. (1963). Remarks upon the acquisition of language in deaf children. *Language and Speech, 6*, 37-45.

Harrison, M., & Roush, J. (1996). Age of suspicion, identification and intervention for infants and young children with hearing loss: A national study. *Ear and Hearing, 17*, 55-62.

Harrison, M., Roush, J., & Wallace, J. (2003). Trends in age of identification and intervention in infants with hearing loss. *Ear and Hearing, 24*, 89-95.

Haskins, H. (1949). A phonetically balanced test of speech discrimination for children. Master's thesis. Northwestern University, Evanston, IL.

Holt, R. F., Beer, J., Kronenberger, W. G., Pisoni, D. B., & Lalonde, K. (2012). Contribution of family environment to pediatric cochlear implant users' speech and language outcomes: Some preliminary findings. *Journal of Speech, Language, and Hearing Research, 55*, 848-864.

Holt, R. F., Beer, J., Kronenberger, W. G., & Pisoni, D. B. (in press). Developmental effects of family environment on outcomes in pediatric cochlear implant recipients. *Otology and Neurotology.*

Holt, R. F., & Svirsky, M. A. (2008). An exploratory look at pediatric cochlear implantation. *Ear and Hearing, 29*, 492-511.

Hudgins, C. V., & Numbers, F. C. (1942). An investigation of the intelligibility of the speech of the deaf. *Genetic Psychology Monographs, 25*, 289-392.

James, D., Rajput, K., Brown, T., Sirimanna, T., Brinton, J., & Goswami, U. (2005). Phonological awareness in deaf children who use cochlear implants. *Journal of Speech, Language, and Hearing Research, 48*, 1511-1528.

Jerger, S., Lewis, S., Hawkins, J., & Jerger, J. (1980). Pediatric speech intelligibility test. I. Generation of test materials. *International Journal of Pediatric Otorhinolaryngology, 2*, 217-230.

Johnson, K. C., Eisenberg, L. S., Visser-Dumont, L., Wang, N-Y., Fisher, L. M., Tobey, E. A., Quittner, A. L., Niparko, J. K., & the CDaCI Investigative Team (2012). Rate of growth in speech recognition over five years of follow-up in the CDaCI study. 12th International Conference on Cochlear Implants and Other Implantable Auditory Technologies. Baltimore, MD. May 3-5.

Kennedy, C., McCann, D., Campbell, M. J., Law, C., Mullee, M., Petrou, S., Watkin, P., Worsfold, S., Yuen, H. M., & Stevenson, J. (2006). Language ability after early detection of permanent childhood hearing impairment. *The New England Journal of Medicine, 354*, 2131-2141.

Kirk, K. I. (2000). Challenges in the clinical investigation of cochlear implant outcomes. In J. K. Niparko, K. I. Kirk, N. K. Mellon, A. M. Robbins, D. L. Tucci, & B. S. Wilson (Eds.), *Cochlear implants: Principles & practices* (pp. 225-259). Philadelphia: Lippincott Williams & Wilkins.

Kirk, K. I., Pisoni, D. B., & Osberger, M. J. (1995). Lexical effects of spoken word recognition by pediatric cochlear implant users. *Ear and Hearing, 16*, 470-481.

Kirkham, E., Sacks, C., Baroody, F., Siddique, J., Nevins, M. E., Woolley, A., & Suskind, D. (2009). Health disparities in pediatric cochlear implantation: An audiologic perspective. *Ear and Hearing, 30*, 515-525.

Kishon-Rabin, L., Taitelbaum-Swead, R., Ezrati-Vinacour, R., & Hildesheimer, M. (2005). Prelexical vocalization in normal hearing and hearing-impaired infants before and after cochlear implantation and it is relation to early auditory skills. *Ear and Hearing, 26*(Suppl.), 17S-29S.

Knoors, H., & Marschark, M. (2012). Language planning for the 21st century: Revisiting bilingual language policy for deaf children. *Journal of Deaf Studies and Deaf Education, 17*, 291-305.

Kretschmer, R. R., & Kretschmer, L. W. (1978). *Language development and intervention with the hearing impaired*. Baltimore, MD: University Park Press.

Krose, J., Lotz, W., Puffer, C., & Osberger, M. J. (1986). Language and learning skills of hearing impaired children. *ASHA Monographs, 23*, 66-77. Rockville, MD: American Speech-Language-Hearing Association.

Lach, R., Ling, D., Ling, A. H., & Ship, N. (1970). Early speech development in deaf infants. *American Annals of the Deaf, 115*(5), 522-526.

Lerner, R. M. (1998). Theories of human development: Contemporary perspectives. In R. M. Lerner (Ed.), W. Damo (Series Ed.), Handbook of child psychology: Vol. 1. *Theoretical models of human development* (5th ed., pp 1-24). New York: Wiley.

Levitt, H., McGarr, N. S., & Geffner, D. (Eds.). (1987). Development of language and communication skills in hearing-impaired children. *ASHA Monographs*, Number 26. Rockville, MD: American Speech-Language-Hearing Association.

Lilly, E., & Green, C. (2004). *Developing partnerships with families through children's literature*. Upper Saddle River, NJ: Merril Prentice Hall.

Ling, D., & Milne, M. (1981). The development of speech in hearing-impaired children. In F. H. Bess, B. A. Freeman, & J. S. Sinclair (Eds.), *Amplification in Education*. Washington, DC: Alexander Graham Bell Association for the Deaf.

Markides, A. (1970). The speech of deaf and partially-hearing children with special reference to factors affecting intelligibility. *British Journal of Disorders of Communication, 5*, 126-140.

McWilliam, R., & Scott, S. (2001). A support approach to early intervention: A three-part framework. *Infants and Young Children, 13*, 55-66.

Martinez, A., Eisenberg, L., Boothroyd, A., & Visser-Dumont, L. (2008). Assessing speech pattern contrast perception in infants: Early results on VRASPAC. *Otology and Neurotology, 29*, 183-188.

Mills, D.L., Coffey-Corina, S.A., & Nelville, H.J. (1993). Language acquisition and cerebral specialization in 20-month-old infants. *Journal of Cognitive Neuroscience, 5*, 317-334.

Mills, D.L., Coffey-Corina, S.A., & Nelville, H.J. (1997). Language comprehension and cerebral specialization from 13 to 20 months. *Developmental Neuropsychology, 13*, 397-334.

Mills, D.L., Prat, C., Zangl, R., Stager, C.L., Neville, H.J., & Werker, J.F. (2004). Language experience and the organization of brain activity to phonetically similar words: ERP evidence from 14 – to 20-month olds. *Journal of Cognitive Neuroscience, 16*, 1452-1464.

Miyamoto, R. T., Houston, D. M., & Bergeson, T. (2005). Cochlear implantation in deaf infants. *Laryngoscope, 115*, 1376-1380.

Moeller, M. P. (2000). Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics, 106*, 1-9.

Moeller, M. P., Hoover, B., Putman, C., Arbataitis, K., Bohnenkamp, G., Peterson, B., Wood, S., Lewis, D., Pittman, A., & Stelmachowicz, P. (2007). Vocalizations of infants with hearing loss compared with infants with normal hearing: Part I – Phonetic development. *Ear and Hearing, 28*, 605-627.

Mohr, P. E., Feldman, J. J., Dunbar, J. L., McConkey-Robbins, A., Niparko, J. K., Rittenhouse, R. K., & Skinner, M. W. (2000). The societal costs of severe to profound hearing loss in the United States. International *Journal of Technology Assessment in Health Care, 16*, 1120-1135.

Monson, R. B. (1978). Toward measuring how well hearing-impaired children speak. *Journal of Speech and Hearing Research, 21*, 197-219.

Moog, J. S., & Geers, A. E. (1990). Early Speech Perception Test for profoundly hearing-impaired children. St. Louis: Central Institute for the Deaf.

Moore, J. A., & Bass-Ringdahl, S. (2002). Role of infant vocal development in candidacy for and efficacy of cochlear implantation. *Annals of Otology, Rhinology, and Laryngology, 111*(Suppl. 189), 52-55.

Musselman, C., & Kircaali-Iftar, G. (1996). The development of spoken language in deaf children: Explaining the unexplained variance. *Journal, 1*, 109-121.

Nicholls, G. H., & Ling, D. (1982). Cued speech and the reception of spoken language. *Journal of Speech and Hearing Research, 25*, 262-269.

Nicholas, J. G., & Geers, A. E. (2006). Effects of early auditory experience on the spoken language of deaf children at 3 years of age. *Ear and Hearing, 27*, 286-298.

Nicholas, J. G., & Geers, A. E. (2007). Will they catch up? The role of age at cochlear implantation in the spoken language development of children with severe to profound hearing loss. *Journal of Speech, Language, and Hearing Research, 50*, 1048-1062.

Niparko, J. K, Tobey, E. A., Thal, D. J., Eisenberg, L. S., Wang, N.-Y., Quittner, A. L., & Fink, N. E., for the CDaCI Investigative Team. (2010). Spoken language development in children following cochlear implantation. *Journal of the American Medical Association, 303*, 1498-1506.

Oller, D. K., Eilers, R. E., Bull, D. H., & Carney, A. E. (1985). Prespeech vocalizations of a deaf infant: A comparison with normal meta-phonological development. *Journal of Speech and Hearing Research, 28*, 47-63.

Osberger, M. J. (Ed.) (1986). Language and learning skills of hearing-impaired students. *ASHA Monographs*. Rockville, MD: American Speech-Language-Hearing Association.

Osberger, M. J., & McGarr, N. S. (1982). Speech production characteristics of the hearing impaired. In N. Lass (Ed.), *Speech and Llanguge: Advances in Basic Research and Practice* (Vol. 8). New York: Academic Press.

Peng, S. C., Spencer, L. J., & Tomblin, J. B. (2004). Speech intelligibility of pediatric cochlear implant recipients with 7 years of device experience. *Journal of Speech, Language, and Hearing Research, 47*, 1227-1236.

Pisoni, D. B., & Geers, A. E. (2000). Working memory in deaf children with cochlear implants: Correlations between digit span and measures of spoken language processing. *Annals of Otology, Rhinology and Laryngology, 109*(Suppl. 185), 92-93.

Pressnell, L. M. (1973). Hearing-impaired children's comprehension and production of syntax in oral language. *Journal of Speech and Hearing Research, 16*, 12-21.

Pressman, L., Pipp-Siegel, S., Yoshinaga-Itano, C., & Deas, A. (1999). Maternal sensitivity predicts language gain in preschool children who are deaf and hard of hearing. *Journal of Deaf Studies and Deaf Education, 4*, 294-304.

Quigley, S. P., Montanelli, D. S., & Wilbur, R. B. (1976a). Some aspects of the verb system in the language of deaf students. *Journal of Speech and Hearing Research, 19*, 536-550.

Quigley, S. P., Wilbur, R. B., & Montanelli, D. S. (1976b). Complement structures in the language of deaf students. *Journal of Speech and Hearing Research, 19*, 448-457.

Quittner, A. L., Cruz, I., Barker, D. H., Tobey, E., Eisenberg, L., & Niparko, J. (2013). Effects of maternal sensitivity and cognitive and linguistic stimulation on cochlear implant users' language development over four years. *Journal of Pediatrics, 162*, 343-348

Robbins, A. M., Bollard, P. M., & Green, J. (1999). Language development in children implanted with the Clarion® Cochlear Implant. *The Annals of Otology, Rhinology, and Laryngology, 108*(Suppl. 177), 113-118.

Robbins, A. M., Renshaw, J. J., & Berry, S. W. 1991. Evaluating meaningful auditory integration in profound hearing-impaired children. *American Journal of Otology, 12*(Suppl.), 144-150.

Sameroff, A. J., & Fiese, B. H. (1990). Transactional regulation and early intervention. In S. J. Meisels & J. P. Shankoff (Eds.), *Handbook of early childhood intervention* (pp. 119 – 149). New York: Cambridge University Press.

Schafer, D., & Lynch, J. (1980). Emergent language of six prelingually deaf children. *Teachers of the Deaf, 5*, 94-111.

Schauwers, K., Gillis, S., Daemers, K., De Beukelaer, C., & Govaerts, P. J. (2004). Cochlear implantation between 5 and 20 months of age: The onset of babbling and the audiologic outcome. *Otology and Neurotology, 25*, 263-270.

Schorr, E. A., Roth, F. P., & Fox, N. A. (2008). A comparison of the speech and language skills of children with cochlear implants and children with normal hearing. *Communication Disorders Quarterly, 29*, 195-210.

Sharma, A., Dorman, M. F., & Spahr, A. J. (2002). A sensitive period for the development of the central auditory system in children with cochlear implants: Implications for age of implantation. *Ear and Hearing, 23*, 532-539.

Sininger, Y. S., Grimes, A., & Christensen, E. (2010). Auditory development in early amplified children: Factors influencing auditory-based communication outcomes in children with hearing loss. *Ear and Hearing, 31*, 166-185.

Sininger, Y. S., Martinez, A., Eisenberg, L., Christensen, E., Grimes, A., & Hu, J. (2009). Newborn hearing screening speeds diagnosis and access to intervention by 20-25 months. *Journal of the American Academy of Audiology, 20*, 49-57.

Smith, C. R. (1975). Residual hearing and speech production in deaf children. *Journal of Speech and Hearing Research, 18*, 795-811.

Spencer, L. J., Barker, B. A., & Tomblin, J. B. (2003). Exploring the language and literacy outcomes of pediatric cochlear implant users. *Ear and Hearing, 24*, 236-247.

Spencer, L. J., Tomblin, J. B., & Gantz, B. J. (1997). Reading skills in children with multichannel cochlear-implant experience. *Volta Review, 99*, 193-202.

Stevens, K. N., Nickerson, R. S., & Rollins, A. M. (1983). Suprasegmental and postural aspects of speech production and their effect on articulatory skills and intelligibility. In I Hochberg, H. Levitt, & M. J. Osberger (eds.), *Speech of the hearing impaired: Research, training, and personnel preparation* (pp. 33-51). Baltimore: University Park Press.

Subtelny, J. (1983). Patterns of performance in speech perception and production. In I Hochberg, H. Levitt, & M. J. Osberger (Eds.), *Speech of the hearing impaired: Research, training, and personnel preparation* (pp. 215-230). Baltimore: University Park Press.

Suskind, D., & Gehlert, S. (2009). Working with children from lower SES families: Understanding health disparities. In L. S. Eisenberg (Ed.), *Clinical management of children with cochlear implants* (Chapter 18, pp 555-571) San Diego, CA: Plural Publishing.

Suskind, D., Leffel, K. R., Hernandez, M. W., Sapolich, S. G., Suskind, E., Kirkham, E., & Meehen. (in press). An exploratory study of "quantitative" linguistic feedback"; Effect of LENA feedback on adult language production. *Communication Disorders Quarterly*.

Svirsky, M. A., Chin, S. B., Miyamoto, R. T., Sloan, R. B., & Caldwell, M. D. (2002). Speech intelligibility of profoundly deaf pediatric hearing aid users. *Volta Review, 102*, 175-198.

Svirsky, M. A., Robbins, A. M., Kirk, K. I., Pisoni, D. B., & Miyamoto, R. T. (2000). Language development in profoundly deaf children with cochlear implants. *Psychological Science, 22*, 153-158.

Svirsky, M. A., Teoh, S. W., & Neuburger, H. (2004). Development of language and speech perception in congenitally, profoundly deaf children as a function of age at cochlear implantation. *Audiology and Neurotology, 9*, 224-233.

Sykes, J. L. (1940). A study of the spontaneous vocalizations of young deaf children. *Psychological Monographs, 52*, 104-123.

Tobey, E. A., Geers, A. E., Brenner, C. B., Altuna, D., & Gabbert, G. (2003). Factors associated with development of speech production skills in children implanted by five years of age. *Ear and Hearing, 24*, 36S-45S.

Tomblin, J. B., Barker, B. A., & Hubbs, S. (2007). Developmental constraints on language development in children with cochlear implants. *International Journal of Audiology, 46*, 512-523.

Tomblin, J. B., Barker, B. A., Spencer, L. J., Zhang, X., & Gantz, B. J. (2005). The effect of age at cochlear implant initial stimulation on expressive language growth in infants and toddlers. *Journal of Speech, Language, and Hearing Research, 48*, 853-867.

Tomblin, J. B., Peng, S-C., Spencer, L. J., & Lu, N. (2008). Long-term trajectories of the development of speech sound production in pediatric cochlear implants. *Journal of Speech, Language, and Hearing Research, 51*, 1353-1368.

Uziel, A. S., Sillon, M., Vieu, A., Artieres, F., Prion, J-P., Daures, J. P., & Mondain, M. (2007). Ten-year follow-up of a consecutive series of children with multichannel cochlear implants. *Otology and Neurotology, 28*, 615-628.

VanDam, M., Ambrose, S. E., & Moeller, M. P. (2012). Quantity of parental language in the home environments of hard-of-hearing 2-year-olds. *Journal of Deaf Studies and Deaf Education, 17*, 402-420.

Wang, N-Y., Eisenberg, L. S., Johnson, K. C., Fink, N. E., Tobey, E. A., Quittner, A. L., Niparko, J. K., and the CdaCI Investigative Team. (2008). Tracking development of speech recognition: Longitudinal data from hierarchical assessments in the Childhood Development After Cochlear Implantation Study. *Otology and Neurotology, 29*, 240-245.

Yoshinaga-Itano, C., Sedey, A., Coulter, D., & Mehl, A. (1998). Language of early and later-identified children with hearing loss. *Pediatrics, 102*, 1161-1171.

Zaidman-Zait, A., & Young, R. A. (2008). Parental involvement in the habilitation process following children's cochlear implantation: An action theory perspective. *Journal of Deaf Studies and Deaf Education, 13*, 193-214.

Zimmerman-Phillips, S., Robbins, A. M., & Osberger, M. J. (200). Assessing cochlear implant benefit in very young children. *Annals of Otology, Rhinology, and Laryngology, 109*(Suppl. 185), 42-43.

ABOUT THE DEAFNESS FORUM

Our Patron is Australia's second longest serving prime minister (1996-2007), the Honourable John Howard AC. Hearing impaired since youth, he has worn two hearing aids throughout his professional career.

Deafness Forum Of Australia

The Australian Government funded the establishment of Deafness Forum in 1993 to provide quality advice to it on behalf of the entire deafness sector. This advice, offered consistently over two decades has informed government policy and played an important role in building a fairer and more inclusive nation.

Deafness Forum aims to improve the quality of life for Australians who have a hearing impairment, a chronic ear disorder or are Deaf by:

- advocating for social change
- providing input to government policy and legislation
- generating public awareness
- being a forum for information sharing

LIBBY'S STORY

Libby's story is one of courage and triumph over adversity by utilising the knowledge of her own severe hearing loss to help others.

Libby started to lose her hearing following a bad dose of flu in the English winter soon after her marriage in 1969. Having returned to Australia in 1970 she began to find difficulty in understanding conversation and instructions, particularly on the telephone which was very important in her profession of pharmacy.

In spite of advice to the contrary, Libby tried hearing aids and found they helped. Had she heeded the negative advice, Libby believed she might never have embarked on the road to self-help, which so enriched her own life and that of many others. She thought her two boys quickly learnt to sleep through the night and her friends remarked they had loud voices, which was the boys' mechanism for coping with a deaf mother!

The more the doctors said nothing could be done to help, the more Libby looked towards self help and so she learnt to lip read, a tool she relied on heavily in her quest to help others.

Libby's will to win led her, with the help of others, to get involved with the setting up of a support group, which became SHHH – Self Help for Hard of Hearing people. The American founder, Rocky Stone, was invited to Australia in 1982 and did a lecture tour entitled "The Hurt That Does Not Show" which cemented the bonds between the US and Australian groups and helped the local SHHH develop.

Libby, with others, then began SHHH News, a quarterly publication, and with Bill Taylor set up the first Hearing Information and Resource Centre at "Hillview", Turramurra with support from Hornsby/Kuringai Hospital. This centre provided reliable information on, and demonstrated, assistive listening devices for hearing impaired people. Through this interest, Libby became an enthusiastic user of technology and with her handbag full of electronic aids was enabled to join in a full social life with family and public.

Libby became President of SHHH in 1986 and began to develop her role as an advocate for hearing impaired people generally.

She became involved in ACCESS 2000, under the Australian Deafness Council, and a member of the Disability Council of NSW. Her horizons broadened further as Vice President of the Australian Deafness Council and then as the first, and two terms, President of the newly formed national peak body in deafness, the Deafness Forum of Australia. In this latter role Libby made a huge contribution to bring together all the different organisations into a central body, and actively lobbied on behalf of Deaf and hearing impaired at the highest level – the archetype of a successful achiever despite her profound hearing loss.

For her work on behalf of hearing impaired people Libby was made a Member of the Order of Australia in 1990. Later she was appointed by the Government to the Board of Australian Hearing Services and was asked to represent the needs of hearing impaired on the Olympic Access Committee.

Unfortunately, Libby faced another hurdle when she was diagnosed with breast cancer in 1995. Following surgery, she continued her family and volunteer work with undiminished vigour. She would wickedly show off her wig at public functions after her chemotherapy, and talked openly of her "mean disease". She died peacefully on 1 August 1998 and was honoured by hundreds who attended her Thanksgiving Service on 6 August.

In her own words, Libby related her outlook:

"I look back over these years since I became hearing impaired and realise that any efforts that I have made have been returned to me threefold. I have found talents I never knew I had, I have gained so much from the many people I have met and worked with to improve life for people with disabilities and through self help I have turned the potential negative of a profound hearing loss into a positive sense of purpose and direction in my life".

LIBBY HARRICKS MEMORIAL ORATION SERIES

Since 1999, Orations have been presented annually across Australia by a series of outstanding Orators. To achieve wider and more permanent coverage, the Oration Series is published by Deafness Forum in Monograph form. It is also available in e-copy on the Deafness Forum website www.deafnessforum.org.au.

In order, the Orations to date are:

1999: *'Hearing Access Now!'*
Emeritus Professor Di Yerbury AM (Sydney)

2000: '*Recent Advances in the Understanding of Meniere's Disease and Tinnitus*'
Professor William Gibson AM (International Federation of Hard of Hearing Conference, Sydney)

2001: '*The Politics of Deafness*'
Senator Margaret Reid (National Press Club, Canberra)

2002: *'The Prevalence, Risk Factors and Impacts of Hearing Impairment in an Older Australian Community: The Blue Mountains Study'*
Professor Paul Mitchell (XXVI International Conference of Audiology, Melbourne)

2003: *'Disability Law and People with Hearing Loss: We've come a long way (but we're not there yet)'*. Ms Donna Sorkin MCP BA (Hons) (Macquarie University, Sydney)

2004: '*A Sorry Business: Lack of Progress in Aboriginal Hearing Health*'
Dr Peter Carter (3rd National Deafness Summit, Brisbane)

2005: '*Deafness and Disability Transformed: An Empowering Personal Context*'
Alex Jones (Blue Mountains NSW) (This Oration was presented in Auslan)

2006: '*Hearing Loss: The Silent Epidemic: Who, why, and what can we do about it?*'
Professor Harvey Dillon (4th National Deafness Summit, Perth)

2007: *'Hearing and Communication – A Primary Concern in Aged Care.'*
Richard Osborn (9th Rural Health Conference, Albury)

2008: *'Access, Equity and Hearing Loss in Australia in 2008'*
Professor Robert Cowan (5th National Deafness Summit, Canberra)

2009: *'The Bionic Ear: From an Idea to Reality'* Professor Graeme Clark AC (GP Continuing Education , Sydney)

2010: '*Early Identification of Hearing Loss in Australia: Well Begun is not All Done'*
Professor Greg Leigh (6th National Deafness Summit, Sydney)

2011: *'Molecules,Managers or Mentors: How Can We Minimize Noise Damage in the Worksite?'*
Dr Robert Patuzzi (11th National Rural Health Conference, Perth)

2012: *'A Report Card on the Social Well-being of Deaf and Hearing Impaired People in Australia'*
Dr Anthony Hogan (7th National Deafness Summit, Melbourne)

THE LIBBY HARRICKS MEMORIAL ORATION

The Libby Harricks Memorial Oration program is supported by the Libby Harricks Memorial Fund of the Deafness Forum of Australia. Donations to this fund are tax deductible.

Donations should be made payable to Deafness Forum. Additional donation forms and general information regarding deafness can be obtained from:

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