



# Hearing Review™

Making Education Easy

Issue 20 - 2010

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## Welcome to the twentieth issue of Hearing Review.

A couple of studies in this issue concern primary school children with hearing loss (HL); the findings show that having even only minimal HL impacts greatly upon overall academic achievement. Hearing assessments are thus highly recommended for all young children, especially those who are performing poorly academically.

It seems that all children – whether or not they have HL – benefit from being in classrooms that have installed a sound-field FM amplification. Findings from a First Nations elementary school classroom show that this amplification system significantly improved classroom performance among all students – most especially, their attention levels (something that we all like to hear about).

I hope you enjoy the latest edition and I welcome your comments and feedback.

Kind regards,

**Valerie Looi**

Lecturer in Audiology, University of Canterbury

[valerielooi@researchreview.co.nz](mailto:valerielooi@researchreview.co.nz)

## Temporal stability of music perception and appraisal scores of adult cochlear implant recipients

**Authors:** Gfeller K et al

**Summary:** This research examined whether adult cochlear implant (CI) recipients show significant improvement over time in perceptual acuity or appraisal of specific music listening tasks and whether any particular demographic variables predict those CI recipients most likely to show improvement with extended CI use. The study cohort comprised 209 adult CI recipients with ≥9 months' implant experience before their first year of measurement. Data were collected at the patients' annual visits over two consecutive years. There were no significant differences in music perception outcomes as a function of type of device (brand or model) or processing strategy used. Only familiar melody recognition (FMR) and recognition of melody excerpts with lyrics (MERT-L) showed significant improvement from year 1 to year 2. After adjustment for the baseline effect, significant predictors of FMR improvement included hearing aid use, months of use, music listening habits after implantation, and formal musical training in elementary school. Significant predictors of MERT-L improvement included having bilateral implants, formal musical training in high school and beyond, and a measure of sequential cognitive processing.

**Comment:** The finding that there were no significant differences in music perception and appraisal scores from 1 to 2 years post-implant for 4/6 measures implies that music listening does not improve from circumstantial exposure, and suggests that dedicated training and/or focused listening practice may be required. The only measures to record improvement over time were familiar melody recognition and music excerpt recognition with lyrics. This is probably attributable more to an improvement in speech recognition abilities over time, rather than an improvement in music perception skills. Significant predictors of improved melody recognition were use of a contralateral hearing aid, and increased time spent listening to music post-implant; both were factors unrelated to the implant itself. These factors are important for audiologists to incorporate when counselling potential and new CI recipients, particularly those for whom music is an important part of their lives.

**Reference:** *J Am Acad Audiol.* 2010;21(1):28-34.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844251/?tool=pubmed>



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## Effects of cochlear implants: a qualitative study

**Authors:** Rembar S et al

**Summary:** This qualitative study used four open-ended questions to explore the effects of cochlear implants (CIs) on recipients' lives, as perceived by the recipients themselves. Responses were analysed from 74 adult patients from two Norwegian implant centres. Overall, psychological well-being was improved.

**Comment:** The four open-ended questions used in this study could not only be used by clinicians working with CI recipients, but also those fitting hearing aids (HAs) to gauge patients' satisfaction and outcomes:

- 1) What benefits have you gained from your CI (HA)?
- 2) What shortcomings have you found with your CI (HA)?
- 3) Has your CI (HA) positively affected your emotional well-being?
- 4) Has your CI (HA) negatively affected your emotional well-being?

The latter two questions asked respondents to provide examples of such areas or situations.

The results identified one overarching category ('A new life') and four subcategories – 'Interacting with the world'; 'Experience of oneself'; 'Hearing the world', and 'Device-related issues' – relating to the global impact of a CI on the recipient. The qualitative response analysis provided similar findings to those from existing survey-based QOL studies.

**Reference:** *Cochlear Implants Int.* 2009;10(4):179-97.

<http://www3.interscience.wiley.com/journal/121638854/abstract>

## Short-term hearing aid benefit in a large group

**Authors:** Ivory PJ et al

**Summary:** A revised version of the Self-Assessment of Communication (SAC-Hx) was used to estimate the short-term benefit after hearing aid (HA) fitting in 4584 veterans with an adult-onset hearing loss mild to severe, sloping, symmetrical, sensorineural hearing impairment. Responses to the SAC-Hx were gathered before and at 6 weeks after HA fitting. Post-treatment SAC-Hx scores revealed significant benefit in each category of self-perceived communication consequences, with the greatest magnitude of benefit among new HA users. Duration of experience did not markedly affect the magnitude of benefit, which was comparable among all groups with various durations of experience. Severity of the baseline scores paralleled degree of hearing impairment when impairment was defined using a better ear pure tone average at 1000, 2000, 3000, and 4000 Hz. Also, severity of perceived communication consequences paralleled poorer monosyllabic word recognition. HA treatment proved to be of significant benefit across all categories of hearing impairment.

**Comment:** This large-scale study of 4584 veterans found that HA fitting provided significant communication improvement for 84%, with all levels of hearing impairment benefiting from HAs. Interestingly, those with a profound loss reported the greatest magnitude of benefit, although even those with a mild or minimal loss obtained significant benefits as well.

The SAC-Hx screening tool contains 6 questions related to activity limitations for communication, and one each on participation restrictions, personal emotions, perception of other's attitudes, quality of life, hours of HA use, and overall satisfaction. All use a 5-item Likert response scale. It could easily be administered pre- and post-fitting. There are 2 major factors to consider in interpreting the results, though. Firstly, all the participants were veterans who received their HA(s) for free, and secondly, the follow-up was conducted at approximately only 4 weeks post-fitting.

**Reference:** *Trends Amplif.* 2009;13(4):260-80.

<http://tia.sagepub.com/cgi/content/abstract/13/4/260>

## Familial aggregation of age-related hearing loss in an epidemiological study of older adults

**Authors:** Raynor LA et al

**Summary:** These researchers investigated genetic contributions to presbycusis, using data from audiometric measurements taken at the most recent hearing examination in a population-based Epidemiology of Hearing Loss Study (EHLS). This involved 3510 participants aged between 48 and 100 years. Heritability of presbycusis was estimated using maximum likelihood methods in 973 biological relative pairs from 376 families. Familial aggregation was also evaluated in 594 sibling pairs from 373 sibships. The prevalence of presbycusis increased with age and male sex. Heritability estimates for presbycusis adjusted for age, sex, education level, and exposure to work noise exceeded 50%, and siblings of an affected relative were at 30% higher risk. Estimates of familial aggregation were higher in women than men.

**Comment:** In the USA, presbycusis is the third most prevalent chronic health condition for older adults, with prevalence estimates ranging from 25–40% in those aged ≥65 years, and 40–66% for ages ≥75 years. Existing research suggests that presbycusis is a polygenic disorder, with both genetic and environmental risk factors contributing to its development and progression. In this study, the prevalence rate was between 48% and 57%, and those with a hearing loss (HL) were more likely to be older, male, less educated, with a history of occupational noise exposure. Once adjusted for these 4 factors, the heritability estimate was 0.68. Further, siblings of those with a HL had a 4.69 times higher odds of having a HL than siblings of those without a HL, with this risk ratio greater in women (5.46) than in men (2.51). The sex-specific differences in heritability could also be suggestive of mitochondrial (maternal) inheritance. The role of genetics in presbycusis may help inform prevention and treatment approaches. For example, the presence of a genetic predisposition may suggest the need for greater preventative measures and more frequent hearing checks.

**Reference:** *Am J Audiol.* 2009;18(2):114-8.

<http://aja.asha.org/cgi/content/abstract/18/2/114>

## The benefit of sound-field amplification in First Nations elementary school children in Nova Scotia, Canada

**Authors:** Langlan LA et al

**Summary:** In a First Nations elementary school classroom, use of a sound-field FM amplification significantly improved students' classroom performance – whether or not they had hearing loss (HL). Among the areas that improved – academics, attention, communication, class participation, and school behaviour – the area of attention showed the greatest increase during use of amplification. The researchers suggest that it is the most readily influenced behaviour.

**Comment:** The findings that sound-field amplification (SFA) benefits all children, irrespective of whether they have a HL or not, suggests that its use in classroom environments should be seriously considered. It may be particularly warranted for low-decile schools, and/or those with a higher proportion of Māori or Pacific Island students. It is well recognised that the occurrence of otitis media and associated HL is significantly higher in Indigenous populations. Further, the fluctuating and asymptomatic nature of HL makes it hard for teachers and parents to identify, and hence the use of SFA can help to minimise the educational impact of unidentified HL. SFA tends to amplify the teacher's voice by approximately 10dB, improving the signal-to-noise ratio by 10–20dB across the whole classroom, regardless of the position of the student or teacher. Further, teachers themselves reported that children are more attentive and able to understand them better, and that SFA was easy to use and reduced voice fatigue. Schools, community groups, teachers and parent groups may wish to consider potential sources of funding to assist with the purchase of SFA systems for classrooms.

**Reference:** *Aust N Z J Audiol.* 2009;31(2):55-71.

<http://search.informit.com.au/documentSummary;dn=706438507116291;res=IELHEA>

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## Effect of age on directional microphone hearing aid benefit and preference

**Authors:** Wu Y-H

**Summary:** In order to determine whether older and younger adults obtain and perceive comparable benefit afforded by directional microphone hearing aids (DMHAs), 24 hearing-impaired adults aged between 36 and 79 years were fitted with switchable-microphone hearing aids and tested in the laboratory and the field. Laboratory assessments used speech-recognition-in-noise tests to measure the listeners' directional benefit and preferences for microphone modes (directional vs omnidirectional). A four-week field trial used a paired-comparison technique and paper-and-pencil journals to determine the benefit provided by directional processing. After controlling for the effect of hearing loss, age did not have a significant effect on directional benefit and preference as measured in the laboratory. However, in the real world setting, older users tended to perceive less benefit from DMHAs than that reported by younger users.

**Comment:** Although the theoretical benefits of directional microphones (DM) are well marketed, there is little evidence showing that older listeners benefit substantially from it. This study found that whilst both older and younger users benefit from DMs in a laboratory setting, older users report less benefit than younger ones in the real world. The authors suggested that this discrepancy may be due to age-related social and cognitive changes. For example, older adults often have a more restricted social network and social schedule, tending to maintain a smaller circle of close friends. Hence, as they may encounter fewer difficult listening environments, or less demanding environments, and most of their communication may be with familiar talkers, the potential of DM benefit is reduced. Clinicians may need to consider their clients' social lifestyles in determining the potential cost-benefit of DMs. Further, factors related to cognitive aging may have affected the results; previous research has shown that older adults may be less able to compare between 2 tasks (e.g. comparing microphone modes whilst trying to carry out a conversation), and subsequently recalling the differences perceived at a later time.

**Reference:** *J Am Acad Audiol.* 2010;21(2):78-89.

<http://tinyurl.com/ykxnaf2>

## Multi-site diagnosis and management of 260 patients with auditory neuropathy/dys-synchrony (auditory neuropathy spectrum disorder)

**Authors:** Berlin CI et al

**Summary:** These researchers discuss test results and management data compiled over a >20-year period involving 260 patients with diagnoses of Auditory Neuropathy Spectrum Disorder (ANS), of whom 85 had received hearing aids and 49 had tried cochlear implants (CIs). Approximately 15% reported some benefit from hearing aids for language learning, while improvement in speech comprehension and language acquisition was reported in 85% of patients who were implanted. All patients showed absent/grossly abnormal auditory brainstem responses, often 'ringing' cochlear microphonics, and the presence or history of otoacoustic emissions. Factors relating to the birth and postnatal period for 153 patients in the database in the age range of birth to 18 years revealed that only 59 (38.5%) reported normal birth and neonatal history. Multiple risk factors were common for many patients and included premature birth, hyperbilirubinaemia, exchange transfusions, anoxia, etc.

**Comment:** In this article on 260 subjects with ANSD, some of the interesting findings included that 19 had unilateral ANSD, 32 had another family member with ANSD, 23 had concurrent neuropathies, 73 were born prematurely, 74 had hyperbilirubinaemia, and 44 had been administered ototoxic drugs. There was a wide range of levels of hearing loss, but only 25 subjects had word recognition in quiet scores >0%, and just 5 had any word recognition ability in both quiet and noise. Only 12 (15%) of the 85 who had tried HAs obtained 'some' or 'good' benefit from them, although 42 (86%) of the 49 CI recipients were reported to be 'successful'. Thirteen (5%) of the children developed speech and language without the need of any intervention. One interesting clinical testing finding was that middle-ear muscle reflexes (acoustic reflex) were absent in 90% of patients at all frequencies assessed, with no patient having normal reflexes across all frequencies.

**Reference:** *Int J Audiol.* 2010;49(1):30-43.

<http://informahealthcare.com/doi/abs/10.3109/14992020903160892>

## On the benefits of using chained stimuli for frequency-specific ABR acquisition

**Authors:** Petoe M et al

**Summary:** This study analysed the latency variance in Wave V for auditory brainstem responses evoked by representative chained stimuli (tone-pulse series stimulation with simultaneous Gliding Highpass Noise Masker; 'GHINOMA') and conventional nonchained stimuli (tone bursts). The results showed that these 'chained stimuli' attain frequency-specific ABR waveforms in less time than conventional stimuli, without compromising the 'quality' of obtained waveforms.

**Comment:** Tone-burst ABRs usually require around 2 hours to obtain a clear diagnostic picture for non-sedated patients. ABR test time depends on the rate of stimulus presentation, the number of averages required for a satisfactory signal-to-noise ratio, and the number of frequencies to be tested. The use of chained stimuli has been trialled to cut test time. Chained stimuli may minimise adaptation effects caused when the stimulus repetition rate in tone-burst ABR is increased. Instead, several discrete stimuli are interleaved to maximise acquisition efficiency, based on the assumption that different neural populations will be sequentially stimulated if the frequency separation is sufficient. It also enables the benefits of forward masking to be exploited. The results of this study show that chained stimuli ABRs may be acquired in approximately ¾ the time taken for tone-burst ABRs when testing 8 frequencies. No compromise in morphology, Wave V amplitude, or test-retest reliability was observed. Hence, there is potential for more widespread use in clinical settings.

**Reference:** *Aust N Z J Audiol.* 2009;31(2):80-95.

<http://search.informit.com.au/documentSummary;dn=706624836828873;res=IELHEA>

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## Children with minimal conductive hearing impairment: speech comprehension in noise

**Authors:** Keogh T et al

**Summary:** These Australian researchers report findings from a cohort of 1071 primary school children (5.3–11.7 years), 10.2% of whom had conductive hearing loss in 1 or both ears. In a subset analysis of binaural speech comprehension scores for 540 children, those with bilateral conductive hearing loss had the lowest mean scores of 60.8–69.3% obtained under noise conditions. These scores were significantly lower than the corresponding scores of 69.3–75.3% obtained by children with possible middle ear disorders but no apparent hearing loss, 70.5–76.5% obtained by children with a unilateral conductive hearing loss and 72.0–80.3% obtained by their normally hearing peers.

**Comment:** The issue of minimal (or mild) HL and its impact is hotly debated, and is of additional importance in determining both the referral guidelines and follow-up procedures for the UNHSEIP. For example, the level to which newborns are screened will affect whether those with a mild loss are even identified. Although this study focused on the prevalence and effect of a minimal conductive loss in school-aged children, it provides insight into the educational impact of minimal HLs.

Ten percent of the 1071 children had a conductive loss in at least one ear, with 19% failing tympanometry testing. Those who failed the hearing test had a mild or moderate loss. Speech-in-noise results were significantly poorer for children with a bilateral conductive loss than the control group. However, even children who had normal hearing but failed tympanometry testing (i.e. suggesting some middle ear dysfunction), and those with a unilateral conductive loss, scored poorer than the controls. These findings have implications when considering the educational development of children. For example, speech-in-noise performance can be affected even without a noticeable HL (e.g. slight ME dysfunction or unilateral losses).

**Reference:** *Audiol Neurotol.* 2010;15:27-35.

<http://content.karger.com/ProdukteDB/produkte.asp?doi=10.1159/000218360>

*Independent commentary by Dr Valerie Looi, a Lecturer in Audiology for the Department of Communication Disorders at the University of Canterbury. Her primary areas of research are in the field of cochlear implants, along with the music perception of those with a hearing impairment. She is particularly interested in developing a music training programme for cochlear implant users.*

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## The effect of mild hearing loss on academic performance in primary school children

**Authors:** Khairi MDM et al

**Summary:** This cross-sectional study from Malaysia reports findings on hearing loss (HL) and its association with academic performance among 257 primary school children enrolled in grade five (~11 years of age) at five schools that each contained three classes (A, B and C) of grade five. Student selection into these classes was determined by their final term examination in standard four. Class A was for the highest academic achievers while class C was for the poorest. Pure tone audiometry hearing tests were completed by a total of 234 students; 149 (64%) were from class A and 85 (36%) were from class C.

**Comment:** Whereas the previous article looked specifically at speech-in-noise performance, this article looked at overall academic performance. Existing research has reported that younger children with a mild sensorineural HL scored lower on tests of reading, vocabulary, language development, word analysis, spelling and science ( $p < 0.001$ ). By grades 6–9, the differences are less marked.

Fifteen percent of the children in this study had a mild HL; of these, 89% were conductive, with the others being sensorineural. Of the children with a HL, 70% were in the poorest academic class; the school streamed children into 3 classes per grade level based on academic performance. Impacted cerumen and otitis media with effusion were the 2 most common causes of HL. Keeping in mind that the average ambient noise level in a class is over 70dB(A), it would seem that even a mild HL could significantly impede a child's ability to reach their academic potential.

**Reference:** *Int J Pediatr Otorhinolaryngol.* 2010;74(1):67-70.

<http://tinyurl.com/yzk4tr4>

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