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Welcome to the fifth issue of Hearing Review.

Hearing Review is a unique New Zealand publication providing topical, relevant and accessible information for healthcare professionals working in the area. In each edition our independent reviewers hand-pick some of the most important studies from key international and local journals. The Review summarises each study in an easy to read format, and our local experts provide commentary on the importance of the work and implications for clinical practice in New Zealand. Web links to the abstract or fully published papers are also provided where possible so you can make your own judgements.

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

Kind regards,

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Receptive language and speech production in children with auditory neuropathy/dyssynchrony type hearing loss

Authors: Rance G et al

Summary: This study compared the receptive language and speech production abilities of 12 school-aged children (aged between 57 and 167 months) with auditory neuropathy/dyssynchrony (AN/AD) with those of a matched cohort of children with sensorineural (SN) hearing loss. Each of the AN/AD subjects was a full-time hearing aid user or had been just before testing. The Peabody Picture Vocabulary Test (PPVT) was used to assess receptive language skills, while the Diagnostic Evaluation of Articulation and Phonology (DEAP) and a Speech Intelligibility Rating Scale measured speech production ability. Test results revealed that receptive vocabulary and speech production were delayed (to varying degrees) in each of the AN/AD subjects, compared with normally hearing children. The group PPVT Language Quotient score was 0.65 and the average number of pronunciation errors was 11% higher than expected for age. However, testing outcomes for both language and speech production were similar for both groups of children. The authors conclude that while AN/AD type hearing loss can pose a significant developmental risk, conventional amplification aids can assist in developing reasonable speech and language abilities.

Comment: This study is timely, as it provides a fresh insight into the speech and language abilities of school-aged children with AN/AD type hearing loss. Although this study is based on a small sample, it appears that these children's receptive language and speech production errors are likely to parallel those with sensorineural hearing loss, and some of them also benefit from using amplification devices.

<http://dx.doi.org/doi:10.1097/AUD.0b013e31812f71de>

Reference: *Ear Hear.* 2007;28:694-702

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Test-retest reliability of wideband reflectance measures in infants under screening and diagnostic test conditions

Authors: Vander Werff KR et al

Summary: This study investigated the test-retest reliability of wideband reflectance (WBR) measures in infants under screening and diagnostic hearing test conditions. The study also examined WBR test results for infants who passed and failed otoacoustic emission (OAE) screening, to determine whether these measures distinguished between the two groups. Repeated WBR measures were collected from a total of 127 infants, tested in an outpatient hearing screening setting or in a diagnostic test setting. Ten adults also underwent testing and served as controls. Findings revealed smaller mean test-retest differences for the diagnostic group compared with the screening group. Test-retest differences were largest under a reinsertion condition and for frequencies below 500 Hz. While the low frequencies were variable, the test-retest differences were smallest in the mid-frequency range; the frequency range thought to be most sensitive to middle ear dysfunction. Test-retest performance did not differ between infants who passed or failed OAE screening. However, infants who failed OAE screening had significantly higher WBR in the range from 630 to 2000 Hz than infants who passed OAE screening. The study concludes that while test-retest performance was poor for frequencies below 500 Hz, test-retest differences were generally small across the important mid-frequency range.

Comment: WBR measures are a more meaningful way of evaluating middle ear function. Simply put, WBR is a measure of the dynamic properties of the middle ear system across frequencies. The small test-retest differences in the mid-frequency region which is the most sensitive region for middle ear dysfunction make WBR a reliable tool for measuring middle ear dysfunction. The WBR measures also relate well to pass/fail outcomes on OAE screening, thus making it a potentially useful addition to OAEs in newborn hearing screening programmes.
<http://dx.doi.org/doi:10.1097/AUD.0b013e31812f1b1>

Reference: *Ear Hear.* 2007;28:669-81

Audiovisual integration and lipreading abilities of older adults with normal and impaired hearing

Authors: Tye-Murray N et al

Summary: This study aimed to determine how age-related hearing impairment affects lipreading and auditory-visual integration in two groups of adults aged >65 years; 53 with normal hearing and 24 with mild-to-moderate hearing impairment. Testing comprised auditory-only (A), visual-only (V), and auditory-visual (AV) speech perception, using consonants, words, and sentences as stimuli. Measures of V and AV speech perception revealed generally similar outcomes for the two groups of participants. However, adults with hearing impairment performed significantly better than those with normal hearing on V identification of words. Moreover, further analyses revealed that visual enhancement, auditory enhancement, and auditory-visual integration did not differ as a function of hearing status. In conclusion, the overall results suggest that although older adults with hearing impairment rely increasingly on visual speech information, their V speech perception or auditory-visual integration is no better than that of age-matched individuals with normal hearing. "These findings indicate that inclusion of V and AV speech perception measures can provide important information for designing maximally effective audiological rehabilitation strategies", the authors state.

Comment: This study has shown that although older adults with hearing loss do rely more on visual information for word identification, they were no different from normal hearing adults on visual speech perception or visual-auditory integration. As the authors have pointed out, these findings might motivate clinicians to seriously consider measuring the visual-only and audiovisual integration skills of their clients before embarking on a comprehensive rehabilitation program.

<http://dx.doi.org/doi:10.1097/AUD.0b013e31812f7185>

Reference: *Ear Hear.* 2007;28:656-68

Sleep complaints in elderly tinnitus patients: a controlled study

Authors: Hébert S and Carrier J

Summary: This study investigated sleep difficulties in 51 patients with tinnitus, who were matched for health and relevant socioeconomic factors with 51 subjects who did not have tinnitus. Participants were assessed with the Pittsburgh Sleep Quality Index (PSQI), the Beck-II depression inventory, a hyperacusis questionnaire, and a tinnitus-reaction questionnaire (tinnitus group only). Results revealed greater self-reported sleep difficulties among tinnitus patients compared with control subjects, specifically regarding sleep efficiency and sleep quality, and that high tinnitus-related distress is associated with greater sleep disturbance. The authors conclude that sleep complaints in tinnitus patients are mainly explained by hyperacusis, and to a lesser extent by subclinical depressive symptoms, rather than hearing loss.

Comment: It is well known that most tinnitus sufferers have difficulties with sleep. While most clinicians tend to subscribe to the view that sleep problems are due to the underlying stress or depression associated with the tinnitus, the results of this study indicate that sleeping disturbances are largely attributable to hyperacusis rather than the depressive symptoms.

<http://dx.doi.org/doi:10.1097/AUD.0b013e31812f71cc>

Reference: *Ear Hear.* 2007;28:649-55

Independent commentary by Dr Ravi Sockalingam, Senior lecturer, Communications Disorders, University of Canterbury.

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An assessment of threshold shifts in nonprofessional pop/rock musicians using conventional and extended high-frequency audiometry

Authors: Schmuziger N et al

Summary: This study sought to determine the clinical value of extended high-frequency audiometry for the detection of noise-induced hearing loss, by assessing the relative temporary threshold shift (TTS) in both the conventional frequency range and the extended high-frequency range. Pure-tone thresholds from 0.5 to 14 kHz were measured in both ears of 16 non-professional pop/rock musicians (mean age 35 years), before and after a 90-minute rehearsal session. All had experienced repeated exposures to intense sound levels during at least 5 years of their musical careers. After the rehearsal, median threshold levels were significantly poorer for frequencies from 0.5 to 8 kHz, but were unchanged in the extended high-frequency range from 9 to 14 kHz. Decreases in the median threshold values measured before the rehearsal were present across the conventional frequency range, most notably at 6 kHz, but were not observed in the extended high-frequency range. In conclusion, these results do not appear to support the use of extended high-frequency audiometry for early detection of noise-induced hearing loss, say the authors.

Comment: The results of this preliminary study are interesting, as they effectively negate the value of extended high-frequency audiometry, which has been found to be generally useful in audiometric monitoring of drug-induced ototoxicity. That said, more studies like these employing larger population samples, including those with normal baseline hearing thresholds, are needed.

<http://dx.doi.org/doi:10.1097/AUD.0b013e31812f7144>

Reference: *Ear Hear.* 2007;28:643-8

Noise-induced permanent threshold shifts in the occupational noise and hearing survey: an explanation for elevated risk estimates

Authors: Dobie RA

Summary: Noise-induced permanent threshold shift (NIPTS) values were estimated from the 1968–1972 Occupational Noise and Hearing Survey (ONHS) data and compared with NIPTS predictions from an international standard (ISO-1999). The study also sought to determine why excess risk estimates based on the ONHS are so much higher than those based on ISO-1999. Binaural average thresholds from 0.5 to 6 kHz were calculated for each of 1291 noise-exposed subjects (80 to 94 dBA, for up to 30 years, all tested just before their shifts) and 665 non-noise-exposed control subjects (mostly office workers, tested throughout the work day). In the 3 to 6 kHz region, median NIPTS estimates were generally consistent with the NIPTS predictions of ISO-1999. At lower frequencies, especially at 0.5 and 1 kHz, the ONHS estimates were significantly larger than the ISO-1999 predictions, even for exposures below 90 dBA; however, these differences did not increase systematically with exposure level and duration. The authors surmise that although differences between exposed and control low-frequency thresholds in the ONHS are higher than predicted by ISO-1999, these differences probably relate more to socioeconomic or test procedure effects than to occupational noise exposure. They conclude that these low-frequency effects explain why the ONHS excess risk estimates exceed those based on ISO-1999.

Comment: This study is the first to compare NIPTS estimates from the ONHS to the ISO standard based on ISO-1999 that is typically used in Europe. Except for the low frequencies where the ONHS risk estimates were larger than those based on ISO-1999, the two estimates did measure up quite well against each other.

<http://dx.doi.org/doi:10.1097/AUD.0b013e31806dc286>

Reference: *Ear Hear.* 2007;28:580-91

Effect of stimulus bandwidth on auditory skills in normal-hearing and hearing-impaired children

Authors: Stelmachowicz PG et al

Summary: This study examined the effects of stimulus bandwidth on auditory skills in children aged 7–14 years; 32 had normal hearing and 24 had sensorineural hearing loss. Participants were tested in four different auditory tasks: 1) nonsense syllable perception, 2) word recognition, 3) novel-word learning, and 4) listening effort. Auditory stimuli recorded by a female talker were low-pass filtered at 5 and 10 kHz and presented in noise. For the children with normal hearing, significant bandwidth effects were observed for the perception of nonsense syllables and for words but not for novel-word learning or listening effort. In the 10 kHz bandwidth condition, children with hearing loss showed significant improvements for monosyllabic words but not for nonsense syllables, novel-word learning, or listening effort. However, further analyses revealed marked improvements for the perception of specific phonemes; e.g., bandwidth effects for the perception of phonemes /s/ and /z/ were not only significant but much greater than those seen in the normal-hearing group. These findings show that a restricted stimulus bandwidth can negatively affect the perception of /s/ and /z/ spoken by female talkers, say the authors. They conclude that in the light of how important these phonemes are in the English language and how early caregivers tend to be female, perceiving these sounds incorrectly may adversely impact both phonological and morphological development.

Comment: The new generation advanced hearing aids have bandwidths up to 12 kHz. With these aids, we can expect children with hearing loss to better perceive the words and the high-pitched sibilants. More research, however, is needed to document these improvements over time as children mature in their ability to process auditory information.

<http://dx.doi.org/doi:10.1097/AUD.0b013e31806dc265>

Reference: *Ear Hear.* 2007;28:483-94

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The Words-in-Noise (WIN) test with multitalker babble and speech-spectrum noise maskers

Authors: Wilson RH et al

Summary: This study evaluated the criterion validity of the Words-in-Noise (WIN) test by comparing recognition performances under multitalker babble (MTB) and speech-spectrum noise (SSN) conditions in listeners with normal hearing and listeners with hearing loss. The MTB and SSN had identical rms and similar spectra but different amplitude-modulation characteristics. For the listeners with normal hearing, performances were 2 dB better in MTB than in SSN, and about 10 dB better than the performances by the listeners with hearing loss; these were about 0.5 dB better in MTB with 56% of the listeners better in MTB and 40% better in SSN. The slopes of the functions for the normal-hearing listeners were steeper than the functions for the listeners with hearing loss (8–9%/dB vs 5–6%/dB). The data indicate that the WIN has good criterion validity.

Comment: Most of us would agree that this “words-in-noise” test would be a welcome addition to a battery of tests we could see ourselves using especially with our paediatric population. At present, we lack a valid and reliable test to measure word recognition in noise in children.

Reference: *J Am Acad Audiol.* 2007;18:522-9

PMID: 17849640

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Hearing aid maximum output and loudness discomfort: are unaided loudness measures needed?

Authors: Mackerse CL

Summary: This evaluation of a clinical protocol for setting hearing aid maximum output (MPO) in adult users involved matching of prescriptive targets for MPO followed by aided loudness validation and adjustment. Twenty-eight adults fitted with multichannel hearing aids during the previous two years were recalled for unaided loudness measures. During the recall visit, unaided frequency-specific loudness discomfort levels were measured for frequencies between 250 and 3000 Hz. These values were converted to real-ear levels by adding individually measured real-ear dial differences. Real-ear saturation responses (RESR) were measured using a 90 dB pure-tone sweep and compared to the real-ear loudness discomfort levels. All participants completed the Abbreviated Profile of Hearing Aid Benefit (APHAB) Aversiveness scale and Munro-Patel loudness questionnaire. Twenty of the participants also completed the Profile of Aided Loudness. The average RESR-UCL difference was –5.7 dB, and the maximum difference was 15 dB. For all but one participant, the average RESR values (0.5–3 kHz) were either less than or no more than 5 dB above the loudness discomfort levels, and the aided APHAB Aversiveness scores were below the 80th percentile. No significant correlations were observed between the scores on the loudness questionnaires and the differences between RESR and loudness discomfort level values. The authors conclude that, according to these findings, unaided loudness discomfort level measures may be redundant if aided loudness validation measures are completed.

Comment: This study has important implications for clinical practice. Unaided loudness levels are often measured as part of the diagnostic work-up prior to hearing aid fitting, but if we are measuring aided loudness as part of the real ear measures, we could be saving valuable clinical time by measuring just the latter.

Reference: *J Am Acad Audiol.* 2007;18:504-14

PMID: 17849638

Influence of music and music preference on acceptable noise levels in listeners with normal hearing

Authors: Gordon-Hickey S and Moore RE

Summary: This study aimed to determine whether acceptable noise level (ANL) for music was different from ANL for twelve-talker babble and whether any correlation existed between ANL for music samples and preference for those music samples. According to the results, ANL for music tended to be better than ANL for twelve-talker babble, indicating that listeners were more willing to accept music as a background noise than speech babble. Moreover, ANL for the music samples did not correlate with preference for the music samples, indicating that ANL for music was not related to music preference. It appeared that music was processed differently from twelve-talker babble as a background noise, conclude the authors.

Comment: The findings of this study seem to have significant implications for the perception of music using hearing aids. It would be interesting to correlate ANL for music with acceptability of hearing aids for music listening. But then again, the acceptability of hearing aids would depend upon a range of factors – quality of the hearing aids used, acoustics of the room, and the type of music, just to name a few.

Reference: *J Am Acad Audiol.* 2007;18:417-27

PMID: 17715651

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