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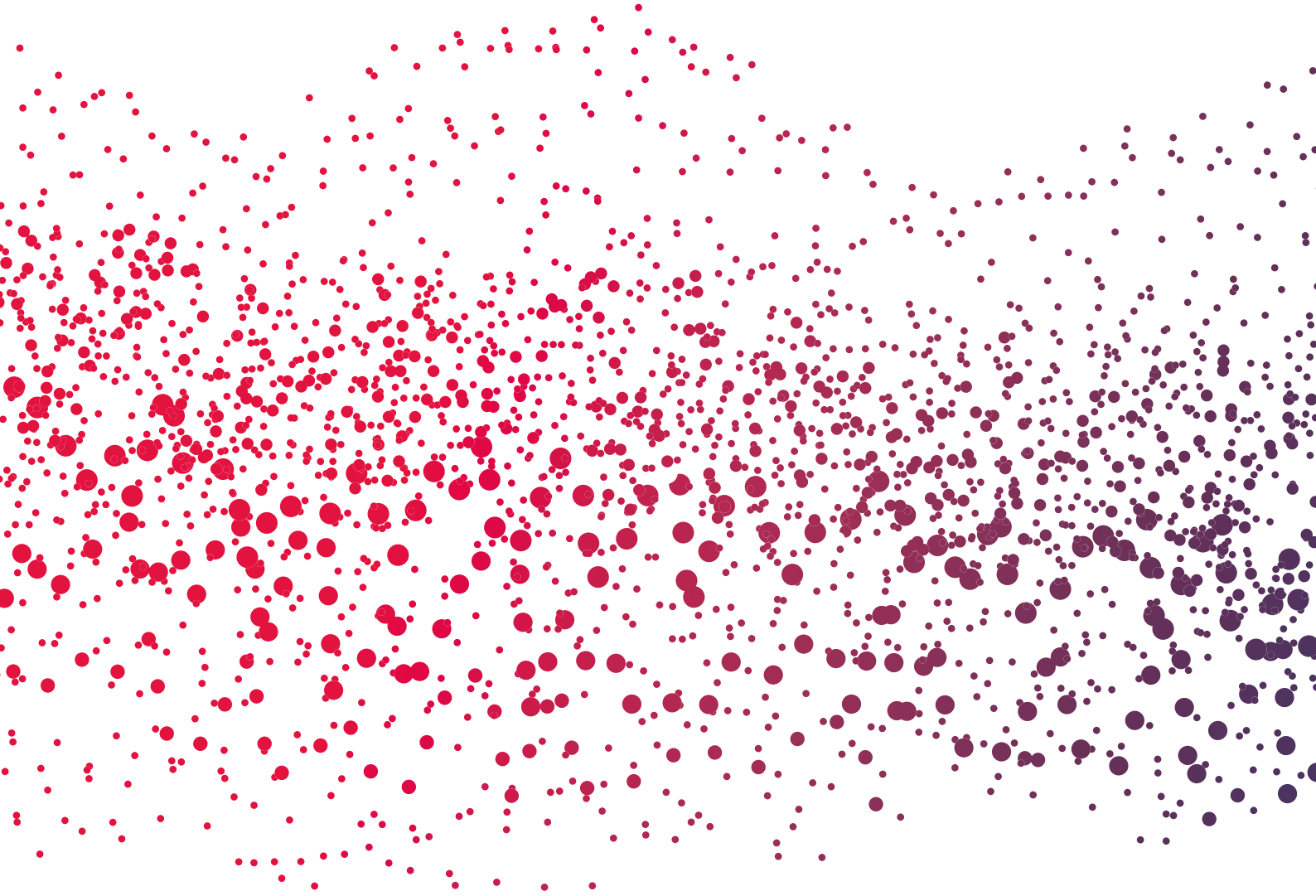
Otology & Audiology Article Review



JULY 2017

July 2017

- Page 06: Melissa Babbage – New Zealand ✓:
  - Changes in psychosocial measures after a 6-week field trial.
    - *Jamie Desjardins & Karen Doherty.*
    - *American Journal of Audiology, Vol. 26 (June 2017) p119–128.*
    - *This study is correlational but suggests that a hearing aid trial can change personal attitudes towards wearing hearing aids and decrease hearing handicap. This is valuable information for clinicians to consider when encouraging patients to engage in hearing aid trials.*
- Page 08: Melissa Babbage – New Zealand ✓:
  - Efficacy of Bone-Anchored Hearing Aids in Single-Sided Deafness: A Systematic Review.
    - *Gaeun Kim et al.*
    - *Otology & Neurotology 38 (2017) p 473-483.*
    - *This study provides a good review of current data regarding the efficacy of BAHAs in restoring some hearing functions in patients with SSD. Patients with BAHAs can expect a significant improvement in their ability to discriminate speech in noise but not in their ability to localise sounds.*
- Page 10: Min Roh – New Zealand ✓:
  - Endolymphatic hydrops in patients with unilateral and bilateral Meniere's disease.
    - *Morimoto K, Yoshida T, Sugiura S, Kato M, Kato K, Teranishi M, Naganawa S, Nakashima T & Sone M.*
    - *Acta Oto-Laryngologica, 2017, 137(1), p 23-28.*
    - *There was a significant association between the duration of Meniere's disease and hearing level on the affected side. Furthermore, there was a positive correlation between the degree of endolymphatic hydrops in the cochlea and hearing level in the affected ear.*
- Page 12: Tine De Boodt – Belgium & Min Roh – New Zealand ✓:
  - Speech Intelligibility as a Cue for Acceptable Noise Levels.
    - *Recker KL and Micheyl C.*
    - *Ear & Hearing, 2017, 38(4), 465-474.*
    - *The results showed that for normal hearing participants, a high SII (>98%) was maintained throughout the 4 levels of speech used in the ANL. This means that the participants chose ANLs that would have allowed them to essentially 'follow' the speech passage presented. For participants with hearing loss, the SII was seen to increase with each increasing speech presentation level. This means that for this group speech intelligibility is not the primary listening cue used to determine ANL.*
- Page 14: Min Roh – New Zealand ✓:
  - Prevalence of Auditory Problems in Children With Feeding and Swallowing Disorders.
    - *Vishakha Waman Rawool.*
    - *Journal of Speech, Language, and Hearing Research, 2017, 60(5), 1436–1447.*
    - *This study suggests that children with feeding and swallowing disorders have a significantly higher prevalence of excessive cerumen, middle ear dysfunction, and hearing loss. These results promote the inclusion of audiologists in the multidisciplinary management of a child with feeding and swallowing disorders, and by doing so will maximise the overall benefit of intervention.*
- Page 16: Min Roh – New Zealand ✓:
  - Pilot Electroacoustic Analyses of a Sample of Direct-to-Consumer Amplification Products.
    - *Reed NS, Betz J, Lin FR, & Mamo SK.*
    - *Otology and Neurology, 2017, 38(6), 804-808.*
    - *The authors conclude that although there is great heterogeneity in the quality and performance of DTCs, they have vastly improved in performance since their early days, and suggest that otolaryngologists and other hearing care professionals be aware that some DTCs are capable of providing appropriate amplification for a person with mild-to-moderate ARHL. However, it is crucial to understand that*

modern hearing aids are much more capable at amplifying certain frequencies, and that the hearing impaired need much more than greater audibility of frequencies in an audiogram.

- Page 18: Min Roh – New Zealand ✓:
  - Middle-Ear Sound Transmission Under Normal, Damaged, Repaired, and Reconstructed Conditions.
    - *Dong W, Tian Y, Gao X, & Jung TTK.*
    - *Otology and Neurology, 2017, 38(4), 577-584.*
    - *The medical glue and PORP (partial ossicular replacement prosthesis) strategies used in this study resulted in a more rigid ossicular chain (tight coupling with the stapes), which may have affected the complex motion of the ossicular chain at the higher frequencies as mentioned above. Thus it may be necessary to develop repair and reconstruction techniques that mimic the 3D motion of the ossicular chain as closely as possible.*
- Page 19: Tom De Neve – Belgium :
  - The Influence of Noise Reduction on Speech Intelligibility, Response Times to Speech, and Perceived Listening Effort in Normal-Hearing Listeners.
    - *Maj van den Tillaart-Haverkate et al.*
    - *Trends in Hearing, Volume 21 23 May 2017: 1–13.*
    - *Objective benefit was measured for both noise-reduction algorithms in that they reduced the response time to digit triplets at high SNRs (SI>97%). Subjectively, rated listening effort showed a significant benefit of IBM (ideal binary mask) only.*
- Page 21: Laure Huighe – Belgium ✓:
  - Stages of change in audiology: comparison of three self-assessment measures.
    - *Elisabeth Ingo et al.*
    - *International Journal of Audiology 2017; 56: p 516–520.*
    - *This study found a correlation between the three stages of change measures. Further investigation to evaluate the predictive value of the measurements is needed.*
- Page 22: Reddy Sivaprasad – India ✓:
  - Sudden Hearing Loss Due to Anterior Inferior Cerebellar Artery Infarction.
    - *Maeda Y et al.*
    - *Otology & Neurology, 2017; Vol. 38 (2), e3-e4.*
    - *This case study shows how blood supply can selectively, and at an early stage, affect inner ear functioning – hearing and balance. The study also shows the recovery pattern in line with immediate medical care.*
- Page 23: Reddy Sivaprasad – India ✓:
  - The Association between Hearing Loss, Postural Control, and Mobility in Older Adults: A Systematic Review.
    - *Maayan A et al.*
    - *Journal of the American Academy of Audiology, 2017; Vol. 28 (6), 575-588.*
    - *This systematic review analysed 32 research publications on HL leading to postural control problems. The study established specific objective measures of postural control found to be abnormal in people with hearing loss. The study clearly delineates the need for modification of fall prevention programmes to include treatment of HL as an important component.*
- Page 25: Reddy Sivaprasad – India ✓:
  - Cochlear synaptopathy in acquired sensorineural hearing loss: Manifestations and mechanisms.
    - *Liberman MC and Kujawa SG.*
    - *Hearing Research, 2017; Vol. 349, 138-147.*
    - *This is a review study introducing a new understanding of SNHL and the need for changes in treatment and hearing conservation programs. The study created a nice framework to understand a series of studies so that several clinical questions may be answered. The study highlights the immediate need for*

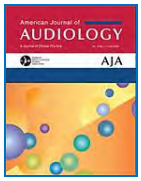
professionals to update their knowledge on Cochlear Synaptopathy and also upgrade their clinical setup to identify them at the right stage.

- Page 27: Reddy Sivaprasad – India ✓:
  - The new classification system for inner ear malformations: the INCAV system.
    - *Adibelli ZH et al.*
    - *Acta Oto Laryngologica, 2017; Vol. 137 (3), 246-252.*
    - *Inner ear malformations are common in children with SNHL. Classification of these malformations is crucial for taking decisions such as CI candidacy. This study proposed a clear-cut classification system separately for the results of MRI and CT scans which describes the defects in 5 inner ear structures and the degree of malformation ranging from 0-6.*
- Page 28: Barry Downes – United Kingdom ✓:
  - Exploring Audiologists' Language and Hearing Aid Uptake in Initial Rehabilitation Appointments.
    - *Anna Sciacca, Carly Meyer, Katie Ekberg, Caitlin Barr & Louise Hickson.*
    - *American Journal of Audiology, 2017. Vol. 26, 110–118*
    - *The purpose of this study was to examine the effect of the language and jargon used by audiologists during hearing assessment appointments and the extent to which this affected patients' decisions about obtaining hearing aids.*
- Page 31: Barry Downes – United Kingdom ✓:
  - Relationship Between Objectively Measured Physical Activity, Cardiovascular Disease Biomarkers, and Hearing Sensitivity Using Data From the National Health and Nutrition Examination Survey 2003–2006.
    - *Paul D. Loprinzi and Chelsea Joyner.*
    - *American Journal of Audiology, 2017. Vol. 26, 163–169*
    - *This study examines the interrelationships between cardio-metabolic parameters, physical activity and hearing function with findings associating hearing dysfunction with several cardiovascular disease risk factors.*
- Page 33: Johanna Van Coillie – Belgium ✓:
  - A Qualitative Case Study of Smartphone-Connected Hearing Aids: Influences on Patients, Clinicians, and Patient-Clinician Interactions.
    - *Ng., Stella L.; Phelan, Shanon; Leonard, MaryAnn; Galster, Jason.*
    - *Journal of the American Academy of Audiology, Vol 28, 506-521, 2017.*
    - *This research concludes that further research is needed, as this was one of the first researches that focused on how modern connectivity influences clinicians, patients and their interactions.*
- Page 35: Lorenzo Notarianni – Italy :
  - The Influence of Social Support and Coping on Quality of Life Among Elderly With Age – Related Hearing Loss.
    - *Sarah Moser, Wolfang Luxenberger, and Wolfang Freidl.*
    - *American Journal of Audiology, Vol. 26, June 2017 pp 170-179*
    - *The aim of this research was to explore the influence that hearing problems, various coping strategies, and perceived social support may have on quality of life. Sixty-five older adults with age-related hearing loss in Austria participated and completed a paper–pencil survey with well-known standardised questionnaires. Perceived social support may be a relevant factor to focus on in auditory rehabilitation programmes. The involvement of significant others in counselling could facilitate the everyday life of older adults with age-related hearing loss and their significant others. Evidence is provided on how there is significantly greater hearing aid adoption when participants attended audiology appointments with a significant other.*
- Page 37: Lorenzo Notarianni – Italy :
  - The Effect of Tinnitus on Listening Effort in Normal Hearing Young Adults: A Preliminary Study.
    - *Sofie Degeest, Hannah Keppler, and Paul Corthals.*
    - *Journal of Speech, Language, and Hearing Research, 2017, 60(5), 1036-1045.*

        - *This study investigated the effect of chronic tinnitus on listening effort on thirteen normal-hearing young adults with chronic tinnitus that were matched with a control group for age, gender, hearing thresholds, and educational level. A dual-task paradigm was used to evaluate listening effort in different listening conditions. Listening effort significantly increased in the tinnitus group across listening conditions. No significant difference in listening effort between listening conditions was demonstrated, nor was there an interaction between groups and listening conditions. Subjective listening effort did not significantly differ between both groups. This study is a first exploration of listening effort in normal-hearing participants with chronic tinnitus showing that listening effort is increased as compared with a control group.*
- Page 39: Lorenzo Notarianni – Italy :
    - Speech Recognition in Adults With Cochlear Implants: The Effects of Working Memory, Phonological Sensitivity, and Aging.
        - *Aaron C. Moberly, Michael S. Harris, Lauren Boyce, and Susan Nittrouer.*
        - *Journal of Speech, Language, and Hearing Research, 2017, 60(5), 1046-1061*
        - *This study addressed subjects obtaining a cochlear implant after years of hearing loss and their "top down" linguistic and cognitive functions such as phonotactic constraints and working memory and how they may possibly facilitate recognition under conditions of degradation, often experienced under adverse listening conditions such as in noise. Thirty adults with cochlear implants and 30 age matched controls with age-normal hearing underwent testing of verbal working memory using digit span and serial recall of words. Phonological capacities were assessed using a lexical decision task and non-word repetition. Recognition of words in sentences in speech-shaped noise was measured. Implant users had only slightly poorer working memory accuracy than did controls*
- Page 41: Lorenzo Notarianni – Italy :
    - Auditory Processing of Older Adults with Probable Mild Cognitive Impairment.
        - *Jerri D. Edwards. Jennifer J. Lister, Maya N. Elias, Amber M. Tetlow, Angela L. Sardina, Nasreen A. Sadwq, Amanda D. Brandino, Aryn L. Harrison Bush.*
        - *Journal of Speech, Language, and Hearing Research, 2017, 60(5), 1436–1447*
        - *The aim of this research was to compare older adults with and without probable mild cognitive impairment (MCI) across two domains of auditory processing (auditory performance in competing acoustic signals and temporal aspects of audition).Those with probable MCI demonstrated significantly poorer performance than those without MCI on Synthetic Sentence Identification with Ipsilateral Competing Message, Dichotic Sentence Identification, and the ATTR within-channel subtest. No group differences were found for time-compressed speech, ATTR across-channel, or audiometric measures. Older adults with cognitive impairment not only have difficulty with competing acoustic signals but may also show poor temporal processing. The profile of auditory processing deficits among older adults with cognitive impairment may include multiple domains.*
- Page 43: Katrien Hoornaert – Belgium :
    - Child-Adult Differences in Using Dual-Task Paradigms to Measure Listening Effort.
        - *Erin M. Piccou, Lauren M. Charles and Todd A. Ricketts.*
        - *American Journal of Audiology, Vol. 26, June 2017, 143-154*
        - *Noise negatively affected word recognition performance, but the effect was independent of age group and secondary task. Increasing depth of processing increases paradigm sensitivity for adults, but for children, the deep paradigm resulted in the most variable effects of noise on response times. These findings demonstrate that dual-task paradigms can be useful for evaluating listening effort in school-age children.*
- Page 44: Paul van Doren – Belgium :

- Effects of Hearing Impairment and Hearing Aid Amplification on Listening Effort: A Systematic Review.
  - *Barbara Ohlenforst, Adriana Zekveld, Elise Jansma, Yang Wang, Graham Naylor, Artur Lorens, Thomas Lunner, Sophia Kramer.*
  - *Ear & Hearing 2017;38;267–281*
  - *Bearing in mind that a systematic effort in hearing aid development schemes to lessen listening effort and to take in account central processes is rather recent, we should have more research to find out if listening effort can or can't be influenced using amplification.*

Changes in psychosocial measures after a 6-week field trial.



Jamie Desjardins & Karen Doherty.

American Journal of Audiology, Vol. 26 (June 2017) p119–128.

Hearing aid use has been associated with improving some of the negative psychosocial effects of hearing loss in older adults yet hearing aid uptake remains low. If people decide not to obtain hearing aids they miss experiencing their benefits. A trial gives people with hearing loss the opportunity to try hearing aids and determine whether they experience satisfaction from them. The purpose of this study was to assess whether a 6 week hearing aid trial would reduce the psychosocial consequences of hearing loss in adults who have previously not sought treatment for their condition.

A group of 24 adults aged 50-74 years old were included in the experimental group in the study. The experimental group participants had a mild to moderate sensorineural hearing loss in both ears. They were fitted with RIC hearing aids in both ears and wore them for 6 weeks. A control group of 16 age-matched adults completed the same experimental protocol but did not trial hearing aids. Although age-matched, the control group's hearing thresholds did not match those of the experimental group which was a limitation of the study. The control group was included to ensure significant changes measured in the experimental group were not a result of normal test-retest reliability on the experimental measures. All participants reported that they never had a hearing assessment and have not worn hearing aids before. A description of the protocol for the experimental and control groups is set out below.

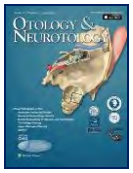
The analysis showed the following:

1. *IOI-HA: Experimental group participants' scored within or above the published norms for each of the seven subscales according to the group data for clients with mild to moderate hearing loss, suggesting that the hearing aid trial was successful.*
2. *HHQ: Experimental group participants' hearing handicap was significantly less after the trial than before participants were fitted with hearing aids. There was no significant difference in the control group's scores over the same period of time suggesting that the change in hearing handicap for experimental group participants was likely to be due to the hearing aid trial.*
3. *HARQ*
    - *Personal Distress/Inadequacy (PDI) was significantly reduced in the experimental group participants immediately after the hearing aid trial compared with scores before the hearing aid trial. In this experimental group, there was no significant difference in PDI measures before the hearing aid trial compared to 2 weeks after the hearing aid trial ended. PDI attitudes appeared to return to their levels before the hearing aid fitting two weeks after the hearing aid trial ended. There was no significant change in PDI across sessions for the control group. This indicates that PDI in the experimental group likely decreased as a consequence of wearing the hearing aids.*
    - *In the experimental group, Hearing Aid Stigma (HAS) was significantly less at the end of the trial and 2 weeks after the trial ended than before the participants were fitted with the hearing aids. There were no significant differences between scores at 6 weeks of hearing aid use and 2 weeks after hearing aid use so stigma appeared to be reduced even after the hearing aid trial ended. There was no significant change in HAS across sessions for the control group. It was likely that HAS was lessened due to trialling hearing aids.*

This study is correlational but suggests that a hearing aid trial can change personal attitudes towards wearing hearing aids and decrease hearing handicap. This is valuable information for clinicians to consider when encouraging patients to engage in hearing aid trials. Further research is required to evaluate the impact of a trial on whether a person decides to obtain hearing aids.

Experimental group participants had relatively excellent unaided speech recognition scores so a clinician may not have recommended hearing aids for some of the participants. However, these participants experienced a reduction in psychosocial consequences after the hearing aid trial. The results suggest that adults who report trouble hearing speech in quiet and/or background noise could benefit from hearing aids even if they have relatively excellent speech discrimination scores.

Efficacy of Bone-Anchored Hearing Aids in Single-Sided Deafness: A Systematic Review.



Gaeun Kim et al.

Otology & Neurotology, Vol 38 (2017) p 473-483.

Single-sided deafness (SSD) has been shown to significantly impair sound localisation ability and the comprehension of speech in the presence of background noise in addition to reducing the perception of sound on the affected side. One current option for reducing hearing disability in SSD is bone-anchored hearing aids (BAHAs). BAHAs are implanted in the skull on the poorer hearing side and allow patients to hear through direct bone conduction of the signal to the contralateral cochlea. The purpose of this review was to evaluate the efficacy of BAHAs in improving 1) speech perception in the presence of competing noise; 2) accuracy of sound localisation; and 3) subjective quality of life, in patients with SSD.

This paper presents a systematic review of 14 studies encompassing 296 patients that were identified from a database search as reporting on the hearing outcomes of interest following BAHA implantation in patients with SSD. Results were combined across studies where the same measurement tools were used and data was integrated with qualitative evaluations of study results. All patients had a pure-tone average greater than 90 dB HL in the poorer ear and normal hearing in the contralateral ear. One study included subjects 6 – 19 years of age, while all the others were limited to adult patients.

Of the six studies presenting data on sound localisation accuracy pre- and post-BAHA implantation, none reported a significant change in localisation performance after implantation. In the one study that compared localisation in BAHA implant patients with a normal control group, the BAHA group scores remained significantly lower than the normal control group after implantation.
In contrast, the twelve studies investigating speech discrimination performance in background noise, primarily using the Hearing in Noise Test (HINT), consistently showed a significant improvement following BAHA implantation. The improvement was, however, dependent on the direction from which the speech and noise stimuli were presented. The greatest improvement was noted when noise was presented to the front and speech was presented to the side with the BAHA. In this scenario, average speech discrimination across the studies increased significantly after BAHA implantation, and the improvement was greater for BAHAs than for patients using CROS hearing aids. No significant improvement was found when noise was presented to the BAHA side with a speech signal from the front.

Subjective indicators of satisfaction post-implantation were also evaluated with studies primarily using the Abbreviated Profile of Hearing aid Benefit (APHAB) and the Glasgow Hearing Aid Benefit Profile (GHABP). The review indicated a significant improvement in profile scores with BAHAs compared to the results before implantation. Across studies, the majority of patients with SSD described their quality of life as improved with BAHA amplification.

Overall, the objective assessments of BAHA benefit reviews in this paper indicate that in patients with SSD, BAHAs can improve the ability to discriminate speech in noisy situations. This improvement is believed to be caused by a reduction in the head shadow effect by carrying the sound to the opposite side. However, this reduction in the head shadow effect does not appear to be sufficient to improve localisation accuracy.
The authors conclude that the BAHA represents a good solution for restoring some of the functions lost with the elimination of binaural hearing in patients with SSD. They propose that the alleviation of some of the hearing handicap is associated with an improvement in self-reported quality of life in these patients. The authors acknowledge that this review is limited by the small number of participants in each study and the variability across studies in terms of measurement variables and

the type of BAHAs implanted. Despite these limitations, this review of the benefits and limitations of BAHAs is important information for clinicians counselling patients with SSD regarding their treatment options.

This study provides a good review of current data regarding the efficacy of BAHAs in restoring some hearing functions in patients with SSD. The findings that post-implantation, patients with BAHAs can expect a significant improvement in their ability to discriminate speech in noise, but not in their ability to localise sounds, are important for clinicians to include when counselling clients who are making the decision about whether to proceed with a BAHA. The data reported regarding subjective outcomes and improvements in quality of life are also valuable for both patients and prescribing clinicians. Further research that examines whether outcomes are affected by the type of BAHA device used, and patient factors such as the severity and aetiology of the hearing loss, will be important to ensure the best possible devices are fitted depending on patient needs and that patients are counselled regarding expectations that are specific to their type of hearing loss.

Endolymphatic hydrops in patients with unilateral and bilateral Meniere's disease.

Morimoto K, Yoshida T, Sugiura S, Kato M, Kato K, Teranishi M, Naganawa S, Nakashima T, & Sone M.

Acta Oto-Laryngologica, 2017, 137(1), p 23-28.

This study utilises an MRI technique to analyse the endolymphatic space size of the cochlea and vestibule in patients with unilateral and bilateral, definite Ménière's Disease. Endolymphatic hydrops was identified in the cochlea and vestibule of the affected ear in all patients with Ménière's Disease. It was also identified in 50% of patients with unilateral Ménière's Disease in the non-affected ear. The progression to bilateral Ménière's Disease is dependent on the formation of endolymphatic hydrops in the other side first. Endolymphatic hydrops was not associated with the duration of the pathology, rendering further investigation in the pathophysiology of endolymphatic hydrops in Ménière's Disease.

Ménière's Disease (MD), first described by Prosper Ménière in 1861, is characterised by: fluctuating sensorineural hearing loss, episodic vertigo, and often a roaring tinnitus with aural fullness of the ear. Endolymphatic hydrops (EH) is a pathological marker of MD, however it does not fully explain the clinical symptoms that arise in MD. Of the patients diagnosed with definite, unilateral MD, the probability of bilateral progression is up to 35% within 10 years, and 47% within 20 years of MD diagnosis, with no obvious risk factors.
Recent advancement in imaging techniques has allowed the evaluation of endolymphatic space using a gadolinium contrast agent with magnetic resonance imaging (MRI), and the authors sought to investigate this in patients with MD. The purpose of this study was to investigate the endolymphatic space size in patients with unilateral and bilateral MD, and to identify potential factors for the progression of unilateral to bilateral MD including the degree of EH, hearing level, and duration of MD.

29 patients with definite unilateral MD (16 male, 13 female) and 12 patients with definite bilateral MD (7 male, 5 female) were recruited via a hospital. Unilateral MD patients used in the study had a pure-tone average (0.5kHz, 1kHz, 2kHz) of 20dB HL or less in the non-affected ear. Diagnosis of MD was based on criteria established by the American Academy of Otolaryngology—Head and Neck Surgery (AAOHNS).
Three-dimensional fluid-attenuated inversion recovery (3D-FLAIR) MRI was performed using a 3T MRI scanner. Injection of the gadolinium contrast agent was done either intravenously (gadodiamide hydrate, 0.1mmol/kg body weight) or via intratympanic injection (gadopentetate dimeglumine, diluted 8-fold with saline). A radiologist blinded to the patient's clinical symptoms processed the images to identify and classify the degree of EH in the cochlea and vestibule into either none, mild, or significant.

In the unilateral MD cohort, the degree of EH in the affected ear was greater than that of the non-affected ear, suggestive of the efficacy of this technique to evaluate EH. 100% of patients with definite, unilateral MD had EH in the cochlea of the affected side and 90% in the vestibule of the affected side as well. 48% of patients had EH in the cochlear of the non-affected side, and 55% had EH in the vestibule of the non-affected side.
There was a significant association between the duration of MD and hearing level (pure-tone average of 0.5kHz, 1kHz, 2kHz) on the affected side. Furthermore, there was a positive correlation between the degree of EH in the cochlea and hearing level in the affected ear. There was a non-significant but positive correlation between the degree of EH in the vestibule and hearing level in the affected ear.

There was no relationship between the duration of MD and the degree of EH in either the cochlea or the vestibule.

All definite MD patients had EH at least in the cochlea or the vestibule of the affected side. Furthermore, of the unilateral MD cohort EH was identified in almost 50% in the non-affected side. These findings indicate that EH formation may occur before MD symptoms develop. However, a longitudinal study is required to confirm this assumption.
Because symptomatic MD appears from asymptomatic EH with additional co-factors, it is assumed that the probability of immediate progression to bilateral MD from unilateral MD is very low in patients without EH on the non-affected side. The relationship between EH and clinical symptoms needs to be studied further in the near future.
The study also revealed that the degree of EH was not directly associated with the duration of MD. Factors other than the duration of the disease must therefore be associated with formation of EH, and the development of MD symptoms.

Speech Intelligibility as a Cue for Acceptable Noise Levels.

Recker KL & Micheyl C.

Ear and Hearing 2017, 38(4), p 465-474.

This study sought to investigate the effects of predicted speech intelligibility (as measured by the speech intelligibility index, SII) in determining the Acceptable Noise Level (ANL), which subsequently is able to predict whether or not somebody will be successful with their hearing aids. The SII was determined by using the ANL testing, as well an alternative ANL testing method on both normal hearing participants and hearing impaired participants. Results show that speech intelligibility was the primary psychoacoustic cue in determining one's ANL in normal hearing participants, but not in hearing impaired participants. Thus further investigation is required to uncover the psychoacoustic cues used by the hearing impaired in determining their ANL and subsequently their likelihood of a successful hearing aid fitting.

Recent studies have shown that the Acceptable Noise Level (ANL) test may be useful in determining the degree of success in a patient with hearing aids. The ANL test is a measure of the level of background noise tolerance in the presence of running speech. Participants are asked to select a comfortable listening level for speech. They are then asked to increase the background speech babble until it becomes the maximum level the patient will deal with whilst listening to the speech. The ANL is calculated by subtracting the maximum tolerable background noise level from the comfortable listening level of speech. The ANL can range from -5 to 42dB, and previous studies have shown that people with a low ANL (<7dB) tend to be more successful with hearing aids (that is, people who can accept more background noise), whereas those with a high ANL (>13dB) are more likely to be unsuccessful with hearing aids.

Currently, there are no known factors that influence the ANL, nor have any cues/mechanisms of determining one's ANL been identified. Previous studies sought to investigate the role of speech recognition in determining one's ANL that is, choosing the ANL depending on how much speech the participant can recall. One disadvantage of this method is the fact that another speech material must be used as the speech material used for the ANL test is not suitable to test speech recognition. One alternative is to investigate speech intelligibility at the ANL level instead, which can either be done using a separate speech list, or by predicting the amount of speech that is intelligible to the patient at the specified ANL level using the Speech Intelligibility Index (SII).

This study investigates whether speech intelligibility is used to determine participants' ANL. Determining this will allow the prediction of those that are unlikely to be successful with hearing aids, such that other strategies could be used to improve their chances of success with hearing aids. The authors sought to use the predicted SII based on people's ANLs to investigate whether speech intelligibility based cues were used in people with normal hearing and those with hearing impairment.

A retrospective analysis of data from a previous study was used. In total, there were 21 participants with near normal hearing, and 21 participants with a mild-to-moderate sensorineural hearing loss. There were 7 normal hearing and 7 hearing impaired participants in each group with a low, moderate, and high acceptance of background noise (as determined by the ANL test (low, mid, high ANL). A modified ANL test was also conducted, by which the speech sound was fixed at 4 different levels (50, 63, 75, and 88dBA) and participants were asked to modify the background noise. The SII was determined for each participant's ANL levels, and statistical analyses were done across each ANL group and between hearing levels.

The results showed that for normal hearing participants, a high SII (>98%) was maintained throughout the 4 levels of speech used in the ANL. This suggests that for normal hearing participants, speech intelligibility was primarily used as a listening cue in determining the ANL. This means that the participants chose ANLs that would have allowed them to essentially 'follow' the speech passage presented.
For participants with hearing loss, the SII was seen to increase with each increasing speech presentation level. This means that for this group speech intelligibility is not the primary listening cue used to determine ANL. Thus more research in this field must be conducted in order to identify other psychoacoustic cues that are used by the hearing impaired to determine the ANL. It would also be beneficial to measure the benefits of amplification in determining the ANL, and whether speech intelligibility now becomes the primary cue for determining the ANL.

What do we miss in this research? This test was conducted by using a touch screen where people could alter the background themselves. But as the researchers in this study state, persons with hearing loss tend to overrate their acceptance of background noise. We should observe people while conducting this test, there was no remark about this method in this research. In this manner, we can literally see if people are making an effort to still concentrate and accept the noise.
It is, though, interesting that normal hearing people do use speech understanding as a criterion for accepting noise levels.

Prevalence of Auditory Problems in Children With Feeding and Swallowing Disorders.

Vishakha Waman Rawool.

Journal of Speech Language and Hearing Research. 2017, 60(5), 1436–1447.

One of the main causes of feeding and swallowing disorders is premature birth and low birth weight infants. With the advancements in medical intervention to rescue this population, there is an increase in prevalence of feeding and swallowing disorders in these children. There is a prevalence of up to 25% in typically developing children and 80% in the developmentally delayed children. Feeding and swallowing disorders are often co-morbid with other disorders such as deafness, blindness, cerebral palsy, mental retardation, and congenital heart disease.

Often a multidisciplinary approach is taken for the management of children with feeding and swallowing disorders. This team generally comprises of physiotherapists, speech-language pathologists, social workers, paediatricians, dieticians, nutritionists, gastroenterologists, nurses, radiologists, psychologists, occupational therapists, and otolaryngologists. The involvement of audiologists, and evidence for this, is currently lacking in current literature, and so the author sought to report the prevalence of hearing loss in children with feeding and swallowing disorders.

The purpose of this study was to report the prevalence of audiological and middle ear problems in children who were referred to a community-based interdisciplinary feeding and swallowing clinic and to compare the prevalence of these problems with that in a group of typical children.

A total of 103 children were included in the study; 44 with feeding and swallowing disorders aged from 3 months to 11 years old (13 girls, 33 boys), and 59 typically developing children aged from 3 years to 6 years. Hearing screening assessments were performed on all children, including otoscopy, screening tympanogram, and hearing screening down to 25dB HL at 500Hz, and 20dB HL at 1000Hz, 2000Hz, and 4000Hz.

The results from this study showed that the proportion of children with an excessive amount of cerumen in the ear canal was significantly higher in children with feeding and swallowing disorders than in typically developing children (16% vs. 1%). The rate of middle ear dysfunction was significantly higher in children with feeding and swallowing disorders than typically developing children (55% vs. 29%). Failing the screening test (at one or more frequencies in either ear) was more prevalent in children with feeding and swallowing disorders than in typically developing children (50% vs 7%).

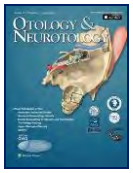
The authors speculate that the higher prevalence of transient and permanent hearing loss in children with feeding and swallowing disorders may disrupt the team approach in the management of these children. Current strategies around treatment involve behaviour modification via verbal reinforcements, but if a hearing loss was to be present, the social praise may not be effective. Furthermore, letting the parents be aware of the hearing loss may promote communication triggers to improve speech transmission to the child, such as speaking closer to the child or going into a quieter environment to talk to the child.

The lack of further objective testing, such as distortion product otoacoustic emissions (DPOAEs) and auditory brainstem responses (ABRs) would have served as a strong cross-check to the behavioural

results obtained in this study. Furthermore, some bias lies in the recruitment of participants, including a lack of age-matching, and only having children with voluntary parental approval being screened.

Conclusively, this study suggests that children with feeding and swallowing disorders have a significantly higher prevalence of excessive cerumen, middle ear dysfunction, and hearing loss. These results promote the inclusion of audiologists in the multidisciplinary management of a child with feeding and swallowing disorders, and by doing so will maximise the overall benefit of intervention.

Pilot Electroacoustic Analyses of a Sample of Direct-to-Consumer Amplification Products.



Reed NS, Betz J, Lin FR, & Mamo SK.

Otology & Neurotology, 2017, 38(6), p 804-808.

With the increasing proportion of hearing impaired people (in particular with age-related hearing loss, ARHL), and the non-increasing percentage of those with amplification devices, there is a huge disparity between those who need hearing aids and those who actually possess them. Perhaps the biggest reason for the reduced accessibility of amplification devices is the financial aspect and because of this, novel approaches such as direct-to-consumer (DTC) amplification products, have surfaced to the market. DTC's are available to the public at a more affordable price point and can be fitted by the user with no audiological assistance, offering both accessibility and affordability in the highly demanding market.
Although earlier DTC products were seen to over-amplify the lower frequencies whilst giving no gain at the higher frequencies (hence, a poor consensus on these devices), there is a lack of information on recent devices currently on the market, hence the purpose of this study was to analyse the electroacoustic properties of DTC products available today, albeit on a smaller scale.

A total of 9 DTC devices available for purchase over the internet were used in this study. Measurement of electroacoustic specification as well as simulated real ear measurements (REMs) was done using the Audioscan Verifit 1.0 test box by different audiologists. The electroacoustic standards were based on the American National Standards Institute (ANSI) standards as well as specification sheets of currently available hearing aids. The electroacoustic specifications measured included:
i) Frequency Range (Bandwidth): to adequately amplify speech; a bandwidth of 250Hz – 6000Hz was considered to meet this criterion.
ii) Total Harmonic Distortion (TDH) at 500Hz, 800Hz and 1600Hz: this measures the level of unwanted distortion, and was not to exceed 3% at any given frequency.
iii) Equivalent Internal Noise (EIN): the internal noise of the device during amplification should not exceed 28dB.
iv) Maximum output sound pressure level at 90dB SPL (MaxOSPL90) & maximum output sound pressure level at 90dB SPL frequency (MaxOSPLFrequency). The former represents the maximum sound output of the device and the latter represents the frequency at which the peak output level is at. A MaxOSPL90 of under 120dB SPL was considered to meet this criterion.
Simulated REMs using the test box evaluated the ability of the devices to meet the National Acoustic Laboratories (NAL) NAL-NL2 and NAL-R prescriptive targets for common mild-to-moderate ARHL configurations. Speech mapping at soft (55dB SPL), average (65dB SPL), and loud (75dB SPL) input levels were presented, and their ability to meet nine targets (250Hz – 6000Hz) within 5dB or 10dB were evaluated.

Results showed that of the nine DTC devices tested, five devices met all four of the electroacoustic specifications while one device did not meet any. All but one device were able to meet at least half of the REM targets within 10dB SPL, with one DTC device meeting at least half the targets within 5dB SPL. Thus the authors conclude that although there is great heterogeneity in the quality and performance of DTCs, they have vastly improved in performance since their early days, and suggest that otolaryngologists and other hearing care professionals be aware that some DTCs are capable of providing appropriate amplification for a person with mild-to-moderate ARHL. They also note that some patients will require more professional guidance from an audiologist for the professional fitting of a hearing aid as well as rehabilitative counselling.

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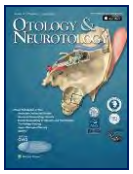
Personal Thoughts

The outcomes of this study show good outcomes for DTCs to be considered an alternative that could potentially meet the demands of those with poor accessibility and financial status in the near future. However, it is crucial to understand that modern hearing aids are much more capable at amplifying certain frequencies, and that the hearing impaired need much more than greater audibility of frequencies in an audiogram. Features such as feedback cancellation, directional microphones, noise processing, and binaural synchronising are examples of those that help support the hearing impaired to listen to incoming speech signals. End-user benefit as a result of these advanced features should be appreciated when considering the use of affordable DTCs. Furthermore, test box measures do not and should not replace validation by subjective feedback; it is the hearing aid users that need to benefit from the amplification devices, yet this was not considered in this study design.

Middle-Ear Sound Transmission Under Normal, Damaged, Repaired, and Reconstructed Conditions.



Dong W, Tian Y, Gao X, & Jung TTK.

Otology & Neurotology, 2017, 38(4), p 577-584.

The purpose of the middle ear (containing the tympanic membrane and the ossicular chain) is to match the impedance between the air-filled ear canal and the fluid-filled cochlea, providing a pressure gain to the incoming signal. Recent studies have shown that the mechanism of the middle ear movement is highly dependent on the frequency input. Low frequencies cause a relatively simplistic motion of the middle ear by which the tympanic membrane and the ossicular chain move together as one rigid body. At higher frequencies, the tympanic membrane's vibration pattern is broken up into small zones of vibration, while the ossicles display dysynchronous movement, causing 'slippage' between the ossicles. This complex motion of the ossicular chain and its significance in the transmission of hearing is an important and ongoing area of research.

Thus any disruption in the conductive system of the middle ear is bound to cause a significant hearing loss. Repairing or reconstructing the ossicular chain involves either a partial or total ossicular replacement prosthesis (PORP or TORP respectively); however, there is large variation in the post-operative outcomes. To reduce this variability and maximise hearing outcomes, further understanding of the performance of the repaired middle ear is required.

The purpose of the study was to investigate the remaining conductive hearing loss as a result of the PORP of the incus or stapes in human temporal bones. This would provide insight as to the current effectiveness of ossicular reconstruction, and the directions that need to be taken in order to improve patient outcomes.

Temporal bones of eleven human cadavers were extracted and prepared for measurements. Middle ear transmission was characterised by measuring velocity and pressure responses in four conditons: normal middle ears; those with a disarticulated incus and stapes; those repaired using medical glue; those repaired using PORP. A laser Doppler vibrometer was used to measure the velocity responses along the ossicular chain, followed by a micro-pressure sensor to measure the pressure responses to sound stimuli from 0.2kHz to 70kHz.

Compared to results from the normal middle ear, the disarticulated incus and stapes caused a 40-60dB loss at frequencies up to 10kHz. Repairing with either medical glue or PORP restored hearing at frequencies up to 4kHz, but not frequencies greater than 4kHz. The degree of coupling between the PORP and stapes also affected the frequency response, with a looser coupling yielding better results.

The medical glue and PORP strategies used in this study resulted in a more rigid ossicular chain (tight coupling with the stapes), which may have affected the complex motion of the ossicular chain at the higher frequencies as mentioned above. Thus it may be necessary to develop repair and reconstruction techniques that mimic the 3D motion of the ossicular chain as closely as possible.

The Influence of Noise Reduction on Speech Intelligibility, Response Times to Speech, and Perceived Listening Effort in Normal-Hearing Listeners.

Maj van den Tillaart-Haverkate et al.

Trends in Hearing May 2017, Volume 21: 1–13.

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Intro:
The aim of the noise-reduction algorithm is to improve the signal-to-noise ratio (SNR) by adjusting the gain in each time-frequency region according to the estimated SNR in that specific region (Bentler & Chiou, 2006). Hearing aid users have been shown to prefer noise reduction (Bentler, 2005; Boymans & Dreschler, 2000; Ricketts & Hornsby, 2005). Researchers have been trying to understand this preference and to develop objective measures to quantify the benefit of noise reduction.

Several studies examining the objective effect of noise reduction have focused on speech intelligibility (SI). These studies revealed that existing single-microphone noise-reduction algorithms do not improve SI in noise and may even worsen it (Alcàntara, Moore, Kühnel, & Launer, 2003; Bentler, Wu, Kettel, & Hurtig, 2008; Boymans & Dreschler, 2000; Desjardins & Doherty, 2014; Neher, Grimm, & Hohmann, 2014; Ricketts & Hornsby, 2005; Sarampalis, Kalluri, Edwards, & Hafter, 2009). Therefore, it seems that noise-reduction algorithms either do not adequately eliminate the noise that masks speech or they remove the noise resulting in speech distortion (Jorgensen & Dau, 2011; Houben, Dijkstra, & Dreschler, 2012; Lunner, Rudner, & Rönnberg, 2009). The evaluation of noise-reduction algorithms has recently shifted from a focus on SI toward a focus on the objective assessment of cognitive measures, particularly listening effort.

Aim:
There is an ongoing search for objective measures that quantify the effects of noise-reduction algorithms on listening effort, even or especially when SI is unaffected. Therefore, this study looked to see if RT (response time) can be used to assess listening effort when listening to unprocessed speech in noise and speech in noise processed with a noise reduction algorithm, when this speech in noise is highly intelligible.

Method:
Participants: Twelve normal-hearing listeners
Stimuli: Dutch digit triplet test, in noise, in four different SNR's:-5, 0, + 5, and +∞ dB (i.e. in quiet, thus no noise added. The stimuli were presented diotically through headphones.

Two types of noise reduction; IBM (ideal binary mask which can be considered as ideal noise reduction, as it receives noise and speech as separate inputs) and MMSE (minimum mean-square error), the more realistic algorithm.

Results:
Objective benefit was measured for both noise-reduction algorithms in that they reduced the RT's to digit triplets at high SNRs (SI>97%). This effect of noise reduction was found only for the more complex AR (add the initial and final digit) task and not for the ID (identification of final digit) task. In other words, the measurement results suggest that RT to an AR task can provide an objective measure of the benefit of noise reduction.
Subjectively, rated listening effort showed a significant benefit of IBM only.
The finding that MMSE led to significantly improved RTs suggests that the method using RTs is more sensitive than other methods applied because this effect could not be detected with the Speech Intelligibility test or subjective Listening Effort test.

Future research:
The authors suggest that the next required step would be to examine if this effect also holds for hearing-impaired listeners, hearing aid users, other types of signal processing, and how RT relates to perceived listening effort.

Stages of change in audiology: comparison of three self-assessment measures

Elisabeth Ingo et al.

International Journal of Audiology, 2017; Vol 56: p 516–520.

Screening of hearing loss has been reported to create awareness and improve help seeking in general hearing health care. However, buying hearing aids is not an evident consequence for every person with hearing loss. This action demands a change in health behaviour and knowledge about these stages of change can help to understand the process a person with hearing loss is going through. It allows the audiologist to adapt information and guide the client to a more successful uptake of hearing aids.

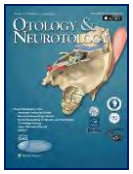
The initial stages of change towards health behaviour change are precontemplation (unaware of hearing problem/ unwilling to act), contemplation (aware of the hearing problem, looking for information, considering pros and cons), preparation (looking for information and willing to find help within 30 days), action (doing something to change), and maintenance.

Within this study, a correlation has been found between three stages of change measures of different lengths. These measures (one 24-item and two 1-item) could be used as a short self-assessment measure prior to the clinical visit.

All participants performed three self-assessment measures: URICA, Staging algorithm and Line. The majority of the 224 participants were in one of the stages associated with information and help-seeking (contemplation and preparation). These are the stages where people are usually not looking for information but can be influenced by external motivators.
In conclusion, this study found a correlation between the three stages of change measures. Further investigation to evaluate the predictive value of the measurements is needed.

Improving our knowledge on health behaviour changes, can improve the impact we have on clients. Think about motivational interviewing and involving the external motivators (e.g. influencers). Also the idea of using a pre-appointment measurement to define the stage of change a client is supposed to be at can have an impact on both length and content of an appointment. Why not test one of these measurements and see how it impacts our productivity?

Sudden Hearing Loss Due to Anterior Inferior Cerebellar Artery Infarction.



Maeda Y et al.

Otology & Neurotology, Vol. 38 (2) 2017, p e3-e4.

A 63-year-old man developed acute onset of vertigo and ataxia. On the 2nd day after onset, he visited an otolaryngologist, and a pure-tone audiogram (PTA) showed mild sensorineural hearing loss (SNHL) on the left. Mild spontaneous horizontal nystagmus towards the right side was observed in the supine position.

He also visited a neurological hospital on the 2nd day, but no other neurological manifestations except for ataxia were observed, and brain magnetic resonance imaging (MRI) demonstrated no abnormalities. MR angiography (MRA) visualised both the right and left anterior inferior cerebellar arteries (AICAs). The right vertebral artery was hypoplastic. On the 7th day, he was referred to a university hospital. Otolaryngologists observed the spontaneous horizontal and rotatory nystagmus towards the right side. The spontaneous nystagmus was exaggerated with a blindfold on infrared charge coupled device camera observation. He was experiencing rotatory vertigo and unable to stand due to ataxia. His hearing loss also worsened in the left ear.

A week of in-patient medical care has almost reversed all symptoms – nystagmus, hearing loss and ataxia.

Typically AICA infarction includes sudden SNHL, vertigo, nystagmus, and other brainstem or cerebellar signs such as ataxia, facial palsy, diplopia, and hypalgesia. In rare cases such as this, AICA infarction presented only with auditory and vestibular symptoms without obvious brainstem or cerebellar signs.

The labyrinthine artery (LA) which supplies entire inner ear, is a branch of the AICA, and is not supplied by any collateral circulation. Hence the effects of any disturbance in AICA pose immediate impediment to inner ear functioning and hence the auditory and vestibular symptoms. The SNHL and nystagmus were likely predominantly peripheral cochleovestibular symptoms as MRI detected no active lesion in his brainstem.

This case study highlights 2 facts: Hearing loss and vestibular function could be early signs of malfunctioning of blood supply through the AICA. Secondly, immediate treatment can reverse most of the damage.
This case study shows how blood supply can selectively, and at an early stage, affect inner ear functioning – hearing and balance. The study also shows the recovery pattern in line with immediate medical care.

The Association between Hearing Loss, Postural Control, and Mobility in Older Adults: A Systematic Review.

Maayan A et al.

Journal of the American Academy of Audiology (2017); Vol. 28 (6), 575-588.

Hearing loss in older adults has been associated with social isolation, depression, and poor quality of life while it is also found to be associated with increased odds for cognitive impairment, accelerated cognitive decline, and reduced memory and executive functions. Some studies have also suggested that people with HL have an increased risk of falls of the order of 1.4 times per 10 dB of HL above 25 dB HL.

WHO considers falls as a major problem in the elderly with dramatic effects on the health status and QoL of older individuals. In addition, falls cause approx. 40% of all injury deaths in older adults and 81–98% of hip fractures. However HL is ignored as a factor leading postural stability problems viz., falls in elderly.

The most popular theory for understanding the postural control mechanism and for guiding its measurement is the System Framework for Postural Control. The framework encompasses six major components that reflect the postural control subsystems: (a) constraints on the biomechanical system, (b) movement strategies, (c) sensory strategies, (d) orientation in space, (e) dynamic control, and (f) cognitive processing. Postural control can be assessed using subjective assessment by examinations, objective assessment by scale-based tests, and quantitative measures by means of force platforms.

Although self-reported falls represent a late manifestation of postural control impairment, objective measures may help with early detection and perhaps shed light on the nature of this comorbidity. Studies have found that one's own auditory feedback is essential in postural control and especially in the elderly. The aims of this systematic review of literature were to (a) describe the comorbidity between HL and objective measures of postural control and mobility, (b) offer potential mechanisms for the relationships between them, (c) discuss clinical implications, and (d) articulate future directions for exploration of this relationship.

Online search for studies revealed 32 relevant studies on postural control and hearing loss in the elderly population.

Participants ranged from 40 to 4000. Their hearing was measured through audiometry or hearing scales such as HHIE-S. Postural control was evaluated objectively in all studies. Gait speed and walking endurance was widely measured. A few studies have used test batteries such as the Established Populations for the Epidemiologic Studies of the Elderly Short Physical Performance Battery (EPESE-SPPB) that includes gait speed, standing balance, and chair stand.

Statistical analysis revealed a significant, positive association between HL and postural control. Participants with HL had slower gait speed, lower standing balance, lower walking endurance, more difficulties walking 0.5 or 2 km, and lower SPPB scores, performed fewer chair stands, experienced greater difficulties in stair-climbing, and had lower physical activity and hence higher risk for falls. Severity of HL was connected to higher prevalence of difficulties in walking and to falls. Additionally, it was apparent that people with lower hearing abilities tended to participate less in the community and to ambulate mostly in their closest environment. In addition, when comparing aided and unaided

performance of older adults on the Romberg foam test as well as the tandem test, performance was significantly improved with hearing aids.

Overall, the studies included in the current review demonstrated independent relationships between HL and postural control, even after controlling for major covariates such as BMI, physical activity, comorbidities, and smoking status. These effects were strongly pronounced in participants with more severe manifestation of HL.

The review also suggested three types of underlying connections:

(a) Common pathophysiological processes that may influence auditory and postural systems. According to this explanation- neural, overall vestibular, vascular and genetic changes in the cochlea cause HL, and also the deterioration in the vestibular system is leading to changes in balance and poor physical functioning

(a) Extra cognitive resources are needed for older adults to perform listening as well as gait which is already weakening in the old age

(c) Behavioural mechanisms as a consequence of HL in terms of spatial orientation, social parameters, and the interaction between the effects of reduced mobility and reduced auditory inputs

The authors call for new study designs to further substantiate a few links between these processes and also call for fall prevention programmes to take up HL rehabilitation as an important component too.

This study has analysed a spectrum of studies published on HL and postural control and has yielded some important answers related to HL as a factor or cause for falls seen in the elderly. Several mechanisms have been reported along with specific objective measures to be considered in the evaluation of elderly.

Cochlear synaptopathy in acquired sensorineural hearing loss: Manifestations and mechanisms.

Liberman MC and Kujawa SG.

Hearing Research, Vol. 349 (2017), p 138-147.

Common causes of SNHL in adults are – ageing, noise and ototoxicity or a combination of them. A longstanding view in text books about how they lead to measurable hearing loss is that these insults degenerate hair cells. Less often spoken is what happens to spiral ganglion cells and primary auditory neurons. In this review of current knowledge on this topic, the authors have compiled and answered several questions.

Audiologists use threshold elevation as a key metric for the overt effects of cochlear insult. In many cases, as has been widely evidenced in clinics, the audiometric thresholds do not reflect reported or demonstrated auditory perceptual defects. This major question is also addressed in the review as a new test has been recommended in this review to address this condition.

From a series of recent experiments, it is now clear, at least in the noise-exposed and ageing ears, that cochlear neurons are a primary target (not hair cells as it is believed widely), that their peripheral synaptic connections are the most vulnerable elements among all cochlear structures and that cochlear nerve synapses can be destroyed even when hair cells survive. This condition has been named as Cochlear Synaptopathy (especially of IHCs).

1. *Ribbon loss as Cochlear Synaptopathy*

Mice were exposed to brief but loud noise to induce TTS (temporary threshold shift) which resulted in 30-40 dB threshold shift and this recovered completely in 2 weeks. Even their DPOAEs returned to normal levels after 2 weeks. Light microscopy was used to examine the cochlear structures of these mice which revealed an acute loss of synapses between IHCs and the peripheral terminals of the spiral ganglion neurons that contact them even after 8 weeks post noise exposure. Similarly, studies tracking these changes in ageing mice showed that cochlear synaptopathy also precedes hair cell loss and threshold shift.

The following microscopy results clearly show synapse ribbon loss as the number of dots in B (from mice exposed to noise) reducing compared to that of A (normal mice). It is now identified that this entire process seem to get kick started by swelling of neural endings at synapses (shown in separate picture).

This process is seen both in noise-exposed as well as ageing mice. Several studies used various methods to non-invasively identify the synaptopathy.

2. *ABR peak I as the indicator of synaptopathy*

It has been observed in several experiments that when DPOAE responses return to normal or have not yet deteriorated, the suprathreshold amplitude of ABR wave 1 can be highly predictive of the degree of cochlear synaptopathy, as affected neurons are silenced with the loss of their synaptic connection. This is explained from the below data. To date, the wave I amplitude is considered the most accurate measure of synaptopathy.

3. Selective damage of synapses – low SR fibres

It is also clear from the images that not all types of synapses are lost. What are lost are the synapses of low-SR (low spontaneous rate) fibres. These fibres respond to moderately loud sounds and primarily believed to be responsible for speech understanding in noise. Low-SR neuropathy may be a major contributor to a classic impairment in SNHL, speech-in-noise difficulty.

Many of these studies suggest that the cochlear synaptopathy also may be a key elicitor of what are commonly the most troubling sensory anomalies associated with SNHL, tinnitus and hyperacusis. This may be the result of a compensatory plasticity, wherein the synaptic gain in auditory central circuits is increased when neural signals from the periphery are attenuated.

Based on this new understanding, the authors called for a paradigm shift in existing hearing conservation programmes. As synapse loss in humans precedes threshold elevation and OHC loss after noise or ototoxic drugs, as it does in all animal models evaluated thus far, clinical decision-making and occupational health monitoring protocols would require revision to identify earliest injury, with the goal of preserving hearing function.

This review study highlights the huge shift required in the existing understanding of SNHL. Clearly summarised and addressed several unanswered clinical questions. The authors also pointed out future direction of this research.

The new classification system for inner ear malformations: the INCAV system.

Adibelli ZH et al.

Acta Oto-Laryngologica, 2017; Vol. 137 (3), 246-252.

Prevalence of SNHL at birth is pegged at approx. 1 in 2000 newborns and 6 in 1000 children by the age 18. One-half of congenital SNHL cases are estimated to occur due to environmental exposure during pregnancy, whereas the other half were caused by genetic bases. Cytomegalovirus infection is believed to be the most common non-genetic cause of paediatric SNHL. Using imaging techniques it is found that 26% of the cases have varying degrees of inner ear malformation and 65% of them are bilateral.

Imaging techniques such as CT scan and MRI are often used to take decisions on cochlear implant candidacy. Inner malformations have been classified by several authors and the most prominent of all comes from Jackler et al. who divided the cochlear malformations into five groups; complete labyrinthine aplasia (Michel deformity), cochlear aplasia, common cavity, cochlear hypoplasia and incomplete partition (IP). Incomplete partition (IP) is further defined into two completely different types of IP anomalies of the cochlea, as IP-I, IP-II and IP-III (seen in X-linked deafness). However all these classification systems were defined basis CT scan results only. There is no system that can use MRI results for classification. Also several scans fall out of any classification system making it an impediment for decision about CI surgery.

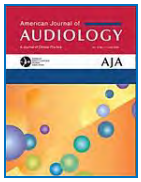
This study was conducted to explore a more specific, definitive classification system for inner ear malformations of SNHL, based on radiological criteria mostly by using MR imaging, but also it could be used by computed tomography (CT) imaging. Authors retrospectively analysed the data of 5 years from a hospital. Among 440 patients evaluated with MRI, this study focuses on the 43 patients (21 women, 22 men) who had congenital inner ear malformation depicted with both CT and MR imaging. Audiological tests - both objective tests, namely tympanometry, otoacoustic emission measurements, evoked response audiometry as well subjective tests, namely behavioural observational audiometry, visual reinforcement audiometry and pure-tone audiometry were also used.

The authors proposed a new classification system (INCAV system) based on five anatomical sub-groups of the inner ear structures ; internal acoustic canal (I), cochlear nerve (N), cochlea (C), vestibular aqueduct (A) and vestibule (V). Based on their malformations, these anatomical structures have been assigned grades and have been classified. Grade 0 for normal structures and Grade 6 for aplastic structures and separate classification for CT and MRI has been described.

Among these 43 patients, there were 80 inner ear malformations and six normal inner ears: I0N0C0A0V0. There were 30 ears with isolated enlarged vestibular aqueduct or enlarged endolymphatic duct and sac, seven ears with IP-I, 16 ears with IP-II, six ears with IP-III, two ears with Michel aplasia, two ears with common cavity, seven ears with cochlear hypoplasia, three ears with internal aquatic canal stenosis, two ears with cochlear aplasia, and five ears with miscellaneous malformations. 26.25% of the patients, who could not be categorised with existing classification schemes, could be defined successfully by using the INCAV system.

This study proposed a new system to classify inner ear malformations based on MRI and CT scan reports. The classification system is very clear as it eliminates subjectivity and is specific to the imaging technique. The authors used several proven elements from the existing framework. This is a good attempt to standardise reporting of inner ear malformations and to reduce confusion in inner ear interpretations. The study needs further reviewing by other authors and clinicians.

Exploring Audiologists' Language and Hearing Aid Uptake in Initial Rehabilitation Appointments.



Anna Sciacca, Carly Meyer, Katie Ekberg, Caitlin Barr, and Louise Hickson.

American Journal of Audiology, Vol. 26 June 2017, p110–118.

As we all know, there is a significant disparity between the incidence of hearing impairment and estimates of hearing aid uptake. Research in recent years has highlighted the number and variety of factors which can influence patients' decisions about obtaining hearing aids. However, there has been less research about how the interaction between the audiologist and patient can influence this decision.

Research has made us aware that older adults with hearing impairment increasingly want to be involved in the decision to obtain hearing aids. Such input aligns with a shared decision-making model in which both patients and clinicians need to be involved in information exchange and treatment decisions. For shared decision-making to occur, audiologists should recognise that their communication skills can, as numerous studies have shown, either help or hinder shared decision-making. One aspect of this interaction that warrants closer consideration is patients' health literacy levels. Patients with lower health literacy skills recall significantly less spoken health information compared to adults with adequate health literacy. Health literacy is particularly relevant within audiology practice as both hearing and health literacy are poorer amongst older adults.

So far, most studies have focused on health literacy of written materials with far less investigation into verbal communications in the clinical audiology process. It is important that both written and spoken health information can be easily understood by the patient. There is a growing body of research in audiology that has evaluated the suitability and effectiveness of written material, such as hearing aid user guides, for older adults which are often written at a level above the recommended reading grade level of five, with most having a mean reading grade level of eight or higher.

This study extends previous research, involving two of the authors, into the nature of verbal communication between the audiologist and older adults throughout the diagnosis and management planning phase of audiology appointments. This previous research noted that some of the information conveyed by audiologists was complex and included jargon terms. The present study aimed to:-
1) Describe the complexity of spoken language used by audiologists, including the use of audiological jargon, during initial hearing assessment appointments
2) Explore the associations between audiologists' language and patients' decisions to obtain hearing aids.

The authors hypothesised that audiologists' language would be more complex than the recommended level for older adults and would include the use of audiological jargon. Greater language complexity and the use of jargon were expected to be associated with lower hearing aid uptake rates.

Method
Participants
84 initial hearing assessment appointments were recorded audiovisually. 22 appointments were excluded for one of several reasons leaving a total of 62 initial appointments which were included for this study. The appointments were transcribed, in full, by a professional transcription service and de-identified by the research team.

The demographic information relating to the appointments. 26 Australian audiologists (16 female and 10 male) working in adult audiology rehabilitation participated in the study. The audiologists had a range of experience from 1 to 40 years, and each consulted up to four patients aged 55 years or older. The patients ranged in age from 55 to 93 years, with an average age of approximately 72 years. The patients' hearing ranged from within normal limits to severe–profound hearing loss, with the majority (45%) having mild–moderate hearing impairment.

Data Analysis
Each transcript was analysed using two language measures:-

1) General Language Complexity:-
a) The Flesch Reading Ease Score and Flesch-Kincaid (F-K) reading grade level were used to measure word length (i.e., syllables per word) and sentence length (i.e., words per sentence).
b) The Flesch Reading Ease Score provides a number from 1 to 100 indicating the readability ease of the text, whereas the F-K reading grade level indicates the years of education required to comprehend the text.
c) The Flesch Reading Ease Score and F-K reading grade level are approximately inversely correlated such that text that has a higher Flesch Reading Ease Score should have a lower F-K reading grade level.
2) Use of Jargon Terms:-
a) A list of 38 jargon terms was compiled by two members of the research team after viewing five recorded audiology appointments.
b) A small group of the participants, aged 63 to 84 years, were asked to indicate which of the 38 terms they would understand (in context) with no clarification and which would require some clarification. A final list of 33 jargon terms was used for the subsequent analysis.
c) The following was recorded for each transcript: total incidence of jargon, number of different jargon terms, number of jargon terms not well clarified, and the percentage of terms not well clarified. Jargon terms were considered to be well clarified if the audiologist provided an explanation of the term.

Results
There was considerable variability for each of the measures:-
1) On average, audiologists' oral language was found to have a Flesch Reading Ease Score of 83.36 and an F-K reading grade level of 4.80 during the diagnosis and management planning phase of appointments.
2) On average, between 3 and 4 different jargon terms were introduced during each appointment with 62% of these terms being judged as not well clarified. The five most frequently used jargon terms were high/low frequency, (hearing aid) channels, advanced directional microphone, mould, and decibels.

The decision to obtain hearing aids was associated with a lower F-K reading grade level. Some audiologists were found to engage in complex language discussions about hearing aid technologies and did not take account of the fact that their patients may have reduced health literacy. These complex discussions may have influenced patients' decisions to obtain hearing aids because, if patients did not understand their diagnosis and treatment recommendations, they may have become disengaged in the decision-making process. This has important clinical implications, especially as the diagnosis and management planning phase of appointments is the key phase during which audiologists should be facilitating patient involvement in decision-making. The incorporation of shared decision-making within health care interventions has been found to facilitate increased knowledge, leading to informed choices, improved outcomes, and adherence to the rehabilitation recommendations.

The results of this study demonstrated that, on average, the F-K reading grade level and Flesch Reading Ease Score were 4.80 and 83.36, respectively. These results adhere to the current guidelines for written health literacy but there are no recommendations for the F-K reading grade level of verbal communication. Guidelines for the F-K reading grade level of verbal communication

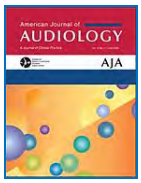
would most likely be lower than that for written health information because of the shorter processing time to comprehend verbal information compared with written information. In addition, the presence of hearing impairment would also have implications for optimal comprehension due to the impact it has on the processing of auditory information.

The audiologists' use of jargon was less than anticipated and did not appear to influence patients' decisions to obtain hearing aids. However, on average, audiologists used between three and four different jargon terms per appointment often without clarification of the jargon terms. Previous research has found that the use of four unclarified jargon terms affects patient comprehension. Given that the mean number of unclarified jargon terms was similar to what was found in this study, it is likely that some patients might have had difficulty understanding the audiologists' recommendations.

Clinical Implications
This study has identified that audiologists' spoken language complexity may be associated with a patient's decision to obtain hearing aids. Patients who did not obtain hearing aids were provided with information by audiologists, on average, more than one grade higher than the patients who obtained hearing aids. These results demonstrate the need for audiologists to modify their communication to use clear, concise language with older patients to ensure greater understanding of recommendations and to facilitate shared decision-making. Audiologists should also consider limiting the use of unexplained audiological jargon during appointments although no associations were found between audiologists' use of jargon and hearing aid uptake.

It is well established that hearing loss and decreased health literacy are more prevalent in older age groups. This study is one of only a few which have looked at language complexity and jargon use during real, rather than simulated, appointments. Bearing in mind the opening statement of this review about the disparity between the prevalence of hearing loss and the acceptance of hearing aids, if the language used by audiologists can positively influence decisions to accept hearing aids, then we have a responsibility to use simpler and more concise language to communicate information and recommendations. This study highlights the need for more research to better understand optimal verbal health literacy for audiological practice.

Relationship Between Objectively Measured Physical Activity, Cardiovascular Disease Biomarkers, and Hearing Sensitivity Using Data From the National Health and Nutrition Examination Survey 2003–2006.



Paul D. Loprinzi and Chelsea Joyner.

American Journal of Audiology, Vol. 26 June 2017, 163–169.

In addition to the many commonly reported causes of hearing loss, some evidence exists which indicates that various metabolic risk factors are associated with hearing dysfunction. However, few studies have examined the specific association between physical activity and hearing function, so there is little evidence to conclude whether physical activity is indeed associated with hearing function. Physical activity may play a role in preserving hearing function because emerging empirical evidence shows that regular physical activity is negatively associated with obesity, markers of immune function such as C-reactive protein (CRP), insulin levels, triglycerides (type of fat in the blood) and positively associated with HDL ("good") cholesterol. Given that physical activity is associated with numerous health outcomes which are associated with hearing function, it is possible that the relationship between physical activity and hearing function is not only direct but also indirectly influenced through mediating variables such as HDL cholesterol. Using a nationally representative sample of adults, the purpose of this study was to examine whether various health outcomes associated with both physical activity and hearing function affect this relationship.

Method
Design and Participants
Data from the National Health and Nutrition Examination Survey (NHANES) 2003–2006 were used in the analyses. NHANES uses a representative sample of non-institutionalised US civilians. Participants were interviewed in their homes and subsequently examined in mobile examination centres (MEC) across 15 locations.

This study had a final sample of 1,070 NHANES participants (533 men, 537 women) aged 30 years and older. Adults 30 years and older were chosen because this is the age when hearing function may start to progressively decline. Of the 1,070 participants, 490 (253 men, 237 women) attended a morning session in the MEC where fasting triglycerides and insulin levels were obtained. The remaining 580 (280 men, 300 women) participants did not attend the morning fasting session and had their blood taken for assessment of HDL cholesterol and CRP. All participants had their height and weight measured in the MEC for assessment of body mass index (BMI).

Measurement of Hearing Ability
In the MEC, pure-tone audiometry was conducted. As with previous hearing studies of NHANES data, low-frequency pure-tone average (LPTA) was obtained in the worse ear by calculating the average of air conduction pure-tone thresholds at 500, 1000, and 2000 Hz and high-frequency pure-tone average (HPTA) was obtained by the average of air conduction pure-tone thresholds at 3000, 4000, 6000, and 8000 Hz. Results were computed separately for LPTA and HPTA because previous research demonstrates that health behaviours may differentially influence hearing at different frequencies.

Measurement of Physical Activity
Participants were asked to wear an accelerometer on the right hip for 7 days following their examination to measure their physical activity. Only those participants with at least 4 days of 10 or more hours per day of monitoring data were included in the analyses described in this article.

Data Analysis
Various linear regression models were tested to examine the direct (i.e., physical activity → hearing function) and indirect (i.e., physical activity → metabolic risk factor → hearing function) influence of physical activity on hearing function. In the direct and indirect models, age, sex, race-ethnicity, and smoking status were controlled for, as these variables are associated with both physical activity and hearing function.

Results
The NHANES analytical sample. The mean age was 52 years, there was similar distribution for both sexes, the mean BMI was 28 kg/m2, and the majority of participants were White (81.5%). Participants, on average, engaged in 23 min/day of moderately vigorous physical exercise (MVPA).

For the LPTA model, physical activity was negatively associated with triglycerides and insulin. None of these health outcomes were significantly associated with LPTA. The direct path from physical activity to LPTA was not significant. It is notable that HDL cholesterol was inversely associated with LPTA, whereas BMI was positively associated with LTPA.

For the HPTA, triglycerides and insulin were positively associated with HPTA. It is notable that HDL-cholesterol (HDL-C) was inversely associated with LPTA. The direct path from physical activity to HPTA was not significant.

These findings suggest that regular physical activity is associated with favourable levels in intermediate outcomes, such as triglycerides and insulin levels and these parameters are associated with hearing. However, no direct association between physical activity and hearing was observed. The findings for triglycerides and insulin are in support of previous work demonstrating that elevated triglycerides are associated with worse hearing function and that physical activity is favourably associated with both triglyceride and insulin levels.

In support of a relationship between insulin and hearing function, previous research has shown that individuals with type 2 diabetes mellitus were at a higher risk of hearing loss (particularly in the low- and mid-hearing frequencies), specifically with hyperglycaemic control by insulin demonstrated to be a risk factor for hearing loss. The pathology underlying the association between hyperinsulinaemia and hearing loss is not clear, but a plausible explanation is that elevated insulin levels may result in microvascular disease of the cochlea.

Although this study did not observe a significant association between physical activity on HDL-C and BMI, previous work has demonstrated that replacing time spent in sedentary behaviour with MVPA has favourable associations with BMI. The significant association between physical activity and HDL-C and BMI, coupled with our observation that HDL-C and BMI were associated with hearing function, suggests that HDL-C and BMI may also play a role in the relationship between physical activity and hearing.

A major strength of this study was the use of objectively measured physical activity, metabolic risk factors, and hearing sensitivity data in a nationally representative sample. A limitation of this study includes the cross-sectional nature of the study design. As a consequence, it was not possible to examine changes in physical activity and intermediate health outcomes to determine whether any causal relationships among physical activity, metabolic risk factors, and hearing function exist. In the future, any work regarding the effects of physical activity on hearing should also consider the role of dietary behaviour.

Although this is a relatively short article and not easy reading in parts, it adds to a growing body of evidence associating several cardiovascular disease risk factors with hearing function and how these risk factors are modifiable by regular physical activity.

A Qualitative Case Study of Smartphone-Connected Hearing Aids: Influences on Patients, Clinicians, and Patient-Clinician Interactions.

Ng., Stella L.; Phelan, Shanon; Leonard, MaryAnn; Galster, Jason.

Journal of the American Academy of Audiology (2017); Vol. 28 (6), 506-521.

Technology has developed at an amazing speed in this last decade, and thoroughly influences our everyday life, our identities and our social interactions. These influences are observed in the rehabilitation and healthcare industry as well, and are especially noticeable in the hearing aid industry. Present hearing aids go hand in hand with modern technology and mobile devices, and there is a need for good research on the connection between hearing aids and current mobile devices by Bluetooth.

This study focuses on changes in clinicians' and patients' experience and perception of hearing aids, and on changes in the relationship between the clinician and the patient. We also zoom in on the sociocultural and ethical implications of smartphone-connected hearing aids.

The research contains three different components: the within-case research, including the clinician experience and the patient experience, the between-case research, which looks at the interactions between both, and lastly the across-case research that focuses on the perception of connected hearing aids. The sample contained 11 patients (age 44-74 years old) and 8 clinicians, of whom all had a different level of experience with connected hearing aids and/or mobile devices.

Clinicians' reasons for recommending a connected hearing aid to their patients vary from first impressions to detailed candidacy heuristics, depending on the personal judgements of each clinician. The heuristic-based approach can be appropriate, but only under certain conditions as there is a danger of ruling out patients who seem technologically not savvy enough although they could be perfectly capable of using mobile devices.

The patients describe themselves as competent or incompetent technology users but overall we observe a great desire to learn more. The increased empowerment that patients gain by getting more control over their hearing aids leads to more involvement and more joy in their experience.

As for the changes in interaction between the clinician and patient, we observed several elements: The clinicians felt that they got to know the patients better because the connected hearing aids made the patient's experiences and preferences more specific, which prolonged the appointment duration. Despite these appreciably increased clinical interactions, patients also experienced a lot of frustration when the connection didn't work perfectly and their expectations about the results with hearing aids were too high.

Between the across-case findings, there was a remarkable lack of concern about privacy issues on the smartphone, like the tracking of location or other personal information that is collected by using the application.

The stigma of hearing aids as an indicator of old age has decreased a lot by the use of a cool and modern application on your smartphone to easily and discretely change your hearing aid settings. This innovation lowered the threshold to hearing aids, which convinced a lot of people to finally take the step to start with hearing aids. Furthermore, hearing aids are increasingly perceived as part of the everyday technology, rather than an isolated group of clinical prostheses needed for your hearing impairment.

This research concludes that further research is needed, as this was one of the first r that focused on how modern connectivity influences clinicians, patients and their interactions.

These changes and innovations are very positive to persuade more people who need hearing aids. However, the stigma about hearing loss and hearing aids remains present, partially because the entire hearing aid industry still heavily focuses on discretion when advising on hearing aids. Shouldn't we instead put more energy in sensitisation about hearing health care and promote social acceptance, rather than stimulate discretion? While glasses became a fashion object, hearing aids are still a taboo, which won't change while clinicians and innovators continue to focus on the discretion of hearing aids. The communication about rehabilitation plays a very important role and has the power to change this stigma.

The social acceptance of hearing loss has increased compared to the past but we still have a long way to go. However, many other disabilities (such as wheelchair use) also still have a stigma and have fewer chances to become mainstream.

The privacy issues on the smartphone, such as people's lack of awareness and concern for the use of a smartphone in general, is a global social and ethical discussion, and are therefore not specific to the fitting application that is used in this research. Nonetheless, paying attention to these issues remains important to prevent unnecessary loss of privacy, no matter in which subject or branch.

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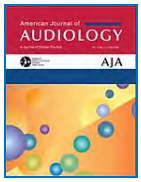
The Influence of Social Support and Coping on Quality of Life Among Elderly With Age – Related Hearing Loss.



Sarah Moser, Wolfang Luxenberger, and Wolfang Freidl.

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It is well known that Hearing loss is one of the most prevalent chronic conditions among older individuals (Bagai, Thavendiranathan, & Detsky, 2006; Bainbridge & Wallhagen, 2014; Yamasoba et al., 2013) and that age-related hearing loss is considered a serious global public health issue. Much of the research on ageing and hearing loss has been, in the past, on pathogenic, biomedical correlates, identification of risk factors, and negative health outcomes, such as (co)morbidities and mortality (Faltermaier, 2005). Most models concentrate on disease and consider health as an absence of illness, thereby classifying individuals as either being ill or healthy (Antonovsky, 1979). Although the pathogenic paradigm is crucial to identifying needs, challenges, and treatment plans, this deficit-oriented perspective appears to be insufficient in promoting health and quality of life (Kuhn, 1970). The pathogenic perspective tends to ignore psychosocial dimensions, as well as resources and capabilities for health and quality of life (Engel, 1977). The criticism in terms of the pathogenic paradigm concerns the reductionist perspective of health, which is the reason why Engel (1977) focused on the consideration of health from a holistic and resource-oriented perspective (salutogenesis).

Although It is well documented in the literature that coping and social support have a potential influence on an individual's health and linkages between choice of various coping strategies and psychological well-being among older adults with age-related hearing loss, the association between quality of life and the support of significant others in the life of this population, as well as the role of various coping strategies and perceived social support as a resource of quality of life, have not yet been fully addressed in audiological research.

The purpose of the present study was to ascertain a set of psychosocial factors or capacities that may have an influence on the quality of life of older adults with age-related hearing loss. The main goal of this study was to examine the impact of assessed hearing loss from an audiological perspective, the often inevitable perceived effects of hearing loss (hearing handicap), choice of generic coping strategies, and perceived social support on various categories of quality of life (physical, psychological, social, environmental, and global).

The participants in the test consisted of older adults with age-related hearing loss living in Vorarlberg and Styria, two provinces in Austria. They were required to meet the following inclusion criteria: (a) women and men age 55 years and older; (b) bilateral age-related hearing loss of 25 dB HL or more (binaural mean thresholds across four frequencies: 0.5, 1, 2, and 4 kHz); (c) mastery of the German language. Older adults with manageable hearing loss through surgery or medications were excluded. Another exclusion criterion was the self-reported presence of severe disease, dementia, or cognitive impairment. Participants included 65 older adults with age-related hearing loss (32 women and 33 men), with a mean age of 71.6 years. Sociodemographic characteristics. The majority attended compulsory school or an apprenticeship training; hence, the proportion of participants with higher education levels (secondary school and university) was low.

Self-report outcome measures were used to quantify hearing handicap, coping, social support, and quality of life.

Patients with age-related hearing loss who visited an ear, nose, and throat specialist in practice in Styria, Austria, or an audiologist in the Department of Audiology in Vorarlberg, Austria, between Autumn 2015 and Spring 2016 were informed about the study and asked to participate. A consent form and standardised survey form, including the self-report outcome measures and a postage-paid envelope, were distributed to the potential participants, who were additionally asked to return the questionnaire by mail.

The statistical program SPSS (Version 22; IBM, Ehningen, Germany) was used for all quantitative data analyses. For the description of sample characteristics, descriptive statistics to calculate frequency distribution, the mean and standard deviation were used.

The independent variables of perceived social support and multimorbidity made a unique contribution to the variance in the dependent variable psychological health (including items about enjoying life, ability to concentrate, and negative feelings, such as anxiety or depression). Perceived social support was the strongest predictor in this model. These results suggest that higher scores on the social support scale, (indicating highly perceived social support), contributed to increased psychological quality of life. The psychological quality of life of hearing-impaired participants was poorer when persons suffered from additional diseases.

Social Quality of Life: There were significant correlations among the dependent variable social relationships and the independent variables multi morbidity ($r = -.212$, $p < .05$) and perceived social support ($r = .377$, $p < .01$), which were entered in the regression model. The regression model explained 16.8% of the variance in the dependent variable social relationships ($p < .01$).

An interesting paper providing some surprising evidence about the significantly greater hearing aid adoption when participants attended audiology appointments with a significant other instead of attending appointments alone for persons with mild hearing loss (Singh & Launer, 2016). It is suggested, and audiologists and hearing aid specialists may want to consider this in their daily practice, that quality of care and well-being of hearing-impaired older adults could be improved by actively involving family members, relatives, and friends in counselling as part of the treatment or rehabilitation to address hearing impairment. Counselling, including education or information about the nature of hearing loss, the use of hearing aids, and the real benefits of hearing aids and assistive listening devices, and by teaching a skill set of coping, particularly of communication strategies could make a valuable contribution by enabling significant others to provide appropriate social support to facilitate communication and, particularly, to improve everyday life for both sides (Hallberg et al., 2008).

The Effect of Tinnitus on Listening Effort in Normal Hearing Young Adults: A Preliminary Study.

Sofie Degeest, Hannah Keppler, and Paul Corthals.

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Tinnitus occurs in adults, with an overall prevalence of 10% to 15% (Shargorodsky, Curhan, & Farwell, 2010; Sindhusake et al., 2003) involving a wide range of underlying mechanisms or possible origins. Previous studies have indicated that excessive noise exposure represents one of the most common causes of tinnitus (Kowalska & Sułkowski, 2001; Penner & Bilger, 1995). Acute tinnitus can last from a few minutes to a few weeks after noise exposure, whereas chronic tinnitus lasts for months to years (Kaltenbach & Manz, 2011). In addition to the well-known harmful effects of occupational noise, a correlation between leisure noise and tinnitus has already been reported (Davis, Lovell, Smith, & Ferguson, 1998; Figueiredo et al., 2011). This is especially true in young adults, and there is an increased concern about the effects of leisure noise on hearing, with previous research showing that the prevalence of chronic tinnitus was approximately 6.5% in young Flemish adults exposed to leisure noise (Degeest, Corthals, Vinck, & Keppler, 2014; Degeest, Keppler, Corthals, & Clays, 2017).

Chronic tinnitus can result in comorbid distressing symptoms such as problems experienced with concentration or speech understanding in various listening conditions (Andersson, Khakpoor, & Lyttkens, 2002; Tyler & Baker, 1983). These difficulties were attributed to distraction and irritability caused by the presence of tinnitus, making it difficult to concentrate (Tyler & Baker, 1983). Evidence for this assumption may be derived from research on cognitive functions, which may be deteriorated by the presence of tinnitus (Gatehouse, 1991; Jacobson et al., 1996).
Furthermore, tinnitus may disrupt the processing of auditory verbal information that is mediated by working memory (Andersson & McKenna, 2006; Baddeley, 1986). Because attention and working memory are reported to be related to speech processing (Pichora-Fuller, Schneider, & Daneman, 1995; Schneider, Daneman, & Pichora-Fuller)

Any condition making the primary task more difficult results in less spare mental capacity to perform the secondary task. Therefore, decreased performance on the secondary task indicates more listening effort (Downs, 1982). Because of the involvement of cognitive capacities in the amount of listening effort, and because it is well known that tinnitus is often accompanied by different levels of distress (Degeest, Corthals, Dhooge, & Keppler, 2016), it will be important to control for tinnitus distress as a possible factor that may influence the amount of listening effort.

Participants in the Tinnitus Group (TG) consisted of 13 adults (7 men and 6 women) aged 19 to 31 years (M = 23.8 years, SD = 4.30 years). All participants were native speakers of Dutch. They all experienced chronic tinnitus, which was defined as tinnitus that has occurred for at least 3 months (National Institute on Deafness and Other Communication Disorders, 1994– 1995). One participant (7.7%) experienced tinnitus for less than 6 months, 3 participants (23.1%) experienced tinnitus between 6 months and 1 year, and 9 participants (69.2%) experienced tinnitus for more than 1 year

The Control Group, also consisting of 13 participants, was selected after data collection was completed for the TG. CG participants were also native Dutch speakers. They were each matched to an individual from the TG according to the following criteria: (a) Age difference was less than 2 years, (b) individuals were of the same gender, (c) educational levels were equal according to UNESCO

(2012), and (d) hearing threshold differences were less than 15 dB HL at each tested frequency. The CG consisted of 7 men and 6 women aged 20 to 31 years (23.8, SD = 3.90 years). Like the TG, none of the participants had a history of communication or learning problems, and none had known neurological disorders. Both groups were equivalent with respect to gender and educational level. An independent-samples t test revealed no significant differences between both groups according to age, t (24) = −0.47, p > .05

The average baseline speech-recognition scores for the participants in the TG and CG. The two-factor 2 × 3 ANOVA to evaluate mean differences in speech-recognition scores across groups (TG or CG) and different listening conditions (quiet, SNR+2dB, and SNR-10dB) revealed a significant main effect of listening condition on speech-recognition scores, F(2, 74) = 92.62, p < .05. The group effect was not significant, F (1, 74) = 0.05, p > .05; and there was also no significant interaction between listening condition and group, F (2, 72) = 1.72, p > .05. Post hoc Scheffé tests were performed for the variable listening condition and showed a significant mean difference in speech-recognition scores between the quiet condition and the condition with an SNR of −10 dB, as well as between the condition with an SNR of +2 dB and the condition with an SNR of −10 dB (p < .05). The mean percentage score on the baseline secondary visual memory task was 98.4% (SD = 3.76, range = 90%–100%) for the TG and 99.2% (SD = 2.77, range = 90%–100%) for the CG. This difference between both groups was not significant according to the Mann-Whitney U test (p > .05).

This study is a first exploration of listening effort in tinnitus patients showing that, independent of hearing sensitivity and tinnitus handicap, listening effort is significantly increased in the tinnitus group across listening conditions. The authors believe that including a test for listening effort in clinical practice may therefore be useful to better understand the complaints about concentration related to speech recognition indicated by tinnitus patients. Further research investigating the contribution of cognitive functioning to the amount of listening effort as well as research on the effects of masking noise on listening effort may be useful to increase insight in the assessment of tinnitus and the use of various treatment strategies such as hearing aids and/or noise generators.

The authors suggest that further investigations are needed on the relationship between cognitive functions, important for speech understanding, and the presence of tinnitus and listening effort. These findings suggest that factors other than hearing or tinnitus handicap may have caused the increased listening effort in the participants from the TG. A very interesting and significant aspect emerging from this test is that listening effort was considered to be related to cognitive processes required for speech understanding such as selective attention, working memory, and processing speed. Several authors have suggested that selective attention (Andersson, Eriksson, Lundh, & Lyttkens, 2000; Hallam et al., 2004; McKenna & Hallam, 1999) and working memory capacity (Baddeley, 1986; Rossiter et al., 2006; Stevens et al., 2007) could be affected by the presence of tinnitus. It would thus seem reasonable to argue that increased listening effort found in participants with tinnitus concerns causes a shift of attention toward the tinnitus, which can be considered as task-irrelevant information (Hallam et al., 1984, 2004). It is plausible that cognitive capacity may have been reduced in the tinnitus participants and this may have important implications for envisaging novel and meaningful strategies in managing tinnitus patients.

Speech Recognition in Adults With Cochlear Implants: The Effects of Working Memory, Phonological Sensitivity, and Aging.

Aaron C. Moberly, Michael S. Harris, Lauren Boyce, and Susan Nittrouer.

Journal of Speech Language and Hearing Research. April 2017; Vol. 60, 1046-1061.

Most adults with postlingual deafness receiving cochlear implants obtain some benefit in speech recognition, yet the outcomes can heterogeneous, extremely variable and subject to individual differences. Approximately half of this variability can be explained by factors that relate to the expected differences in individuals' sensitivity to spectral and temporal cues after implantation, such as the condition of the peripheral auditory system (e.g., duration of deafness or amount of pre-operative hearing) and the positioning of the electrode array (e.g., proximity to the modiolus or angle of insertion; (Holden et al., 2013; Holden, Reeder, Firszt, & Finley, 2011; Kenway et al., 2015). However, there is increasing evidence from adults with various degrees of hearing loss that cognitive functions may explain additional variability in speech recognition.

The primary goal of this study was to examine what factors, other than those associated with the damaged peripheral auditory system, might be involved in the variability in outcomes for adults with postlingual deafness who get CIs. The first objective was to examine whether verbal WM abilities were poorer for postlingually deaf adult CI users compared to age-matched NH peers. Two measures of verbal WM were included: digit span and serial recall of lists of established words. This test was included because its design could help identify whether any group differences in WM were due to differences in participants' access to phonological structure (storage) or to differences in WM response times (processing). During the serial recall task, listeners completed a picture-pointing task in which they heard a string of words and were asked to point to pictures on the screen in the order recalled as quickly as possible. Three kinds of words were incorporated: (a) non-rhyming nouns that are phonologically distinct, (b) rhyming nouns that are phonologically confusable, and (c) non-rhyming adjectives that are phonologically distinct but not so obviously related to pictures.

Sixty adults were recruited for this experiment, thirty of whom were experienced CI users between the ages of 50 and 82 years who were recruited from a pool of departmental patients. CI users had various aetiologies of hearing losses and ages at implantation, but all experienced a progressive decline in their hearing during adulthood. All CI participants received their implants at or after the age of 35 years and were found to be candidates for implantation on the basis of clinical sentence recognition criteria in place at that time. All participants underwent screening via the use of the validated Mini-Mental State Examination (MMSE) of cognitive function to ensure that they had no obvious evidence of cognitive impairment or dementia; MMSE is a validated screening assessment tool for memory, attention and the ability to follow instructions.. Raw scores were converted to T scores, which are based on age and education. A T score of less than 29 is a concern for cognitive impairment, and a score of 50 represents the mean and 1 SD above or below the mean of T scores of 60 or 40, respectively. Participants with T scores less than 29 would have been excluded from data analyses, but no participants had T scores less than 29. In addition to the MMSE, all participants were assessed for basic word-reading ability with the Word Reading subtest of the Wide Range Achievement Test, 4th edition (Wilkinson & Robertson, 2006) as a basic metric of language proficiency. All participants had standard scores ≥ 85, so no participant had a score poorer than 1 SD

below the mean. Although significant differences were observed between the NH listeners and the CI users for the MMSE and the Word Reading subtest, scores for neither of these independent variables were correlated with any of the dependent variables that were measured in this study.

All participants used Cochlear devices (Sydney, Australia), with an Advanced Combined Encoder speech processing strategy. Thirteen CI participants used a right CI, nine used a left device, and eight used bilateral devices. Thirteen participants used a contralateral hearing aid. During testing, participants wore their devices in everyday mode, including use of any contralateral aids, and were instructed to keep the same settings throughout the experiment. Unaided audiometric assessment was performed immediately prior to testing to assess residual hearing in each ear. Regarding production abilities, none of the CI users showed any evidence of diminished intelligibility. Thirty NH participants were tested as a control group and they were matched closely in gender and age to the CI users, meaning ages between matched individuals were within 5% of the younger individual's age. Control participants were evaluated for NH, assessed immediately before testing, defined as four-tone (0.5, 1, 2, and 4 kHz) pure-tone average thresholds better than 25 dB HL in the better hearing ear.

Mean non-word repetition (NWR) scores across syllable lengths for cochlear implant (CI) users and listeners with normal hearing (NH). Error bars represent standard errors of the means.

Speech recognition outcomes are usually conditioned significantly by postlingual hearing loss and subsequent CI. This study was conducted to examine the contributions to variability in outcomes of WM, phonological sensitivity, and ageing. The study was motivated by findings from earlier work demonstrating that (a) phonological sensitivity underlies individual differences in verbal WM in older adults with NH and in children with CIs, (b) auditory deprivation in adults with acquired deafness results in degradation of phonological sensitivity, and (c) verbal WM skills are important for making sense of impoverished auditory input during spoken language recognition for individuals with hearing loss, including those listening with hearing aids. On the basis of these previous findings, the current study was conducted to test four hypotheses: (a) CI users have poorer verbal WM skills relative to age-matched NH peers, and group differences are most pronounced on tasks that rely heavily upon phonological sensitivity; (b) CI users have deficits in phonological skills, relative to their NH peers, as a result of auditory deprivation and their experience listening to impoverished input through their CIs; (c) advancing age is associated with declines in tasks of verbal WM; and (d) verbal WM performance or phonological sensitivity predicts recognition of words in sentences.

Though potentially in conflict with previous findings, this well designed and statistically robust study does provide convincing support for the idea that clinical outcomes in speech recognition for adult CI users are related to sensitivity of these users to phonological structure and only minimally to verbal WM skills. Phonological capacities in CI subjects may serve as potential targets for clinical interventions, such as by implementing phonological training programmes or clinical rehabilitation strategies that focus on preserving or restoring phonological skills. These types of intervention strategies may possibly be particularly useful for older adult CI users.

Auditory Processing of Older Adults with Probable Mild Cognitive Impairment.

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Rates of dementia are increasing ever more rapidly with the ageing population, and there is an ever growing need to understand the factors that are associated with cognitive decline. Cognitive decline and the onset of cognitive impairment are often gradual, with symptoms becoming increasingly apparent over time. A diagnosis of mild cognitive impairment (MCI) was proposed to identify individuals at a transitional stage between normal cognitive ageing and Alzheimer's disease or another type of dementia (Albert et al., 2011; Petersen et al., 1999). MCI is distinct from dementia which is irreversible and encompasses more severe cognitive impairment that noticeably impairs daily function.

Deficits in auditory processing can present impaired sound localisation and lateralisation, auditory discrimination, auditory pattern recognition, temporal aspects of audition, including temporal integration, temporal discrimination (e.g., temporal gap detection), temporal ordering, and temporal masking, auditory performance in competing acoustic signals (including dichotic listening), and/or auditory performance with degraded acoustic signals (American Speech-Language-Hearing Association, 2005). Diagnosis of an auditory processing disorder requires abnormal performance in at least two of these areas. Studies indicate that many older adults have difficulty across all areas of auditory processing. Such difficulty increases with age (Golding, Taylor, Cupples, & Mitchell, 2006; Humes et al., 2012), and is associated with social isolation, depression, and reduced quality of life (Jerger, Oliver, & Pirozzolo, 1990). The prevalence estimates of auditory processing disorder indicate that up to a staggering 80% of older adults could be affected, with estimates varying widely (Golding, Carter, Mitchell, & Hood, 2004; Rodriguez, DiSarno, & Hardiman, 1990; Sanchez, Nunes, Barros, Gananca, & Caovilla, 2008; Stach, Spretnjak, & Jerger, 1990.)

Little is known about auditory processing dysfunction among individuals with MCI. Previous research demonstrates that older adults with MCI perform worse on measures of auditory processing of competing acoustic signals, such as SSIICM, DSI, and Dichotic Digits Tests (Gates et al., 2008; Idrizbegovic et al., 2011). Rahman, Mohamed, Albanouby, and Bekhet (2011) further showed that individuals with MCI have difficulty with auditory pattern recognition (i.e., Pitch Pattern Sequence Test). No differences between the groups were found on a single measure of temporal aspects of auditory processing (i.e., a measure of fusion, the Auditory Fusion Test). The present study examined auditory processing among individuals with and without probable MCI.

For this, participants included older adults diagnosed with MCI from the Suncoast Memory Clinic at the University of South Florida (USF) Byrd Alzheimer's Institute, who agreed to release their contact information to the USF Cognitive Aging Lab or the USF Psychoacoustics Lab. Older adults with and without probable MCI were also recruited from the Tampa, FL, area. Such individuals expressed interest in participating in research through community memory screening events, in response to educational talks or media ads or via purchased mailing lists of individuals living within the vicinity of the USF campus.

Demographic data and outcome variables by eligible participants with and without probable MCI

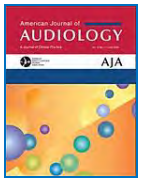
The purpose of this study was to compare older adults with and without probable MCI on auditory processing measures of competing acoustic signals, which have previously been studied, and measures of temporal aspects of audition, which are new to this area of research. It was hypothesised that in a sample of community-dwelling older adults, individuals with probable MCI would perform worse on SSI-ICM, DSI, TCS, and ATTR than those without MCI. The findings partially support this hypothesis, indicating that participants with probable MCI performed worse on measures of SSI-ICM, DSI, and ATTR within channel as compared with participants without MCI. No statistically significant differences between the groups in pure-tone thresholds or on TCS were evident in the sample.

Older adults with and without probable MCI were compared on several measures of auditory processing. The findings indicate that performance on measures of competing acoustic signals and some temporal aspects of audition differed between older adults who have probable MCI and those who do not. No significant differences between the groups in peripheral hearing, as measured by pure-tone thresholds, were evident. Research clearly shows that processing of competing acoustic signals is impaired in MCI. This study further demonstrates that some aspects of temporal processing may also be impaired in MCI. Future research should examine other aspects of auditory processing that have yet to be investigated in relation to cognitive status such as sound localisation and lateralisation.

The results from this study add to the already rich literature documenting the associations between cognitive impairment and poor auditory processing of competing signals and provide new evidence that specific aspects of temporal processing are also impaired among those with probable MCI. The results obtained from this test are similar to previous research by Gates and colleagues (Gates et al., 1996, 2008, 2010) who found that older adults with cognitive impairment performed worse.

This paper is of great interest considering the vast amount of investigations undergoing on the topic of cognition. To understand the differences in auditory processing between cognitively healthy older adults and those with probable MCI could promote early detection through appropriate referrals with all the positive consequences that it may possibly provide for public spending. This could require a rethinking of present models and strategies used in managing such patients. Auditory processing deficits have been found to precede dementia diagnoses (Gates et al., 2002; Idrizbegovic et al., 2011), which has clinical relevance, in that early detection of MCI could facilitate neurological treatment and possibly delay progression of the disease (Gates et al., 2008). Previous researchers, as shown in the literature, recommend that older adults performing poorly on auditory processing measures should be referred for further neuropsychological evaluation (Gates et al., 2002, 2010) and this puts audiologists and also hearing aid specialists in a very privileged position. In particular, poor performance on tests of competing acoustic signals and potentially on gap detection might be considered red flags.

Child-Adult Differences in Using Dual-Task Paradigms to Measure Listening Effort.



Erin Piccou, Lauren Charles & Todd Ricketts.

American Journal of Audiology, Vol. 26 (June 2017) p143-154.

Listening in complex environments can be problematic, partly because these complex environments may increase the mental effort necessary for a listener to understand speech. This additional mental effort, or listening effort, can have important consequences for children who are still learning. Mental effort is not directly observable, objective measures rely on inferences and assumptions about human cognition. Increased listening effort is inferred on the basis of slowed responses to a speech stimulus or slowed responses during a secondary task.

During a dual-task paradigm, the secondary task must require cognitive resources in order to be indicative of excess or spare cognitive capacity.

This study tends to evaluate the effect of increasing secondary task complexity and depth of processing in a dual-task paradigm for measuring objective listening effort by using secondary tasks that are appropriate for school-age children. A control group of adult listeners also participated to confirm the previously established effects of increasing complexity and depth of processing.
Three dual-task paradigms were developed for school-age children. The primary task was word recognition. The secondary task was a physical response to a visual probe (simple task), a physical response to a complex probe (increased complexity), or word categorisation (increased depth of processing). 16 adults and 22 children (9 – 17 years) were tested during the 3 paradigms in quiet and noise.

Results and discussion

Noise negatively affected word recognition performance, but the effect was independent of age group and secondary task. These findings demonstrate that dual-task paradigms can be useful for evaluating listening effort in school-age children.
Increasing depth of processing increases paradigm sensitivity for adults, but for children, the deep paradigm resulted in the most variable effects of noise on response times. Some of the youngest children responded faster when noise was present than in quiet. There are several explanations for this somewhat surprising finding, including the development of object naming (children's mental representations are less sophisticated, the task may have been too easy), inattention (it is possible that during the deep paradigm, younger children were inattentive in quiet and more attentive in noise), response scoring (during the deep paradigm all responses were accepted, not only the correct responses, so guessing might influence response times) and level of processing (might be not deep enough to increase paradigm sensitivity, only the size needed to be considered).

So when evaluating school-age children, it may be important to avoid increasing the depth of processing and evaluate task difficulty to ensure that performance on the primary or secondary task does not improve during dual task testing.

Evidence of activity-dependent plasticity in the dorsal cochlear nucleus, in vivo, induced by brief sound exposure.

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Ear & Hearing 2017;38;267–281.

Listening effort is one of the factors influencing speech comprehension. One can presume that comprehension in complex situations can be more difficult for hearing impaired persons. Manufacturers claim that noise reduction schemes can reduce listening effort and hence decrease fatigue and mental distress. The authors of this article did a systematic review of relevant publications related to this subject. They posed 2 research questions:-
1) Does hearing impairment affect listening effort?
2) Can hearing aid amplification affect listening effort during speech comprehension?
They started with 7071 hits on their keywords, and ended up with 41 articles fulfilling the selected criteria. However, the quality of evidence was low and the authors stated that, indeed, listening effort increases when hearing impairment was observe but they could not find evidence to support the second question. They stated that there is a lack of consistency, low statistic evidence and too many differences in how studies define listening effort.

Bearing in mind that a systematic effort in hearing aid development schemes to lessen listening effort and to take in account central processes is rather recent, we should have more research to find out if listening effort can or can't be influenced using amplification.