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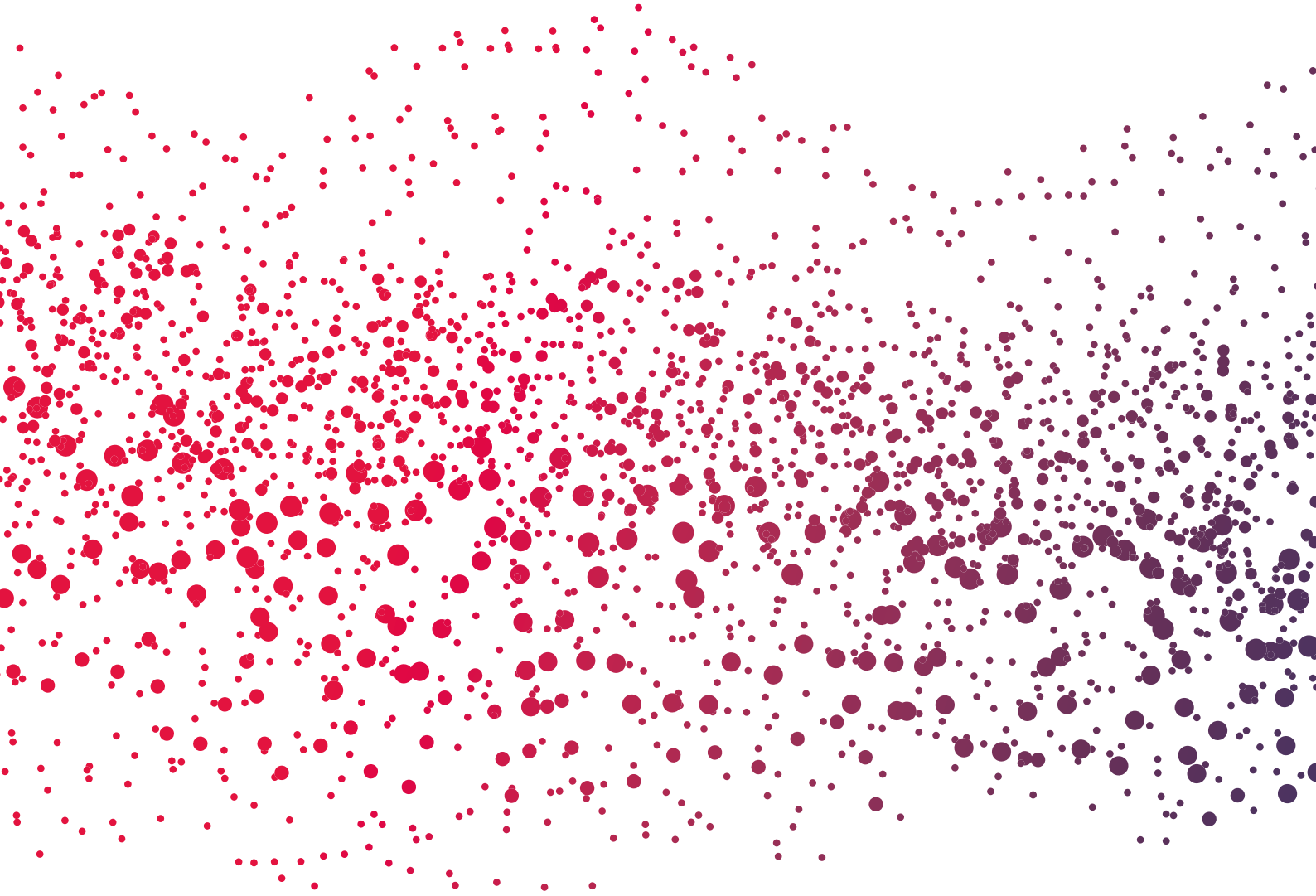
Otology & Audiology Article Review



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- Page 06: Katrien Hoornaert – Belgium ✓:
  - Masked speech perception across the adult lifespan: Impact of age and hearing impairment.
    - *Tine Goossens, Charlotte Vercammen, Jan Wouters & Astrid van Wieringen.*
    - *Hearing Research 344 (2017) 109 -124.*
    - *Even when peripheral hearing is considered to be normal and there is no indication of even mild cognitive impairment, speech perception declines between young and middle age and decreases further on to older age. The age-related speech perception difficulties are apparent in the event of energetic masking as well as in the event of informational masking, but they are most salient in the latter type of masking, which induces a higher cognitive load.*
- Page 09: Lorenzo Notarianni – Italy ✓:
  - Considerations for Pediatric Cochlear Implant Recipients With Unilateral or Asymmetric Hearing Loss: Assessment, Device Fitting, and Habilitation.
    - *Laura Greaver, Hannah Eskridge & Holly Teagle.*
    - *American Journal of Audiology, Vol.26, 1-8.*
    - *The purpose of this clinical report is to present case studies of children who are non-traditional candidates for cochlear implantation because they have significant residual hearing in one ear and to describe outcomes and considerations for their audiological management and habilitation. The authors report that their experience with cochlear implantation for children with UHL or AHL has far exceeded our initial expectations.*
- Page 11: Lorenzo Notarianni – Italy ✓:
  - Unilateral Hearing Loss: Understanding Speech Recognition and Localization Variability-Implications for Cochlear Implant Candidacy.
    - *Firszt, Jill B.; Reeder, Ruth M.; Holden, Laura K.*
    - *Ear and Hearing, Vol. 38(2) March Apr 2017 p 159-173.*
    - *Along with the negative consequences of unilateral hearing loss such as sound localisation and understanding in noisy environments there exists considerable unexplained individual variability in the magnitude of its effects. Little is known about factors that could impact performance or if there is a group at risk for poor cochlear implant outcomes when hearing is near normal in one ear. The goal of this research is to investigate the range and source of variability in speech in noise and localisation and help determine factors relevant to decisions regarding cochlear implantation. Findings of the study showed that individuals with UHL localised sound better than NH listeners listening monaurally, suggesting that over time UHL participants had developed strategies for making use of monaural directional information.*
- Page 13: Lorenzo Notarianni – Italy ✓:
  - Visual Temporal Acuity Is Related to Auditory Speech Perception Abilities in Cochlear Implant Users.
    - *Jahn, Kelly N.; Stevenson, Ryan A.; Wallace, Mark T.*
    - *Ear and Hearing, Vol. 38(2) March Apr 2017 p 236-243.*
    - *Despite significant improvements in speech perception abilities following cochlear implantation, many pre-lingually deafened cochlear implant (CI) recipients continue to rely heavily on visual information to develop speech and language. Increased reliance on visual cues for understanding spoken language could lead to the development of unique audiovisual integration and visual-only processing abilities in these individuals. The findings provide behavioural evidence that visual temporal acuity is related to post-implantation CI proficiency as indexed by auditory – only speech perception performance.*
- Page 15: Lorenzo Notarianni – Italy ✓:
  - Crossmodal plasticity in auditory, visual and multisensory cortical areas following noise-induced hearing loss in adulthood.

    - *Ashley Schormans, Marei Typlt & Brian Allman.*
    - *Hearing Research - Vol 343 January 2017 p 92-107.*
    - *Complete or partial hearing loss results in an increased responsiveness of neurons in the core auditory cortex of numerous species to visual and/or tactile stimuli (i.e., cross modal plasticity). At present, however, it remains uncertain how adult-onset partial hearing loss affects higher-order cortical areas that normally integrate audiovisual information. It is reasonable to predict that the transition in the functional border of the audiovisual cortex observed in the present study could lead to behavioural consequences in tasks requiring audiovisual processing.*
- Page 17: Tom De Neve - Belgium ✓:
    - Comparison of Speech-in-Noise and Localization Benefits in Unilateral Hearing Loss Subjects Using Contralateral Routing of Signal Hearing Aids or Bone-Anchored Implants.
        - *Hillary Snapp, Fred Holt, Xuezhong Liu & Suhrud Rajguru.*
        - *Otology & Neurotology, Vol. 38 No. 1, 2017 p 11–18.*
        - *Both CROS and Bone-Anchored Implants to not improve localisation. In an ideal setup (speech coming from the poor ear and noise from the best ear side) there is a significant improvement in understanding in noise with both systems. Also subjective performance is significant for both systems. There was no difference between CROS and Bone-Anchored Implants.*
- Page 19: Tali Bar-Moshe - Israel & Reddy Sivaprasad - India ✓:
    - The Effects of Service-Delivery Model and Purchase Price on Hearing-Aid Outcomes in Older Adults: A Randomized Double-Blind Placebo-Controlled Clinical Trial.
        - *Larry Humes, et al.*
        - *American Journal of Audiology, Vol. 26, March 2017, p53–79.*
        - *This randomised double-blind clinical trial study compared the traditional "Audiologist-Based Services" with that of a conceptualised "Over The Counter" model and with a placebo group. The results showed that the Audiology Based model yielded higher satisfaction and better outcomes, although this the Audiology Protocol was stripped and only gain and compression was professionally selected and set, no features were specifically selected and adjusted based on specific patient needs or assessment. The authors seem to be positive on the OTC model they introduced, although all the subjects went through a complete audiological assessment before the procedure, which is not really in line with what a possible "Over The Counter" model might look like in the future.*
- Page 21: Reddy Sivaprasad – India ✓:
    - Auditory Distraction and Acclimatization to Hearing Aids.
        - *Piers Dawes & Kevin Munro.*
        - *Ear and Hearing, Vol. 38(2) March Apr 2017, 174–183.*
        - *This study tried to reconceptualise acclimatisation in new HA users. It measured several subjective and objective speech in noise and distraction measures in 3 different visits in new and experienced HA users. Results show an improvement in speech in noise scores in moderate and more severe hearing loss. The study failed to show any correlation of this improvement with distraction measures.*
- Page 22: Reddy Sivaprasad – India ✓:
    - Development of An Evidence-Based Decision Pathway for Vestibular Schwannoma Treatment Options.
        - *Xuan Su, Caiyun He, Tao Tang, Weichao Chen, Zhaoqu Li, Yong Chen & Ankui Yang.*
        - *American Journal of Otolaryngology, Head and Neck Medicine and Surgery, Vol 38, (2017) p 52 – 56.*
        - *This study used multiple methods to develop a decision support model that compares all the available treatment options for Vestibular Schwannoma. This is a small but significant step in implementing patient-centred care in ENT services.*
- Page 23: Tali Bar-Moshe – Israel ✓:

  - What Otolaryngologists Need to Know About Hearing Aids.
    - *Kenneth Grundfast & Sara Liu*
    - *JAMA Otolaryngology–Head & Neck Surgery February 2017 Vol. 143, N° 2 p 109-110.*
    - *This article address the HA issue from a narrow point of view of the HA pricing. The authors do not try to understand the hearing rehabilitation process the person needs to go through in order to learn to use their HA successfully and the audiologist's role in this process.*
- Page 24: Laure Huighe – Belgium ✓:
  - The Utilization of Social Media in the Hearing Aid Community.
    - *Moumita Choudhury, Zoë Dinger & Elena Fichera.*
    - *American Journal of Audiology, March 2017, Vol. 26, 1-9.*
    - *Although it is an interesting topic to research, it is a difficult one if you want to avoid subjective factors. As a service provider, it is wise to know where our future/current clients look for information and how this is evolving, as well as what information they are looking for.*
- Page 25: Laure Huighe – Belgium ✓:
  - Audiological Rehabilitation for Facilitating Hearing Aid Use: A Review.
    - *Hashir Aazh & Brian Moore.*
    - *Journal of the American Academy of Audiology, Vol 28 N°3 (2017), p. 248-260.*
    - *There's no strong relationship measured between audiological rehabilitation and hearing aid use, self-perceived handicap and quality of life. Analysing the studies, the focus is more on education than on influencing behavioural change.*
- Page 26: Shantelle Chandra – New Zealand ✓:
  - Examining the short term effects of emotion under an Adaptation Level Theory model of tinnitus perception.
    - *Mithila Durai, Mary O'Keeffe & Grant Searchfield.*
    - *Hearing Research 345 (2017) p 23-29.*
    - *The findings show that negative emotional changes resulting from stimuli presentation were linked with greater tinnitus perception when using auditory stimuli, but not visual stimuli. Increased tinnitus perception was measured by higher subjective tinnitus loudness ratings in males and females, and higher subjective tinnitus annoyance ratings in males only. Males had higher emotional appraisal scores and emotional suppression scores than females.*
- Page 28: Melissa Babbage – New Zealand ✓:
  - Importance of an Inter-professional Team Approach in Achieving Improved Management of the Dizzy Patient.
    - *Amanda Rodriguez et al.*
    - *Journal of the American Academy of Audiology Vol 28:177–186 (2017).*
    - *These data suggest that using a team approach for dizziness management improves the ability to refer patients to the most suited professional for treatment, and potentially reduce symptoms earlier.*
- Page 30: Kinau Venter – New Zealand ✓:
  - Increases in the Rate of Age-Related Hearing Loss in the Older Old.
    - *Kapil Wattamwar et al.*
    - *JAMA Otolaryngol Head Neck Surg. 2017;143 (1):41-45.*
    - *Results showed that changes in hearing among age brackets were higher during the 10th decade of life compared to the 9th decade of life. Furthermore the annual rate of LOW frequency hearing loss was faster during the 10th decade of life, representing a fundamental change in the mechanistic process of presbycusis.*
- Page 31: Min Roh – New Zealand ✓:
  - Tinnitus with a normal audiogram: Relation to noise exposure but no evidence for cochlear synaptopathy.
    - *Hannah Guest, Kevin Munro, Garreth Prendergast, Simon Howe & Christopher Plack.*

        - *Hearing Research 344 (2017) 265-274*
        - *This study confirms that tinnitus in normal hearing participants is highly correlated with a significant history of noise exposure, with no electrophysiological evidence of cochlear synaptopathy present.*
- Page 32: Gemma Sheehan – New Zealand ✓:
    - Hearing Impairment and Undiagnosed Disease: The Potential Role of Clinical Recommendations.
        - *Nicole Marlow et al.*
        - *Journal of Speech, Language and Hearing Research, Vol. 60 (January 2017), p 231–237.*
        - *The purpose of the study was to use cross-sectional, nationally representative data to examine the relationship between self-reported hearing impairment and undetected diabetes, hypertension, hypercholesterolemia, and chronic kidney disease.*
- Page 34: Veronica Hoffman – New Zealand ✓:
    - Cochlear Implantation in the Elderly: Does Age Matter?
        - *Katharina Rohloff et al.*
        - *Otology & Neurotology, Vol38 No. 1, 2017, p 54–59*
        - *While the post-operative complication rate for older adults is higher than younger implant recipients, the auditory benefit achieved is comparable to that of younger adults. Results support that the ageing brain is still plastic enough to comprehend and adapt to the modified information provided by a cochlear implant.*
- Page 35: Johanna Van Coillie – Belgium ✓:
    - Evaluation of the Self-Fitting Process with a Commercially Available Hearing Aid.
        - *Elizabeth Convery, Gitte Keidser, Mark Seeto & Margot McLelland.*
        - *J Am Acad Audiol 28 (2) (2017) p 109-118.*
        - *Several variables (such as gender, age, HA experience) were measured but none was useful in predicting which participants were likely to be successful. Furthermore, there was no statistically significant effect from previous experience with a tablet or smartphone, or from the presence of an assisting partner.*
- Page 36: Anna Pugh – United Kingdom ✓:
    - Visual Context Enhanced: The Joint Contribution of Iconic Gestures and Visible Speech to Degraded Speech Comprehension.
        - *Linda Drijvers & Asli Özyürek.*
        - *Journal of Speech, Language, and Hearing Research, January 2017, Vol. 60, 212-222*
        - *Participants benefitted from both visible speech and gestures, and the effect of this "double enhancement" was more pronounced when exposed to greater degrees of signal degradation.*
- Page 38: Anna Pugh – United Kingdom ✓:
    - The effect of hearing loss on source-distance dependent speech intelligibility in rooms.
        - *A. Westermann and J. M. Buchholz.*
        - *J. Acoust. Soc. Am. 141 (2), February 2017 p EL140 - EL145*
        - *Compared to subjects with normal hearing, the hearing-impaired subjects were much more negatively affected by the condition where the target speech was presented at a further distance relative to the masker.*
- Page 39: Anna Pugh – United Kingdom ✓:
    - Working Memory, Sleep, and Hearing Problems in Patients with Tinnitus and Hearing Loss Fitted with Hearing Aids.
        - *Reza Zarenoe, Mathias Hällgren, Gerhard Andersson & Torbjörn Ledin.*
        - *Journal of the American Academy of Audiology, Volume 28, Number 2, February 2017, p 141-151*
        - *The results demonstrated that the group of participants with tinnitus improved their memory task performance, when measured at follow up, but it was the*

impact of poor sleep to the tinnitus group that seemed to be significantly reduced once hearing aids are fitted.

- Page 41: Barry Downes – United Kingdom ✓:
  - Self-Assessed Hearing Handicap in Older Adults With Poorer-Than-Predicted Speech Recognition in Noise.
    - *Mark Eckert, Lois Matthews & Judy Dubno.*
    - *Journal of Speech, Language, and Hearing Research, January 2017, Vol. 60 (1), 251-262.*
    - *The findings of this study provide further evidence that self-assessed hearing handicap is not simply due to reduced speech audibility related to hearing loss.*
- Page 44: Barry Downes – United Kingdom ✓:
  - Binaural Interference and the Effects of Age and Hearing Loss.
    - *Bruna Mussoi and Ruth Bentler.*
    - *Journal of the American Academy of Audiology, 28:5–13 (2017)*
    - *This study explores the phenomenon of binaural interference as one possible reason for subjective preference for a single hearing aid in spite of bilateral, symmetrical hearing loss. The aim of this study was to investigate the occurrence of binaural interference in groups of younger and older adults, and the effects of hearing loss in the older age group.*
- Page 47: Sofie Peeters – Belgium ✓:
  - Characterizing the binaural contribution to speech-in-noise reception in elderly hearing-impaired listeners.
    - *Tobias Neher.*
    - *The Journal of the Acoustical Society of America 141 (2 – Feb 2017). p EL159 - EL163.*
    - *4 groups of elderly participants with or without near-normal binaural intelligibility level difference (BILD) and with or without audiometric asymmetry <2kHz were recruited and were matched in terms of age and overall degree of hearing loss. Using measures of monaural and binaural phase sensitivity as well as cognitive function, these groups were then characterised further to shed more light on the underlying processes.*

Masked speech perception across the adult lifespan: Impact of age and hearing impairment.

Tine Goossens, Charlotte Vercammen, Jan Wouters & Astrid van Wieringen.

Hearing Research, 344 (2017) 109-124.

With advancing age, people experience greater difficulty following a conversation. Speech perception is influenced by a combination of factors: peripheral hearing loss, changes in cognitive abilities and suprathreshold auditory processing deficiencies. This study tends to investigate the extent to which each of them contributes to the speech perception difficulties of ageing persons.

Background noise causes energetic masking (EM) when it overlaps in time and frequency with the target signal. Speech-weighted noise can be stationary of interrupted across time. NH older listeners benefit less from temporary increases in the SNR compared to NH young listeners.
Speech perception in the presence of informational masking (IM), for example competing speech, requires higher-level, cognitive processing. NH older listeners appear to have worse speech perception compared to NH young listeners. Other previous studies focus on the difference between young and old but there are no data about middle-aged listeners.

83 Participants: There were 3 age groups: 20-30, 50-60 and 70-80 years. Per age group: NH and HI individuals. All have normal cognitive capacities.

Speech perception performance was investigated by means of the Leuven Intelligibility Sentence Test (LIST).

Three different background noises: Two energetic maskers (stationary speech-weighted noise and amplitude modulated speech-weighted noise) and one informational masker (the International Speech Test Signal)

Adaptive procedure: The intensity of the noise was varied with a step size of 2 dB to target the SNR at which 50% of the speech was identified correctly. The intensity of speech was kept constant, 60 dB SPL for NH participants, a modified intensity for the HI listeners to allow them to score ≥ 8/10.

Three results: SRT stationary, SRT modulated and SRT ISTS.
RFM (Release from Masking) is calculated by SRTmod – SRTstat. The presence of RFM leads to a negative result.

Effect of age: (comparing the results of NH participants)
Although the older persons' rated themselves equally high on the subscale speech of the SSQ12, our results show that speech perception declines by middle age and decreases further into older age.
EM *When comparing the SRTstat and SRTmod, NH young and middle-aged adults appear to benefit from temporary increases in the SNR. This supports previous studies that report an age-related decline in temporal sensitivity. NH older listeners did not demonstrate this; they performed similarly in both EM conditions. It is suggested that this deficit can be attributed to an age-related reduction in recovery from forward masking (this is likely to compromise perceptual restoration).*
IM *This study indicates that speech perception difficulties of NH ageing persons are most salient in the most cognitively demanding background noise (ISTS), so there are other degrading factors to be taken into account. The explanation can be that central executive functions like inhibiting irrelevant information are also vulnerable to age.*
We assume that NH ageing persons need to invest more mental resources into compensatory speech recognition mechanisms because of their speech input being distorted due to their reduced

temporal processing efficiency. As a result, they have insufficient cognitive capacity left to selectively attend to the target speaker and/or disregard the competing speaker.

Effect of hearing-impairment:
IM *The results indicate that, similarly to the impact of age, the impact of hearing impairment on speech perception performance is higher in background noises that induces a higher cognitive load (IM vs. EM). This certainly applies to young and middle-aged HI adults, but not to older HI listeners. For older listeners, the impact of hearing impairment on speech intelligibility appears to be as detrimental for EM as it is for IM. This is in accordance with the ageing-induced cognitive load hypothesis: with advancing age, seemingly easy listening situations become cognitively more demanding. Indeed, the similar declines across EM and IM suggest that older HI adults must re-allocate cognitive resources, irrespective of the cognitive load of the background noise. The remaining cognitive capacity is insufficient.*
EM *Comparing modulated SWN to stationary SWN, we would expect improved speech perception, but this is not the case for the hearing impaired listeners. Previous studies have attributed this RFM deficit to a combination of reduced audibility of the noise and degraded temporal processing efficiency, both being associated with reduced recovery from forward masking.*
Hearing impairment appears to have a similar impact on speech perception. By demonstrating that the impact of hearing impairment on speech intelligibility is as detrimental for young and middle-aged as it is for older adults, this study emphasises the importance of auditory rehabilitation at all ages.

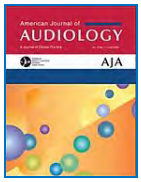
Interplay between age and hearing impairment
EM *The data show that, in the event of EM, the peripheral hearing loss is the main factor limiting speech perception performance.*
IM *As for speech perception in background noises that result in IM, the study proves that elevated audiometric thresholds exert a larger detrimental effect than age for middle-aged HI adults. For older adults, however, hearing impairment and age affect speech perception to the same extent. Not only the accuracy, but also the mechanisms underlying speech perception performance change as people grow older.*
The impact of age on speech perception in the event of IM results forms a combination of age-related deficiencies in temporal processing and central executive functions. The authors suggest that the impact of age on daily speech perception performance should not be underestimated given that most background noises in everyday life cause IM. The authors believe that hearing aid users can benefit from complementary auditory training when this incorporates bottom-up as well as top-down approaches, exercises to enhance perceptual sensitivity and to improve focusing on a speaker, respectively. There is evidence supporting the efficacy of auditory training for improving speech perception skills in HI adults.

Conclusion
Even when peripheral hearing is considered to be normal and there is no indication of even mild cognitive impairment, speech perception declines between young and middle age and decreases further on to older age. The age-related speech perception difficulties are apparent in the event of EM as well as in the event of IM, but they are most salient in the latter type of masking, which induces a higher cognitive load.
Similarly to the effect of age, the impact of hearing impairment is higher when the background noise is cognitively more demanding. When cognitive capacities are assumed to be within the normal range, the impact of hearing impairment on speech perception performance is as detrimental for young and middle-aged as it is for older adults.
EM*: HI appears to be the main factor underlying speech perception difficulties of middle-aged and older HI persons.*
IM*: both age and HI are significant factors affecting speech intelligibility. Aage-related deficits on everyday speech communication should not be underestimated.*

This study makes it very clear that understanding speech in noise is not only related to audibility but that other factors like central auditory processing, temporal aspects and

cognition-related issues play a very important role. The concept they use in this study may be a good alternative to using the Reading Span test, a method to assess working memory capacity in clinical practice. Since both audiologists and senior subjects don't feel very comfortable when test procedures focus on cognitive aspects and not on tests relating to auditory performance.

Considerations for Pediatric Cochlear Implant Recipients with Unilateral or Asymmetric Hearing Loss: Assessment, Device Fitting, and Habilitation.



Laura Greaver, Hannah Eskridge & Holly Teagle.

American Journal of Audiology, 2017, Vol. 26, p1-8.

In this research case information is presented for 5 children with profound hearing loss in 1 ear and normal or mild-to moderate hearing loss in the opposite ear and who have undergone unilateral cochlear implantation. Pre- and post-operative assessments were performed per typical clinic routines with modifications described. Post-implant habilitation was customised for each recipient using a combination of traditional methods, newer technologies, and commercial materials.

At the Children's Cochlear Implant Program at the University of North Carolina, a comprehensive assessment on an ongoing basis and habilitation for all recipients was provided. "Nontraditional" CI candidates were evaluated before and after surgery with the same speech/language and speech perception test battery and schedule as other traditional recipients. Although some of the children had a trial period with amplification in the poorer ear, none of the children included in this review was using amplification in the poorer ear at the time of pre-operative assessment. Speech and language and speech perception assessments were collected from each child with no sensory aid in the ear with severe-to-profound hearing loss. Post-implant, the implanted ear was isolated to accomplish device programming, some assessments of benefit, and therapy services.

All recipients underwent surgery with no post-operative complications or sequelae. Electrically evoked compound action potential assessment was performed intra-operatively, which provided a reference for program levels at the initial stimulation. Although there was variability among recipients, evoked compound action potential responses from Cochlear Corporation devices tend to correspond to the electrical comfort levels in the electrical dynamic range with some predictability (Brown et al., 2000; Holstad et al., 2009). With experience, all of the children were able to participate in a conditioned response task to set electrical thresholds when in a quiet room with the programming software volume muted. Most were able to scale loudness and report on comfort with good reliability. In fact, device programming with this population was not significantly different compared with traditional candidates.

The 5 children included in this report are consistent users of their cochlear implants and demonstrate speech recognition in the implanted ear when isolated from the better hearing ear.
Speech perception results as shown may not reflect functional benefits parents and children reported post-implant. In the absence of a standardised questionnaire to explore these differences, parents shared many anecdotal examples of their children's increased ease of listening and acceptance of using the CI. These included reports of the advantages of listening to music and games in the car, a preference to keep the processor on while falling asleep, and generally greater confidence and willingness by the children to participate in social endeavours. Datalogging was monitored for all recipients. Of the five children, three had established full-time at the time of their most recent evaluation. S1 had an average of 11.1 hr per day of use, S2 had an average of 11.9 hr per day, and S5 had an average of 8.4 hr per day. S4 moved out of state, and at his most recent appointment, datalogging average was 3.8 hr per day. S2 mostly uses his CI at school and had an average of 3.7 hr per day.

This is a particularly interesting article because the premise that UHL creates educational, social, and behavioural challenges for children has been acknowledged for several decades

(Bess, 1986; Bess, Tharpe, & Gibler, 1986; Borton, Mauze, & Lieu, 2010; Lieu, 2004; Ruscetta, Arjmand, & Pratt, 2005; Tharpe, 2008), and the ability to treat and provide habilitation for these children has been limited.

Candidacy criteria for cochlear implantation are evolving. Children with single-sided deafness or asymmetric hearing loss who have traditionally not been considered candidates for cochlear implantation should be evaluated on a case-by-case basis. Audiological management of these recipients is not vastly different compared with children who are traditional cochlear implant recipients. Assessment and habilitation techniques must be modified to isolate the implanted ear to obtain accurate results and to provide meaningful therapeutic intervention.

Unilateral Hearing Loss: Understanding Speech Recognition and Localization Variability – Implications for Cochlear Implant Candidacy.

Firszt, Jill B.; Reeder, Ruth M.; Holden, Laura K.

Ear and Hearing 2016; Vol. 38(2) March Apr 2017 p 159-173.

Numerous observations challenge the customary notion that communication and localisation problems have a minimal impact on daily life for those with UHL as for example was demonstrated by the examination of questionnaire responses (Noble & Gatehouse 2004) reported that patients with asymmetric hearing were significantly more disabled than those with symmetric hearing loss. Adults with severe/profound hearing loss in one ear and normal hearing in the other ear were recruited for this test and organised into three similarly-sized groups matched for age and sex.
For the test procedure, one ear of the normal hearing unilateral group was blocked with a plug and muff. Speech and understanding was evaluated with the Hearing in Noise test (Nilsson et al, 1994) in the R-space. Restaurant noise was presented from each loudspeaker at 60 dB SPL to create a diffuse, noisy environment. Hearing in Noise test sentences were presented from the front loudspeaker (0° azimuth) beginning at +6 db SNR. Localisation and word recognition were measured using a Roving Consonant Vowel Nucleus Consonant (CNC) measure. The test setup used 15 loudspeakers arranged 10° apart on a horizontal plane. Each test administration included 100 presentations. The participants were instructed to face the centre of the loudspeaker between each presentation but were allowed head turns during each carrier word presentation. After each presentation the participant repeated the word and indicated the source loudspeaker. For word recognition, the percentage of words correctly identified for each administration was averaged. Spondees were spoken by a male talker and always presented from a front-facing loudspeaker, 0° azimuth and 1.5 m from the participant. Competing noise was presented from loudspeakers at the front of the participant, at 90° to the right and 90° to the left.

This research investigated and quantified speech recognition in adults with either unilateral or bilateral hearing using varied and roving source locations and varied noise types. In this study, the unilateral listeners (UHL and NH unilateral) were at a significant disadvantage compared to the binaural listeners. There were significant and meaningful differences in the ability to understand speech in the presence of varied noise types between unilateral and bilateral listeners. In this study, localisation was significantly poorer for NH – unilateral listeners than UHLs, and among UHLs who were differentiated by age at onset, those with later and more recent onset performed poorer than those with earlier onset. Both these results suggest that some individuals with UHL learn strategies to extract monaural cues, presumably spectral cues, to enhance their localisation performance and that experience or amount of time as a unilateral listener has a positive effect.
Some individuals with UHL are being considered for cochlear implantation to improve communication deficits through restored hearing function to the poor ear. Considerable work remains to fully understand communication deficits and expected benefits from cochlear implantation.
This present study suggests that UHL individuals with pre-/peri-lingual onset of severe – profound hearing loss localise better than individuals with recent severe – profound hearing loss onset, but exhibit the same range of disabilities for speech recognition in noise.
According to the authors of this present research not all individuals with unilateral severe – profound hearing loss will necessarily have improved localisation abilities as the result of cochlear implantation.

Multiple variables in addition to the hearing levels in each ear impact the functional ability of an individual with UHL and their potential interest in a CI.

Candidacy evaluations should include a thorough case history with confirmation of age at onset of hearing loss, particularly if the loss was diagnosed early in life, and quality of life assessments to document the impact of unilateral loss.
The authors suggest that results from UHL listeners support the need for a revised and diverse set of clinical measures to evaluate CI candidacy in individuals with unilateral severe – profound hearing loss.

Visual Temporal Acuity Is Related to Auditory Speech Perception Abilities in Cochlear Implant Users.

Kelly Jahn, Ryan Stevenson & Mark Wallace.

Ear and Hearing 2017; 38(2) March April p. 236-243.

Brain imaging studies have demonstrated that good CI performers, as indexed by auditory-only speech perception abilities, have different patterns of visual cortex activation in response to visual and auditory stimuli as compared with poor CI performers. However, no studies have examined whether speech perception performance is related to any type of visual processing abilities following cochlear implantation. The purpose of the present study was to provide a preliminary examination of the relationship between clinical, auditory-only speech perception tests, and visual temporal acuity in pre-lingually deafened adult CI users. It was hypothesised that pre-lingually deafened CI users, who exhibit better (i.e., more acute) visual temporal processing abilities would demonstrate better auditory-only speech perception performance than those with poorer visual temporal acuity.

The importance of atypical visual cortical activation has been observed via electroencephalography studies where CI users were divided based on auditory speech perception abilities into "poor performers" and "good performers" (Doucet et al. 2006; Buckley & Tobey 2011; Kim et al. 2016). These studies showed that good auditory speech perception abilities are related to larger visual evoked potentials in the visual cortex in response to visual stimuli. On the other hand, poor auditory speech perception abilities are related to enhanced visual evoked brain activity in more anterior and temporal regions of the cortex (Doucet et al. 2006; Buckley & Tobey 2011; Kim et al. 2016). This relationship has been demonstrated in both pre-lingually deafened (Doucet et al. 2006; Buckley & Tobey
2011) and post-lingually deafened (Kim et al. 2016) adult CI users. Thus, cross-modal plasticity may account for some of the variability observed in speech perception performance after cochlear implantation and good CI performers may utilise visual cues differently than poor CI performers to compensate for the degraded auditory signal.

Ten pre-lingually deafened adult CI users were recruited for this study. Participants completed a visual temporal order judgment task to quantify visual temporal acuity. To assess auditory-only speech perception abilities, participants completed the consonant–nucleus–consonant word recognition test and the AzBio sentence recognition test. Participants completed a vTOJ task in the Multisensory Research Laboratory at Vanderbilt University (Stevenson et al, 2013, 2014). Speech perception data were collected from each participant, and were gathered either during the patients' most recent audiology clinic visit at the Vanderbilt Bill Wilkerson Center, or collected by the experimenters on the same day as the visual Temporal Order Judgement (vTOJ) testing.

Results were analysed using two-tailed partial Pearson correlations, Spearman's rho correlations, and independent samples t tests.
Results showed how visual temporal acuity was significantly correlated with auditory-only word and sentence recognition abilities. In addition, proficient CI users, as assessed via auditory-only speech perception performance, demonstrated significantly better visual temporal acuity than non-proficient CI users.

These preliminary data bring to light the possible future role of visual temporal acuity in predicting CI outcomes before implantation, as well as the possible utility of visual training methods in improving CI outcomes. The implications in the field of aural rehabilitation and for clinical assessment of CI outcomes are important. Behavioural and neuroimaging evidence suggest that visual only processing abilities in adult CI patients are significantly correlated with CI outcomes. Taken together with the present findings, the ability of behavioural indices of pre-implantation visual temporal perception to predict CI outcomes should be explored. Understanding the factors that relate to better performance with CI can help with CI candidacy evaluations, counselling, and development of realistic expectations of CI benefit.

This interesting research suggests the importance held by the sense of vision in CI outcomes; a suggestion that seems obvious in light of the important role that vision plays in speech processing and perception.
Prior research has widely demonstrated the powerful influence of vision on auditory processing in individuals with normal hearing, as well as those with hearing loss. The ability to observe visual articulations in addition to hearing the speaker during a linguistic utterance significantly improves a listener's speech perception and this has many an implication in hearing therapy.

Cross modal plasticity in auditory, visual and multisensory cortical areas following noise-induced hearing loss in adulthood.

Ashley Schormans, Marei Typlt, & Brian Allman.

Hearing Research, 343 (2017) p 92-107.

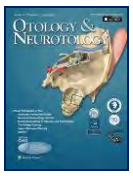
Hearing loss represents a clinically-relevant form of sensory deprivation which can lead to extensive anatomical and physiological changes throughout the central auditory system. The consequences of this experience dependent neuroplasticity are not restricted to how sound is processed, as cross modal plasticity can also occur, which is characterised by an increased responsiveness of neurons in the central auditory system to visual and/or tactile stimuli. Functional neuroimaging studies in hearing-impaired humans and single-unit recordings in animal models have identified that the nature and extent of cortical cross modal plasticity depends on the severity of the hearing loss (e.g., profound deafness versus mild hearing impairment) as well as the age at which the deprivation commenced (e.g., congenital/early-onset versus in adulthood). For example, studies on humans, mice and cats have revealed that early-onset profound deafness results in sensory replacement, whereby there is an increased recruitment of the deprived auditory cortex for visual and/or tactile processing. Fourteen adult male Sprague-Dawley rats (age: 103 ± 3 days; body mass: 425 ± 8 g) were used in this study. All rats were housed in a temperature controlled room on a 12-h light-dark cycle with food and water ad libitum. Hearing levels were assessed using an auditory brainstem response (ABR) which was performed in a double-walled sound attenuating chamber. Sound stimuli were generated by a Tucker-Davis Technologies (TDT, Alachua, FL) RZ6 processing module at 100 kHz sampling rate and delivered by a magnetic speaker (MF1; TDT) positioned 10 cm from the animal's right ear. The left ear was occluded with a custom foam earplug. Sound stimuli for the ABR, noise exposure procedure and electrophysiological recording experiments were calibrated with custom Matlab software (The Mathworks, Natick, MA) using a 1/4-inch microphone (2530; Larson Davis, Depew, NY) and preamplifier. While under ketamine (80 mg/kg; i.p.) and xylazine (5 mg/kg; i.p.) anaesthesia, rats were bilaterally exposed for 2 h to a calibrated broadband noise (0.8e20 kHz) at 120 dB SPL. This noise exposure protocol was similar to one used by in rats to induce persistent changes in auditory processing at the level of the ABR as well as the auditory cortex. The broadband noise was generated with TDT software and hardware (RPvdsEx; RZ6 module), and delivered by a super tweeter (T90A; Fostex, Tokyo, Japan) which was placed 10 cm in front of the rat.

To determine the effect of the noise exposure on hearing sensitivity, the ABR threshold of the 4 kHz, 20 kHz and click stimuli were compared at baseline versus two weeks post-noise in the exposed rats (n ¼ 7). A repeated-measures ANOVA with Bonferroni corrected post-hoc tests (significant p-value adjusted to $p < 0.017$ to account for multiple comparisons) revealed that the noise exposure caused a significant increase in the ABR threshold of the click (pre noise 20.7 ± 0.7 dB SPL vs. post-noise 35.0 ± 3.6 dB SPL, $p < 0.017$), with a trend for an increase in the threshold of the 4 kHz stimulus (pre-noise 22.9 ± 1.0 dB SPL vs. post-noise 39.3 ± 4.6 Db SPL, p ¼ 0.021) and 20 kHz stimulus (pre-noise 22.1 ± 1.5 dB SPL vs. post-noise 44.3 ± 8.3 dB SPL, p ¼ 0.044). In addition to determining the ABR threshold, the amplitude of the first positive wave of the ABR trace (wave I) in response to the 90 dB SPL click stimulus was used to assess the level of damage to the cochlear hair cell afferents caused by the noise exposure. Compared to baseline, the noise exposure resulted in a 49.6 ± 6.2% reduction of wave I amplitude measured two weeks later (pre noise 1.5 ± 0.1 mV vs. post-noise 0.7 ± 0.1 mV, $p < 0.001$, paired t-test;, whereas the baseline wave I amplitude in the noise exposed rats was consistent with that of the controls (1.5 ± 0.1 mV, p ¼ 0.95), unpaired t-test). Furthermore, as revealed with a one-way ANOVA ($F(1,12)$ ¼ 3.2, p ¼ 0.099) the ABR thresholds did not differ between the control rats and the noise exposed rats at baseline for the click stimulus (controls 23.6 ± 1.4 dB SPL vs. pre-noise 20.7 ± 0.7 dB SPL), 4 kHz tone (controls 24.0 ± 1.0 dB SPL vs. pre-noise 22.9 ± 1.0 dB SPL) or 20 kHz tone (controls (19.0 ± 1.0 dB SPL vs. pre-noise 22.1 ± 1.5 dB SPL).

According to the authors despite the prevalence of hearing impairment, a limited number of studies have investigated the functional implications of hearing loss-induced cross modal plasticity on audiovisual integration. Contrary to the their predictions, older adults with moderate hearing loss showed similar temporal integration of audiovisual speech stimuli compared to younger normal hearing listeners when the subjects were asked to judge the simultaneity of auditory and visual sentence recordings. Consistent with these findings, audiovisual integration of speech stimuli was similar between older adults with mild-moderate hearing impairment compared to normal-hearing listeners of the same age.

The authors suggest that future studies on animal models could provide important insight into the lower limit of hearing loss necessary to induce cross modal plasticity, as well as the time course of these cortical changes and the underlying anatomical and/or neural substrates. This of course could potentially provide important and far reaching implications in amplification therapy. Such studies are expected to contribute to the continued refinement of our understanding of the adaptive versus maladaptive effects of cross modal plasticity on auditory, visual and audiovisual processing.

Comparison of Speech-in-Noise and Localization Benefits in Unilateral Hearing Loss Subjects Using Contralateral Routing of Signal Hearing Aids or Bone-Anchored Implants



Hillary Snapp, Fred Holt, Xuezhong Liu & Suhrud Rajguru.

Otology & Neurotology, 2017; Vol. 38 No. 1, 2017 p 11–18.

Objective
To compare the benefit of wireless contralateral routing of signal (CROS) technology to bone-anchored implant (BAI) technology in monaural listeners.

Intro
Individuals with a severe-profound unilateral sensorineural hearing loss (SNHL) become monaural listeners, thereby losing access to the differences in timing and level cues for a sound arriving to two ears. These essential auditory cues are critical for processing of complex auditory signals such as speech perception in noise and localisation of sound.
Lifting the head-shadow can significantly improve listening in noise ability in monaural listeners. To accomplish this, the signal of interest must be routed from the impaired (deaf) ear to the normal cochlea for processing.

- *Historically, this was achieved using contralateral routing of signal (CROS) hearing aids where a microphone is placed at the impaired ear, which then routes the acoustic signal to a hearing aid worn in the normally functioning ear.*
- *The introduction of bone-anchored implants (BAI) resulted in a resurgence in treatment for unilateral SNHL. The processor stimulates the implant, which sends the signal of interest to the contralateral (normal) cochlea by way of transcranial bone conduction.*

The authors hypothesised that non-invasive wireless CROS technology is capable of providing similar benefit to the more invasive BAI system for unilateral severe-profound sensorineural hearing loss. In particular, they compared the speech perception in noise and localisation abilities of monaural listeners using a BAI to monaural listeners using a CROS hearing aid.

Materials and methods
Test group:

- *24 to 77 years, controls 24- 49 years*
- *Control group n = 24, bilateral normal hearing (≤ 25 dBHL)*
- *13 CROS: Phonak Audéo V50 (device use ≥ 34 months) omnidirectional mode and NAL-1 target, based on better hearing ear*
- *14 percutaneous BAI (device use 66 months) target based on better hearing ear*

Test conditions
Localisation

- *19 loudspeakers over +/- 90 degrees*
- *Narrowband 500 Hz, narrowband 4000 Hz and broadband noise at 65 dB SPL, answers given by a 19-pushbutton feedback panel*

Speech-in-noise

- *QuickSIN™ sentences*
- *Speech in poorer ear , noise in better ear (90 degrees/270 degrees azimuth)*

Subjective assessment

- *Speech Spatial and Qualities (SSQ) of Hearing Benefit questionnaire was used for subjective assessment of spatial perception.*
- *The Glasgow Hearing Aid Benefit Profile (GHABP) questionnaire was used for assessment of handicap, disability, use, benefit, and satisfaction.*

Results:

Localisation:

- *There was no improvement in localisation ability for voiced ''hey,'' 1 of 3 octave 500 Hz, or 1 of 3 octave*
- *4000 Hz stimuli for any of the test subjects in the aided condition for BAI users or CROS users.*
- *When BAI and CROS users were compared, there was no significant difference in performance for aided localisation ability between groups.*
- *The better ear performance was not negatively affected in aided condition*

Speech-in-noise

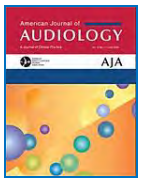
- *When speech was directed at the poorer ear and noise directed at the better ear (90 of 270) a significant improvement in signal-to-noise ratio loss from the unaided to aided condition for monaural listeners was observed ($p<0.0001$).*
- *Both BAI and CROS subject groups significantly improved on tasks of speech perception in noise from the unaided to aided condition ($p<0.0001$). This was roughly a 9 dB improvement in SNR; a shift from moderate SNR loss to normal performance.*
- *There was no significant difference between BAI and CROS subject groups for unaided or aided performance.*

Subjective assessment:

- *SSQ: There was no overall statistical difference in spatial perception between BAI and CROS subject groups but some patients do perceive improved spatial perception.*
- *GHABP: High satisfaction and use rate among CROS hearing aid users as well as significant reduction in disability and handicap*

Despite the homogeneous nature of the group data, as with other studies in monaural listeners, the authors observed a high degree of inter-subject variability among the subjects. The authors add that based on their previous work that the inter-subject variability exists in monaural listeners before treatment and suggests that variations in performance are individual-specific. The authors are working on an intra-subject comparison of CROS versus BAI, thereby reducing the potential impact of the inter-subject variability observed in monaural listeners. Nice, straightforward study on the treatment of SSD subject; looking forward to the inter-subject continuation.

The Effects of Service-Delivery Model and Purchase Price on Hearing-Aid Outcomes in Older Adults: A Randomized Double-Blind Placebo-Controlled Clinical Trial.



Larry Humes et al.

American Journal of Audiology, 2017, Vol. 26, p 53-79.

This study was conducted in view of the National Academies of Sciences Engineering and Medicine report and the National Institute on Deafness and other Communication Disorders/National Institution and Health (NIDOTC/NIH) recommendations of ways to improve access and affordability of HA for elderly with mild-moderate HL. Those reports included suggestions for the FDA to create a new category of over-the-counter (OTC) HA delivery model that will not include audiological care.

***Aims**: To compare the efficacy and outcomes of HA fitting for first time users using audiology-based best-practice model and OTC model as well as to investigate the influence on purchase decision.*

***Procedure**: The participants, recruited through ads in a local newspaper, assigned to one of three groups after initial thorough audiological evaluation: AB group (n=53) audiology-based best-practices service delivery; OTC group (n=55) consumer-decides or OTC Service delivery; P group (n=55) placebo. In the 2nd session all participants were fitted bilateral with ReSound Alera 9 mini-BTE open-fit HA using NAL-NL2. Participants in group P were fitted with HA programmed for 0 dB insertion gain (acoustically transparency). Group AB and P audiology best-practice fitting protocol included full pre-fitting audiological counselling, orientation, hands-on practice and care, written user guide, real-ear measurements to fine tune the instruments and electroacoustic measurements to verify the fitting. Group OTC choose the HA by themselves from instruments that were pre-programmed to match NAL-NL2 acoustic output prescription for three most common mild-moderate HTL patterns among USA elderly population. They choose their own domes type and tubing length, watched a brief instruction video and got a written user guide. Most of group P tried 2-4 instruments before choosing the HA they wanted. At the end of this session all the participants paid $3,600 or $600 with 8.33% credit.*
The 3rd session took place 6 weeks later. During those 6 weeks, participants' problems were dealt with via telephone call. Only participants continuing to complain were invited to meet the audiologist. At the 3rd meeting, primary and secondary outcomes measures were made to all groups. At the end of the study the participants were asked if they wanted to keep the HA. Regardless of their answer, they were offered another 4-5 week trial following AB service-delivery model for group OTC and P and fine-tuning for group AB.

***Results**: AB outcomes were generally positive and significantly better than P indicating that HA do provide benefits to elderly with mild-moderate HL. The use of best-practice including individual evaluation and adjustments of the MPO of HA based on listener's UCL did not yield better perception of disturbing loud sounds and daily usage was not affected by service-delivery approach.*
HA satisfaction was significantly lower in OTC group than AB group. This is not surprising since a large part of the test items checked satisfaction were referred to the pre-fitting counselling and orientation given by the audiologist. Group OTC was not different from the others on the measures of perceived distorted sounds and daily usage. OTC group tend to select less high-frequency gain than prescribed by the NAL-NL2. The second 4 weeks AB-based trial improved significantly the OTC outcomes and led to greater retention of HA.
Age and HL were significant to purchase decision (HA were return by younger and less HL) while price had no significant effect on it.

Conclusions: *The study established that HA are efficacious in adults with mild-moderate HL for an audiology-based best-practice delivery model. It also showed that OTC model of OTC yield only slightly poorer outcomes than the AB model. The authors concluded that OTC can increase accessibility and affordability to HA and can be an alternative starting point for adults that want to enter the HA world.*

Limitations:
Fairly homogeneous study sample; the study used higher HA technologies in terms of electro-acoustical and coupling capabilities than those that will most likely be offered by OTC models; results cannot be generalised to other HA technologies, OTC models or clinical protocols.
The Audiology Best practice protocol did not include a full assessment of specific patient needs, noise acceptance, understanding in noise, localisation and ability to stay concentrated for a longer time during a conversation, which would allow an evidence-based selection and setting of hearing aid features other than only gain and compression. Further, this protocol did not include follow-up appointments during trial period.
It can also be argued that the OTC group experience some aspects of audiology best practice (a full audiology evaluation) that influenced the results.

Personal opinion: As audiologists professionalise in hearing rehabilitation we all know that the human hearing system is complicated, connected to perception, cognition, social awareness and participation and influence communication and emotions as well as self-perception and quality of life.
Different OTC HA delivery models are already here, questioning the audiologist's role and professional contribution to the elderly patient's hearing rehabilitation journey, under the pretext of affordability and accessibility.
This study diminished the hearing rehabilitation process to minimum and stripped it from the essence of the audiologist's post-fitting care and HA fine tuning.
I think that the most important result of this study is the significant higher HA satisfaction among the AB group compare to the other two groups. The authors explanation that this higher satisfaction is due to the audiologist's counselling and orientation which the AB group received is consistent with results from a survey of Taylor & Rogin (2011) which presented the main 10 reasons for HA satisfaction among 890 adults HA users. Among those reasons were the fact that HAs do help with the professional input of the audiologist and the counselling given to them. The second reason was the follow-up sessions and the first one was the audiologist who took care of them!

(Taylor B., Rogin C., 2011 "The Top-10 Ways to Create Consumer Delight with Hearing Aids" Hearing Review 18:7 10-23)

Auditory Distraction and Acclimatization to Hearing Aids.

Piers Dawes & Kevin Munro.

Ear and Hearing 2017; Vol. 38 (2), 174-183.

Auditory acclimatisation is considered to be a process of perceptual learning, whereby an individual learns over time to make use of the change in acoustic information provided by the hearing aid. Both clinicians as well as new hearing users recognise the need for such an adjustment period. However, acclimatisation research has equivocal evidence leading many authors to conclude that the effect is clinically insignificant. Such a difference between clinical experience and research evidence could be because of various factors including the design and definition factors. In recent studies users described acclimatisation (getting used to) as the experience of amplified background sound was initially overwhelming, but that after a few days of hearing aid use, these undesirable sounds ceased to be noticeable.

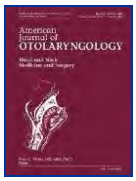
The current study hypothesises auditory acclimatisation as refocusing of auditory attention – Among people with normal hearing, audible background sounds with no behavioural relevance (such as ventilation noise, street noise, rustling clothes, etc.) are ignored. In the case of people with long-standing hearing loss, background sounds are inaudible or very quiet. However, when someone with long-standing hearing loss obtains a hearing aid, the audibility of background sounds is suddenly restored. Immediately after hearing aid fitting, background sounds intrude on conscious attention due to their novelty. Newly audible background noises may exert a detrimental distracting effect on speech recognition (i.e., "informational masking"). "Informational masking" refers to degradation of auditory detection or discrimination of a signal that is not related to energetic masking caused by physical interaction between the masker and the signal.

In the present study, new adult hearing aid users (42 new users and 22 experienced users) completed an experimental test battery on the day of first hearing aid fitting and at 1, 7, and 30 days post-fitting. The study tested 4 hypotheses (H1-H4):
(1) speech recognition thresholds would improve over time, with new hearing aid users achieving equivalent levels of recognition at more adverse SNRs over time post hearing aid fitting, and
(2) that new hearing aid users would show reduced distractibility over time.
(3) If reduced distractibility to background sounds underlies improvements in speech recognition in noise, then reductions in distractibility should correlate with improvements in speech recognition.
(4) Improvements in speech recognition and reduced distraction should also be accompanied by self-report of reduced annoyance.

SIN results showed an acclimatisation effect in the form of greater improvement for new hearing aid users (with hearing loss >40 dB HL and who use their hearing aids >6 hr/day) compared with a control group of experienced hearing aid users. There was no difference between experimental and control groups when the experimental group had subjects with PTA less than 40 dB HL. Thus H1 stands proven. However, distraction task scores did not change with time in all severities of hearing loss. There was no association between SIN score improvement and distraction scores. There was no evidence to support H2 and H3. Improvements in SIN were associated with self-report of reduced annoyance of amplified background sound and reduced consciousness of wearing a hearing aid. This was consistent with the hypothesis of reduced intrusiveness of background sounds being linked to improvements in SIN performance, which proves H4.

This study, which examines acclimatisation in new hearing aid users with a new perspective, found evidence that acclimatisation leads to improvements in understanding speech in noise for moderate loss and above. However, it failed to find evidence to the hypothesis that acclimatisation is a reduction of informational masking. There is a greater need for further study of acclimatisation using new tools available in the latest generation of hearing aids.

Development of an evidence-based decision pathway for vestibular schwannoma treatment options.



Linkov F et al.

American Journal of Otolaryngology- Head and Neck Surgery, 2017; Vol. 38, 57-64.

Vestibular schwannoma (VS), or acoustic neuroma, is a benign, slow-growing tumour that arises from the 8th Cranial Nerve, which controls balance and hearing in the inner ear. VS tumours arise due to an over-production of Schwann cells and as the tumour grows within the narrow confines of the internal auditory canal and cerebellopontine angle, pressure is exerted on the vestibular and cochlear nerves. The primary symptoms are asymmetrical hearing loss, tinnitus, and disequilibrium. Secondary symptoms consist of facial numbness and weakness (if tumour affects the 5th and 7th cranial nerves), changes in taste and difficulty in swallowing and hoarseness if the lower cranial nerves are affected by larger tumours. Diagnosis of VS is made with radiographic imaging such as magnetic resonance imaging (MRI) scans.

The three main treatment options for VS are surgery, stereotactic radiosurgery (SRS)/stereotactic radiotherapy (SRT), and conservative management (CM). The optimal treatment is very difficult to establish, as each treatment has its possible advantages, complications, and limitations. Due to the anatomical location of VS, the morbidity and potential side effects of treatment on quality of life are profound with alterations in balance, communication, and appearance. Surgery is more likely to be recommended for large symptomatic tumours, whereas for those with small tumours (<1.5 cm) all the options are available.

There is a need to compare the efficacy of these treatment options using modern research methods. The goal of this paper is to systematically gather evidence from literature, patients, and providers to identify factors important for decision making in patients with VS and to use that evidence to develop a decision support tool for VS patients.

Mixed methods were used to compare the treatment options.

- *Focus group (n=5) comprised of patients previously diagnosed with VS, caregivers of VS patients, health care providers, and researchers*
- *3 surveys of surgeons using Delphi method (n=8)*

Using these data, multi-criteria decision model using data collected in stages I and II following a systematic decision framework to generate alternative treatment options, to develop success criteria and metrics for evaluating alternatives, to build in ability to elicit value judgments on the importance of criteria and metric relevance, and to score the alternatives by applying value weights.

Finally, a second focus group consisting of 4 previously diagnosed VS patients (already treated for VS) and one caregiver, where we further explored the decision making process retrospectively through the administration of surveys, and tested the feasibility of implementing the decision pathway.

Based on all the data, the authors developed a decision support model for the treatment of VS patients. The tool paves way for a patient-centred approach in such a critical treatment offered by an ENT specialist.

This study developed a decision making tool for treatment of VS patients based on the 2 rounds of focused-group interviews and surveys. This is the first of its kind in this subject. More studies required to further strengthen the model.

What Otolaryngologists Need to Know About Hearing Aids

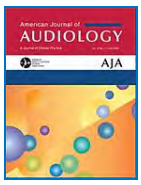
K. Grundfast & S. Liu.

JAMA Otolaryngology-Head & Neck Surgery, February 2017, Vol 143(2) 109-110.

This viewpoint article is trying to establish HA pricing as the main reason for the low HA usage rate among elderly people. The authors stated that the price of HA was steadily increased over the years due to R&D and audiologists' costs. HA and hearing services usually are not covered by USA health insurance programs, leaving HA out of the reach of many elderly Americans. The article mentioned cheaper alternative HA delivery models that do not involve audiologists' care (Wholesale retailers like Costco or internet purchase). The authors described recent suggestions for policy changes including the President's Council of Advisors on Science and Technology (PCAST) and the National Academies of Sciences, Engineering and Medicine (NASEM) recommendations to remove the pre-fitting mandatory hearing evaluation and to change the FDA (Food and Drug Administration) HA manufacturing requirements. The PCAST also recommended that the manufacturers of personal sound amplification products (PSAPs) will be allowed to market these devices as improving hearing for hearing impaired people. The authors suggested that with proper education and use, PSAPs, which are less expensive, could potentially benefit individuals with mild to moderate HL. According to the authors, if audiologists will be paid for counselling regardless of where the HA were purchased, they will also be able to help individuals who got their HA through alternative delivery models such as purchasing online and help them cope with their hearing problems with PSAPs and ALDs. The authors stated that otolaryngologists should encourage insurance programmes and the healthcare system to reimburse those who need HA, for costs incurred for hearing care services and HA purchase. They also suggested that otolaryngologists should recommend low-priced HA or other devices that may not be optimal but can somewhat improve communications abilities for adults with HL.

Personal opinion:
Over the last couple of years more and more articles have been published describing the "new" models of HA fitting (over the internet, self fitting HA...), some of them do not include any audiological evaluation, counselling and guidance. There are more and more voices saying that PSAPs and self-fitting HA bought on the internet as well as tele-audiology can be good solutions because they will be cheaper and affordable. This article address the HA issue from a narrow point of view of the HA pricing. The authors do not try to understand the hearing rehabilitation process which the person needs to go through in order to learn to use their HA successfully and the audiologist's role in this process. They do not take into consideration the importance of the hearing evaluation we are doing, the counselling we provide, the expectation matching process we are doing with the patient and his family, the holistic way in which we consider each and every aspect of the patient life, needs and desires and "tailor" an individual rehabilitation solution for them, the explanations, strategies and guidance given pre- and post-fitting along the patient hearing rehabilitation journey. It is very easy to quantify the HA price or our salary but it is much more difficult to evaluate and quantify our professional, added value, knowledge and professionalism.
This article's implicit disregard of audiologists' work and intentions are outrages. Only someone that has no understanding of the hearing rehabilitation process can encourage otolaryngologists to recommend sub-optimal solutions such as low-priced HA (=low technology) and other assistive hearing devices only because they are cheaper!
We must be aware that our profession is going through major changes and our professional borders are threatened and we must take action.

The utilization of social media in the hearing aid community.



Moumita Choudhury, Zoë Dinger & Elena Fichera.

American Journal of Audiology, 2017, Vol. 26, p 1–9.

Social media have become an important communication channel, used by more people than teenagers and generation X/Y/Z.
By social media, this article is looking at Twitter, Facebook, YouTube, forums & blogs. The research analyses the way in which these channels are being used by the hearing aid community. How popular are they? What's most used? Which topics are being discussed? …
After identifying the sources and measuring the activity on the different platforms, the conclusion is that Facebook & Twitter are the most popular platforms. On forums there were discussions on a variety of hearing aid-related issues.
Both Facebook and Twitter are good sources for both users and their families in the search for a service provider.
These service providers use social media to post information and use it as a marketing channel. They could get more information out of these channels by analysing the topics discussed in Facebook groups and forums, leading to a better understanding of issues concerning hearing aid users and their family. In the article, it is suggested to make use of a moderator (i.e. audiologist) to improve the quality of discussions and provide correct information.
There was a comparison on how social media are used by hearing aid users, compared to CI users. Whereas CI users the topics relate more to emotional user stories; for hearing aid users it's more about the use of hearing aids and support (e.g. videos on how to clean).
Some side-notes

- *It could be interesting to focus on the influencers in the decision-making process and how social media affect them. Since they are sometimes more eager to use social media (without stereotyping the 'older' generation of hearing aid users) and will most likely look for information on the internet as well.*
- *Using emotion in marketing and thus in social media for hearing aid users, could improve the hearing aid uptake (i.e. ambassadors sharing their story).*
- *The classification of topics on social media channels has been done in a subjective way.*
- *There was no check on the quality of the content of topics discussed in social media.*

Although it is an interesting topic to research, it is a difficult one if you want to avoid subjective factors. As a service provider, it is wise to know where our future/current clients look for information and how this is evolving, as well as what information they are looking for.

Audiological rehabilitation for facilitating hearing aid use: a review

Hashir Aazh & Brian Moore.

Journal of the Amercan Academy of Audiology, 2017; 28:248–260.

The article reviews 7 studies about audiological rehabilitation.
Every study investigated the effects of audiological rehabilitation (AR) on hearing aid (HA) use and outcomes but differed in the way the study was conducted (e.g. group discussions or home education).

The reviewers were interested to see if the studies showed any evidence that AR programmes improve HA use and quality of life.

AR programmes consisted of education of the HA user on both the use of hearing aids (handling) as well as information about anatomy (understanding of how hearing works), communication problems / strategies,… group discussions covered the same topics and additional topics, e.g. related to personal objectives.

There's no strong relationship measured between AR and HA use, self-perceived handicap and quality of life.
Analysing the studies, the focus is more on education than on influencing behavioural change. Behaviour change is more complex, thus needing more motivational tools and client-centred counselling, which is more demanding for the therapist as well, who needs to be more transparent about feelings and motivations as well as being more empathetic towards the customer.

Side-notes
- Future studies could focus more on the emotional and counselling part of AR.
- We could benefit from focusing on these aspects during the trial, developing a specific AR programme to improve conversion from trial to adoption of hearing aids.

Examining the short term effects of emotion under an Adaptation Level Theory model of tinnitus perception.

Durai M, O'Keeffe MG, & Searchfield GD.

Hearing Research, Vol. 345 (2017), 23-29.

Tinnitus is the perception of sound in the absence of an external sound source, with up to 20% of patients facing disruption in their quality of life because of it. The causes of it are largely unknown, but it is thought to be generated in the cortical and sub-cortical regions of the brain. This study builds upon the existing body of literature suggesting a relationship between tinnitus and emotion. The Adaption Level Theory (ALT) of tinnitus posits that an internal reference point for magnitude sensation is established for tinnitus. This reference point is malleable and is thought to be made from the individual's focal component (tinnitus), contextual component (background noise), and residual components (behavioural, cognitive, and emotional characteristics). Emotion can be modelled along two non-orthogonal dimensions: valence (pleasant ~ unpleasant), and arousal (calm ~ excited), and these emotional stimuli are thought to be processed first in the auditory cortex before the limbic system.
Based on the ALT model of tinnitus, as well as the high co-activity of the auditory and limbic system in patients with tinnitus, the authors sought to discern the ability of emotional stimuli to modulate tinnitus outcomes in the short-run.
The aim of the study was to investigate the effects of short-term emotional changes on tinnitus outcomes. The authors hypothesised:

1. *Negative valence and/or high arousal stimuli would lead to greater tinnitus loudness and annoyance than positive valence and/or low arousal stimuli.*
2. *Auditory rather than visually-induced emotional stimuli, because it is in the same modality as tinnitus, would have a greater effect on tinnitus outcome measures.*

22 participants (12 female, 10 male) with chronic tinnitus volunteered in the study. The 10-item Emotion Regulation Questionnaire (ERQ) was administered to all participants, which uses self-statement ratings to assess individual differences in strategies used for emotional regulation and control; emotional reappraisal and emotional suppression. This helps to assess one's response to emotional stimuli.
Participants were tested over two sessions (one auditory, one visual) spaced two weeks apart. Participants were then assigned to 6 modalities: positive valence, neutral valence, negative valence, positive arousal, neutral arousal, negative arousal. 20 auditory and visual stimuli obtained from IADS-2 and IAPS respectively, were presented for 6s to the participant (inter-stimulus gap of 6 seconds). Following each experimental condition, participants rated the valence and arousal of the stimuli, as well as their tinnitus loudness and annoyance. Psychoacoustic measures of tinnitus loudness were measured at this point.

The findings show that negative emotional changes resulting from stimuli presentation were linked with greater tinnitus perception when using auditory stimuli, but not visual stimuli. Increased tinnitus perception was measured by higher subjective tinnitus loudness ratings in males and females, and higher subjective tinnitus annoyance ratings in males only. Males had higher emotional appraisal scores and emotional suppression scores than females.

The results of this study suggest that negative valence auditory emotional stimuli had affected tinnitus outcomes, without affecting the psychoacoustical measures of tinnitus loudness. This discrepancy is explained by the ALT model of tinnitus, where the reference points for loudness are different for both the subjective and objective measures. These preliminary findings lead the researchers to ponder whether the use of positive emotional auditory stimuli might improve tinnitus outcomes, and have a useful role in providing tinnitus relief clinically. Future

studies could examine the effects of applying positive auditory stimuli to volunteers with tinnitus over varying schedules. It may also be interesting to look into whether existing emotionally-based therapies may influence tinnitus perception.

Importance of an Inter-professional Team Approach in Achieving Improved Management of the Dizzy Patient

Amanda Rodriguez et al.

Journal of the Amercan Academy of Audiology, 2017; 28: 177 – 186.

Dizziness or balance disturbance is often complex and can result from otological, neurological, or vascular impairments, and/or be anxiety- or medication-related. The complex pathophysiology makes it difficult for clinicians, such as a GP, to independently and effectively diagnose and manage patients. Patients are most often referred to an otolaryngologist (ORL) for assessment; however, the cause may be non-otological. Referring to allied health professionals such as audiologists, physical therapists, and pharmacists for assessment and management where appropriate can potentially alleviate wait times for ORL appointments and improve patient prognosis.

The purpose of this study was to assess the effect of assessment and management by an interprofessional team of clinicians and allied health professionals on dizziness diagnoses, referral practices and patient outcomes. A retrospective chart review was conducted of 134 patients who were referred to a university hospital for balance evaluation over three years. An interprofessional management team composed of an ORL, neurologist, audiologist, physical therapist, pharmacist, and the patient's GP was established in year 3. All patients referred to ORL for dizziness were first seen by audiology for vestibular testing. Following the assessment, the audiologist discussed the results with the team to verify the diagnosis, to decide the intervention plan and to which specialist to refer for treatment.

Charts were reviewed to determine the initial referring diagnosis compared to the final diagnosis made following assessment; the vestibular diagnosis, if any; specialist(s) the patient was referred to for intervention, if any; and patient subjective report of symptom improvement 6 weeks after testing. Results were compared from year 3 when the interprofessional approach was used, to years 1 and 2, before the team was established.

Results showed that in the year the interprofessional team was established, disease-specific diagnoses and the range of diagnoses made increased compared to the previous two years. There was a decrease in number of matches between initial referring diagnoses and diagnoses after vestibular assessment observed in year 3, which the investigators suggested may be a result of the implementation of the interprofessional approach helping to achieve more specific diagnoses. The increased range of diagnoses, and particularly the higher incidence of non-otological diagnoses made in year 3, resulted in the team recommending that a larger percentage of patients return to their GP for management, or referring to an allied health-care professional. This corresponded to a drop in referral rates to ORL for management compared to years 1 and 2.

A significantly higher number of patients were also diagnosed with multifaceted dizziness (defined as more than one diagnosis to explain symptomology; e.g. BPPV and anxiety-related dizziness) with the implementation of the team approach (53.7%) compared to year 1 (3.7%) and year 2 (8%). The authors report that symptoms of chronic dizziness are often related to overlapping non-otological disorders. Without an interdisciplinary approach and vestibular and balance assessment, individual clinicians may misdiagnose or overlook a contributing disorder.

Six weeks following assessment and intervention, there was a significantly higher percentage of patients who reported a reduction in their symptoms in the years where a team approach was used compared to the years without a team approach. These data suggest that using a team approach for dizziness management improves the ability to refer patients to the most suited professional for treatment, and potentially reduce symptoms earlier.

The authors conclude that interprofessional management of dizzy patients can assist in identifying specific and multifaceted dizziness diagnoses, as well as non-otological disorders, and thereby reduce the amount of referrals to the ORL by involving other health-care professionals as alternative referral sources. Assistance from other medical and allied health professionals for benign vestibular disorders or non-otological dizziness can potentially reduce waiting periods for patients seeking to reduce their symptoms and improve patient outcomes.

This retrospective review provides evidence of the benefits of employing a multidisciplinary team approach in the assessment and management of dizzy patients. In particular, the results indicate that using a team approach together with a complete vestibular and balance assessment of all patients referred for dizziness prior to ORL assessment, results in more specific diagnoses and potentially more effective management plans. Whereas previous studies have questioned the need for complete vestibular assessment, the authors of this paper provide evidence that such assessment, when interpreted by a team of health professionals, can provide better patient outcomes. Prospective studies across multiple sites will be an important next step in determining the generalisability of these findings.

Increases in the Rate of Age-Related Hearing loss in the Older Old

Wattamwar, K et al.

JAMA Otolaryngology-Head & Neck Surgery, February 2017, 143(1):41-45.

Presbycusis / age related hearing loss affects approximately 2/3rds of adults older than 70 years and 4/5ths of those older than 85 years. Poor hearing is associated with increased incidence of cognitive impairment and rate of cognitive decline. Despite the negative health consequences and high prevalence of hearing loss, hearing aids are underused in older adults despite the fact that hearing aids have shown to improve the social, functional and emotional effects of hearing loss.

The objective of this study was to determine if the rate of age-related hearing loss is constant in the older old (≥80 years). A retrospective review on 647 patients aged 80 – 106 years was performed. The degree of hearing loss was compared across four age brackets: 80 – 84 years, 85 – 89 years, 90 to 94 years and 95 years and older. From an individual perspective, the rate of hearing decrease across two audiograms was compared with age.

Results showed that changes in hearing among age brackets were higher during the 10th decade of life compared to the 9th decade of life. Furthermore the annual rate of LOW frequency hearing loss was faster during the 10th decade of life, representing a fundamental change in the mechanistic process of presbycusis.

Hearing aids are under-utilised in this population despite a universal benefit that increases with age. It is thought that social stigma, cosmetics, complex dispensing procedures as well as cost of devices contributes to poor update of hearing aids. There is urgency to increase hearing aid use amongst the older population as there is increasing evidence that untreated hearing loss is associated with social isolation, depression, dementia, inability to work, reduced physical activity and falls.

To improve use, hearing aids should be thought of as a lifestyle modification. Work needs to be done to change the negative perception of hearing aids by educating people on the positive effect on quality of like, enhancing cognition and decreasing the burden of disease. More attention should be placed on counselling patients on accepting hearing aids in a primary care setting using techniques such as motivational interviewing. .

Tinnitus with a normal audiogram: Relation to noise exposure but no evidence for cochlear synaptopathy.

Hannah Guest, Kevin Munro, Garreth Prendergast, Simon Howe & Christopher Plack.

Hearing Research, 344 (2017) 265-274.

Hidden hearing loss is a phenomenon by which there is subjective loss of hearing that cannot be detected by a pure-tone audiogram. Previous studies in animal models have shown damage to the primary afferent synapse, but not hair cell integrity as a result of moderate noise exposure. This sub-clinical damage to the auditory system is known as cochlear synaptopathy, and is thought to underlie the perceptual deficits in hearing in patients with normal audiograms. Electrophysiological measures of cochlear synaptopathy have been reported by a reduced Wave I in the auditory brainstem response (ABR), as well as a reduction in synchronicity of the envelope following response (EFR).

This study explores the pathophysiology of tinnitus in 'normal-hearing' patients, which makes up approximately 8% of the tinnitus population. The authors sought to investigate the role of this cochlear synaptopathy in the mechanism of tinnitus generation in patients with normal audiograms.

A total of 40 normal-hearing young-adult participants (20 with tinnitus) were matched for age (average 25.6yo), gender, and audiometric thresholds up to 14 kHz. A systematic noise history was obtained, detailing the level, duration and activities performed. Auditory evoked potential measurements (ABR and EFR) which are thought to be sensitive to cochlear synaptopathy were obtained.

Normal-hearing participants with tinnitus had significantly greater lifetime exposure to noise than matched controls. There were no significant differences between participants with tinnitus and no tinnitus in Wave I amplitude of the ABR. Synchronicity of the EFR in participants with tinnitus decreased, but did not reach statistical significance. There was no correlation between the electrophysiological results and the noise history of the participants.

This study confirms that tinnitus in normal hearing participants is highly correlated with a significant history of noise exposure, with no electrophysiological evidence of cochlear synaptopathy present. At this point, further non-invasive methodological considerations need to be considered to find a more sensitive measure for cochlear synaptopathy. Nonetheless clinicians should be aware that patients who report tinnitus with normal audiometric thresholds may be a result of sub-clinical damage caused by excessive noise exposure.

Hearing Impairment and Undiagnosed Disease: The Potential Role of Clinical Recommendations.

Nicole Marlow et al.

Journal of Speech Language and Hearing Research. 2017; Vol. 60 231-237.

Between 30 and 48 million Americans have hearing loss or impairment. Consequently, some individuals with hearing impairment may conceal that loss to avoid stigma. This activity may lead to a lack of disclosure of their condition or a decreased ability to communicate with their primary care provider. Effective communication between the clinician and the patient is an essential element in establishing a strong therapeutic relationship because it can improve the quality of the information obtained during patient–physician encounters and ultimately improve patient care.

The purpose of the study was to use cross-sectional, nationally representative data to examine the relationship between self-reported hearing impairment and undetected diabetes, hypertension, hypercholesterolemia, and chronic kidney disease.

The National Health and Nutrition Examination Survey (NHANES) for the years 2007–2012 was used. The NHANES is a representative survey of non-institutionalised population in the United States. Adults 40 years of age and older were included.

Participants had to meet specific criteria to be considered to have undiagnosed diabetes, high blood pressure, high cholesterol or chronic kidney disease. Participants included in the hearing impaired group had self-reported moderate hearing trouble or worse.

The sample size was 9,786 Americans. There were no significant differences between respondents with hearing loss and respondents with typical hearing for undiagnosed diabetes, undiagnosed hypertension, and undiagnosed hypercholesterolemia. However, a larger percentage of respondents with hearing loss had undiagnosed chronic kidney disease compared with respondents with typical hearing. Those with chronic kidney disease were more likely to have four or more visits to their health care provider per year.

The results of this study show that adults with hearing impairment are more likely to have undiagnosed chronic kidney disease than their counterparts with typical hearing.

The results suggest significant implications for detection of hearing impairment in clinical practice, patient–physician communication, and quality of care.

Developing guidelines for a greater number of diseases, including chronic kidney disease, has the potential to increase diagnosis among patients with disease and to create opportunities for better patient care than the current system currently affords.
This study highlights a key issue regarding the communication between health care provider and patient with respect to hearing impairment and undiagnosed chronic kidney disease.

Increased awareness of hearing loss is vital to ensure that appropriate and meaningful conversation is maintained between patient and provider. Perhaps even more critical, there is a need—through

health education or health communication campaigns—to increase awareness among people with hearing impairment to disclose their hearing loss to their providers.

This study has several limitations. First, this study uses self-reported assessments of both hearing impairment and previously diagnosed disease. Second, the NHANES data used in this report do not provide longitudinal information to assess the duration of other markers relevant to kidney damage. Third, the data presented were cross-sectional, which do not allow for determination of cause and effect. Fourth, we do not have any way of assessing patient–physician communication.

This study looks at whether a relationship exists between self-reported hearing impairment and undiagnosed diseases including diabetes, high blood pressure, high cholesterol and chronic kidney disease. A significant relationship was found between self-reported hearing impairment and undiagnosed chronic kidney disease. No other significant relationships between self reported hearing loss and undiagnosed disease were found. The study interprets this as a reason to develop screening guidelines that will increase diagnosis among patients with disease in order for patients to have better overall care by breaking down potential communication barriers. However, given that there was no significant relationship between self-reported hearing loss and any of the other undiagnosed diseases, it seems more likely that undiagnosed kidney disease and self-reported hearing loss have a physiologically-based relationship rather than being due to a lack of communication between patient and provider. The study concludes that increased awareness of hearing loss is vital for appropriate and meaningful conversations between patient and provider and that campaigns are necessary to increase patient awareness of the importance of disclosing that they have hearing loss to their provider.

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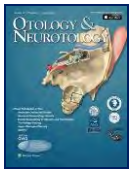
Cochlear implantation in the Elderly: Does Age Matter?



Rohloff K, Koopmann M, Weib D, Rudack C, & Savvas E.

Otology & Neurotology, 2017; Vol. 38 No. 1, 2017 p 54-59.

The indication for cochlear implantation in adults has expanded with patients with single-sided deafness and various degrees of residual hearing now being routinely implanted. Implants have proven to be reliable; modern chip and coding strategies and have improved stimulation and processing of acoustic information. Surgical techniques have become standardised with few complications arising and rehabilitation now generally achieves maximal hearing improvement within the first year of implantation. These factors have seen older adults implanted.

This study looked at whether older adults (> 70 years old at age of implantation) can achieve the same auditory benefit as younger adults (< 70 years old at age of implantation), the number of auditory rehabilitation sessions required to achieve maximal results, and whether there was any difference in surgical and post-operative complications between younger and older adults.

185 post-lingually deafened patients from University of Muenster were looked at in a retrospective analysis. Criteria were then reduced to include only those with Cochlear Ltd devices who had received rehabilitation at the University and did not have issues with language barriers, or significant handicap/mental retardation. 145 patients fulfilled criteria, 111 with unilateral implantation and 34 with bilateral implantation (each side was assessed separately) giving a total of 179 implants. Mean age for the < 70 years group was 50.2 years while the older > 70 group mean was 74.8 years. Preoperative audiological status and duration of deafness was similar in both groups.

Post-implantation audiological evaluation was based on the German Freiburg Monosyllabic word test (FM) and Oldenburg Sentence Test (OLSA), which is a more complex speech in noise/ auditory processing test which usually takes several months post CI activation to achieve a valid score. As can be seen below similar mean scores were achieved in both groups and time taken to achieve a valid OLSA score was not significantly different between groups. These results are in contrast to earlier studies which have found poorer speech-in-noise and in-quiet results in younger cohorts.

The table also highlights that there was not a significant difference in number of auditory therapy rehabilitation sessions received between groups (<70 year old group average 18.9 sessions; >70 year old group average of 15.6 sessions). Post-operative hearing results plateaued at 12 months and remained constant at the 2 and 3 year time intervals for both groups with no statistical difference found for FM or OLSA tests.

The study did find that there was an increased rate of complications in the older >70 years group, with vertigo, dysgeusia, wound infection and facial nerve paralysis being the most commonly presenting problems. Increased rates of vertigo in older CI patients have previously been reported in several other studies. It is thought that muscle weakness, poorer peripheral proprioception and cognitive impairment in older adults could contribute to this.

In summary, while the post-operative complication rate for older adults is higher than younger implant recipients, the auditory benefit achieved is comparable to that of younger adults. Results support that the ageing brain is still plastic enough to comprehend and adapt to the modified information provided by a cochlear implant. Older adults did not require significantly more auditory therapy sessions and were able to achieve longstanding improvements in hearing performance at the same level as younger adults at 12, 24 and 36 months post-activation. This study reinforces the benefit and effectiveness of implanting older adults with cochlear implants.

Evaluation of the Self-Fitting Process with a Commercially Available Hearing Aid

Elizabeth Convery et al.

Journal of the American Academy of Audiology, Vol 28:2,109-118, 2017.

Self-fitting hearing aids which are purchased online are becoming more and more available. The main reason for this upcoming parallel market is the shortage of hearing care professionals due to an ageing population. Besides this, people with hearing problems have the idea that the cost of a traditional hearing aid fitted by a professional is too high and that the perceived benefit of hearing aids is insufficient, especially in noisy environments.

As little evidence regarding the success of self-fitting devices exists, this research aimed to determine whether a group of 40 adults (age 66 – 88) with mild to moderately-severe hearing loss could successfully follow a set of written, illustrated instructions to fit a hearing aid on a tablet. The group consisted of 20 current hearing aid users (the "experienced group") and 20 other adults without experience (the "new" group). 24 of the participants were accompanied by an adult partner who could assist. The partners' presence and support was encouraged by the experimenters.

The test devices were a behind-the-ear, receiver-in-canal hearing aids with a retractable tube and instant-fit ear tips in 3 different sizes. There were 10 instruction steps for the entire process, including inserting and adjusting the hearing aid, connecting the hearing aid to the tablet, performing the automatic hearing test and fine-tuning of the settings. The steps were divided in "hearing aid" and "non-hearing aid" steps.

The most common errors during the "hearing aid" steps occurred during the automatic audiometry and while inserting the devices into the ears. In the "non-hearing aid" steps, most errors were made during the pairing of the devices in the application and assigning them to the left and right ear.

Several variables (such as gender, age, HA experience) were measured but none was useful in predicting which participants were likely to be successful. Furthermore, there was no statistically significant effect from previous experience with a tablet or smartphone or from the presence of an assisting partner. 55% of the participants managed to fit the hearing aids successfully by following all the steps until the end.

The parallel market of (online available) self-fitting hearing aids is growing quickly but gives not (yet) a decent alternative for the traditional hearing care by a professional. The danger of online purchase without control by a professional is that the hearing aids can give incorrect and potentially damaging levels of amplification and that medical problems, such as acoustic neuroma or cholesteatoma, remain undiscovered.
Although the instructions were written and illustrated, instructions in video format would be a lot easier to follow correctly. Some of the most common errors made in this self-fitting procedure, such as insertion of the self-customised hearing aids or badly executed audiometry, are very important and can't be simply ignored. Especially as each step builds on the previous step, every error lays the groundwork for subsequent inaccuracies.
These risks and errors prove that the self-fitting procedure is not (yet) ready to be applied reliably without any help of a professional. Especially as the majority of hearing aid users are seniors, who typically have more difficulties with hearing aid placement and with usage of a tablet or smartphone.

Visual Context Enhanced: The Joint Contribution of Iconic Gestures and Visible Speech to Degraded Speech Comprehension.

Linda Drijvers & Asli Özyürek.

Journal of Speech Language and Hearing Research. 2017; Vol. 60 p. 212–222.

Total communication and augmented communication approaches have always been a fascination for me as a Hearing Therapist, so I was interested to read this paper considering the benefits of visible speech and gestural clues to increase speech understanding.

The benefits of speech-reading, lip-reading or visual speech cues have been studied by many researchers particularly in adverse listening environments. Gestures and signs that indicate and direct to objects, spatial information and actions are recognised as contributing to better speech comprehension (Goldin-Meadow 2005, Kelly 2010, Obermeier 2012).

This paper considers both gestural information and visual speech, and whilst not directly addressing issues of hearing impairment and the impact of hearing acuity on speech comprehension, does provide some useful research data on combining communication modalities.

29 participants performed a series of listening and observing tasks, balanced by a pre-test experiment of 20 participants to provide a control group dataset.

Nine conditions were created using an actress – "speech+ blurred lips", "speech +visible speech", "speech +visible speech+ gesture", and three with increasing severity of noise degradation. In all the participants experienced 220 video clips.

The results indicate that participants benefitted from both visible speech and gestures, and the effect of this "double enhancement" was more pronounced when exposed to greater degrees of signal degradation. They were able to re-affirm previous research which reports that speech and gesture can create an integrated communication system, and the benefits of this "multimodal" approach can influence linguistic processing successes.

Drijvers and Ozyurek suggest that in adverse listening conditions, language processing information may be automatically sought from semantic and gestural sources, and propose that their work could be incorporated into studies with people with hearing impairments and other non-verbal cue sources

For audiologists looking for a theoretical and research basis for a multimodal communication strategy, this paper offers some good data on speech comprehension, and is a recommended read.

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The effect of hearing loss on source-distance dependent speech intelligibility in rooms.

A Westermann & J. M. Buchholz.

J. Acoust. Soc. Am. 141 (2), February 2017 p EL140 - EL145.

I was intrigued by this article which considers and promotes the benefits of separating the source of a signal and masking noise for "normal hearing" and "hearing impaired" listeners.

As we all know, our patients find it very difficult to communicate well in noisy scenarios, and research has shown that some people can take advantage of the spatial cues and reverberant information provided to achieve better speech reception thresholds (SRT), (Westerman and Buchholz, 2015, Akeroyd and others 2007).

This research paper set up two scenarios to measure the effect of distance between listener, signal and masker for 9 people with symmetrical, sloping sensorineural hearing losses, who were experienced hearing aid wearers, and compared this data with 16 people with "normal hearing thresholds".

The participants were presented with a 'Listening in Spatialized Noise-Sentence' test (LiSN-S, Cameron and Dillon 2007) and two maskers; a speech modulated "noise masker" (Best 2013), and a "speech masker" – two talker discourse (CRM, Bolia 2000)

Relative to the same distance for speech masker (two talker discourse) and target (both at 0,5m), when the speech masker was presented at 10m and the target at 0.5m (condition 1) the hearing impaired subjects received a 7dB benefit in SRT in noise. When the speech masker was presented at 0.5m and the target signal at 10m (condition 2), the hearing impaired subjects had a 5dB disadvantage in SRT in noise. For normal hearing subjects, condition 1 resulted in a 10 dB improvement and they had no disadvantage in condition 2.

When repeating the same experiment with a Noise Masker (modulated noise) the normal hearing subject performed the same in all conditions. The hearing impaired subjects performed the same in condition 1 but had a 7dB disadvantage in condition 2.

The results also indicate that the ability to attend to the target signal is highly dependent on individual factors such as cognitive attentiveness, as well as hearing acuity, when listening in noisy environments, but that separating the signal from the noise can improve speech intelligibility.

An interesting paper. References:

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Working Memory, Sleep, and Hearing Problems in Patients with Tinnitus and Hearing Loss Fitted with Hearing Aids

Reza Zarenoe et al.

Journal of the American Academy of Audiology, Vol 28:2, 141–151, 2017.

As a Hearing Therapist with an especial interest in tinnitus, I was looking forward to reading this paper which studied 92 people; half with hearing impairments and tinnitus, the other half with hearing impairments but didn't experience any tinnitus, to consider how their tinnitus may affect concentration and cognitive processing through a pathway of hearing rehabilitation.

Whilst there are many studies which corroborated anecdotal evidence that tinnitus distress can impact on cognitive function, cause sleep disturbances and working memory, surprisingly there is no recognised theory which identifies which cognitive function is associated with tinnitus distress. (Mohamad et al 2015)

It is, therefore suggested that it is the attention to the tinnitus which creates the deficit in function and task performance. Tyler and colleagues (Tyler et al 2006, 2007, 2014) have produced a wealth of research that demonstrates and measures the impact of tinnitus on emotional responses, hearing, sleep and concentration, and Lin considered the effect of hearing loss on cognition and attention (Lin et al 2013)

Other research has considered how poor sleep quality can influence attention and concentration (in particular the development of the Pittsburgh Sleep Quality Index , Buysse and colleagues 1989), and the PSQI formed part of the suite of questionnaires and outcomes measures used in this study. Other tools included: Hearing-In –Noise Test, HINT (Hallgren 2006), Reading Span Test (Ronneberg 1989), Hearing Handicap Inventory for the Elderly, HHIE (Ventry and Weinstein 1982), Tinnitus Handicap Inventory, THI (Newman 1998), audiological assessments and hearing aid fitting.

The results demonstrated that the group of participants with tinnitus improved their memory task performance, when measured at follow up, but it was the impact of poor sleep to the tinnitus group that seemed to be significantly reduced once hearing aids are fitted. This research can enable us to share this information with our patients, and may support and encourage hearing aid retention.

A very interesting and informative study, which has led me to explore how I can incorporate this information in my daily practice.

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Self-Assessed Hearing Handicap in Older Adults With Poorer-Than-Predicted Speech Recognition in Noise.

Mark Eckert, Lois Matthews & Judy Dubno.

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Age-related hearing loss is a chronic condition affecting the majority of older adults. It reduces quality of life and creates concerns which are related to treatment-seeking behaviour. Hearing impairment and self-assessment of hearing handicap predict social isolation. However, reduced audibility of speech associated with elevated, pure-tone thresholds is not the only factor contributing to self-assessed hearing handicap.

Hearing handicap for older adults is often measured with the Hearing Handicap Inventory for the Elderly (HHIE) which provides emotional, social and total handicap scores. Both the emotional and social subscales of the HHIE show significant but modest associations with pure-tone thresholds and with word recognition, both in noise and in quiet. Older adults consistently exhibit speech recognition that is poorer than predicted from their pure-tone thresholds. However, the findings of this study provide further evidence that self-assessed hearing handicap is not simply due to reduced speech audibility related to hearing loss.

One aim of this study was to determine the strength of the association between audibility-adjusted speech recognition in noise and self-assessed hearing handicap. Additionally, it also examined self-assessed ratings of workload immediately after a speech-in-noise task. These workload ratings provided an opportunity to determine the extent to which variance in workload demonstrated the same or unique variance in speech recognition in noise as with the HHIE. In this study, the National Aeronautics and Space Administration (NASA) Task Load Index was used to assess listening effort and frustration. With the increasing interest in understanding the listening effort that older listeners with hearing loss experience, the authors of this article predicted that these task-specific ratings of effort and frustration would explain significant variance in speech recognition.

Method

- *Participants were 162 middle-aged to older adults with a mean age of 68.9 years; 64% were female and 36% were male.*
- *The HHIE was completed prior to any audiometric testing or discussions about hearing loss. The 25-item HHIE was used to establish the self-assessed social/situational and emotional consequences of hearing loss. Participants were asked to indicate the extent to which they agreed with a question about their perceived handicap. The total score indicated the degree of self-assessed hearing handicap.*
- *A pure-tone average (PTA) was obtained from both ears using thresholds at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz. There was a broad range of ear-averaged pure-tone thresholds across participants and the generally mild-to-moderately severe, gradually sloping hearing loss commonly found in middle-aged to older adults.*
- *The speech recognition in noise measure was the Revised Speech Perception In Noise (R-SPIN) test. One of four R-SPIN test lists was presented in multitalker babble to measure recognition for the final key word in each sentence. The lists include 25 high-context (semantic and syntactic information) and 25 low-context (syntactic information)*

sentences. Predicted scores for the SPIN low- and high-context sentences were obtained using Articulation Index (AI) values for comparison with measured values (observed-predicted).

- *Participants also completed a modified version of the NASA Task Load Index immediately following the SPIN task to assess the effort and frustration experienced while performing the SPIN task. Participants rated their effort and frustration using a 20-point scale.*

Results

Hearing handicap, i.e. HHIE total score, was significantly negatively correlated with SPIN low-context observed–predicted speech recognition. So, poorer-than-predicted speech recognition was more likely in participants with greater self-reported hearing handicap. In contrast, there was no significant association between hearing handicap and SPIN high-context observed–predicted differences. These results indicated that:-

- *Reduced speech audibility alone does not explain why people with speech recognition problems experience hearing handicap*
- *Elevated pure-tone thresholds at frequencies that are not strongly weighted in the AI prediction of speech recognition also contribute to the relationship between the HHIE and speech recognition. This pure-tone threshold variance may relate to the effects of ageing on both the peripheral and central auditory system.*

An analysis of the individual HHIE item responses revealed that scores from 13 of the 25 items exhibited a significant association with SPIN low-context observed–predicted differences. Together, the 13 significant correlations suggested that handicap was experienced as a consequence of communication problems, particularly in social settings.

Although the NASA effort and frustration measures accounted for variance in audibility-adjusted speech recognition that was explained by the HHIE, they were not unique predictors of SPIN scores in comparison to the HHIE. Thus, self-assessed hearing handicap based on a broad range of communication experiences and listening difficulty in daily life was a better predictor of speech recognition scores than ratings of effort and frustration obtained immediately following the speech recognition task.

Conclusions

The lower reported quality of life experienced by some older adults with communication difficulties is often attributed to reduced speech audibility due to hearing loss. This hearing loss effect on speech recognition and hearing handicap is clear in the results of this study as demonstrated by the significant associations between hearing handicap and SPIN low- and high-context observed scores.

The results of this study indicate that individual differences in the peripheral and central auditory system, which are not related to threshold elevation, may contribute to hearing handicap and speech recognition difficulties experienced by middle-aged and older adults. The authors of this study observed that the expected and quite strong association between low-context speech recognition and hearing handicap remained significant after accounting for audibility using the AI and also when controlling for the average pure-tone threshold. Although these results suggest that additional peripheral and central factors contribute to some extent to the variance to hearing handicap, this variance appears also to be due to the accumulation of multiple negative communication experiences, particularly in social settings, rather than just the effort and frustration in trying to understand speech in more difficult listening conditions. Together, the results demonstrate that the

HHIE is a good tool for identifying auditory and potential non-auditory factors that contribute to difficulties in speech recognition in noise.

This study adds to existing evidence that self-assessed hearing handicap is driven by a number of factors that are additional to the effects of reduced audibility resulting from pure-tone threshold elevations. Its findings confirm that we should not underestimate the individuality and complexity of hearing handicap.

Binaural Interference and the Effects of Age and Hearing Loss

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The advantages of listening with two ears rather than just one are well established. As it is generally assumed that listening with both ears is always preferable, two hearing aids are usually recommended for those with bilateral hearing loss. However, this assumption was first challenged in the mid-1990s by case reports of binaural interference resulting in performance with two ears being poorer than with the better ear alone.

This article provides an interesting review of studies exploring binaural interference as a possible reason for unsuccessful, bilateral hearing aid use in spite of symmetrical hearing thresholds. The authors of this study identified three possible confounders in previous studies to explain the considerable variation in the findings of these studies, particularly about the prevalence of binaural interference:-

- *The use of hearing aids by study participants during testing. Digital processing in hearing aids can introduce subtle time delays. If the processing delay is not the same when two hearing aids are in use, binaural hearing may be hindered by disruption of the very precise timing/phase differences between sounds arriving at the two ears.*
- *In some previous studies, speech-in-noise tests have lacked spatial separation between speech and noise by presenting both through a single loudspeaker. To assess participants' binaural hearing performance during speech perception in noise, spatial separation between the two is important.*
- *Finally, in some studies, the use of veterans as participants could have potentially affected previous findings. Being mostly males and generally with noise-related hearing loss, the effects on the auditory system, as we now know, can go beyond just the loss of cochlear hair cells.*

Although previous studies have had limitations and provided weak support for binaural interference, the evidence still suggests that binaural interference exists in some listeners. Because there is evidence that many users prefer wearing only one hearing aid, it is important to consider the possibility of binaural interference when assessing outcomes from a bilateral hearing aid fitting.

Previous researchers have examined which factors or tests, if any, can predict a preference for unilateral hearing aid use in listeners with symmetrical hearing loss. However, other factors such as cosmetics, cost, and poor manual dexterity may explain the preference for one hearing aid and pose a confounding variable in those studies. Nevertheless, better subjective performance with one hearing aid seems to be an important factor for unilateral hearing aid use which may be explained by a physiological mechanism such as binaural interference. Notably, many of the binaural interference cases reported seem to be found in the elderly population. Older adults in general have difficulty understanding speech in challenging listening situations and seem to have diminished temporal processing abilities.

This study was conducted in an effort to explore further the phenomenon of binaural interference as one possible underlying reason for subjective preference for a single hearing aid. Due to potential confounds introduced by the hearing aids themselves, testing conditions in this study did not involve using hearing aids. The aim of this study was to investigate the occurrence of binaural interference in groups of younger and older adults, and the effects of hearing loss, not due to noise exposure, in the older age group. Because previous studies suggest that the prevalence of binaural interference may not be high enough to be evident with group analyses, within-subject analyses were also performed.

The hypothesis was that binaural interference would be found in a proportion of participants in the within-subject analyses, mostly in the older age groups.
Methods
Thirty-three listeners participated in this study, divided into three groups:-

- *Younger with normal hearing (YNH). 7 female, 5 male, with mean age of 22 years*
- *Older with normal hearing for their age (ONH). 7 female, 2 male, with mean age of 80.2 years*
- *Older with hearing impairment (OHI). 5 female, 7 male, with mean age of 83.2 years.*

All participants exhibited symmetrical audiograms, i.e. no more than a 15 dB left-right difference at any frequency.

- *Speech recognition was tested in three conditions: right ear only, left ear only, and bilaterally using:-.*
- *The Hearing in Noise Test (HINT). An adaptive test to find the signal-to-noise ratio that yields 50% correct speech recognition (SNR-50). Speech materials consist of sentences in a spectrally-matched noise background. The participants' task was to repeat each of 20 sentences (two lists), as spoken by a male talker.*
- *The Connected Speech Test (CST). To assess speech intelligibility in noise. It consists of a large number of passages about familiar topics, with ten sentences per passage topic. The speech is presented in a background of multitalker babble, at a fixed signal-to-babble ratio (SBR). Using two different SBRs, +2 dB and -2 dB, the participants' task was to repeat as much of each sentence as possible.*
- *The Dichotic Digits Test (DDT) was used to assess binaural separation ability which can lead to the expression of binaural interference. In this test, different digits from 1 to 10 (excluding 7, not being a monosyllable digit) are presented simultaneously to both ears. Although brain-processing asymmetries would predict a slight right-ear advantage on the DDT (and on dichotic tests in general), larger asymmetries have been taken as a sign of binaural interference.*

Results - Group Analyses
HINT SNR-50 results revealed a significant main effect of group, with the older hearing-impaired group having the poorest average SNR-50 across the three ear conditions (5 dB), followed by the ONH group (0.6 dB) and the YNH group (-2 dB).

Results - Within-Subject Analyses
Given that the prevalence of binaural interference has been estimated to be as low as 10%, it might be expected that its effects would not be evident in group analysis. Thus, a within-subject analysis was performed, comparing the difference between each participant's bilateral and better unilateral scores to pre-established 95% critical differences for each test. It was evident that at least some participants displayed a large right ear advantage. A right-ear advantage on the DDT, although expected as a result of speech being processed in the left hemisphere, has also been taken as a sign of binaural interference.

On the HINT, the group analysis showed no effect of ear tested, while within-subject analysis showed that 27% of the participants had binaural interference. A different pattern of results emerged with the CST, which showed a significant binaural advantage across all groups in the means analysis. Individual results showed that, similar to the HINT, a small proportion of participants had binaural advantage (12%) at each SBR. However, only one participant had binaural interference at each SBR.

Finally, on the DDT, a significant right-ear advantage was found with group data and, for at least some participants, with individual data.

Regarding the effects of age, although the groups did not differ on the ear condition, within-subject HINT results showed that more participants in the elderly groups had binaural interference (33.3%) than in the younger group (16.7%). The individual CST and DDT analyses are less conclusive on the age effects.

Conclusions
Taken together, the results support the occurrence of binaural interference in at least 16.7% of listeners. Hearing loss does not seem to compound the presence of binaural interference. The findings provide evidence that binaural interference may be more prevalent in older adults. However, more research in this topic is clearly needed. The authors of this study make it clear that the possibility of binaural interference should not change the general practice of bilateral hearing aid fittings for listeners with symmetrical hearing loss. Nevertheless, there should be greater awareness of binaural interference as an explanation for subjective reports of preference for one hearing aid. The potentially adverse consequences of unilateral fittings, such as auditory deprivation, should be carefully considered but the authors suggest that bilateral speech-in-noise testing with adaptive levels of background noise such as with the HINT may provide an objective confirmation of a patient's report.

A highly relevant subject and this article presents both the interesting background to this study and its findings with great clarity. Although it doesn't provide any reason to change the general practice of recommending two hearing aids for a bilateral hearing loss, this study helps to inform our response when a bilateral fitting fails to perform better than a unilateral fitting. It also provides another justification for use of an adaptive speech-in-noise test, such as the HINT or QuickSIN, for both pre- and post-fitting purposes.

Characterizing the binaural contribution to speech-in-noise reception in elderly hearing-impaired listeners.

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A better understanding of the factors involved in binaural speech-in-noise reception could promote individually tailored diagnostics and treatments (e.g., with hearing devices). However this requires good experimental control over the factors of interest. In an effort to accomplish this, the study recruited 4 groups of elderly participants with or without near-normal binaural intelligibility level difference (BILD) and with or without audiometric asymmetry <2 kHz that were matched in terms of age and overall degree of hearing loss. Using measures of monaural and binaural phase sensitivity as well as cognitive function, these groups were then characterised further to shed more light on the underlying processes.

Methods

Participants
40 sensorineurally hearing impaired participants aged 61-85
Large spread in audiometric asymmetry <2 kHz
- *PTA4 = pure-tone average hearing loss 0.5, 1, 2 and 4 kHz*
- *PTALF = pure-tone average hearing loss 0.125, 0.25, 0.5, 0.75, 1 and 1.5 kHz*
- *PTALFΔLR = absolute difference across left and right ears in PTALF*

All but 6 of them were hearing aid users
Normal vision

BILD
SRT's were measured in FF. Speech (S, Oldenburg sentence material) was simulated to come from 0° and the noise (N, stationary speech-shaped noise) from 90° or 270° azimuth.
Stimuli were presented either binaurally or monaurally to the ear opposite N.
The BILD was obtained by taking the difference between the binaural and monaural SRT's per spatial configuration (S0N90 or S0N270), yielding the change in SNR due to binaural interaction.
Typically, normal-hearing listeners achieve BILDs of ~4dB

Psychoacoustic measurements
Sensitivity to phase information in the presence of noise was assessed using monaural random frequency modulation detection (RFMD) and binaural masking level difference (BMLD) measurements.
- *RFMD measurement were performed at test frequencies of 0.5 and 1 kHz*
- *BMLD measurements were also performed at 0.5 and 1 kHz with noise signals identical to those used for RFMD measurements. The noise N and tone S were either presented diotically (N0 S0) or N was presented diotically and S with an interaural phase shift of 180° (N0 Sπ). The BMLD was obtained by taking the difference between N0 S0 and N0 Sπ thresholds. Cognitive measurements to check for any top-down influences on BILD performance, 2 visual cognitive measures were included:*
- *Reading span test (RST)*
- *Distractibility test*

Results/ Discussion and conclusion
Consistent with earlier findings, inter-individual BILD differences were large (>5dB). Standard audiological measures were ineffective predictors of these differences as reflected by the weak correlations with age, PTA4, and PTALF and the fact that it was possible to define 4 subgroups with marked BILD differences that were independent of the effects of PTALFΔLR, age and PTA4. For

auditory profiling purposes a measure of binaural processing abilities in noise thus appears to be informative.

Because the N0 S∏ threshold at 500 Hz could predict the BILD effectively, it constitutes a suitable (and time-efficient) candidate for this.

The moderate correlations between RFMD and HTL data suggest that the RFMD measure captures additional supra-threshold abilities. The fact that there was an influence of BILD status but not audiometric asymmetry on the RFMD thresholds also supports this.

The strong correlations between RFMD and binaural detection thresholds are consistent with the view that monaural phase sensitivity facilitates binaural processing abilities.
Interestingly however, the RFMD thresholds and BMLD's were not correlated and contributed separately to the BILD prediction, suggesting that both monaural and binaural factors play a role in binaural squelch abilities. In contrast, cognitive factors were unrelated to BILD performance, consistent with previous findings.