

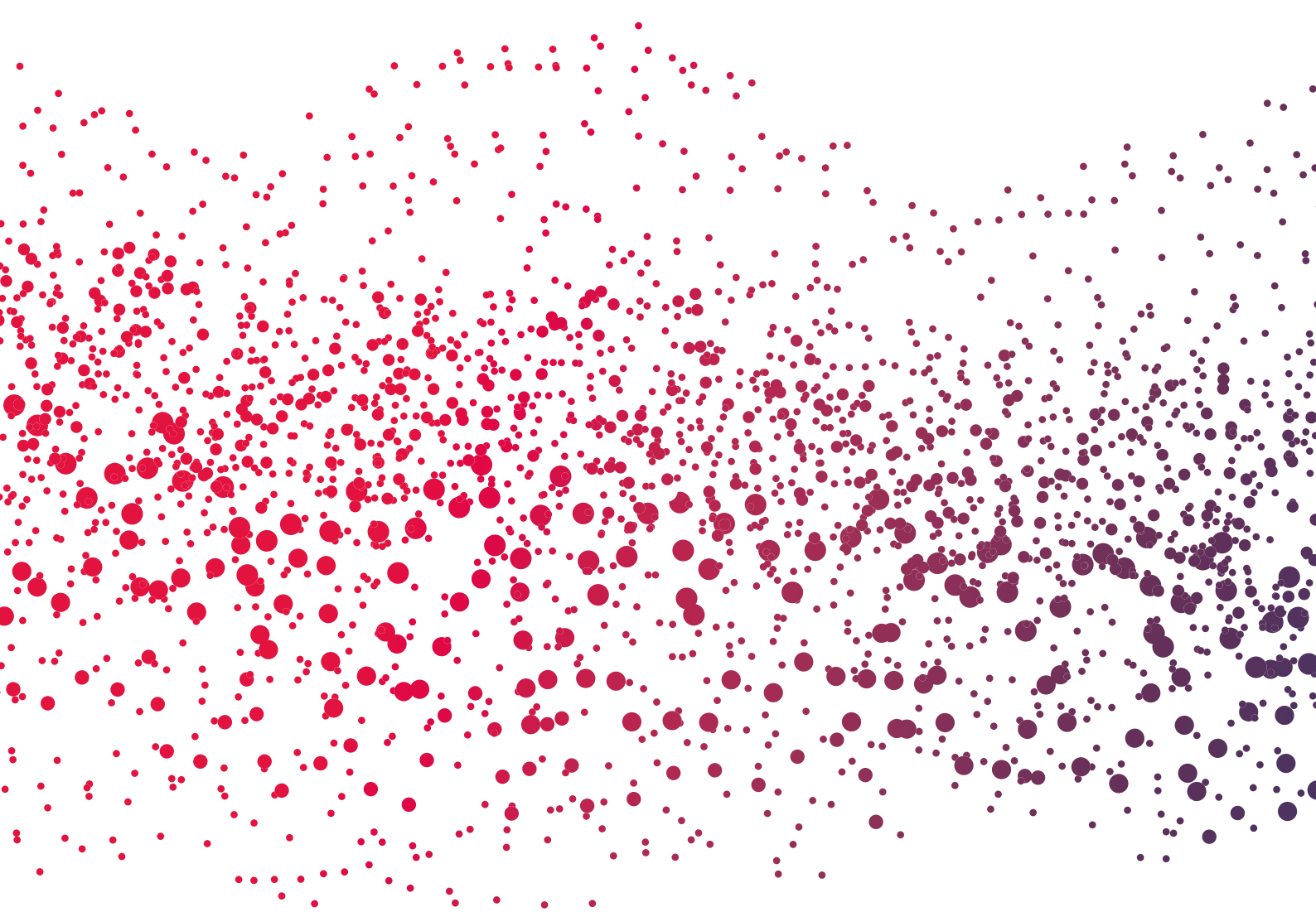


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## Otology & Audiology Article Review



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**APRIL 2015**

- Validation of a Novel Combination Hearing Aid and Tinnitus Therapy Device
  - James A Henry, Melissa Frederick, Sara Sell, Susan Griest, and Harvey Abrams.
  - *Ear and Hearing* 2015; 36; 42-52
  - A US randomised controlled trial to collect data towards a determination of efficacy between the hearing aids or combination hearing aid masking devices in 30 participants with tinnitus, using standardised outcome measurements..
- Stages of Change in Adults Who have failed an Online Hearing Screening
  - Ariane Laplante-Levesque, K.Jonas Brannstrom, Elizabeth Ingo, Gerhard Andersson and Thomas Lunner.
  - *Ear and Hearing* 2015 92 -101.
  - A study into the health change behaviours of adults who fail screening programmes developed from research into 224 Swedish adults who failed an online screening programme, considering the goals and outcome benefits of hearing screening programmes, change behaviour theory, and self reporting attitudes to hearing health care..
- Communication Patterns in Audiological Rehabilitation History-taking : Audiologist, Patients and their Companions.
  - Caitlin Grenness, Lousie Hickson, Ariane Laplante-Levesque, Carly Meyer, and Bronwen Davidson.
  - *Ear & Hearing* 2014 191-204).
  - An interesting exploration of how we communicate with patients during history-taking. Discussing communication dominance, power dynamics and patient centred approaches, in a background of patient satisfaction studies and the move towards a more collaborative partnership. Using RIAS the researchers have closely dissected communication practice, and started the conversation for further research.
- Effects of age and hearing loss on the intelligibility of interrupted speech
  - Valery Shafiro, Stanley Shefy, Robert Risley.
  - *J. Acoust. Soc. Am.* 137, 745 (2015).
  - Individual performance with interrupted speech not exclusively correlated with expected factors such as age, hearing sensitivity, working memory but also with other listener characteristics' such as linguistic skills may provide strong associations.
- The subjective effect of low frequency content in road traffic noise.
  - Antonio J. Torija, Ian H. Flindell.
  - *J. Acoust. Soc. Am.* 137, 189 (2015).
  - The findings in this study are consistent with the available literature where higher frequencies were observed as more significant for road traffic annoyance and where lower frequency content being more dominant indoors.
- Family member involvement in audiology appointments with older people with hearing impairment
  - Katie Ekberg, Carly Meyer, Nerina Scarinci, Citlin Grenness, Loise Hickson.
  - *International Journal of Audiology* Feb 2015, Vol. 54, No. 2: 70-76
  - Family members or S.O's are often subject to third party disability. This study promotes and provides support for the role of family members in attending healthcare appointments.
- Evaluation of wideband frequency responses and nonlinear frequency compression for children with cookie-bite audiometric configuration
  - John, A. et al.
  - *J Am Acad Audiol* 25:1022-1033 (2014)
  - The purpose of this study was to evaluate the effect of NFLC technology for children with cookie-bite audiograms. The detection of high-frequency warble tones and speech recognition in quiet and in noise will be measured.
- Benefit from, and acclimatization to, frequency compression hearing aids in experienced adult hearing-aid users.
  - Rachel J. Ellis & Kevin J. Munro.
  - *International Journal of Audiology* 2015; 54: 37-47
  - The results of VCV recognition in quiet, in noise and sentence recognition in noise are significantly better with frequency compression when compared to the results without. However, this improvement is not reflected in subjective ratings of frequency compression.
- Evaluation of the effects of nonlinear frequency compression on speech recognition and sound quality for adults with mild to moderate hearing loss.
  - Erin M. Picou, Steven C. Marcum & Todd A. Ricketts..

- *International Journal of Audiology* 2015; 54: 162 - 169.
- *All tests show no significant difference between Classic Processing (CP) and Nonlinear Frequency Compression (NFC) in the results at group level, except for consonant discrimination threshold for /s/ centered at 9 kHz (better with NFC). However, there is a large individual variability, with, unfortunately, no predictive variables found.*
- **Hearing Loss and Cognition: The Role of Hearing Aids, Social Isolation and Depression**
  - *Piers Dawes, Richard Emsley, Karen J. Cruickshanks, David R. Moore, Heather Fortnum, Mark Edmondson-Jones, Abby McCormack, Kevin J. Munro*
  - *PLoS ONE* 10(3): e0119616. doi:10.1371/journal.pone.0119616. March 2015
  - *The purpose of the study featured in this article was to test whether the use of hearing aids was associated with better cognitive performance, and if this relationship was connected with social isolation and/or depression.*
- **Validation of a Screening Test of Auditory Function Using the Telephone**
  - *Williams-Sanchez V et al.*
  - *Journal of American Academy of Audiology*, 2015; Vol. 25 (10), 937-951.
  - *This study proposed and validated a National Hearing Test (NHT) for the US on similar lines to the Dutch NHT. The study was conducted with a large group of veterans and the performance of NHT was benchmarked with PTA, HINT and WIN. The results showed that NHT is a valid, reliable, quick and effective hearing screening test.*
- **Bilateral Ménière's disease assessed by an inner ear test battery**
  - *C-H Huang and Y-H Young.*
  - *Acta Oto-Laryngologica*, 2015; Vol. 135, 233-238.
  - *Ménière's disease is generally characterised and defined as a unilateral disease. However, the disease progresses to become bilateral over the years. This throws up challenges in diagnosing the condition. The current study examined a test battery of pure-tone audiometry, VEMP and Caloric tests to understand this disease better and provide appropriate therapeutic solutions.*
- **Tinnitus and Hearing Survey: A Screening Tool to Differentiate Bothersome Tinnitus From Hearing Difficulties.**
  - *Henry JA et al.*
  - *Journal of the American Academy of Audiology*, 2015; Vol. 24 (1), 66-77.
  - *This study proposed a new short questionnaire (Tinnitus Hearing Survey, THS) for separating the effects of tinnitus and hearing loss using just 10 questions. The study examined various psychometric parameters and the test-retest reliability, which indicate a successful choice of questions. THS forms a very strong first step in examining all tinnitus patients and can be used in combination with other severity measurement questionnaires for better patient education and selection of appropriate intervention.*

## Validation of a Novel Combination Hearing Aid and Tinnitus Therapy Device.



James A Henry, Melissa Frederick, Sara Sell,  
Susan Griest, and Harvey Abrams.

*Ear and Hearing* 2015; 36; 42-52

*As a Hearing Therapist I could be forgiven for thinking that this study was exploring a new kind of hearing aid masker instrument. In fact the researchers are considering the difference in effectiveness between hearing aids and hearing aid masker combination instruments for a cohort of people with tinnitus who have not used hearing aids previously, but who are potential hearing aid candidates.*

*There is a presumption in tinnitus management strategies that hearing aids, and combination hearing aid maskers, will always be beneficial to our patients, and in fact 17 out of 18 studies have placed the weight of evidence in favour of this treatment option. However the researchers discovered that there was no direct evidence differentiating between the strategies, or even definitively quantifying benefit. The research team reviewed and critiqued literature and research papers on perceptions of tinnitus, clinical tinnitus management strategies, and hearing aid benefit data including from other researchers and clinicians such as Vernon, Coles, Johnson and Surr, to provide a foundation for their trial outcomes.*

*The team quotes studies from Meikle and Kamalski and colleagues stating that “Numerous clinical studies have reported positive outcomes... however .. statistical evidence.. remains inconclusive..” ( Meikle et al 2008, Kamalski et al 2010)*

*Thirty patients were recruited, screened and segregated into two groups; the experimental group and a control group, using standardised tools namely the Tinnitus Function Index (TFI) (Meikle et al 2012), Hearing Handicap Inventory for the Elderly (HHIE) (Ventry and Weinstein 1982) and the Mini Mental State Exam (MMSE) (Bleeker et al 1988).*

*The candidates were also assessed for motivational goals such as “on a scale from 0 – 10, how motivated are you to try hearing aids?”, and “On a scale of 0-10, how motivated are you to find relief from tinnitus?”, resulting in mean average scores of 9.4 and 9.7 respectively.*

*The subjects had similar hearing sensitivities and cognitive abilities, and had expressed similar difficulties managing their tinnitus; 40% reported “big or very big problems” with their tinnitus. Twenty-two candidates reported constant tinnitus, and 27 had experienced tinnitus for longer than 3 years duration. The mean age of the candidates was 67 with 90% Caucasian ethnic backgrounds and 67% were male. All were fitted bilaterally with receiver in the canal instruments, two patients using moulds rather than domes.*

*The participants attended the research facility on four occasions;*

- Visit 1 for the assessment procedure;
- Visit 2, two weeks later for device fitting, and scripted tinnitus counselling,
- Visit 3, one to three weeks later for follow up, datalogging retrieval and hearing aid adjustments.
- Visit 4 three to four months later for the final completion of outcome measurements.

*Datalogging capture indicated that there was no significant difference in the amount of use of either hearing aid or combination device over time, which reduced from 8.7 hr/d to 7.0 hr/d over Visit 3 to Visit 4.*

*The calculated Tinnitus Functional Index scores between both groups was not significantly different, but indicated that there was an improvement when participants used the instruments.*

*Tinnitus Functional Index (TFI) scores were recorded at 58.3 for the overall group and at the three month point had reduced to 22.2 with aids, and 44.8 without aids, suggesting that people cope better with tinnitus when wearing either hearing aids or combination devices.*

*The study reports the progress of the trials and the testing regimes, discusses previous tinnitus and hearing aid benefit research ( see their references, some of which I highly recommend) and produces some interesting data. The study is unique in that it also provides benefit outcome measurements for patients wearing and not wearing hearing instruments.*

*The researchers conclude that there are measurable improvements to the candidate's perception of their tinnitus, with TFI scores showing a 13 point averaged improvement and 87% reporting a meaningful reduction in their tinnitus. They therefore confirm that the benefit when wearing hearing aids compared to not wearing hearing aids is significant; no other study has apparently reported this finding.*

*The researchers could not however extrapolate any significant difference between hearing instrument alone use or combination instrument use over a three month period, and propose that further studies are conducted examining patient controlled sound generators, different sounds as maskers, and larger participant groups.*

*When we find patients with tinnitus in clinic who are reluctant to wear hearing aids, this research may add to the evidence to support your assertion, (providing the patient has an existing unsupported hearing loss), however it will not help you decide whether a combination masking device will be more beneficial than a hearing instrument.*

*A US randomised controlled trial to collect data towards a determination of efficacy between the hearing aids or combination hearing aid masking devices in 30 participants with tinnitus, using standardised outcome measurements.*

**Extra references:**

*Bleecker ML, Bolla-Wilson K, Kavas C et al (1988) Age specific norms for the Mini-Mental State Exam. Neurology 38 1565-1568*

*Coles RRA (1995) Classification of causes, mechanisms of patient's disturbance, and associated counselling. In JA Vernon & AR Moller (eds) Mechanisms of Tinnitus (p11-19) Needham Heights; Allen & Bacon*

*Johnson RM (1998) the masking of tinnitus. In JA Vernon (Ed) Tinnitus management and Relief (pp164-186) . Needham Heights; Allen& Bacon*

*Kamalski DM, Hoekstra CE van Zanten BG et al (2010) Measuring disease specific health related quality of life to evaluate treatment outcomes in tinnitus patients: a systematic review. Otolaryngology Head and Neck Surgery 143 181-185*

*Meikle MB, Stewart BJ, Griest SE et al (2008) Tinnitus outcomes assessment, Trends in amplification 12, 223-235*

*Meikle MB, Henry JA, Griest SE et al (2012) the tinnitus function index: Development of a new clinical measure for chronic, intrusive tinnitus. Ear and Hearing, 33, 153-176*

*Ventry IM, Weinstein BE (1982) the hearing handicap inventory for the elderly: a new tool,. Ear and Hearing, 3, 128-134*



## Stages of Change in Adults Who have failed an Online Hearing Screening.



Ariane Laplante-Levesque, K.Jonas Brannstrom,  
Elizabeth Ingo, Gerhard Andersson and Thomas  
Lunner.

*Ear and Hearing 2015 92 -101.*

Theories of health behaviour change in adults form a cornerstone to audiological rehabilitation, and this insightful paper offers a review of the goals of screening programmes; questions whether the barriers to access for clinical services influence decision making ; and discusses the psychometric properties and construct validity of stages of behavioural change in individuals who fail hearing impairment screening programmes.

This study considered the behaviours of Swedish people who had failed an online hearing screening test completed by 1500 participants, and included a speech in noise word recognition test and self-reporting hearing disability measurements, within the context of health change behavioural analysis and theory.

365 people were later invited to participate in the study by email, with 224 respondents. 58% of the participants were men, the average age was 68, and 77% lived with other people. On average they had experienced hearing difficulties for around 10 years, which is consistent with previous research (Davis et al 2007), with the majority of participants reporting mild hearing disability.

The research suggested that whilst screening programmes can raise awareness of hearing loss in the general public, a primary goal of screening programmes is to change behaviours in people with hearing impairment to seek help and thereby reduce the negative effects of hearing impairment. This was not supported directly by the evidence and could influence how such programmes are planned and delivered.

It has been suggested that limited access to clinical health care services following screening events may be perceived as a barrier to help-seeking, and the researchers considered two examples of promotional activity and direct access which have had limited effectiveness. Further investigation of this failure indicated that hearing aid benefit, coping skills and levels of self-reported hearing disability significantly influenced the participants in their change behaviours, and other studies have suggested that service availability does not always result in higher uptake.

The transtheoretical model of health behaviour change proposes several stages of change, and this study draws from the University of Rhode island Change Assessment model ( URICA), comprising of a questionnaire with eight items for each stage of change.

This is the second report into URICA scores in audiology and offers comparison between both reports. Of the findings, I would suggest that one of the most important is that:-  
“stages of change are associated with perceived degree of disability, but not with measured degree of impairment or perceived duration of hearing impairment”.

The study also proposes a fourth intermediate stage of change relevant to hearing impairment in that many of the respondents reported an additional stage between contemplation and action, which the researchers named “preparation”. This preparation stage is an advice gathering stage prior to seeking help, which seems pertinent and important for people with hearing impairments as these develop slowly and progressively.

The previous study had been undertaken by direct questioning in clinic with an audiologist and the differences in results can be associated with this difference; namely that the online screening cohort (this study) scored higher on precontemplation , contemplation and preparation, but lower on action than adults who seek help for the first time. In fact only 3% were in the action stage.



*The Study concludes that structured interventions such as completing URICA questionnaire prior to performing screening tests may assist in moving respondents through stages of change, but that other concepts and models, such as the health belief model, may be more appropriate when considering the behaviours of people with hearing impairment.*

*The study offers an opening to further research in this important and interesting area and its relevance to our work with this client group.*

*When listening effort decreases, capacity is freeing for other cognitive tasks. This is interesting because in daily life, people need to be able to multitask. (e.g. combine walking and talking)*

*Reference: Davis A Smith P, Ferguson M et al (2007) Acceptability, benefit and costs of early screening for hearing disability: a study of potential screening test and models. Health Technology Assessment 11, 1-294*

*A study into the health change behaviours of adults who fail screening programmes developed from research into 224 Swedish adults who failed an online screening programme, considering the goals and outcome benefits of hearing screening programmes, change behaviour theory, and self-reporting attitudes to hearing health care.*

**Communication Patterns in Audiological Rehabilitation History-taking : Audiologist, Patients and their Companions.**



Caitlin Grenness, Lousie Hickson, Ariane Laplante-Levesque, Carly Meyer, and Bronwen Davidson.

*Ear and Hearing* 2014 191-204.

*The development of a communication partnership and rapport building is fundamental to good practice and the progression of meaningful engagement with the patient and their companion, so, as a Hearing Therapist and Audiologist, I was delighted to review this study.*

*The study explains that there has previously been little research into verbal communication practice within adult rehabilitation settings, despite communication dynamics playing a significant role in the relationship between patient and professional. The study involved 63 video-recorded initial audiology consultations in Australia in a variety of audiology clinical settings. The majority of audiologists was female, over half the patients were male, (average age 76), with 27% having companions at the appointment, generally spouses.*

*A person-centered, or in this instance, patient-centred, approach to healthcare service delivery was a given baseline of best practice against which the communication envelope was examined, following research into patient satisfaction studies, outcome measurements studies and treatment adherence. Research has highlighted the differences of patient-centred services to traditionally focused interactions in five ways; “a biopsychosocial perspective is taken, the patients’ individual experience of the condition is understood; power and responsibility are shared; the therapeutic alliance is emphasised; and the Practitioner reflects on their practice.”*

*The study reports that specific communication practices are observable in different phases of a consultation where rapport building occurs in the beginning of the consultation, and decision making follows the clinical examination. Roter suggests that the “Gold Standard” for patient centred services should be that the consultation is “mutual, negotiated and in partnership”. (Roter 2000)*

*The researchers refer to Eide where “the presence of psychosocial talk in the history taking phase influences patient satisfaction more positively than at any other phase..” (Eide et al 2002)*

*The researchers considered that qualitative or phenomenological evidence lacked robust datasets, and based their analysis on the Roter Interaction Analysis System (RIAS), developed by Roter et al in 2002, as having been shown to produce repeatable and accurate validations, underpinned by social exchange theory. RIAS divides talk into categories of utterances and allocates a weighting to each set and subset. In particular this study reviewed “Education and Counselling with 2 elements: Biomedical topics and Psychosocial topics”, “Data gathering”, “Building a relationship”, and “Facilitation and Patient Activation”. Utterances were recorded and tabulated according to variations and categories.*

*The study looked at the first few minutes of the consultation, specifically the history taking sequence in terms of opening structure, communication profiles, and communication dynamics.*

*The average consultation was 57.4 minutes, with the history taking element taking on average 8.8minutes, but in some cases merely 1.7minutes. 62% of the audiologists began with a closed question, and interrupted the patients on average after 21 seconds in 76% of the consultations. Over half the closed questions were biomedical in nature. Audiologists did at least produce more positive utterances than negative.*

*Communication dominance suggests that the audiologists were more likely to ask closed-ended questions, and may miss opportunities to solicit patients concerns or reasons for attending. The 14%*



*of audiologists who asked open-ended questions were later less likely to hold dominance over the structure of the history taking process.*

*This balance of communication power is perceived to be an important factor in patient satisfaction. Interestingly the research showed that lifestyle factors influencing how the patient functions with their hearing loss was not apparent in the observed history-taking period of the consultations.*

*This study has the right to say that it is a “novel first look at the nature of communication. In audiological rehabilitation consultations”, and as such I would suggest is worthy of taking time to read and digest the information, conclusions and ideas.*

*I found the proportional calculations very interesting, however it did not detract from the underlying issue that this was a history taking element of the consultation, in which a distinct and detailed list of questions must be asked and recorded. I wondered about my own practice and whether this requirement to get this specific information from the patient leads perhaps to a dominance of the phase, and whether I rebalanced this further along during the consultation. I hope I do, but I will be taking more time to think about history-taking from tomorrow morning.*

*Extra references:*

*Eide H Graugaard P, Holgersen K et al (2002) Physician communication in different phases of a consultation at an oncology outpatient clinic related to patient satisfaction. Patient Education and Counselling 54, 259-266*

*Roter D (2000) The enduring and evolving nature of the patient-physician relationship. Patient Education and Counselling 39, 5-15*

*Roter D, Larson S (2002) The Roter Interaction Analysis system (RIAS); Utility and flexibility for analysis of medical interactions. Patient Education and Counselling 46, 243-251*

## Effects of age and hearing loss on the intelligibility of interrupted speech.



Valery Shafiro, Stanley Shefy, Robert Risley.

*J. Acoust. Soc. Am.* 137, 745 (2015).

Typical factors such as age and hearing loss may affect how interrupted speech is perceived and may vary based on both the physical properties of preserved or obliterated speech fragments and individual listener characteristics.

To investigate perceptual processes and interruption parameters influencing intelligibility across interruption rates, participants of different age and hearing status heard sentences interrupted by silence at either a single primary rate (0.5–8 Hz; 25%, 50%, 75% duty cycle) or at an additional concurrent secondary rate (24 Hz; 50% duty cycle).

This study investigated the effects of age and hearing impairment on the perception of speech gated with these two concurrent rates by comparing older normal hearing subjects (ONH) and older hearing impaired subjects (OHI) to younger normal hearing subjects (YNH). A reduced overall intelligibility of interrupted speech was expected for the ONH and OHI groups. All listeners were tested with 4 types of materials: interrupted speech sentences, speech in noise tests, tests of basic auditory abilities, and working memory test. 31 participants were divided into two groups based upon their hearing status.

The findings demonstrate that **both age and hearing loss affect the perception of interrupted speech**, which is consistent with previous studies. Even in cases of generally mild losses listeners performed poorer than ONH listeners, which in turn performed poorer than YNH subjects. Although age and hearing loss significantly affected intelligibility, the ability to integrate sub-phonemic speech fragments produced by the fast secondary rate was similar in all listener groups. Age and hearing loss interacted with rate, with smallest group differences observed at the lowest and highest interruption rates of 0.5 and 24 Hz. Furthermore, intelligibility of dual-rate gated sentences was higher than single-rate gated sentences with the same proportion of retained speech. Correlations of intelligibility of interrupted speech to pure-tone thresholds, age, or measures of working memory and auditory spectro-temporal pattern discrimination were generally low-to-moderate and mostly non-significant.

These findings demonstrate rate-dependent effects of age and hearing loss on the perception of interrupted speech, suggesting complex interactions of perceptual processes across different time scales.

*This carefully planned study provides compelling evidence of how the integration of low level speech cues can be integrated towards obtaining higher levels of linguistic information thanks to interdependent cognitive processes such as working memory, attention, and speed of processing. This is particularly significant when taking into account how daily life speech perception typically takes place in the presence of extraneous sounds. Possible implications in hearing aid fitting and auditory training strategies to overcome lexical uncertainty and benefits derived from contextual cues such as in the McGurk effect.*

*The subjective effect of low frequency content in road traffic noise.*



Antonio J. Torija, Ian H. Flindell.

*J. Acoust. Soc. Am.* 137, 189 (2015).

*Thirty three normal hearing listeners were randomly divided into 11 groups of three listeners with the aim of identifying the difference in sound levels at which low frequency (LF) content becomes subjectively dominant over mid and high frequency (MHF) content.*

*Participants were instructed that sounds were recorded outdoors alongside a busy main road and that they should judge the sounds in that precise context. In the second task they were instructed to judge sounds as if they were indoors and the sounds originating from the nearby main road. The subjective scaling method used was the relative magnitude estimation method.*

*For the low frequency subjective dominance test, increasing LF dominance demonstrated to have a linearly increasing effect on subjective loudness and subjective annoyance.*

*For the indoor test condition a greater increase in subjective annoyance than subjective loudness for increasing amounts of LF and MHF content within the overall frequency spectrum. Subjective loudness appears to be equivalently sensitive to changes in LF and MHF content whereas subjective annoyance appears to be relatively more sensitive to changes in LF content than to equivalent changes in MHF content.*

*The authors found that typical road traffic noise (as measured indoors) loudness reported by the participants was similarly affected by variations in the relative amounts of LF and MHF content, while reported annoyance was dominated by the MHF region. It was found that differences of at least +30 dB between low frequency and the mid/high frequency content had as much effect on subjective annoyance as equivalent changes in mid and high frequency content.*

*Interesting and well-organised study comparing objective acoustical dominance with subjective annoyance and how these may modify based upon outdoor versus indoor conditions. More proof of the importance of subjective domains in evaluating annoyance and, though tested on normal hearing subjects, this paper may possibly have implications for hearing aid users such as the electro-acoustical settings and various algorithms deployed. A spin off of this study may be the investigation of possible links and rationale similarities with the Acceptable Noise Level test.*

*Family member involvement in audiology appointments with older people with hearing impairment.*



*Katie Ekberg, Carly Meyer, Nerina Scarinci,  
Citlin Grenness, Loiuse Hickson.*

*International Journal of Audiology Feb 2015,  
Vol. 54, No. 2: 70–76.*

*Sixty two initial hearing assessment appointments that involved an adult client aged 55 years or older were filmed throughout Australia but this study was based upon the seventeen of these which had a family member present. The study involved filming of the audiological appointments. The talk of the audiologists, clients and family members was profiled by two raters for their total number of utterances per consultation, and thus their percentage of total contribution within the appointment.*

*Conversational analysis was performed on the video data to explore triadic interaction between the three parties. This study has demonstrated how family members have a minor role in the appointments having contributed 12% of total talk time. Close conversation analysis demonstrated how family members were not typically invited to join the conversation; rather audiologists directed their questions almost entirely at the client and this was regardless of the fact that family members displayed an interest, by self-selecting to participate in the triadic interactions.*

*This study demonstrates how third party members contribute marginally during audiological appointments and how audiologists generally direct their questions to the clients while substantially disregarding family member's tentative attempts to contribute via self-initiated participation.*

*This interesting study provides convincing insight into the implications of family member participation during hearing assessment appointments and how this may be beneficial in the hearing healthcare process. This is not in contradiction with all the guidelines emphasising the importance of clients making their own decision. Family members are often subject to third party disability and it would seem convincing to address this in healthcare strategies and is certainly worthy of further investigation.*

## Evaluation of wideband frequency responses and nonlinear frequency compression for children with cookie-bite audiometric configuration.



John, A. et al.

*J Am Acad Audiol* 25:1022–1033 (2014)

*Previous research has demonstrated that children and adults experience improvements in speech recognition and audibility when nonlinear frequency compression (NLFC) is used. Patients with moderate to severe high-frequency hearing loss showed significant improvements in word recognition, consonant recognition and fricative identification with NLFC use compared with wideband and conventional amplification.*

*Also, other studies reported an improvement for consonant and plural recognition with NLFC technology, but no change was observed for vowel recognition.*

*The authors also noted a greater improvement in performance with NLFC for children compared with adults. Furthermore, more NLFC benefit was associated with greater degrees of high-frequency loss.*

*Nowadays, there are no studies evaluating the use of NFLC for children with cookie-bite audiograms (more precisely: hearing thresholds in the high frequencies (4000 – 8000 Hz) are better than thresholds in the mid frequencies (1000 – 4000 Hz)). Published research has shown that one of five children possessed a cookie-bite audiogram. Regarding the use of NFLC for children with cookie-bite audiogram, it is reasonable to suppose that NFLC degrades performance because the technology will lower high-frequency speech sounds to a lower frequency range with poorer thresholds.*

*The purpose of this study was to evaluate the effect of NFLC technology for children with cookie-bite audiograms. The detection of high-frequency warble tones and speech recognition in quiet and in noise was measured.*

*Seven children (mean age 10,8 yr; mean PTA right ear 39,8 dB HL; mean PTA left ear 37,1 dB HL; mean threshold 8000 Hz right ear 20,6 dB HL and left ear 18,8 dB HL) participated in the study. All participants were fitted binaurally with Oticon Safari 300 and Phonak Nios S III behind-the-ear hearing aids. The study included three 4 – 6 week trial periods: (1) Oticon Safari 300 with a bandwidth of 8000 Hz, (2) Phonak Nios S III with NFLC disabled, and (3) Phonak Nios S III with NFLC enabled.*

*Four assessments were performed in a binaural-aided condition:*

- *an assessment of aided high-frequency tone thresholds,*
- *the UWO Plurals Test,*
- *the UWO-DFD Test and*
- *the Phoneme Perception Test.*

*The aided sound-field thresholds were measured with warble tones centered at 4000, 6000 and 8000 Hz using the Hughson-Westlake method.*

*The UWO Plurals Test is a speech-recognition task to evaluate a hearing aid wearer's ability to hear the high-frequency phonemes /s/ and /z/ indicating plurality. The test was presented at 50 dB A. Children need to have access to acoustic energy beyond 6000 Hz (approximately 7050 Hz) for correct identification.*

*The UWO-DFD Test consists of 16 phonemes embedded in a medial position within a nonsense token. The stimuli were presented at 60 dB A. Participants need to select the consonant heard in the medial position.*

*The Phoneme Perception Test consists of three subtests: (1) a detection task, (2) a recognition task, and (3) an identification task. Only the detection and recognition task were used for this study. The detection task involves the determination of the threshold (dB SPL) of four phonemes: /sh/ low, /sh/*



high, /s/ low and /s/ high. The recognition subtest involves the adaptive presentation of seven nonsense tokens (/asa/, /ada/, /afa/, /aka/, /asha/, /aha/ and /ama), at the end of a phrase. This test determines the presentation level of 50% correct performance.

Results of this study showed no significant differences among the three conditions for the four tests as described above.

Also, no deterioration in performance was observed with the use of NLFC. Other studies, evaluating the effects of NFLC for children with mild or moderate high-frequency hearing loss, demonstrated significant benefit for NFLC regarding the recognition of high-frequency thresholds and speech understanding. The reason why this effect wasn't achieved in this study is that participants reached ceiling-performance without NFLC. They had normal or near-normal hearing thresholds in the high-frequency range.

The findings of this study have clinical relevance. NFLC should not be ruled out as a fitting option, but should be disabled in default fittings for children with cookie-bite audiograms. The clinician should consider the degree of high-frequency hearing loss. Further, a need exists for the development of tests that assist a clinician in determining whether NFLC is needed and how the parameters should be selected.

On the other hand, in the introduction of this article the authors state that “previous research has demonstrated that children and adults experience improvements in speech recognition and audibility when nonlinear frequency compression (NLFC) is used” – unfortunately they don't mention that there are almost no evidence based studies with a decent cross over design and a control group on this topic. Certainly when using this kind of technology for young children, one should be very careful when strong evidence is lacking.

**Benefit from, and acclimatization to, frequency compression hearing aids in experienced adult hearing-aid users.**



Rachel J. Ellis & Kevin J. Munro.

*International Journal of Audiology* 2015; 54:  
37-47.

Twelve adults with symmetrical bilateral moderate-to-severe high-frequency sensorineural hearing loss and >1 year hearing-aid experience took part in the study. Participants were fitted bilaterally with Phonak Naida V SP hearing aids programmed to match NAL-NL2 prescription targets with frequency compression disabled. Once the initial gain settings were finalised, frequency compression was enabled. In almost all cases, the enabled frequency compression setting was stronger than the setting recommended in the fitting software (i.e. a lower cut-off frequency and higher compression ratio).

After fitting the hearing aids, an A-B-A design was used where

- A = frequency compression disabled, and
- B = frequency compression enabled.

Patients were not told whether frequency compression was enabled or disabled at any point in the trial. Participants completed a number of speech tests and questionnaires at the end of each trial period, and at three additional sessions that took place at 0, 1 and 3 weeks after frequency compression was enabled in order to investigate the effect of short-term acclimatization.

Acclimatization: only the results of VCV recognition in noise-test were significantly better after 6 weeks of frequency compression (no significant difference either for VCV recognition in quiet or for sentence in noise recognition).

This indicates that acclimatization in the first 6 weeks of frequency compression use is limited to changes in the perception of certain high frequency phonemes. This effect seems to be greatest in difficult listening situations.

Benefit: the results of VCV recognition in quiet, in noise and sentence recognition in noise are significantly better with frequency compression when compared to the results without. However, this improvement is not reflected in subjective ratings of frequency compression.

A-B-A design is the strength of the study. This study has studied specific effects of acclimatization on FC and other potential variables observed from previous literature. Moreover, the subjects in the study were all adults which have implications for large clinical population. The study leaves its readers with a jinx that why there has been no improvement in subjective scales in spite of significant improvement in the speech perception tests.

**Evaluation of the effects of nonlinear frequency compression on speech recognition and sound quality for adults with mild to moderate hearing loss.**



Erin M. Picou, Steven C. Marcrum & Todd A. Ricketts..

*International Journal of Audiology* 2015; 54:  
162 - 169.

*Some manufacturer's software activates nonlinear frequency compression (NFC) by default, sometimes NFC is used to disrupt the acoustic feedback loop. This study aims to investigate what influence NFC has, when activated for listeners who are not traditional candidates for NFC. Therefore, participants were listeners with mild to moderate hearing loss.*

*All (17) participants were fitted bilaterally with Phonak Exelia Art. Occluding, non-custom eartips were utilised. Two distinct settings were programmed: CP (conventional processing), matched to NAL-NL1 and NFC, identical to the CP program, but Sound Recover was activated.*

*After 3 to 4 weeks trial period with the NFC program, 4 tests were completed in both the CP program as the NFC program: consonant discrimination threshold, consonant recognition, sentence recognition and sound quality.*

*All tests showed no significant difference between CP and NFC in the results at group level, except for consonant discrimination threshold for /s/ centered at 9 kHz (better with NFC). However, there is a large individual variability, with, unfortunately, no predictive variables found.*

*The weaknesses of this study are that: 1) There were only adult listeners with mild to moderate sensorineural hearing loss. 2) There was no trial period with CP and the trial period with NFC was relatively short. 3) The NFC parameters were chosen using a specified method. 4) The experimenter was not blinded to the hearing-aid condition.*

## Hearing Loss and Cognition: The Role of Hearing Aids, Social Isolation and Depression.



Piers Dawes, Richard Emsley, Karen J. Cruickshanks, David R. Moore, Heather Fortnum, Mark Edmondson-Jones, Abby McCormack, Kevin J. Munro.

PLoS ONE 10(3): e0119616. doi: 10.1371/journal.pone.0119616. March 2015.

*The purpose of the study featured in this article was to test whether the use of hearing aids was associated with better cognitive performance, and if this relationship was connected with social isolation and/or depression.*

*Hearing loss in older adults is associated with cognitive decline with both conditions being independently associated with social isolation and depression. There are two main hypotheses relating to these associations:-*

- 1. The association between cognitive and hearing variables reflects a 'common cause', namely age-related changes in the nervous system.*
- 2. The 'cascade' hypothesis, where long-term deprivation of auditory input may impact on cognition either directly or through the effects of hearing loss on social isolation and depression.*

*The aim of this study was to model statistical associations between hearing impairment and cognitive performance in a large data set. A positive association between hearing ability and cognitive performance could be consistent with both the cascade and common cause hypotheses. However, if auditory deprivation contributes to cognitive decline, as suggested by the cascade hypothesis, use of hearing aids should be associated with better cognitive performance. The mediating role of social isolation and/or depression was also investigated.*

### **Methods**

*The data set for this study was taken from the UK Biobank of more than 500,000 UK adults. The UK Biobank was established for investigations of the genetic, environment and lifestyle causes of diseases of middle and older age. Recruitment for this study aimed to be as representative as possible of the general population. Participants (See Table 1 below) were a subset of 164,770 aged 40 to 69 years who completed a hearing test (Digit Triplet Test). Cognitive tests were also completed and questionnaires assessed the extent of hearing aid use, social isolation and depression.*

### **Data analysis**

*Structural equation modelling was used to test whether the association between hearing impairment and cognition may be influenced by hearing aid use, social isolation and/or depression in a sequence of four models, as described below and in Fig 1. Structural equation modelling allows statistical evaluation of the inter-relationships or pathways between hearing impairment, cognition, hearing aid use, social isolation and depression.*

## Results

- In Model 1, poorer hearing remained significantly associated with poorer cognition. However, this model was not satisfactory in explaining variation in cognition.
- In Model 2, hearing aid use was associated with better cognitive performance, supporting the cascade hypothesis. The effect of hearing loss on cognition remained significant, implying that the effect of hearing loss on cognition is only partly mediated through hearing aid use.
- In Model 3, social isolation was associated with both poorer cognition and poorer hearing but hearing aid use was weakly associated with more social isolation. The effect of hearing aid use on cognition is partly mediated through social isolation, but there remains a significant direct effect.
- In Model 4, social isolation and poor hearing were significantly associated with higher frequency of depression. Frequency of depression and social isolation were associated with poorer cognition. Hearing aid use was not associated with depression, but was associated with greater social isolation and with better cognition.
- Overall, fit statistics indicated that models 2, 3 and 4 were a good fit with the data.

## Conclusions

Hearing aid use was associated with better cognition in a large cross-sectional study of UK adults. The association was independent of social isolation and depression. This finding was consistent with the hypothesis that hearing aids may improve cognitive performance, although, if hearing aids do have a positive effect on cognition, it is not likely to be via reduction of the adverse effects of hearing loss on social isolation or depression. Further research is required to determine if there is any direct causal relationship between hearing aid use and better cognition, and whether hearing aid use reduces rates of cognitive decline measured longitudinally. Treating hearing loss may make a significant contribution to reducing the burden associated with cognitive decline and reduced quality of life.

Although the causal connections between hearing loss and cognitive decline and between hearing aid use and reduced rates of cognitive decline remain elusive, this article reinforces the evidence associating hearing aid use with improved cognition. In spite of the large number of participants in this study, it was restricted to adults aged 40 to 69. As the authors of this article point out, longitudinal studies are required before a causal association between longer term hearing aid use and cognitive performance could be established. Such studies would need to include older adults, in whom hearing loss, hearing aid use and cognitive impairments are more common.



## Validation of a Screening Test of Auditory Function Using the Telephone.

*Williams-Sanchez V et al.*

*J Am Acad Audiol 2015; Vol. 25 (10), 937-951.*



*Hearing loss may be under recognised and given less priority to be treated (by physicians) but shown to have significant effects on quality life, including psychological and cognitive function effects.. That's why several screening techniques have been developed to encourage individuals to go for comprehensive testing and, when appropriate, treatment options. Hearing screening has been traditionally advocated in primary healthcare centres, open houses, health fairs and care facilities for the elderly.*

*Hearing screening is very economical in terms of time and resources, yet high on yield. Effective screening instruments must be accurate, practical, and administered quickly without specialised training and should be innovative in the changing healthcare scenario. There are many diverse forms of screening tests (not just pure-tone audiometry), and some have proven to be more adequate than others because different screening protocols can evaluate different aspects of hearing function. Whatever form it is, an effective screening test should identify all those individuals who need diagnostic testing.*

*Questionnaires give false-positives and thus have their limitations. Sound emitting devices such as otoscopes use which also present pure-tones have excellent face validity but can't be used in all types of environments. Speech stimuli (phonemes) can resist the test environment, they have familiarity effect. Speech (digits) presented in noise over the telephone has the best resistance to the test environment and other measurement biases. These tests determine the signal-to-noise ratio (SNR) required for 50% correct recognition of three-digit sequences spoken in a noisy background. Several countries have developed such telephone-based screening tests.*

*In the US, the authors are involved in developing a National Hearing Test (NHT) with three-digit sequences presented in speech-shaped noise (SNR varies). The test finds out the SNR required to obtain 50% correct score. The aim of the present study was to evaluate the performance of the NHT with a large nationwide veteran population and a wide range of audiological measures of hearing function. This study also included testing in the home as well as in a clinical setting using both traditional landline and cable telephones. The sensitivity and specificity as well as the feasibility of the NHT are discussed.*

*A descriptive study using convenience sampling was used and the subjects were US veterans. All the subjects were first evaluated in an audiology clinic with pure-tone audiometry, word recognition in quiet and monaural Words-in-Noise (WIN) / Quick Speech-in-Noise (QuickSIN). Later, each participant completed the NHT at home/VA clinic. The participants dialled the toll-free number, listened to the instructions, keyed in the identification code using the telephone keypad and completed the NHT on the ear indicated by keying in the three-digit response after each triplet presentation. After completing the NHT on the first ear, the participants hung up and repeated the task on the opposite ear using the second identification code provided.*

*A total of 693 veterans participated in the study. The following were the results:*

1. *The mean audiometric HTLs ranged from 22 dB at 250 Hz to 62 dB at 8k Hz*
2. *The speech recognition scores are summarised in the following table. The difference in SNR is mainly because of the material and type of noise used.*
3. *Appropriate statistical measures were administered to compare NHT results with those of the PTA, WIN and SPIN:*
  - a. *Both 3-freq PTA and 4-freq PTA correlated strongly with the NHT thresholds. Higher the PTA the higher was the NHT thresholds.*
  - b. *WIN thresholds and NHT thresholds showed a strong positive correlation.*

- c. *SPIN thresholds and NHT thresholds showed a strong positive correlation.*
4. *When the NHT threshold was compared with the 3-Freq PTA, the sensitivity was 0.87 and specificity was 0.54. On comparison of the NHT with the 4-Freq PTA, the sensitivity was 0.81 and specificity increased to 0.65, which is very good by all standards. Further analysis showed that the sensitivity and specificity of WIN and NHT were similar.*
5. *The average duration to complete NHT was 6.4 min and it took fewer trials when compared to other speech recognitions tests.*
- This study and others in this series have proposed and validated a National Hearing Test for the US. The test is shown to be valid, reliable and quick. The convenience that it can be administered by telephone makes it accessible to a larger population.*

*The current study has been systematically planned and conducted using convenience sampling. The idea of telephone-based screening test is quite appealing and practical. Methodology and the statistics have been quite suitable for the study.*

**Bilateral Ménière's disease assessed by an inner ear test battery.**



C-H Huang and Y-H Young.

*Acta Otolaryngologica*. 2015; Vol. 135, 233-238.

The American Academy of Otolaryngology-Head and Neck Surgery defines Ménière's disease (MD) by documented hearing loss, tinnitus, at least two bouts of vertigo lasting >20 min, and other causes excluded. Bilateral MD, on the other hand, doesn't have a proper definition and criteria for diagnosis. House et al. proposed that the MD progresses either from unilateral to bilateral involvement or bilateral involvement at initial presentation, as evidenced by audiometry combined with inner ear symptoms, i.e. tinnitus, aural fullness or hearing loss in the opposite ear.

The vestibular-evoked myogenic potential (VEMP) is recorded by stimulating ear with a loud AC or BC sound and record a contraction of neck muscles, termed cervical VEMP (cVEMP), and on extraocular muscles, termed ocular VEMP (oVEMP). cVEMP and oVEMP tests have potential application to explore the dynamic saccular and utricular functions. Their dysfunction in MD can be easily recorded and attributed to the respective structures.

The current study employs a battery of pure-tone audiometry, cVEMP, oVEMP and Caloric tests (ENG) to study the functioning of inner ear structures in 498 patients diagnosed with MD. A total of 100 patients were diagnosed as having bilateral MD.

**Pure-tone Audiometry:** Based on the average of pure-tone thresholds at 500 Hz, 1000 Hz, 2000 Hz and 3000 Hz, staging of MD was done (AAO-HNS guidelines, 1995). Stage I means four-tone average <26 dB; stage II, 26–40 dB; stage III, 41–70 dB; and stage IV, >70 dB. Grading of the test battery ranged from I-IV depending on number of tests (of this battery) with abnormal results.

**Caloric Test:** The norm for slow phase velocity (SPV) of caloric nystagmus was  $31 \pm 70/s$  (mean  $\pm$  SD). Canal paresis is defined when the mean SPV of caloric nystagmus in the lesion ear is  $<170/s$  (mean – 2SD).

**oVEMP:** The norm for bone conduction oVEMP was – nl latency. Those with the nl latency exceeding 13.0 ms were defined as having delayed response. The norm for the asymmetry ratio of oVEMP was  $14 \pm 13\%$ , and those with asymmetry ratio >40% were interpreted as abnormal.

**cVEMP:** A latency of peak p13 exceeding 17.0 ms as delayed cVEMPs. The norm for the asymmetry ratio of cVEMP was  $11 \pm 11\%$ , and those with asymmetry ratio >33% were defined as abnormal.

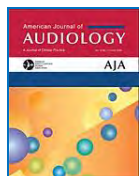
The following were the results:

1. Based on the PTA results, stage I was assigned to 50 patients, stage II to 28 patients, stage III to 16 patients, and stage IV to 6 patients. Of them, 79 patients (79%) had the same Ménière's stage in both ears. The oVEMP test (generated normal responses in 102 ears and abnormal (including reduced, delayed, and absent) responses in 98 ears (49%). Grading (number tests with abnormal results) is as follows.
2. The cVEMP test showed normal responses in 75 ears and abnormal (including reduced, delayed, and absent) responses in 125 ears (63%). In the caloric test, normal responses were observed in 144 ears and abnormal responses in 56 ears (28%).
3. The abnormal percentages decreased in the inner ear test battery was from audiometry (67%), followed by the cVEMP test (63%), oVEMP test (49%), and caloric test (28%).

The decrease in abnormal results indicates the presence of hydrops falling from cochlea, saccule, utricle and semicircular canals. This study clearly demonstrates the need for such a test battery to evaluate each of the clinical symptoms and localise the affected inner ear part. The authors have further explained that the asymmetry of these results indicates the need for different therapeutic options needed for different ears.

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## *Tinnitus and Hearing Survey: A Screening Tool to Differentiate Bothersome Tinnitus from Hearing Difficulties.*



*James A. Henry, Susan Griest, Tara L. Zaugg,  
Emily Thielman, Christine Kaelin, Gino Galvez,  
and Kathleen F. Carlsonb.*

*American Journal of Audiology. 2015; Vol. 24  
(1), 66-77.*

*Tinnitus has been defined as head or ear noise lasting at least 5 min and occurring more than once a week (Dauman & Tyler, 1992). Tinnitus is commonly accompanied by some amount of hearing loss. Usually, patients bothered by tinnitus attribute some communication difficulties to tinnitus whereas the underlying hearing loss seems to be the reason for this.*

*However, tinnitus severity measurement questionnaires such as the Tinnitus Handicap Inventory (THI) have certain questions related to communication difficulties as a part of measuring the tinnitus severity. For this precise reason, tinnitus patients with normal hearing score low on such questionnaires, which doesn't correlate with the tinnitus severity.*

*Hence it is essential to separate tinnitus problems from those of hearing problems so that an appropriate intervention can be selected for a given patient. The current study proposes a short screening tool – Tinnitus and Hearing Survey (THS) to measure these two problems separately. This article describes THS with respect to its construction and its test–retest reliability as well as other basic psychometric properties.*

*THS contains 3 sections – A. Tinnitus section with 4 questions (max score of 16); B. Hearing section with 4 questions (max score of 16); and C. Sound tolerance section with 2 questions (max score of 8). The current study evaluated THS for 67 patients on various psychometric properties (stability, consistency and validity). THI was also administered for each participant. Several statistical measures have been used for measuring each of these properties.*

*The statistical results have shown very high values for each of these parameters including the test–retest reliability, indicating that THS is a very strong tool. It is worth mentioning that the content validity scores very highly which means the idea of separating questions under each of the scales is successfully done. In addition, it has a very strong correlation with THI scores again showing the strong validity of this tool.*

*Apart from this, the authors have mentioned multiple things regarding THS application:*

- 1. Can be administered over phone as well*
- 2. No normative data for THS*
- 3. Section A (tinnitus section) is the most prominent and any score more than '0' indicates that the participant could be a candidate for tinnitus intervention*
- 4. THS can be used as an excellent counselling tool to educate the patient that tinnitus and hearing loss problems are different and should not be confused*
- 5. The authors recommend that if the section A indicates the need for a therapy, TFI (Tinnitus Functional Index) could be used to obtain a baseline score for the intervention*

*TFI and scoring instructions can be downloaded from:*

*[http://download.lww.com/wolterskluwer\\_vitalstream\\_com/PermaLink/EANDH/A/EANDH\\_2011\\_09\\_27\\_HENRY\\_200593\\_SDC15.pdf](http://download.lww.com/wolterskluwer_vitalstream_com/PermaLink/EANDH/A/EANDH_2011_09_27_HENRY_200593_SDC15.pdf)*

*This study successfully demonstrates how a questionnaire should be developed and tested using statistical measures. The idea of segregating tinnitus and hearing problems addresses one of the everyday fundamental challenges. THS and TFI provide an excellent combination in the management of tinnitus.*