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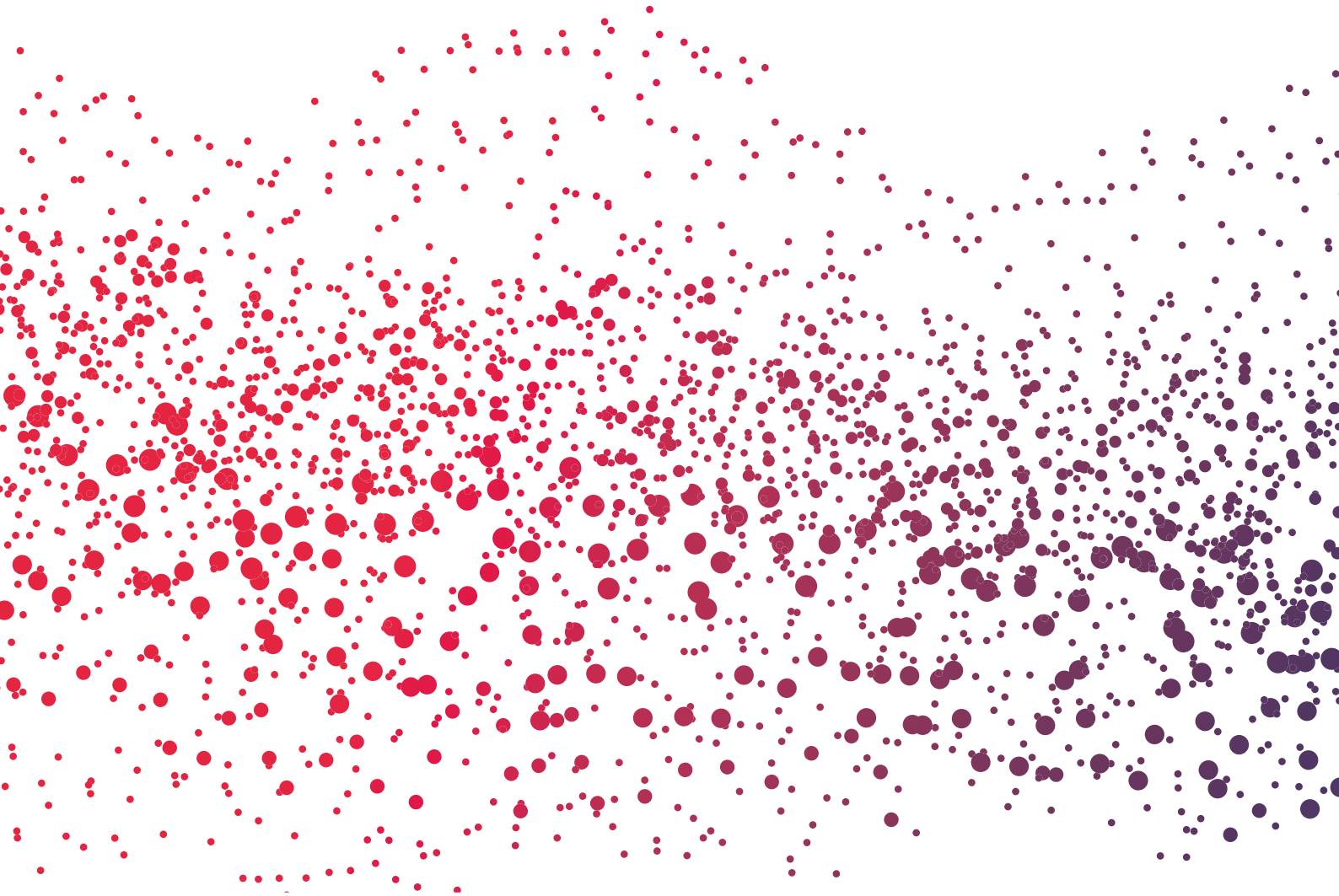

The Associations Of Hearing Sensitivity And Different Cognitive Functions With Perception Of Speech-In-Noise

Guidance On Providing Patient-Centered Care

Hearing Aid Experiences Of Adult Hearing Aid Owners During And After Fitting: A Systematic Review Of Qualitative Studies

CONTENT

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EDITORIAL

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Dear Reader, the Amplifon Centre for Research and Studies, CRS, houses one of the finest private libraries in the field of audiology and otorhinolaryngology, offering the sector's most important international journals. Every quarter, a team of Amplifon Audiologists from around the globe select the most relevant publications in the field of Otology and Audiology and make a comprehensive review. The Amplifon Centre for Research and Studies coordinates the development of this quarterly review. We are happy to share these new reviews with you. For this issue, our team reviewed 11 interesting articles published in the third and fourth quarter of 2022.

This issue features reviews on the relation between hearing sensitivity, cognitive function and speech perception in noise, the importance of providing patient-centred care and the importance of using extended high frequency audiometry for detecting early signs of hearing loss in patients with gout, a specific type of arthritis.

The other reviews focus on hearing aid fitting, adoption, benefit, and satisfaction. They also explore the use of instant ear tips, real ear insertion gain, real ear to coupler difference and audiogram-based prescriptions, with the objective of improving self-reported outcomes. Lastly, one particular paper discusses how the attendance of specific types of 'significant others' during hearing care appointments can positively influence hearing aid adoption.

We hope you enjoy this issue of our *CRS Scientific Journal*

Mark Laureyns
Global International CRS & Medical Scientific Research Manager

The authors have sole responsibility for the content of their articles.

THE ASSOCIATIONS OF HEARING SENSITIVITY AND DIFFERENT COGNITIVE FUNCTIONS

WITH PERCEPTION OF SPEECH-IN-NOISE

Merten N., Boenniger MM., Herholz SC., et al.

The Associations of Hearing Sensitivity and Different Cognitive Functions with Perception of Speech-in-Noise.
Ear Hear *(2022): 43(3), 984–92*

doi: 10.1097/AUD.0000000000001154. PMID: 34983898.

By Michele Borraccino – Italy

The authors analyse the findings of a large prospective study to assess possible correlations between auditory sensitivity and various cognitive functions with speech perception in noise.

Hearing loss refers to the reduction or loss of hearing sensitivity. It can affect one ear or both, involve mild, moderate, or severe loss and it is considered a "social disability". In addition to the loss of hearing sensitivity, another major symptom is the impairment of perception of speech in noise. Today, there is no gold standard for assessing disturbances in speech noise perception in hearing impairment and epidemiological research on it is scarce. In aging, hearing impairment occurs in both the cochlea and the brain regions of the auditory system. There are currently no tests that can separate the contributions of each of these factors to hearing loss. Cognitive processing capacity has been considered a relevant factor in speech perception and in noise, so the authors set out to evaluate the association between auditory sensitivity and various cognitive functions, such as working memory, long-term memory, crystallised intelligence, and executive function, with sentence perception in noise.

POPULATION:

The authors used the Rhineland study, a prospective cohort study of 3,000 participants. Recruitment began in 2016, centred on two geographically distinct areas of Bonn (Germany), with participants being predominantly German of Caucasian ethnicity, aged 30 years or older.

EXCLUSIONS:

Participation was by invitation only, regardless of health status. The only exclusion criterion was failure to understand the informed consent. **The data analyses led to the further exclusion of 415 participants based on the following criteria: cochlear implant users (N=6); dementia or traumatic brain injury (N=5); non-native speakers (N = 200); failure to at least one of the four frequencies till the maximum level of 60 dB HL (N=144); missing speech-in-noise test data (N=60).**

CRITICAL NOTE

The results show a rather clear association between auditory sensitivity and cognitive functions in understanding noise in speech. However, the age range is too wide to accurately assess sensitivity and cognitive function, factors very often age-related. Moreover, the results for tests of speech in noise and cognitive function cannot be generalised because they are too subjective and limited. Further research is required to address these limitations.

ASSESSMENTS:

All participants underwent the following audiometric evaluations, with a soundproof booth (DIN ISO 8253) and air-conduction headphones (Sennheiser HDA 200 and 300):

-Perception of speech in noise, with the Göttinger Satztest test, a validated semiautomatic test of speech in noise with a measurement accuracy of 1dB;

-Hearing sensitivity, with the Automated Pure-tone Audiometry (APTA);

-Cognitive assessments, with a battery of neuropsychological tests administered by experts;

-Crystallised intelligence, with the Mehrfachwahl-Wortschatz-Intelligenztest (MWT-B), a German multiple-choice vocabulary test;

-Executive functioning, with the Trail Making Test (TMT) on a touchscreen

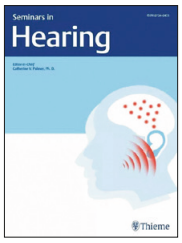
-Work memory, with the Digit Span forward (DS);

-Long-term memory, with a 15-word German Verbal Learning and Memory Test (VLMT).
The authors analysed the data applying a multivariable linear regression model adjusted for: age; sex; income; education; hypertension; body mass index; history of cardiovascular disease; diabetes; ratio of total to high-density cholesterol; intake of lipid-lowering drugs; C-reactive protein level; ototoxic medication users; smoking; depression; and tinnitus.

RESULTS:
-Crystallised intelligence (MWT-B) showed an effect size of -0.10 SNR (reduction in signal-to-noise ratio) dB HL decrease for SD (95% CI: -0.14 to -0.06; p<0.001),
-Executive functioning (TMT) of -0.08 SNR dB HL decrease for SD (95% CI: 0.13 to -0.03; p = 0.002)
-Work memory (DS) by -0.04 SNR dB HL decreases for SD (95% CI: -0.08 to -0.003; p = 0.03)
-Long-term memory (VLMT) by -0.03 SNR dB HL decrease for SD (95% CI: -0.07 to 0.01; p = 0.12)
-The effect of auditory sensitivity (ß = 0.34) on speech perception in noise was four to five times greater than the effects of crystallised intelligence (ß = -0.08) and executive functioning (ß = -0.06).

Crystallised intelligence and executive functions had stronger correlations, whereas working functions and long-term memory showed significantly smaller effects. The results showed that greater sensitivity was associated with better perception of speech in noise (SNR dB HL per 5 dB HL in PTA; 95% confidence interval [CI]: 0.20 to 0.25; p < 0.001), and to a lesser extent, better cognitive function was associated with better perception of speech in noise. •

GUIDANCE ON PROVIDING
PATIENT-CENTERED CARE



English K.
Semin Hear (*2022): 43(2), 99–109*
doi: 10.1055/s-0042-1748834. PMID: 35903078; PMCID: PMC9325083
By Sofie Peeters – Belgium

This article discusses the various components of the patient-centred care approach as defined by the Audiology Practice Standards Organisation, and possible clinical applications and impacts.

This article discusses the clinical applications of the Audiology Practice Standards Organisation (APSO), more specifically, Standard 2 (four components), and Standard 13 (three components), developed so as to focus on the concept of "patient-as-person".
From the outset, the authors highlight a key distinction between the notion of "person-centred care" and that of "patient-centred care". Next to having empathy, respect and engagement, shared decision-making (SDM) is a fundamental part of both person- and patient-centred care. However, the focus in outcome between both approaches is different. Where the former focuses on achieving a meaningful life, the latter, which interests us here, focuses on restoring functional life.
Providing clear communication of our professional values to the patient while at the same time developing a trust-based relationship with them, getting to know their values, goals and reservations in a relatively short period of time, is, without a doubt, a challenge.

CRITICAL NOTE:
We must be mindful of the fact Standards 2 and 13 are not stand-alone tools. They need to be integrated into our technology-reliant clinical practices. There is a general misconception that patient-centred care cannot go hand in hand with the commercial aspects of the audiological profession. However, shared decision-making (SDM) is an important factor in achieving positive outcomes after hearing aid fitting and, by correlation, will result in a reduction of fitting-appointments. It is to be hoped that all players involved in the hearing industry – many of whom, thankfully, have already adopted such standards – also see the benefits of Standards 2 and 13 and take them to the next level in their daily practice.

This can be achieved through four "components" (Standard 2) as labelled by those who designed the method.
1.Clear and Empathic communication.
'Clear communication' consists in the audiologist using layman vocabulary and clear speech techniques; paying attention to face the patient and speaking near the patient, in an environment with little or no background noise.
'Empathetic communication' relies on both verbal and non-verbal cues and, in an audiological setting, can be defined as communication that encourages the patient to express the emotional impact of their hearing loss (HL) and supports them in identifying and labelling those emotions. These can be measured thanks to validated tools, such as the "4 Habits Coding Scheme".

2.Communication in line with the patient's communication mode, comprehension and health literacy.
Oral speech, speech reading, sign language and cued speech are different **communication modes**. Each can be used, alone or combined, to adequately communicate with the patient. Furthermore, the authors highlight the importance of using an interpreter whenever necessary.
When highlighting the **comprehension** skills of the patient it is important to use effective patient educations skills such as the "Teach back" method.
The *Healthy People 2030* framework provides two new definitions for **health literacy**. Personal Health Literacy, i.e. patients ability to find understand and use information to guide their health decisions; and Organisational Health Literacy, i.e. the extent to which organisations provide individuals with the tools necessary to make such decisions.

3.Patient-centred is driven by the patient.
Patient 'value narratives' are just as valuable to the audiologist as audiological and health data. Intake conversations, using open-ended questions, validations, confirmations, etc., are all effective patient-centred communication tools which foster SDM. SDM is a process that consists in fully informing patients about their options and taking their values into account when weighing the pros and cons of each option, while helping them reach a final decision in, for example, choosing hearing aids. Such an approach provides the foundation for building a good patient-clinician relation.

4.Family-centered care is provided.
The patient is encouraged to include communication partners (e.g., family members, significant others, companions) throughout the selection, fitting, and follow-up process.
Hearing loss is a shared or "third-party" disability, defined as the impaired functioning of family and friends due to the health condition of their significant other.
Standard 13 addresses the support provided by audiologists toward overall successful adjustment as defined by the patient. It consists of three components:

1.The audiologist ought to counsel the patient in such a way as to enable patients to appropriately adjust to amplification. In order to achieve joint-goal setting, b**oth technical and personal aspects of adjustment to amplification should** be addressed.

2.This counselling approach should also cover other communication concerns patients may have. This can be achieved thanks to a range of assessment and self-assessment tools, such as the Hearing Handicap Inventory (HHI) for adults or elderly; Self-Assessment of Communication, for adults and older adults. Of particular interest, the authors highlight the more recent **'The Quebec Audiological Assessment Protocol for Younger and Older Adults'**, which presents the double benefit of catering to younger patients too, and of expanding the self-assessment by assessing patient needs (it applies the International Classification of Functioning, Disability and Health model and SDM), thereby setting the foundation for joint-goal setting and planning.
Using all available information enables audiologists to establish an open communication with the patient and the patient to negotiate the treatment programme (promoting **patient responsibility**) and thereby empowering the client to take control of the rehabilitation process (**client empowerment**).
The IDA-institute has developed a range of informational and practical resources and tools, such as the 'Living well' rehabilitation tool.

3.When appropriate, it is recommended to provide additional rehabilitative audiology.

A **holistic approach** in rehabilitation, as opposed to a skill-based approach, is preferable because HL cannot be reduced merely to a functional deficits. It also affects sufferers' daily activities, participation and quality of life. Therefore a combination of sensory management, instruction, perceptual training and counselling is needed.
In a rehabilitation programme **psychological support** should be included. Indeed, this type of counselling enables patients to build up confidence, assertiveness, to set realistic expectations and to come to terms with their hearing loss.
Additional rehabilitative audiology, through dedicated **virtual platforms** such as apps, e.g. the self-managed "mHealth" app, telerehabilitation appointments, providing information about relevant websites, social media and email forums. •

DO WE NEED AUDIOGRAM-BASED PRESCRIPTIONS? A SYSTEMATIC REVIEW

Almufarrij I., Dillon H. & Munro KJ.
Int J Audiol *(2022): 1–12*
doi: 10.1080/14992027.2022.2064925.
Epub ahead of print. PMID: 35531751.
By Gian Carlo Gozzelino - Italy

Do individually prescribed amplification characteristics, using prescription formulas based on audiograms and verified using real-ear probe microphone measurements, provide better results than using amplification characteristics set using a different procedure?

INTRODUCTION

Today the hearing aid market offers a wide range of mass-produced models, with just a wide range of acoustic quality, most of which are at the level of traditional models and adjusted by hearing care professionals (Almufarrij et al. 2019). Thanks to current technological advances, users can customize the settings carried out by hearing care professionals themselves, through controls either directly integrated in the hearing aids or remote controls, so that they can improve their hearing in relation to their individual real-life experience, as opposed to only in relation to their audiogram. (Keidser 1995; Scollie et al. 2010; Walravens et al. 2020). For this reason, it is increasingly important for professionals to be able to measure fitting adjustment outcomes, through the use of real-ear probe microphone measurements, in order to understand the difference between both adjustment procedures.

The object of this review is to identify whether the results in terms of acoustic remediation for adults are better when the fitting is performed based on the hearing test and subsequently adjusted individually by the user.

PARTICIPANTS

The group of users involved adults with conventional hearing aids so as to compare the outcome with hearing aids programmed through the use of dedicated predictive formulas (e.g. NAL-NL2), and subsequently verified using a real-ear measurement system.

The study did not use any implantable nor bone conduction devices, and the study design avoided comparison across devices with different levels of technology, as this could distort the result of the measurements.

MATERIALS, DATA ANALYSIS

The collected data was processed for broader analysis, eliminating possible duplicates and highlighting the difference between people who preferred a given programming option, with a 95% confidence interval.

CRITICAL NOTE

This study provides interesting confirms that even the most sophisticated predictive formulas have limitations and require subsequent fine-tuning. However, it is important to remember that hearing aid users may often find it difficult to adjust the hearing aids themselves, or to provide comprehensive feedback for guiding the hearing care professional through the fine-tuning process. In such cases, when it is not possible to obtain reliable feedback, technical measurements (real ear measurement), based on formulas and not on individual feedback, can therefore be a valuable aid in obtaining the best possible outcome.

COMPARATIVE INSIGHTS

Two studies investigated the effectiveness of the comparative fitting approach as compared to audiogram-based prescription (Metselaar et al. 2008, 2009). However, in each, they used participants already reporting a high level of listening, and therefore adjustment, satisfaction (30-50% reported they were unsatisfied). The studies failed to report the total number of satisfied participants, as well as the standard deviations applied to the analysis. Consequently, these studies can only be considered from a narrative-reporting perspective. The data found that both fitting approaches were comparable over listening in quiet and overall listening, however a significant preference emerged for audiogram-based fittings for speech in noise.

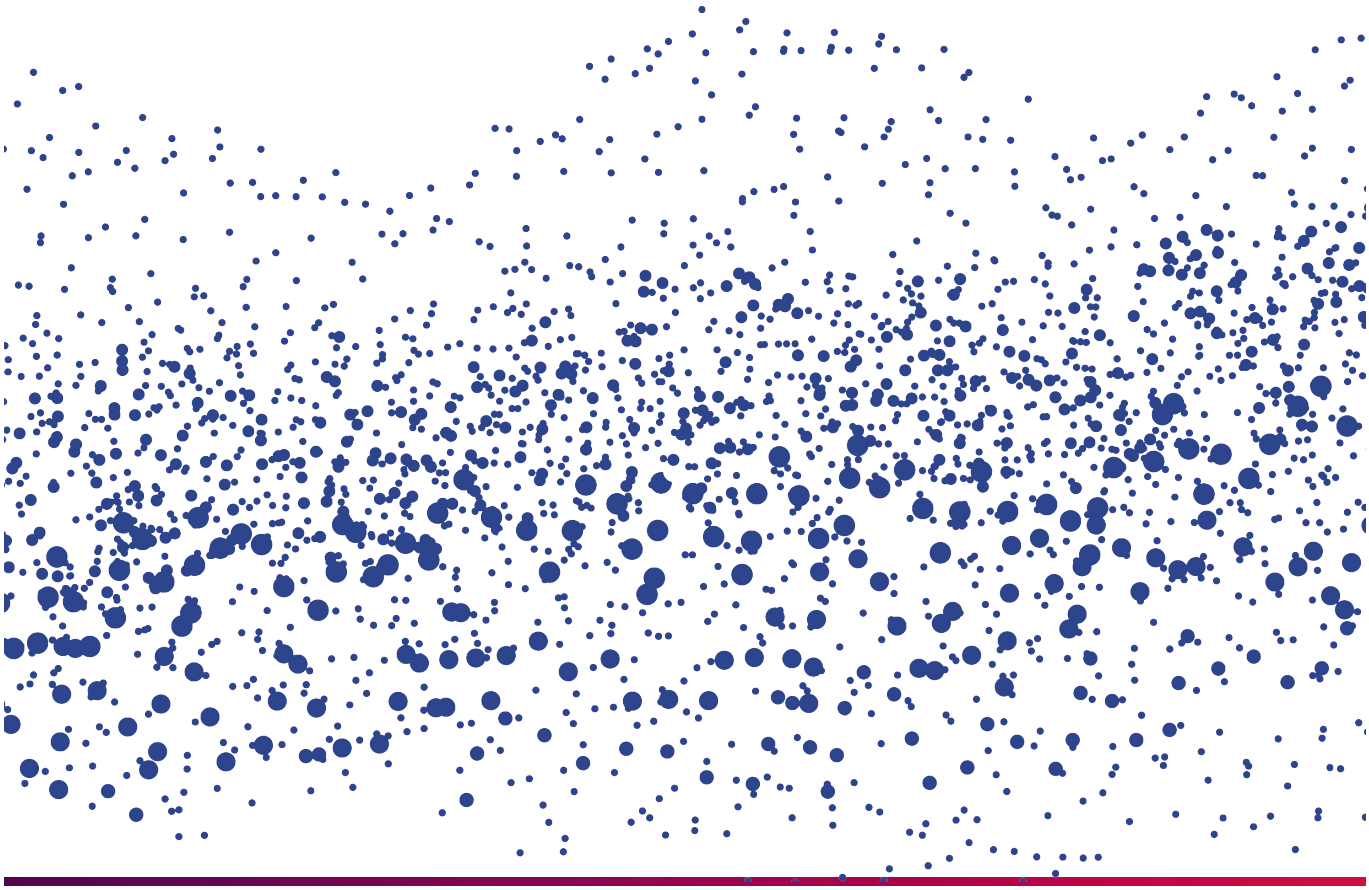
Three studies were used to evaluate the effectiveness of the clients' own choice regarding the adjustment

calculated by the hearing test (Humes *et al.* 2017, 2019; Urbanski et al. 2021). This procedure led to five categories of results: the indicator of quality of life after resolution of the hearing problem; subjective hearing performance based on individual feedback; measured ability to understand speech in silent conditions; speech intelligibility in noisy conditions; and lastly, the overall sound quality.

Furthermore, two other studies were considered for the subsequent self-adaptation made by the end user (Reed et al. 2019; Sabin et al. 2020). Four important insights emerge from these: patients' objective preferences; the subjective hearing performance based on personal feedback; the measured ability to understand speech in noisy conditions; and sound quality.

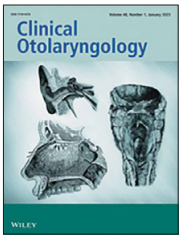
CONCLUSIONS

The results only partially clarify the comparison between fittings based on the hearing test and then verified with real-ear measurements compared to the adjustments not based on the hearing test but personally refined by the end user. Overall the method based on customer feedback offers an equal level of improvement to about a quarter of the total result of the acoustic remediation carried out with HAs. Auto-tuning also seems to produce equivalent and sometimes even better results than a tuning based on a hearing test calculation. Therefore, it is critical to intervene in a highly qualitative way in order to successfully guide hearing care professionals and users involved in such approaches, subsequently verifying the result by comparing them with verification of the ear probe. •



EARLY HEARING LOSS DETECTION

IN GOUT USING EXTENDED HIGH FREQUENCY AUDIOMETRY



Sahin A., Kilic K., Sakat MS., et al.
Clin Otolaryngol. *(2022): 47(5), 577–82*
doi: 10.1111/coa.13950. Epub 2022 Jun 10. PMID: 35635502.

By Sayantanee Ghosh Saikia – Australia

This innovative study is the first to demonstrate the relevance of using extended high frequency audiometry in patients with gout in order to detect potential hearing loss as early as possible.

Early detection of hearing loss (HL) is important to minimise its potential effects in communication. In the recent decades, the incidence and prevalence of Gout have increased, affecting at least 1% of the population. This condition is characterised by hyperuricemia and urate crystal formation and is the most common inflammatory arthritis in adults.

Little is known about the aetiology of the disease, but a number of clinical studies have found that this could be brought on by an imbalance of free radicals and antioxidants in the body affecting the metabolism, resulting into inflammatory gout which, in turn, results in hearing loss (HL) due to cochlear impairment.

The authors of this study posit that pure tone audiometry (PTA) as a conventional method may fail to detect the gout-related HL since this is known to have a significant on higher frequencies. Higher frequencies are important to assess and detect HL induced by noise or other therapeutic drugs/radiation as well as to learn the effects of ototoxicity on hearing. They further argue that relying on extended high frequencies (EHFs) audiometry, i.e. including frequencies of 9000–20.000 Hz, may be critical in achieving early diagnosis of various diseases or their effects on HL. Normal hearing operates in a frequency range of 20–20,000 Hz; traditional hearing tests test a frequency range comprised between 125–8000 Hz in day-to-day clinical audiometry.

Consequently, the goal of the authors was to determine whether or not EHF audiometry could help in the early detection of HL in patients with gout.

The authors included two groups in this comparative cross-sectional study: one consisting of 32 patients (31-65 years, 23 men and 9 women) diagnosed with gout; and the second of 32 healthy volunteers (32-65 years, 16 women and 16 men). A 9.2 dB difference between the two sample groups in terms of the hearing thresholds at 18,000 Hz was also taken into consideration based on the sample size.

Detailed case histories were taken from all participants, i.e. both patients with gout and the healthy controls. They all underwent head and neck examinations, including otolaryngological assessment. People with history of tympanic membrane perforation including acute middle ear pathologies such as otitis media, or a family history of HL or with a reported history of ear surgery, use of medications known to have an effect of hearing, noise-induced HL, or traumatic brain injuries, or had a diagnosis of Meniere's disease, or other diseases such as high blood pressure or diabetes were not included in the study.

All participants underwent a full otological examination before the hearing assessment.

Following the initial examination, including PTA and EHF audiometry tests where the pure tone hearing

CRITICAL NOTE:

This study provides interesting insight into the possibility of early detection of hearing loss in gout patients using the EHF audiometry as opposed to normal PT hearing tests which is impacted by disease activity. Two significant limitations of this study are the small size of the sample and the lack of evaluation of oxidative stress caused by gout on hearing changes. Moreover, further investigation into the implementation of EHF audiometry in day to day test protocols is required, keeping in mind the correlation with health changes, as well as ruling out other metabolic diseases which can also influence changes in the Cochlea and are hard to differentiate from gout without a valid laboratory tests in practice.

thresholds were measured between 125 and 8000 Hz, and the EHF audiometry test was recorded at frequencies of 9000–18,000 Hz. The tests were administered by manually increasing the signal level by 5 dB until the response was given by the subject and then reducing it by 10 dB and increasing again by 5 dB until the response of the subject.

A multifrequency tympanometry for evaluating the static compliance was performed and it excluded all other types of tympanograms except "A tympanograms (type A according to the Jerger scale)s, in order to rule out middle ear pathologies and support the primary aim of the study, i.e. to identify the possible deterioration of hearing in high-frequency values in the participants with gout. The audiological assessments were conducted by the same audiologist using ISO-calibrated equipment.

Various laboratory tests were performed for all subjects across both groups to determine:

- haematological and biochemical parameters
  - Serum uric acid (SUA), C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR)
- haematological parameters
  - haemoglobin (HgB), white blood cell (WBC), red blood cell (RBC), and haematocrit (Hct)
- and biochemical parameters
  - high-density lipoprotein (HDL), low-density lipoprotein (LDL).

The authors carried out the statistical analysis of the sample using SPSS 20.0.They checked the data distribution using the Shapiro–Wilk test, and then performed two-way analyses using Student's t-test and non-parametric Mann–Whitney U test in the event of normal or out of normal distributions respectively. All data were expressed using a mean ± standard deviation (SD).The $X2$ test was used in the analysis of categorical data, along with the Pearson's correlation test for correlation analysis. $p < .05$ which was considered as significant for all analyses.

The authors found no significant difference between the two groups in terms of their age or gender.

The number of gout attacks in a year's time ranged between one and five, with the highest percentage of patients experiencing one attack in a year when compared to lesser number of people experiencing two attacks ranging from 6 months to 12 years, studied in terms of active and inactive phases of gout.

Furthermore, no significant difference in terms of hearing frequencies was determined on pure tone audiograms between the two groups for the threshold levels up to 4,000 Hz.

However, significantly higher thresholds were detected in the patient group compared to the control group at all frequencies from 4,000 Hz and above.

The results revealed significantly higher hearing thresholds for the EHFs without any air-bone gap in the patient group at all the frequencies studied by the authors.

This study also revealed that the hearing thresholds were higher in active gout patients compared to inactive patients.

According to this study there was no significant difference between the gout patient and control groups in terms of the mean hearing threshold values (500–2000 Hz). However, the hearing threshold values at all frequencies (9,000–18,000 Hz) in the gout-patients group were significantly higher when compared to that of the control group for their EHF audiometry results.

A positive correlation was determined between SUA levels and HL as in relation to the significantly higher EHF thresholds which can be a contributing factor for the affected cochlea which is an end-organ nourished solely by the labyrinthine artery and with no collateral circulation, and therefore susceptible to vascular pathologies.

Consequently, this can lead to hypoxia as a result of the reduced cochlear blood flow leading to oxidative stress. This finding in the study under review aligned the several studies which have already demonstrated the existence of a close correlation between HL and oxidative stress. One key limitation of the study, as reported by the authors, is that the various cytokines and chemokines, as well as the parameters showing oxidative status, were not investigated in this study in the gout patients.

Another significant limitation is the small size of the population due to the exclusion of gout patients with associated metabolic disorders. The authors aimed to investigate the various effects of gout on the auditory system where the primary aim was the early detection of the presence of HL, but not to evaluate the underlying pathophysiology for the same.

Moreover, this study was not conducted in the patient group that included only the active phase of gout which was also a critical limitation for the investigation. Lastly, the author's findings highlighted that patients in the active phase of gout experience worse hearing thresholds.

Whereas, in this study, the pure-tone thresholds and the extended high frequency thresholds revealed higher mean hearing thresholds above 4 kHz in the group with gout than in the control group, the mean gap for air-bone thresholds was lesser than 20 dB SL at any given frequency as identified by the authors. Therefore, the authors conclude that the Extended High Frequency (EHF) audiometry is an important assessment tool in the early detection of the potential effect of hearing losses in the patients with active phases of gout. •

THE ACOUSTICS OF INSTANT EAR TIPS AND THEIR IMPLICATIONS FOR HEARING-AID FITTING

Cubick J., Caporali S., Lelic D., et al
Ear Hear *(2022): 43(6), 1771-82*
doi: 10.1097/AUD.0000000000001239. Epub 2022 Jun 23. PMID: 35733244; PMCID: PMC9592182.

By Gerard Ros – The Netherlands

This study addresses the impact of the trend of using uniform domes on measured and perceived quality of sound.

The objective of the study was to explore the impact of instant ear tip on the reliability of hearing aid fittings. To achieve this, the authors conducted a two-fold experiment The first, with a population of 60 normal-hearing ears (30 participants), set out to obtain objective measurement of the vent effect combined with subjective rating of occlusion for each type of ear tip . The second set, focusing on a population of ten normal-hearing participants per ear tip, set out to explore inter-subject variability regarding ear tip properties and insertion, by carrying out the same measurements six times

THE VENT-EFFECT SET-UP:

Data was gathered by measuring the "vent-effect" (VE) across five commercially available ear tips and domes from one specific manufacturer, i.e. Widex. The VE refers to the difference between the Real Ear Measurement (REM) in an occluded ear with impression material as opposed to measurements carried out with an "open" ear, reflecting the real-life experience of a HA user.
The probe placement was checked with a Real Ear Occluded Response (REOR)

MEASUREMENT:

For the first experiment, the hearing aid was set to a linear gain of 10 dB and a controlled level, brown noise was streamed via a TV streaming device.
In the second experiment, the measurements were repeated six times for all twenty ears with open, tulip, single vented closed, double vented closed and double domes.

SUBJECTIVE OCCLUSION:

The participants were required to rate, on a 1-10 scale the sound of their own voice while reading a list of presented words out loud.

CRITICAL NOTE:
The study mentions the impact of open fitting on noise-reduction and directionality, the "crown jewels" of modern hearing aids. The authors demonstrated that a more open fit results in less effective features.
Of concern is perhaps the overconfident trust in feedback cancelation, listening to "on the edge" fitted hearing aids on open domes often produce poor sound quality even if the technology is state of the art.
What does this mean for clinical practice? In selecting the acoustical fit individual clients need for natural or controlled settings, it is important we take into account data from acceptable noise level and speech in noise tests.

The hearing aid was switched off and the test repeated for all type of ear tips.

EAR TIP INSERTION – RE-INSERTION:

The participants were asked to put the hearing aids into their ears by themselves several times after which the vent-effect was measured.
This was repeated six times per type of ear tip.

RESULTS:

Acoustic transparency of domes on average:
Open tips showed little damping and are most transparent (as expected), Tulip and single ear tips are transparent up to 1 KHz with about 10 dB attenuation at 2.6/2.8 KHz. Double domes are transparent up to 600 Hz with 16 dB attenuation at 3 KHz.

THE VENT EFFECT:

Unsurprisingly, the VE is most prominent in low frequencies and varies significantly across participants' ears, likely

due to the difference in form and size of the ear canal and therefore the amount

OBJECTIVE OCCLUSION:

The ratings for occlusion are related to the type of domes again with a spread across the subjects. In general occlusion was preserved higher with a less open dome.

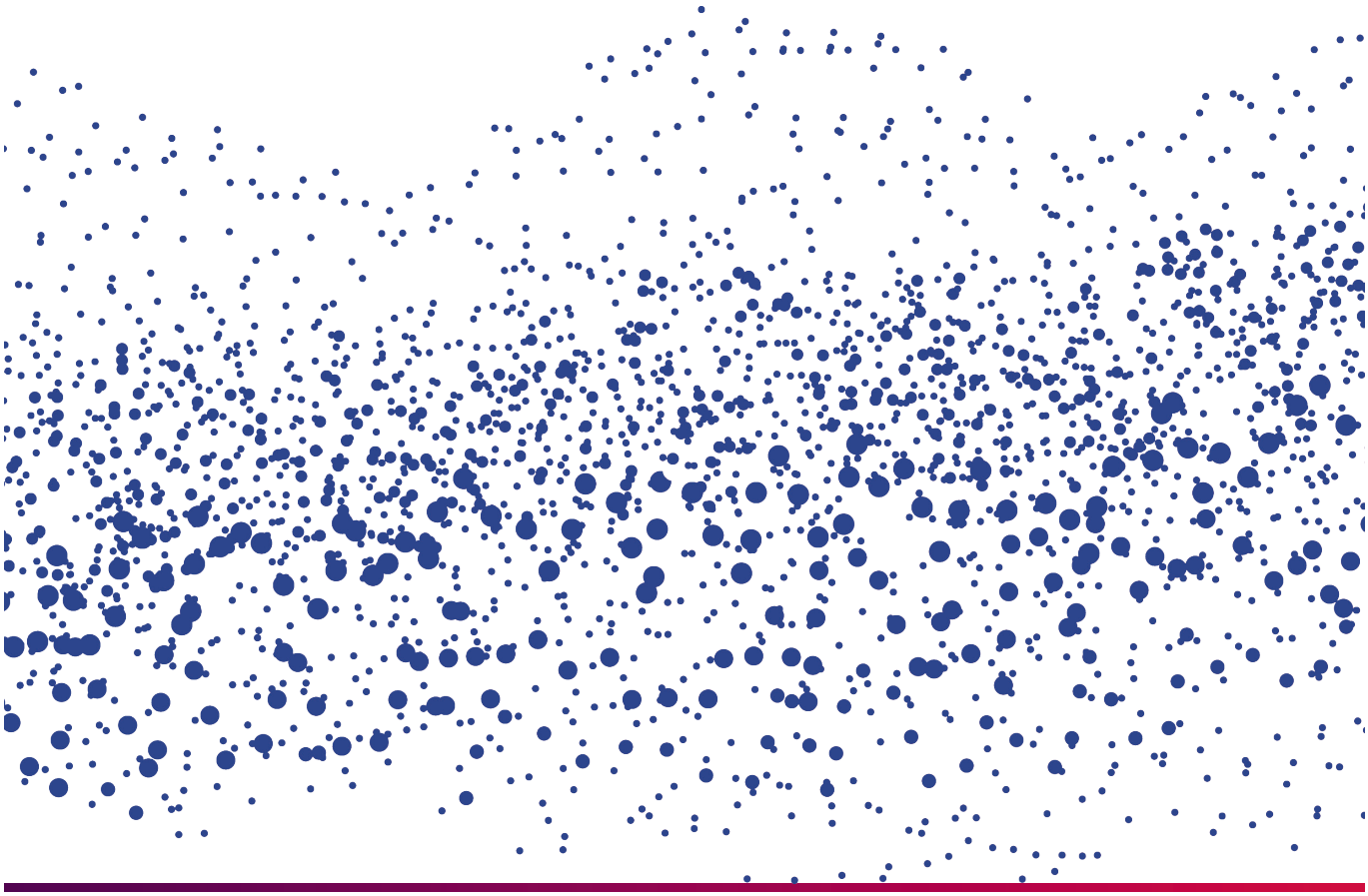
INSERTION – RE-INSERTION:

The variation in VE was quite small, per subject the placement showed to be consistent.

The study provides robust advice on the selection of instant ear tips for individual users.
Due to the variation in the wearers ear canal size and shape, instant ear tips can be rated as "one size fits nobody" without proper selection and verification during the first fitting.
The data positively demonstrated that every time a user inserts the hearing aid into their ear, they do so the same way each time, meaning the correct fitting is likely to stay correct over time

KEY LEARNINGS

- Custom earmolds will seal the ear more effectively, compared to instant ear tips.
- Instant ear tips, depending on type, can be more acoustic transparent compared to earmolds.
- It is important to take the individual size and shape and the targeted output / frequency response into account when selecting the acoustic properties and size of the ear tips
- Probe-measurement should be used to verify the result before sending clients out for their first sound experience with amplification.
- The results show "rules of thumb" on the transparency of different types of ear tips which provides useful insight for professionals for preselection. •



CAN REAL-EAR INSERTION GAIN DEVIATIONS FROM GENERIC FITTING PRESCRIPTIONS PREDICT SELF-REPORTED OUTCOMES?

Narayanan SK., Rye P., Piechowiak T., et al.
Int J Audiol. *(2022): 1–-9*
doi: 10.1080/14992027.2022.2053594.
Epub ahead of print. PMID: 35389316.

By Frederic Debruycker - Belgium

This study determines a very interesting relationship between fitting accuracy and expected outcomes taking into account the experience of the user.

The prescribed gain for restoring intelligibility and loudness sensation adapted to users' degree of hearing loss (HL) generally follows established generic rules or manufacturer methods.

This study analyses the relationship between the deviation from the prescribed gain on the one hand and results as reported by users on the other, through evaluation questionnaires.

Data was collected from almost 2,000 hearing aid (HA) users, bilaterally fitted, all adults, and a balanced representation of new users and experienced users. The authors based their analyses on the following data:

The gain prescription for each participant: calculated for NAL-NL2, NAL-RP and One third gain.

REM measurement: for 55, 65 and 80dB input.

Scores from two different questionnaires:

- **IOI-HA[1]:** evaluating the benefits and limitations encountered when using hearing aids
- **SSQ12[2]:** evaluating various outcomes regarding speech intelligibility as well as qualitative aspects

Real-ear measurements (REM) were used to identify potential differences between the prescribed gain and the other methods. The deviations observed, as well as the level of experience of the users, served a criteria for categorisation into different clusters.

CRITICAL NOTE:

This study highlights a particularly interesting correlation between fitting accuracy and expected outcomes, taking into account user experience. The findings of this study show some differences from other studies on some evaluation criteria. An important strength of this study is its large sample size; the diversity of users and the variety of devices used further contribute to making it a reliable sample.

RESULTS:

Various outcomes were observed in this study:

Overall, users fitted with the manufacturer's "first fit" show less gain in higher frequencies than those fitted with generic fitting rules

Deviation regarding the prescribed gain (cluster) is a factor predicting the self-reported benefits by experienced users. Being closer to the target shows positive results. However, this deviation is not a significant predictor for first-time users.

For first-time users, the findings suggests that user motivation has a positive impact that overpowers the potential effect of gain differences as compared to the generic prescriptions on reported benefit outcomes •

1. *International Outcome Inventory for Hearing Aids*
2. *Speech, Spatial, and Quality of Hearing*

ADAPTIVE HEARING AID BENEFIT IN CHILDREN WITH MILD/MODERATE HEARING LOSS: A REGISTERED, DOUBLE-BLIND, RANDOMIZED CLINICAL TRIAL

Stewart HJ., Cash EK., Pinkl J., et al.
Ear Hear. *(2022): 43(5),1402–15*
doi: 10.1097/AUD.0000000000001230.
Epub 2022 Jun 27. PMID: 35758427.

By Pierre Devos – France

This review assessed whether Oticon's Open Sound Navigator (OSN) assisted signal offered long-term benefits in paediatric hearing aid users. Surprisingly, they found no significative benefit from OSN compared to classical pinna omnidirectional algorithm on key variables such as speech, cognition or academic capacities, or subjective feedback (questionnaires).

It is well established that when it comes to paediatric hearing aid (HA) users, precocity, time of use, audibility and largely positive signal to noise ratios (SNR) are critical to HA use success. More so than adults, children are confronted with noisy environments (school, public transports, activities, etc.). However, compared to adults, they need greater levels, more audibility and more positive SNRs. Industry players have attempted to address this challenge by adapting algorithms, for instance, Oticon's Open Sound Navigator (OSN), including automatic noise reduction and 360° "directionality" which tends to ameliorate the SNR in all directions at the same time, whatever the incidence angle of speech signal.

In this study, the authors set out to explore the benefits of the OSN algorithm. They studied 40 experienced paediatric HA users, aged from 6 to 13, after 13 months of use. They were divided into two similar groups: 20 children using OSN; 20 using the PINNA OMNI (PO) algorithm. Amplification was fine-tuned according to the recommendations of the Desired Sensation Level (DSL) v5.0. and the only difference between groups was OSN (Oticon default settings) versus Pinna Omni (without any noise reduction). Lastly, all participants were provided with a compatible wireless microphone which they were free to use or not.

The potential benefit was measured across a comprehensive range of criteria, including: auditory performance, cognition, academic abilities, caregiver- and self-reports about listening behaviour and listening effort.

CRITICAL NOTE:

This comprehensive long-term study concludes that Oticon's Open Sound Navigator (OSN) and classical Pinna Omni algorithm offer equal results. These findings indicate that OSN neither enhances nor worsens the hearing experience. However, this could have been influenced by the use of wireless microphones with both algorithms at school, which accounts for a significant amount of time in children's lives, and by the 'non ecological' test environment created for the study (the test set-up does not correspond to the real life situations in which the hearing aids will be used).

FINDINGS:

Surprisingly, after 13 months of use, neither of the two algorithms showed a greater performance improvement. Evaluation of word and sentences in quiet and noise, cognition battery test, word and grammar learning, reading and mathematical academic abilities, caregiver- and self-reports (SSQ, GHABP, PROMISE) all pointed to the same conclusion: the OSN neither ameliorates nor reduces performance in the long term. Unfortunately, no data regarding the use of the microphones were collected or exploited in the findings. This is regrettable considering the known SNR gain provided by such systems in noisy environments such as classrooms and outdoor activities, which make up such a large portion of children's everyday life.

This conclusion directly contradicts the findings of Oticon (Ng Tech paper 2017 and Ng, Goverts, Kramer & Zekveld White paper 2019) that showed a 4 dB SRT/30% intelligibility amelioration and decrease of listening effort when using OSN compared to the Omni algorithm.

Most importantly, the key criteria that showed the greatest positive correlation to long-term global improvement, regardless of processing strategy (see Fig. 5 below) are:

- the age of the first HA fitting (effect on reading and mathematical long term improvement);
- the daily duration of HA use (predictive of cognitive and academic scores, proven relationship with selective attention)

Lastly, one detail that was only mentioned briefly in the article is that when participants were unblinded from the protocol, they were given the choice of keeping their initial HA fitting or changing to the other option (OSN or PO). Interestingly, "most participants chose to continue use of the OSN programme, or to enable OSN if they had been in the OMNI group".

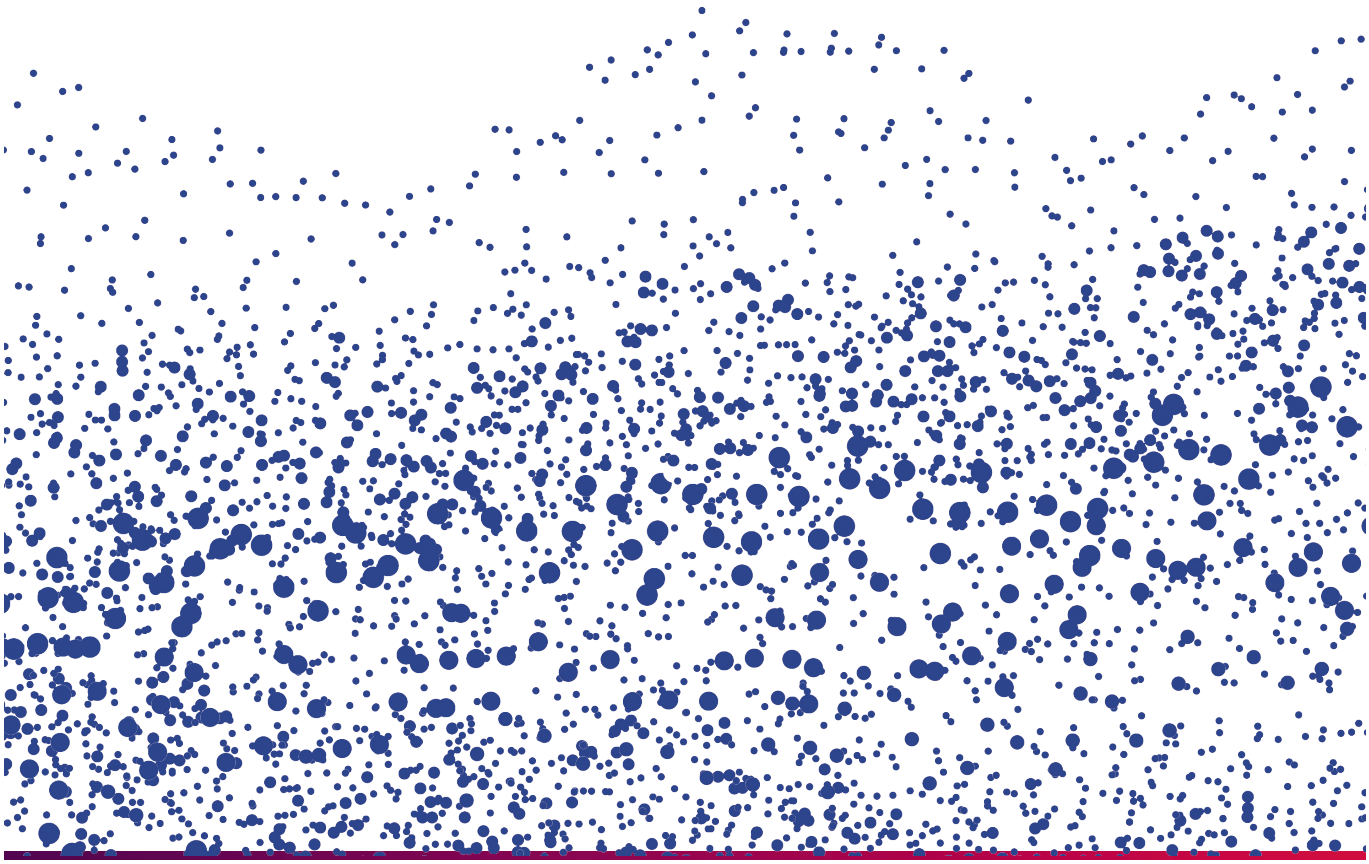
CONCLUSION AND DISCUSSION

The authors conclude that, based on their findings, the Open Sound Navigator neither improved nor hindered long term performance. Is that to say that "adaptative (filtering) algorithms" never improve performance in children ? Probably not, even if we know that real directional microphones and strong noise reductors are not recommended for children. Other studies tend towards the opposite conclusions. Results depend on the algorithm itself, the protocol, the type of noise used for repetition tasks, the evaluation period ("one shot fitting" or several months acclimatisation) and hearing aid model/manufacturer. Oticon devices benefit from large frequency bandwidth, large input dynamic and floating linear gain that maybe partially masked some treatment advantages. Moreover, the undiscussed use of wireless microphones is probably the greatest bias in this study.

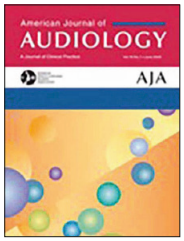
The key take home messages for positive outcomes are:

- Precocity of the fist HA fitting
- Intensive use of HA (at least 8h per day)
- Fine tuning with age-appropriate targets
- Stability of the signal across months and years (acclimatisation)
- The importance of always taking into account the use of wireless microphones because of the need of + 15 dB SNR for children as opposed to adults (+7 to +24 dB depending on the age)

The OSN algorithm was not viewed as "bad" in as far as it does not reduce performance. What is not bad may be good under the right circumstances and deserves further research with actual algorithms. •



REAL-EAR-TO-COUPLER DIFFERENCE: PHYSICAL AND PERCEPTUAL DIFFERENCES



Jorgensen L., Barrett R., Jedlicka D., et al.
Am J Audiol. *(2022): 31(4),1088–97*
doi: 10.1044/2022_AJA-21-00264. Epub 2022 Aug 29. PMID: 36037483.

By Pierre Devos – France

American guidelines for paediatric and adult hearing aid fitting recommend the use of Real-Ear-to-Coupler measurement to ensure sound audibility. For children, individualised measurements are to be used. For adults, however, averaged values can be used. The authors of this study set out to determine the efficiency of custom (individualised) RECD values as opposed to averaged values.

Real-Ear-to-Coupler Difference (RECD) is known as the most precise way to convert dBHL to dBSPL hearing thresholds, on which amplification values will be calculated. While this measure is widely accepted as the gold standard for fitting children, real-world practices show that, for adults, no such individualised approach is taken, relying rather on average RECD values to establish SPL-O-Gram and target amplification for this population.

The goal of this study is to compare RECD average values to measured ones, to compare measured right to left RECD values and to verify the gain in efficiency when using individualised RECD values as opposed to averaged RECD values in an adult population.

This retrospective study enrolled two groups of 85 adults, fitted with NAL-NL1 target values controlled by probe-tube measurement. All conditions across both groups were identical (gender, age, degree of HL and HA models), with the exception of RECD values, with average RECD values for Group 1 and individualised RECD values for Group 2.

The first result concerns intra subject differences between measured RECD in subjects' right and left ear. No significant difference was found, suggesting that if only one ear can be measured, its values can be "copied" to the other side.

Secondly, and more importantly, approximatively 20% of measured RECDs differed from the average value by more than 1 standard deviation (SD).

A deviation of 15dB from the average means a risk of under or over-amplification of the same amount. It is impossible to predict how RECD values will deviate from average values across frequencies for one given patient. This study offers evidence of the importance of measured RECD.

Finally, this retrospective study required patients to complete two patient-reported outcome questionnaires: Handicap Inventory for the Elderly-Screened (HHIE-S), prior and just after fitting; and the Iowa Outcome Inventory for Hearing Aids (IOI-HA), four to six weeks after fitting. The results further support the authors' initial findings.

CRITICAL NOTE:

This retrospective offers concrete evidence of something audiologists have known for a long time, i.e. that individualised and precise audiometric values work better!

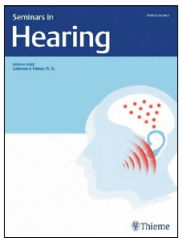
As most gain calculation approaches are based on SPL threshold audiometric values, these must be as precise as possible in order to provide the most appropriate gain values. The only way to ensure accuracy in HL to SPL conversion is to couple insert earphone audiometry with individualised RECD measurements, as we is done with children. Such a shift in clinical practice would lead to improved self-perceived handicap scores and enhanced overall satisfaction with HAs.

HHIE-S results showed a positive impact of measured RECD in the fitting process with lower values on the postfitting scores. This means that the self-perceived hearing handicap is lower after fitting with individualised RECD values than with averages ones. More accurate conversion of dB HL to SPL leads to greater satisfaction after fitting, probably because gain values are more appropriate.

IOI-HA scores also showed more effective HA in self-selected difficult situations and more global satisfaction for Group 2 than for Group 1.

All these results advocate for the generalisation of individualised RECD measurements in adults also. This method coupled with insert earphones audiometry is the most precise in converting HI audiogram to SPL-O-Gram and, as a consequence, in generating appropriate gain and dynamic range targets, and by correlation, leads to increased HA benefit). •

RELATING FACTORS AND TRENDS IN HEARING DEVICE ADOPTION RATES TO OPPORTUNITIES FOR HEARING HEALTH CARE PROVIDERS



Jorgensen L., Barrett R., Jedlicka D., et al.
Am J Audiol. *(2022): 31(4),1088–97*
doi: 10.1044/2022_AJA-21-00264. Epub 2022 Aug 29. PMID: 36037483.

By Majda Basheikh – Canada

A review of the factors that impact hearing aid acquisition and how hearing health care providers can further support these patients' journey.

Despite the best efforts of hearing Health Care Professionals (HCPs) to formally assess and educate patients with hearing loss (HL), only a fraction of these take the initiative to pursue hearing aid (HA) amplification. This is unfortunate considering the perceived need and initial initiative to seek professional support. This article uses data from the recent 2022 MarkeTrak study to explore HA adoption rates and associated trends.

The findings of the MarkeTrak 2022 survey are consistent with previous trends/data that suggest that self-reported HL increases with age. It also highlights that older adults are more likely to adopt amplification. However, this does not rule out that younger populations may also receive support from HCPs. The survey confirms that most patients attribute their HL to aging or noise exposure (NE). In addition, there is an increase in music-related perceived NE, which could be related to increased use of headphones and earphones associated with music listening. Younger populations are usually heavier users of music devices, providing HCPs further opportunity to educate on the impacts of noise-related HL. Middle aged individuals (ages 35 to 64) are reported to be less likely to adopt amplification compared to younger and older individuals. This age group is predominantly made up of working class individuals. HCPs should be aware of the importance of educating these individuals on the benefits of early amplification as well as encouraging hearing protection for those individuals working in noise. Early hearing detection programmes have been successful in identifying HL among the younger population, which may also explain why adoption rates are higher for this age group.

Data from the survey also indicates that individuals who identify as Black, indigenous, and people of colour (BIPOC) are less likely than white individuals to report HL. This has been associated with various factors such as not having the means to prioritise hearing health over other medical factors, less access to medical care, and less trust in the health system. This presents an opportunity for HCPs to increase engagement specifically with BIPOC communities. Successful strategies include employing BIPOC HCPs, which has been shown to increase trust in the medical system, as well as educating HCPs on cultural competency and bias-reducing strategies.

More men report hearing loss compared to women. However, women are statistically more likely to take more initiative regarding their health and pursue hearing amplification earlier than men. Despite a greater pool for male patients, HCPs should continue to seek female clients as they would be more likely to report greater benefit with amplification due to perceived need and motivation to seek support. Female users are also more likely to refer family and friends to their HCP, which also supports another trend that people are more likely to seek support if their friends/family have positive experiences and outcome with a provider. Referrals constitute a key source for clinics. HCPs can exponentially expand their

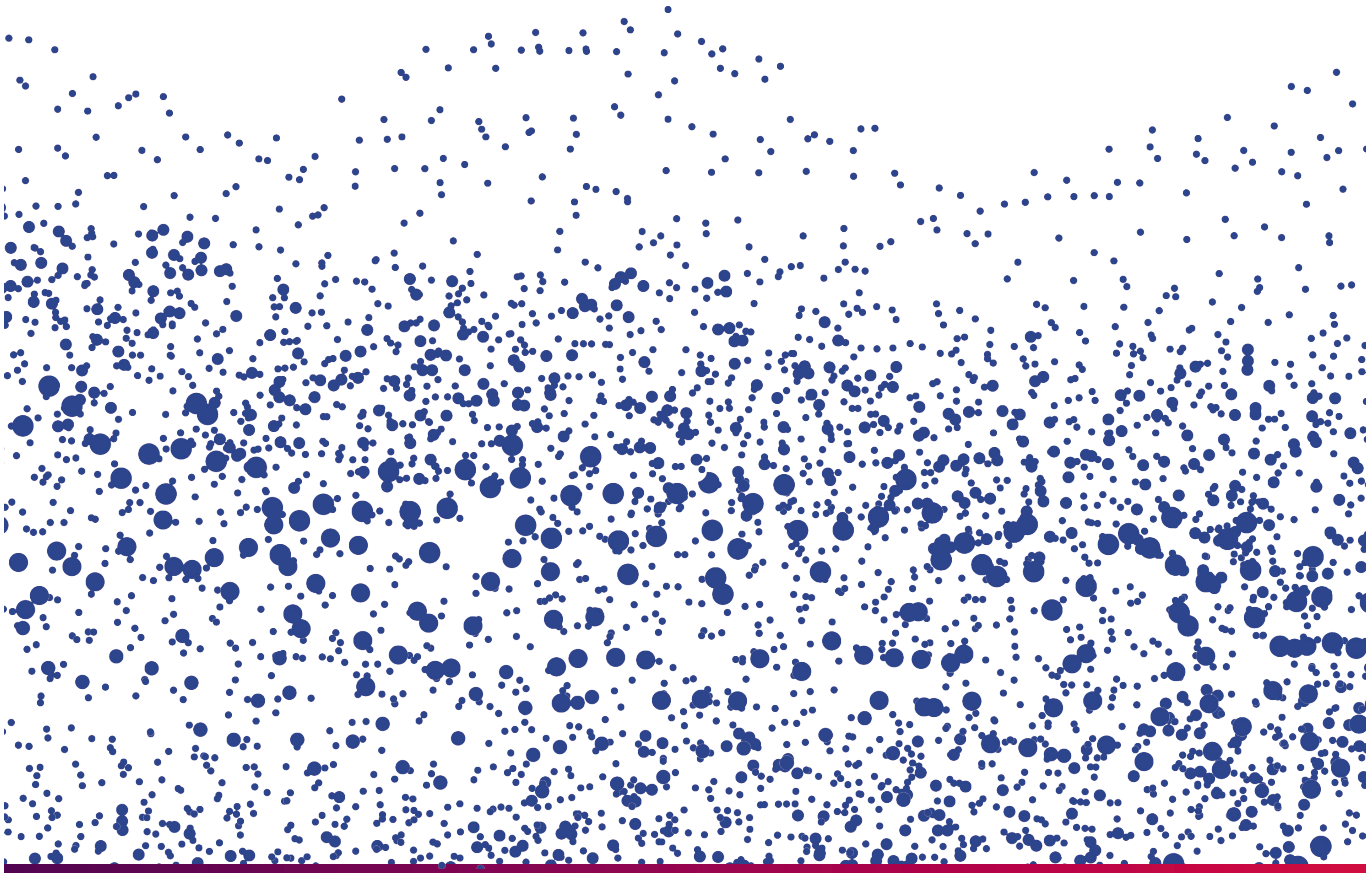
CRITICAL NOTE:
HCPs can utilize MarkeTrak data to provide greater access to hearing health care and reach populations which are traditionally at the margins of hearing healthcare. This report highlights the variety of actions and services hearing HCPs can deploy to positively impact patient experience and outcomes, as well as their clinical practice and clinic as a whole.

clinic database by continuing to provide well rounded care for all their patients.

Recent MarkeTrak data indicates that adoption rates are strongly linked to cost, as self-purchase rates were higher in health care systems that provide greater financial support (i.e. universal health care). With the introduction of Over The Counter (OTC) devices in the U.S. market that are at lower cost and self-fitting, adoption rates are expected to increase. However, it is not anticipated that OTC devices would devalue HAs. As reported in 2018 JapanTrak data, patients reported greater satisfaction, greater reliability, and longer wearing times with HCP-fit medical hearing devices as opposed to OTC devices. Since OTCs are self-fitting, they are targeted at individuals who self-report milder hearing losses. HCPs play an essential role in educating clients on the difference between OTCs and medical hearing devices as well in providing assessments to correctly define the degree of HL and appropriate solutions. In some cases, OTCs can also be regarded as a precursor to obtaining HAs. It may be beneficial for HCPs to provide the option of OTCs for those patients not ready to financially commit to a hearing device. Furthermore, HCPs that provide OTCs are in a better position to ultimately guide such patients towards the potential acquisition of HAs in the future. Offering such services in addition to traditional medical HAs could help clinics to dramatically expand their patient databases.

The most reported factor for purchasing HAs according to the MarketTrak 2022 data was a hearing test indicating hearing loss that requires amplification. Other high-ranking reasons for pursuing amplification include a trustworthy HCP, quality of service, and liking the establishment/company. This emphasizes how essential HCPs are in HA adoption. Their expertise and the quality of their clinic and related services are appreciated and HCPs should continue to strive towards the best possible clinic experience for their patients.

In conclusion, MarkeTrak data continues to provide essential insight into major trends and their impact on the hearing health care industry. HCPs should leverage these findings in order to maximise opportunities for both patients and clinics. •



HEARING AID EXPERIENCES OF ADULT HEARING AID OWNERS DURING AND AFTER FITTING: A SYSTEMATIC REVIEW OF QUALITATIVE STUDIES

Oosthuizen I., Manchaiah V., Launer S., et al.
Trends Hear. *(2022): 26, 1–21*
doi: 10.1177/23312165221130584. PMID: 36300258; PMCID: PMC9618746.

By Perrine Morvan – France

In this systematic review, the authors set out to understand the various factors which can influence hearing aid adoption among hearing impaired subjects.

This systematic review was conducted on three electronic databases (Scopus, PubMed, CINHAL) using keywords, with no restrictions of timeline, up until December 2021 (date at which the search was concluded). This yielded a total of 443 articles, of which 25 were selected for final inclusion. The purpose of this review is to identify factors that may influence therapeutic adherence in hearing impaired adults. The study explored sensorineural or mixed hearing loss (HL), with either single or bilateral fitting.

The studies were classified into three domains: hearing aid (HA) adoption and fitting; HA use; HA sub-optimal use. In addition to patient-reported experiences, the study also factored in the point of view hearing care professionals (HCPs). By compiling the different feedback they received, the authors were able to develop a guideline for improving the therapeutic management of hearing impaired adults with HAs.

The authors stress that HCPs play an essential role in the therapeutic adherence of hearing impaired adults through factors such as: quality of service; information provided on the maintenance and handling of HAs; and the relationship of trust. Such findings emphasise the importance of educating the hearing care teams on these different aspects.

Of course, numerous factors intrinsic to the patient contribute to HA adherence, such as recovering a social life or improving communication with family and friends. However, a number of HA-related factors can significantly hinder HA adoption, for instance, if the amplification quality is poor, if the device leads to discomfort or pain, if it is unreliable, or if its appearance and design are not satisfactory.

In addition, a number of external factors are also at play: the stigma associated with HAs, being associated with older age, negative reactions from others, concerns regarding device handling or operation, or the fact of not being aware of one's HL. Counselling, de-dramatisation and management are necessary to educate patients and their families.

In order to optimise the use of HAs, improve compliance and increase the satisfaction of the hearing impaired, HCPs must develop a personalised approach to patient care. In order to achieve this, it is essential to educate HCPs and clinical teams to the concept of patient-centred care in order to make HA users active participants in their hearing rehabilitation. •

CRITICAL NOTE:
This systematic review successfully identified the needs of hearing impaired adults and the specific areas that need to be addressed to ensure hearing rehabilitation success.
It is clear that including patients in their therapeutic rehabilitation is essential to ensuring they actively adhere to their rehabilitation. Furthermore, hearing care professionals have a key role to play in training and guiding them on their rehabilitation journey.
One limitation of this study is that it would have been interesting to know whether patient complaints differed according to patient age or their type of HL.

HEARING AID ADOPTION IS ASSOCIATED WITH THE TYPE OF SIGNIFICANT OTHER IN ATTENDANCE AT HEARING CARE APPOINTMENTS

Ellis BK., Singh G. & Launer S.

Trends Hear. *(2022); 26, 1–11*

doi: 10.1177/23312165221131703. PMID: 36444131; PMCID: PMC9716445.

By Veronica Hoffman – New Zealand - Italy

This retrospective study explores the correlation between significant-other attendance and hearing care appointments and successful hearing aid adoption.

With an estimated 1.5 billion people globally affected by hearing loss (HL) but relatively low rates of hearing aid (HA) adoption, there is increasing need to understand what motivates patients to proceed with HA rehabilitation. Involvement of family members is a key component of patient- and family-centred care. Previous studies have shown that significant-other (SO) attendance at hearing care appointments positively influences HA adoption, satisfaction, and successful HA use.

This study investigated the typical relationship types of SO's attending hearing care appointments and whether the type/relationship influenced HA adoption. For the purposes of this study, HA adoption referred to the initial uptake or purchase of hearing aids.

The authors carried out a retrospective analysis of the clinical records of >47,000 patients who attended a chain of private UK hearing centres between 2014 and 2016 and met the following inclusion criteria: aged between 18 to 100; presence of mild, moderate or severe hearing loss according to WE4PTA classification; that a HA was recommended to them during the appointment; and documentation that could identify whether they attended alone, or with one of nine relationship tags, i.e. "carer", "child", "family", "friend", "partner", "parent", "semi-attended", "sibling" or "and" – referring to multiple people attending the appointment with the patient.

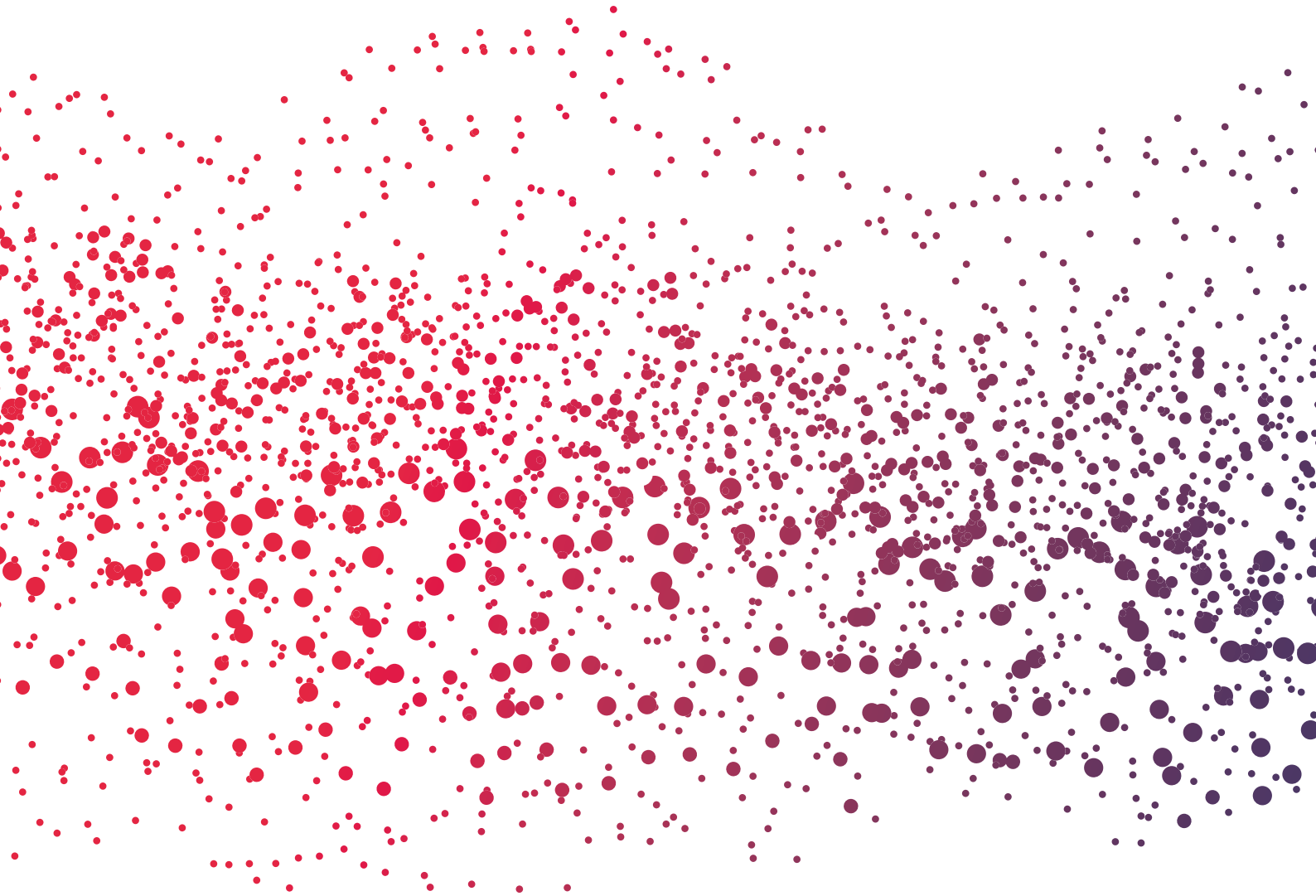
In this cohort, 21% of patients attended the appointment with a SO; 79% alone. The most common relationship types were found to be "partner", making up 66% of SO attendance, and "child", accounting for 26% of SOs.

Odds of HA adoption were found to be higher with stronger familial relationship ties compared to friends or caregivers. In fact, no increase in HA adoption was found when the SO attending the appointment was a caregiver.

Overall, and as found in previous studies, overall HA adoption was higher in those who attended the hearing care appointment with a SO compared to those who did not (75% and 66% adoption rate respectively). •

CRITICAL NOTE:

These findings pave the way for further research into this phenomenon in order to better understand the nature of the SO relationship (e.g. conversation partner/directly impacted by patients hearing loss) and whether these findings are causal. In any event, the insights from this study suggest that a SO should be encouraged to attend hearing care appointments in order to facilitate hearing aid adoption.



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