ABSTRACT BOOK

Lectures, Special Sessions & Communications 2
Posters 219
Authors' Index 329

Lectures – Special Sessions & Communications

KEYNOTE LECTURE

57 - AGE-RELATED HEARING LOSS: FINDINGS FROM A LONGITUDINAL COHORT STUDY OF THE GENERAL POPULATION

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The Medical University of South Carolina (MUSC) Longitudinal Cohort Study of Age-related Hearing Loss is an ongoing (1988-current) community-based cohort study in Charleston, South Carolina, USA. The purpose of this study is to determine the natural history of hearing loss across the adult lifespan, identify genes and variants that cause or contribute to age-related hearing loss - a common and complex disorder with a strong genetic component, and to provide scientific bases for diagnosis, rehabilitation, and prevention. Participants are continuously enrolled and first undergo a baseline examination, which includes pure-tone thresholds at conventional and extended high frequencies, middle ear measures, speech recognition in quiet and noise, otoacoustic emissions, auditory brainstem responses, a battery of cognitive measures, and responses to self-report questionnaires including demographics, medical history, medications, hearing difficulties, hearing and hearing-aid history, and noise exposure history. Blood samples are obtained for clinical chemistries and DNA extraction for whole exome sequencing. Following completion of the baseline protocol, participants return annually to obtain an updated audiogram, health history, and hearing health history. Every 2-3 years after baseline, participants attend a comprehensive follow-up visit where most of the baseline measures are repeated. Currently, the participant sample includes >1,800 adults 18 to >80 years of age at enrollment (mean age ~60 years) with longitudinal data spanning up to 35 years (~55% female; ~18% Black). Prevalence, incidence, and progression of audiometric hearing loss and associated demographic, health-, and hearing-related factors will be reported, along with generational (birth cohort) differences. Notably, patient-reported outcome measures, such as self-reported hearing difficulty, are an increasingly important component in the comprehensive assessment of the functional abilities of individuals with hearing loss and changes following hearing health interventions. Therefore, comparable findings will be presented for self-reported hearing difficulty measured with the RHHI, the influence of demographic factors on the agreement of the RHHI with audiometric hearing loss, and a comparison of the ability of audiometry and RHHI to predict hearing-aid use. Finally, a brief timeline will recount the 35-year history of the MUSC Longitudinal Cohort Study. [Work supported by NIH/NIDCD]

Keywords: aging, longitudinal, cohort study, hearing loss

SPEECH PERCEPTION

74 - A LONGITUDINAL STUDY TOWARDS BENCHMARKING AUDITORY DEVELOPMENT AMONG INFANTS WITH HEARING LOSS

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Objectives:
Infants who are hard of hearing (IHH) are at significantly increased risk for poor auditory development and speech perception, even when identified and fit with hearing aids early in life. Early neural markers of auditory skill development may help identify infants who require additional intervention. Our goal is to develop an objective electrophysiological tool to benchmark auditory development in infancy, enabling early comparison between infants with normal hearing (INH) and IHH. In this study, we (1) document developmental trajectories of cortical auditory event-related potentials (ERPs) to native and non-native speech contrasts in children with normal hearing (CNH) aged 3–12 months, and (2) characterize developmental changes in amplitude, latency, and scalp topography across electrode sites.
Design:
Speech perception development was examined using scalp-recorded electroencephalography (EEG) in response to native and non-native consonant–vowel syllables. Participants included 83 typically developing infants enrolled in a longitudinal study, with data collected at three time points: T1 (3 months), T2 (6 months), and T3 (12 months). All infants passed newborn hearing screening, had no known neurological or hearing conditions, and demonstrated normal middle ear function and otoacoustic emissions. EEG data were processed to extract ERPs corresponding to P1 (100–300 ms), N1 (200–450 ms), P2 (500–800 ms), and the peak mismatch response (MMR; 150–450 ms). Amplitude was quantified using Global Field Power (GFP), Principal Component Analysis (PCA), and traditional mean amplitude measures; scalp distribution was analyzed using the center-of-mass method. Developmental effects were evaluated using mixed-effects models.
Results:
Mixed-effects analyses revealed significant developmental changes. P1 latency exhibited a non-monotonic trajectory across sessions ($p = 0.011$), whereas N1 latency decreased with age ($p = 0.037$). In contrast, MMR latency increased for native—but not non-native—speech contrasts ($p < 0.001$), consistent with emerging phonological processing. Convergent amplitude findings across GFP, PCA, and mean measures (all $r > 0.80$) indicated that GFP and PCA provide robust, reference-free evidence of amplitude development. A significant Session × Channel interaction was observed for P2 amplitude in the native consonant condition ($p = 0.001$). P2 exhibited the largest developmental amplitude change ($p < 0.001$), increasing by 57% from T1 to T2 before slightly declining at T3. Scalp topography analyses revealed spatially non-uniform development: the MMR displayed a systematic anterior shift from T1 to T3; P1 exhibited a **Conclusions:** Robust neural signatures of perceptual attunement for consonants may be more subtle, later-emerging, or stimulus-specific than commonly assumed. The dissociation between stable amplitude and migrating neural generators suggests that spatial location may be as important as response magnitude for characterizing auditory maturation during early infancy. Advanced signal-processing approaches, such as time–frequency response analyses rather than traditional signal averaging, will be examined in future work. These findings are further complicated by differing sleep states over the first year of life. These preliminary results in a typically hearing cohort should be interpreted with caution, and group-level comparisons, overtime with IHH, may yield greater insights as adequate sample sizes become available.

Keywords: Infants, Auditory development, Neural encoding, Hearing loss, Speech perception

77 - SPEECH PERCEPTION OUTCOMES AFTER COCHLEAR IMPLANTATION IN ADULTS WITH UNILATERAL SUDDEN SENSORINEURAL HEARING LOSS

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Background

Sudden sensorineural hearing loss (SSNHL) is an emergent condition among various otologic disorders. Although pharmacologic treatments are often administered, some patients fail to recover. In such cases, cochlear implantation (CI) has been considered for patients with unilateral SSNHL. In general, CI in deaf adults without SSNHL is expected to result in slower speech perception recovery when the age at surgery is higher or the duration of deafness is longer. However, studies specifically evaluating CI outcomes in patients with SSNHL are limited. Therefore, the aim of this study was to assess CI outcomes in patients who failed to recover hearing following SSNHL.

Materials and Methods

We retrospectively reviewed 29 patients who underwent unilateral CI at Asan Medical Center between January 2020 and December 2024. All included patients were adults aged ≥19 years, and all demonstrated normal findings on magnetic resonance imaging (MRI). Demographic and clinical variables were collected, including age at surgery, sex, medical comorbidities, duration of deafness, defined as the interval from the onset of SSNHL to CI, follow-up duration, preoperative and postoperative pure-tone audiometry (PTA) and speech audiometry results. Patients were classified as having single-sided deafness when the unaided air-conduction (AC) threshold of the contralateral (non-implanted) ear was ≤30 dB, asymmetric hearing loss when the AC threshold was between 30 and 70 dB, and deafness when the AC threshold exceeded 70 dB. Statistical analyses were performed using ANCOVA regression models.

Results

The median age at cochlear implantation was 56.9 years [range, 40.2–77.1], and the median duration of deafness was 1.6 years [range, 0.3-15.9]. CI resulted in marked improvements in hearing performance, with median PTA improving from 89.2 dB HL preoperatively to 31 dB HL postoperatively, and median WRS improving from 16% to 80%. In patients with SSNHL, postoperative WRS showed no significant negative correlation with age at implantation or duration of deafness.

Conclusions

Cochlear implantation provides substantial auditory and speech perception benefits in adults with unilateral SSNHL who fail to recover hearing. Favorable outcomes were achieved regardless of age at implantation or duration of deafness. These findings may support that delayed referral or hesitation based solely on these factors may be unnecessary in patients with SSNHL.

Keywords: Speech perception, Cochlear implantation, Sudden sensorineural hearing loss

134 - THE ROLES OF GUT HEALTH AND LIFESTYLE FACTORS IN SPEECH PERCEPTION ABILITY: A POPULATION-BASED COMPARISON OF OLDER ADULTS FROM THE UK AND THE USA

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Background/Rationale: Speech perception ability is a key metric of auditory health, as it reflects the impacts of hearing loss on day-to-day function. 20% of the global population live with hearing loss. However, hearing loss does not affect all members of society equally, and the validity of the concept of age-related hearing loss has come into question. Lifestyle-related hearing loss may be a more accurate conceptualisation; however, lifestyle is impacted by non-modifiable factors such as geographical location, cultural norms and socioeconomic position. Sociological and environmental differences between countries may mediate the influence certain lifestyle factors have on hearing loss. This study investigated whether geographical location (UK vs USA) has an impact on the degree of influence that body mass index (BMI), level of physical activity and gut health (measured indirectly through compliance with the Mediterranean diet) have on speech perception ability in older adults aged 60-80. Although both western first-world countries, the UK and USA, differ in their degree of cultural individualism, which underlies their differing approach to community responsibility, such as for healthcare, and shared language allows for effective comparison of speech perception ability. Insights from this research could highlight the need for different approaches regarding the prevention of hearing loss that are country/culture specific and create more pressure for leaders to address "The U.S. health disadvantage". Materials and Methods: An online design collected data on participant demographics and lifestyle, including age, gender, geographical location (UK or USA), BMI, diet, and physical activity. Participants also completed an online digits-in-noise (DiN) task to assess speech perception ability. A sample of 482 adults aged 60-80 was recruited, 249 from the UK (Mean age = 66.14, *SD* = 5.16) and 237 from the USA (Mean age = 67.27, *SD* = 4.98) through Prolific (www.prolific.com). Data collection is still ongoing. Results: A multiple regression analysis was conducted on preliminary data, with the outcome variable of speech perception ability (DiN) and the predictors: age, geographical location, BMI, diet and physical activity. The model was significant overall, $R^2_{adjusted}$ = .05, $F(8, 477) = 3.65$, p <.001. Participants from the USA had significantly worse speech perception compared to participants from the UK (β = 0.45, p = .006) and greater age was significantly associated with worse speech perception (β = 0.06, p <.001).
Conclusions: The findings imply that age and geographical location, as measured in this study, are significantly associated with speech perception ability in older adults. However, there were no significant associations observed between speech perception ability and the lifestyle factors measured thus far in these preliminary data. Future research should aim to untangle the specific factors underlying the inequality in speech perception ability between the UK and the USA. Auditory health is established as a predictor of well-being. "The US health disadvantage" should continue to be investigated by a broad range of disciplines, and pressure to prioritise the well-being of Americans should continue to be applied to the national leaders of the world's wealthiest country, as everyone deserves to age with a minimum burden of disability.

Key words: Speech perception, Lifestyle, Ageing, Epidemiology, Inequality

135 - SUPPORTING SPEECH PERCEPTION IN DIGITAL COMMUNICATION: EFFECTIVENESS OF TEXT SUPPLEMENTATION

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Background/Rationale
Digital communication via mobile phones or video meetings is a central aspect of modern life. However, digital communication remains challenging for individuals with hearing loss who struggle to listen to a speech signal that is digitally degraded. Communication becomes even more challenging in the presence of background noise during listening situations. Such challenging listening situations are common in everyday life (e.g., environmental sounds, conversations, or music in public places), rendering accessibility to digital communication even more challenging for listeners with hearing loss. However, having access to appropriate text supplementation when listening to speech, such as speech-to-text or automated live captioning, is essential for enabling individuals with hearing loss to fully access and be able to participate in digital communication. Although automated live captioning is available in many digital communication tools and even mobile devices, its use remains limited. This underutilization underscores a critical gap: current assistive technologies fail to provide the necessary settings to support effective speech perception, thereby restricting potential benefits for users. Ongoing issues regarding semantic accuracy and synchronization delays between speech and text supplementation have prevented robust, reliable implementation and broad access to these technologies. Therefore, it is essential to investigate and address these unresolved issues. The present study aims to define the optimal time window for presenting text supplementation to benefit speech perception and ease listening effort. Specifically, we investigate how short and long asynchronous delays and high or low semantic coherence impact speech perception and the associated listening effort to define an optimal time window for their effectiveness.

Materials and Methods
An online study has been designed to present clear or degraded sentences (using noise-vocoding) with or without correct text supplementation and with high or low semantic coherence. When correct text supplementation was provided, a delay of 0, 200, 400, 800, or 1600 ms between the speech content and the text supplementation was used. After the presentation of each sentence, participants with or without normal hearing (NH vs HA) had to rate the clarity of the sentences and the effort required to listen to and understand them. To do so, two Likert scales were used: the first measuring perceived clarity (from 1 = very clear to 7 = not clear at all) and the second measuring listening effort (from 1 = no effort to 7 = very effortful).

Results/Conclusions
Data collection (for NH=60 and HA=60) is currently ongoing and is planned to be completed by the end of March 2026. Preliminary results indicate a main effect of sound quality, a main effect of synchronization delay, and a main effect of coherence. We also observed an interaction with hearing status for synchronization delay and semantic coherence. The pattern of the preliminary results is similar for both the perceived clarity and listening effort ratings. The clearer the sound quality and the shorter the synchronization delay, the better the speech perception and the less the effort required, not only for HA participants but also for NH participants. Importantly, the difference in listening effort and perceived clarity was significantly higher for HA than for NH participants when 1) semantic coherence was low, and 2) no correct text supplementation was available. The benefit of correct text supplementation was significant for delays below 400 ms on perceived clarity, and below 800 ms for listening effort. The preliminary results indicate that low semantic coherence, no correct text supplementation, or correct text supplementation with long synchronization delays above 800 ms are more detrimental for HA participants. Altogether, the results of this study aim to provide clear and precise practical recommendations for implementing text supplementation in assistive technologies, such as speech-to-text or “real-time” automated live captioning (i.e., applications or algorithms aiming to present a written form of the speech).

Keywords: Speech perception, listening effort, synchronization delay

143 - ADDING PSYCHOLINGUISTIC CRITERIA TO BALANCE WORD LISTS IN AUDIOLOGY: IS IT WORTH IT?

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Background/Rationale
Speech audiometry, including its variants in noise, is an integral part of hearing deficits assessment, providing functional insight into real-world communication abilities.The principles used in speech audiometry still valid today have been initiated in the 1930s and word lists currently used in speech audiometry were often designed well before the availability of large computerized lexical databases and therefore are not taking into account several influential factors brought to light by psycholinguistic research. The speech discrimination score is largely used to assess benefit of hearing aids and demands word-lists of equal difficulty, so that the same patient, in the same conditions, would show the same result regardless of the word list used.
We proposed a new procedure for building word lists of similar difficulty, by taking simultaneously into account acoustic, psycholinguistic and psychometric factors. The selection of words was based on psycholinguistic criteria, including the cumulative spoken occurrence frequencies of all phonological forms, phonological neighborhood and distance, and indices of contextual influence. Psychometric curves were obtained for each word, in normally-hearing subjects, allowing further selection. Lastly, the words were spread into different lists, so that each criteria (i.e., psycholinguistic variables; acoustic spectrum for each octave frequency; slopes; contextual influence indexes) were balanced between lists, i.e. same median and same inter-quartile range on every criteria.
The aim of this study was to compare those new word lists (NL), based on such criteria, with the classic “old” French word lists (OL) currently used in clinical practice.

Material and methods
Speech audiometry, in silence, was performed in 48 hearing-impaired patients (mean age: 75.1, SD=4.8), best ear hearing thresholds : 44 dB HL (SD=10.6), using two sets of open set word tests : the classic French bisyllabic word lists, currently used in clinic (OL), and the new lists of bissyllabic word (NL), specifically built using principles summarized above. The order of the sets and lists was counterbalanced between subjects. To evaluate repeatability and list equivalency, 4 ten words lists from each set were presented to each patient, at fixed level corresponding to their speech reception threshold. The order of the different sets and lists were counter-balanced and patients were invited to self-assessed the listening effort they engaged, after each word list, on a visuo-analog scale from 0 to 10. Intra-subject variability in scores was assessed using intra-subject across lists standard deviation (IS_SD).

Results
Intra-subject standard deviation was significantly lower for the NL (5.7, DS=3.0) than the OL (14.2, DS= $F(1,47=97$, $p<0.0001$, analysis of variance for repeated measurement), with a significant interaction with the number of lists considered (2 versus 1 list) ($p<0.0001$). Post-hoc tests with Holm corrections showed that the IS_SD was significantly greater for OL than for NL, even when 2 lists (20 words) were considered for OL versus 1 list (10 words) for NL. Contextual influences, as assessed by Boothroyd & Nittrouer’s j factor, were significantly greater for the OL than the NL ($F(1,47)=29$, $p<0.0001$), shown as well by the significantly lower word score ($F(1,47)=11.5$, $p<0.002$) for NL (54%) versus OL (61%), with a similar score in phonemes.
The NL required significantly more self-assessed listening effort (6.3, SD=1.13) ($F(1,47)=32$, $p<0.0001$) than the OL (5.5, SD=0.99). The IS_SD in listening effort was significantly greater, as well, for OL (0.58) versus NL (0.49) $F(1,47)=4.8$, $p<0.04$.
The minimal detectable change at the individual level (MDC) with 95% confidence level, was calculated from the within-subject standard deviation derived from test–retest differences involving 2 lists (20 words) of each set. The MDC was 30.7% for the OL versus 12.8% for the NL.

Conclusion
The homogenization of word lists according to several acoustic, linguistic and psychometric factors is feasible and could help to reduce substantially the unwanted variability of speech perception scores. In addition, this could help reducing the length of tests, allowing to halve the number of words used without augmenting variability. Although we applied this procedure to word-lists in the French language, it could be equally useful in a wide range of different languages.

Keywords, Speech perception, contextual influence, psycholinguistics, open-set word lists.

184 - LONGITUDINAL CHANGES IN SPEECH-IN-NOISE PERCEPTION, HEARING ABILITY AND WORKING MEMORY IN HEARING AID USERS

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Background: Understanding speech in noisy environments can be a major challenge for individuals with hearing loss, even when using hearing aids. Speech-in-noise (SPIN) perception relies not only on audibility but also on cognitive resources, in particular working memory capacity, which supports the processing and cognitive repair of degraded auditory signals. Furthermore, hearing loss is associated with cognitive decline in older adults. Thus, reduced SPIN perception with increasing age might be driven by changes in either hearing ability, working memory, or a combination of both. However, little is known about the longitudinal dependency of SPIN perception on hearing ability and working memory in older people who use hearing aids, and whether changes in SPIN performance are predicted by changes in hearing ability or working memory capacity in this population.
Aim: To investigate whether longitudinal changes in SPIN perception are predicted by longitudinal changes in hearing ability and/or working memory in older adult hearing aid users.
Methods: A longitudinal study design was employed, involving older adults with hearing aids (age at T1 M = 59.81, SD = 8.59; N = 116) who were assessed at two time points (T1 and T2) separated by, on average, 8.14 years (*SD* = 2.18). SPIN perception was measured using the Hagerman task, a matrix sentence test, in which semantically unpredictable sentences were presented in two background noise conditions (speech-shaped noise and 4-talker babble). Speech-reception threshold (SRT) for 80% correct performance was used as the dependent variable (expressed in dB SNR). Reading span was used as a measure of working memory, and pure tone average (PTA as a measure of hearing ability. To study changes in SPIN over time, and whether changes in hearing ability or working memory capacity predicted this change, linear mixed-effects analysis was used. Predictors of interest included time between test occasions, noise condition (SSN and 4-talker babble), hearing ability and working memory capacity at the start of the study, as well as time-dependent changes in hearing ability and working memory. Age at the start of the study was used as a co-variate.
Results: Compared to T1, SPIN performance at T2 became poorer as indicated by an elevated SRT by 3.95 dB SNR. (*SD* = 3.52). This negative effect interacted with worse hearing ability at T1, such that a participant with above-average PTA4 showed a greater increase in SRT over time. However, neither changes in hearing ability nor changes in working memory capacity were associated with changes in SRT. Thus, worse hearing ability predicts poorer SPIN performance over time, but this decline is not explained by the change in hearing ability itself.
Conclusion: Speech-in-noise perception declined over time in our sample of hearing-aid users. Poor hearing ability at baseline was associated with a greater longitudinal decline in SPIN performance, suggesting that initial hearing status may be related to less favorable longitudinal outcomes. However, longitudinal changes in SPIN performance were not explained by changes in hearing ability or working memory capacity over time. Together, these findings indicate that baseline hearing ability may contribute to differences in long-term SPIN trajectories, while the mechanisms underlying longitudinal change in SPIN remain to be fully understood

Conflict of interest: one or more authors have declared an industry affiliation

214 - A BAYESIAN NETWORK APPROACH TO QUANTIFY SPEECH PERCEPTION DEFICIT COMPENSATION

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Introduction: Hearing impaired patients show high speech perception capacity heterogeneity, which doesn't always correlate with pure-tone thresholds. According to Plomp's model (1978), speech recognition is affected by two components: "Attenuation", a sensitivity loss, which may be compensated by hearing aids (HAs), and "Distortion", related to suprathreshold processing deficit, neural deficit, central auditory processing disorders and impaired cognitive function, which couldn't be fully compensated by HAs. The aims of the study were: 1) quantitative method development to separate sensitivity loss from the central/cognitive contributions into speech perception, and 2) a model creation to predict potential HA effectiveness based on pure tone thresholds and unaided speech test results.

Patients and Methods: The study involved 513 patients (aged 19–93, 403 HAs users), divided into four groups according to their age. Evaluation included otoscopy, impedancemetry, pure-tone audiometry (PTA) and different speech tests sets: mono- and multisyllabic word recognition tests, the Russian matrix sentence test (RuMatrix) in quiet and noise. Speech evaluation in a free sound field (FF) was conducted for HA users without and with HAs to assess HA efficiency.

Non-parametric Bayesian Network (BN) approach was used in order to distinguish the peripheral hearing contribution and the central/cognitive one into speech perception. To this end, audiological methods were divided into the following subgroups: Group A includes PTA (assessment of hearing sensitivity); Group B – speech audiometry in quiet (cognitive compensation for peripheral hearing loss due to linguistic redundancy); Group C – speech audiometry in noise (evaluates the capacity to understand speech in challenging conditions, i.e., evaluates central auditory processing and cognitive abilities). BN was constructed in order to predict speech test outcomes considering only pure tone thresholds, based on partial correlations between PTA and speech test results across the cohort. The discrepancies between patient's speech scores obtained and predicted by the BN, after standardization, were defined as the Speech Perception Deficit Compensation Index (SPDCI). Positive SPDCI indicates effective central/cognitive compensation, negative – its deficit. The second BN was constructed to evaluate the potential HA benefit based on the results of PTA and unaided speech test results [Boboshko, M. Y. et al. Evaluation of speech perception deficit compensation in patients with hearing loss. Int J Audiol. 2025, Sep 8:1-14].

Results: Unaided multisyllabic word recognition in quiet in FF was shown to be reduced; the average Speech Recognition Score (SRS) was 56.4%±29.9%; aided testing showed significant increase in mean SRS to 86.3±16.6%. The average SRS of multisyllabic words in babble noise in FF was 30.9%±24.4% without HAs, and 40.6%±23.3% with HAs. No statistically significant differences were obtained between different age groups, except for the youngest one. Aided RuMatrix test results showed significantly improved intelligibility in quiet 34.4±8.0 dB SPL and noise -4.1±3.8 dB SNR compared to unaided testing: 54.7±9.8 dB SPL and -2.0±3.5 dB SNR respectively.

The actual and PTA-predicted speech test results correlation obtained was just about 0.5, that indicates that only about 50% of speech perception effectiveness is determined by hearing thresholds, the remaining 50% is attributable to central auditory processing and cognitive speech one. SPDCI, calculated considering different tests (in quiet/noise, with/without HAs) showed high consistency (Pearson's coefficient up to 0.84), confirming its high reliability as universal evaluation of compensation, irrespective of the specific test used. The model for predicting aided speech scores from unaided data showed good accuracy, with Pearson correlation coefficients between 0.65 and 0.85. The RuMatrix sentence test demonstrated superior predictive value for HA benefit compared to word tests.

Conclusions: Despite PTA thresholds getting worse with age, speech recognition scores and SPDCI did not demonstrate significant age-dependent differences in the majority of comparisons, emphasizing that compensatory capacity is the function determined not by the age only. The new statistical approach is proposed for differential assessment of peripheral auditory system, central auditory processing, and cognition contributions into speech perception in hearing impaired patients. This method gives an opportunity to identify patients with good or poor cognitive compensation; to make prognosis about potential hearing aids benefit. The approach facilitates more accurate diagnostics and informed management of patients with hearing loss.

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Key words: hearing loss, speech perception, central auditory processing, hearing aids, auditory rehabilitation, Bayesian network

258 - EXPLORING VOWEL PERCEPTION BIASES IN ADULTS – NEW INSIGHTS FROM BEHAVIOR AND NEURAL MEASURES DERIVED USING FAST PERIODIC AUDITORY STIMULATION

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Background

Vowels play a core role in speech communication. Prior research has demonstrated asymmetric perceptual biases favoring focal vowels, which have more extreme articulatory-acoustic properties. The Focal Vowel (FV) bias is observed as a directional asymmetry in discrimination; when presented two vowel sounds, discrimination is easier when perceivers hear a less focal vowel followed by a more focal vowel compared to the reverse direction (Polka & Bohn, 2011). This bias, observed across languages and ages, shows that focal vowels serve as stable perceptual anchors that support vowel processing (Masapollo et al., 2017). Studying FV bias across different languages and developmental stages can reveal how vowel perception is shaped by a complex interplay between acoustic cues and language experience — and how increasing exposure to a language modulates vowel perception preferences over time. Despite extensive behavi evidence for the FV bias, neurophysiological support remains limited, and most studies have used single-speaker stimuli. To address these gaps, we examined the FV bias using multi-speaker stimuli in a standard behavi task and in an electroencephalography (EEG)-based paradigm that is relatively new - Fast Periodic Auditory Stimulation (FPAS; also known as frequency tagging). Frequency tagging is widely used in vision research but has only recently been used to assess speech or auditory perception (Barbero et al., 2021; Bottari et al., 2020; Calce et al., 2024). Frequency tagging has several advantages that make it attractive. It enables investigation of neural responses to natural and variable speech stimuli while also requiring shorter recording sessions (compared to other EEG-based approaches). It can also provide data that is interpretable at the individual level. These factors make it promising for testing infants and children in both clinical and research contexts. The present study explores the FV bias using multiple-speaker behavi tasks and using this novel EEG paradigm.

Methods

Behavi Study: Stimuli — Native English and native French speakers (n= 40) produced the target (French: /e, ø, u, y, œ/; English: /u/) in a carrier phrase; one token per speaker was selected and duration-normalized. The inclusion of multiple French vowels reflects the greater variability of French vowels in terms of spectral energy distribution. *Participants & Procedure* — Twenty-one monolingual English adults completed a same/different discrimination task on four vowel contrasts (French /u/–English /u/, /œ/–/ø/, /u/–/y/, /e/–/ø/). The items within each pair were produced by different talkers; half of the different trials presented the vowels in a less-to-more focal order and half in the reverse order.

EEG Study: Stimuli — The French /u/–English /u/ contrast was selected to begin EEG testing (additional contrasts will be added). Sequences included speaker-varying tokens of one vowel presented at a base rate (3.3 Hz,) with the other vowel embedded at the oddball rate (1.1 Hz). Two sequence types were used (English /u/ vs. French /u/ as oddballs). *Participants & Procedure* — To date, five monolingual English adults listened to sixteen sequences (64.8 s each, presented twice) while EEG was recorded from 32 electrodes.

Results

Behavi Study: As expected, accuracy was higher when vowels were presented in the less focal to more focal direction. For both percent correct and A' scores, the direction effect was significant for each contrast (*t*-test, $p < .05$), except French /e/–/ø/.

EEG Study: Following preprocessing (filtering, down-sampling, segmentation, and artifact correction), frequency-domain analyses of grand-averaged data revealed significant amplitudes at the base and oddball frequencies and their harmonics relative to adjacent frequency bins, which served as noise estimates (Z-score > 1.64). These preliminary results show robust cortical discrimination of French /u/ and English /u/. Signal-to-noise ratios were highest at the target frequencies (signal-to-noise-ratio > 7); this pattern was observed at inddividual levels as well.

Conclusions

The behavi findings replicate prior evidence for the Focal Vowel bias and extend it to a multi-speaker context reflecting more natural listening conditions. Preliminary EEG results show that FPAS is a promising neurophysiological approach for studying vowel perception. How well this method can capture perceptual asymmetries associated with the FV bias remains under investigation. Ongoing behavi and EEG testing for both French and English monolinguals will address this question.

Key words: EEG, frequency tagging, vowel perception, adults

AUDITORY PROCESSING DISORDERS

121 - NEUROPLASTIC BENEFITS OF AMPLIFICATION IN THE TREATMENT OF AUDITORY PROCESSING DISORDER

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Background: An important research finding in the treatment of auditory processing disorder (APD) is the neuroplastic benefit of amplification, with many young users improving to the point where assistive hearing technology is no longer required. Conversely untreated APD has been shown to persist into adulthood.
Methods: In a retrospective study using quantitative and qualitative research methods we investigated improvement in performance on auditory tests by children and adolescents with APD treated with remote microphone hearing aid (RMHA) systems, and duration of use of the hearing systems. The 41 participants were diagnosed with APD and were children at the time of fitting the hearing systems.
Results: All participants found the hearing systems beneficial irrespective of APD sub-type and tests failed. The number of APD tests failed by a sub-group of 26 participants with adequate pre and post assessment data reduced substantially following treatment, indicative of neuroplastic benefit. Six participants did not show improvement though all ceased using their hearing systems. Fifty percent of participants with post-treatment diagnostic reviews no longer met criteria for diagnosis of APD after amplification treatment. On average, participants used RMHA systems for two years and nine months. Children fitted at ages 10-11 years wore their RMHA systems for 13 months less on average than children fitted at younger ages. Optimal average duration of use was estimated on a sub-group of resolved cases as two years and five months though this may be an underestimate.
Conclusions: This study supports other research showing the neuroplastic benefit of amplification in the treatment of APD. On average hearing systems were used for a period of two to three years, but there was wide individual variation as can be expected in a heterogeneous group. Individual differences require that there will always be a wide range of optimal durations of use, with a small proportion potentially needing assistive hearing technology long term. Some researchers contend that APD is primarily an attention, language or cognitive problem. The improvement in hearing ability from a purely auditory treatment in this study supports that the disorder treated was indeed auditory.

Key words: APD, auditory processing disorder treatment, neuroplasticity, assistive hearing technology, remote microphone

122 - QUANTIFYING DEGREE OF DISABILITY IN CHILDREN WITH AUDITORY PROCESSING DISORDER

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Background: There are conventions for quantifying degree of disability for peripheral hearing loss but not auditory processing disorder (APD). The objective of this study was to identify tools with a spread of achievement to help quantify severity of APD in children.
Materials and Methods: The study was conducted in three phases. We reviewed 19 tools; questionnaires, and tests of speech perception in competition. We pilot tested an initial selection on 8 children. We tested 7 tools on 58 children aged 6-11 years, 37 typically developing and 21 diagnosed with APD.
Results: All questionnaires assessed in Phase 3 gave useful results. We found two promising tools that gave a good spread of results potentially suitable for categorising disability; the Teacher Evaluation of Auditory Performance (TEAP) and the Australian Sentence Test in Noise (AuSTIN). The TEAP also correlated well with APD diagnosis.
Conclusions: Behavioural test batteries for diagnosing APD have limitations. Questionnaires contribute to a holistic approach to diagnosis and can assist in planning and monitoring treatment. This study demonstrated that the TEAP questionnaire and AuSTIN test also have potential for quantifying degree of disability in a child's own environment.

Keywords: APD, auditory processing disorder, hearing disability, questionnaires, speech-in-noise

66 - THE ASSOCIATION BETWEEN CENTRAL AUDITORY FUNCTION AND COVID-19 REINFECTION AMONG ADULTS.

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Introduction:
The global COVID-19 pandemic has resulted in substantial morbidity and mortality, with millions of acute infections and thousands of deaths reported since 2020. Beyond the acute phase, COVID-19 has demonstrated long-term health implications, as a considerable proportion of patients experience persistent, post-acute sequelae of COVID-19 (PASC) (Soriano et al., 2022). One of the most frequently reported long-term effects of
COVID-19 includes cochleovestibular symptoms such as dizziness, tinnitus, and otalgia (Ng et al., 2022). A systematic review and meta-analysis identified dizziness (12.2%) as the most common otologic symptom following COVID-19 infection, followed by tinnitus (4.5%) and hearing loss (3.2%) (Jafari et al., 2022). Most studies have found that individuals who experience COVID-19 reinfection have a higher risk of developing PASC compared to those with a single infection, with the risk further increasing as the number of infections rises (Babalola et al., 2025; Bosworth et al., 2023; Bowe et al., 2022; Hadley et al., 2024; Jaramillo et al., 2023).
In this study, we assessed auditory function in participants with one or more prior COVID-19 infections to examine the impact of reinfection on hearing. To the best of our knowledge, this is the first investigation exploring the effects of recurrent COVID-19 infection on auditory function in adults.
Methods:
We recruited 100 adults with confirmed COVID-19 infection (PCR or antigen test) at least four weeks prior to participation. Participants were enrolled through multiple recruitment strategies, including postings on REACH BC, advertisements placed across various locations on the University of British Columbia campus, outreach in hospitals and audiology clinics, and referrals from the Post-COVID-19 Interdisciplinary Clinical Care Network. Each participant underwent a comprehensive audiological assessment, including Wideband tympanometry and reflex, Otoacoustic emission suppression, pure-tone audiometry, speech-in-noise testing, masking level difference (MLD), auditory brainstem response (ABR), and the Multiple Auditory Processing Assessment (MAPA-2).
We investigated the associations between outcomes related to central auditory function and predictors related to COVID infection and participant characteristics. A causal model including the outcomes and a comprehensive set of predictors related to COVID (infection history and symptoms) and other relevant participant characteristics was generated. The causal model was used to determine the sets of predictors that needed to be included in a linear regression model to estimate the causal relationship between specific predictors and outcomes by accounting for other potential confounders. Bayesian linear regression models were used to quantify the probability of the associations between the results of different tests of central auditory function (MLD, ABR, MAPA-2 outcome variables) and predictors such as the number of COVID infections, time since the last COVID infection, and taste loss. All models were analyzed using the "rethinking" software package (McElreath, 2020) implemented for the R statistical programming language (R Core Team, 2017). This package uses the Stan platform for performing Markov Chain Monte Carlo (MCMC) sampling to obtain the
Results:
The results of the statistical analysis showed that participants with more than three COVID-19 infections exhibited lower overall MAPA scores, with pronounced deficits in monaural processing. Infection frequency was weakly associated with MLD or ABR wave latency. However, taste loss during infection episodes was associated with poorer performance in the MLD test. Furthermore, ABR analysis revealed prolonged III–V interwave latency in participants with a history of taste loss.
Conclusion:
Our findings suggest that recurrent COVID-19 infection is associated with impairments in central auditory processing in adults. In particular, taste loss during COVID-19 infection was associated with poorer MLD performance and prolonged III–V interwave latency, indicating potential brainstem involvement that warrants further investigation.
Keywords: COVID-19, Masking Level Difference (MLD), Multiple Auditory Processing Assessment (MAPA-2), Auditory Brainstem Response (ABR).

142 - SPEECH-IN-NOISE PERCEPTION IN KINDERGARTEN CHILDREN : DIFFERENT NOISES, DIFFERENT TRAJECTORIES.

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Background and rationale

Hearing screening is aimed at identifying hearing deficits in silence, related to problems mostly in the peripheral auditory system. However, this leaves the hearing difficulties occurring specifically in noisy environments underdiagnosed in children with otherwise normal auditory thresholds. Such difficulties in speech perception in noise are often associated with speech language impairments and certain forms of dyslexia and are identified in association with those diagnosis, i.e. rarely before 8 years of age.
Using a picture-based four-alternative forced-choice test (Audimages), we showed the neurodevelopmental trajectory of speech perception in babble noise (BN) in primary school children and the potential use of such test for screening specific difficulties in noise (Ginzburg et al., 2025). Here, we explore specifically the feasibility of such test in 5 years old children, and differences in speech perception in two types of noise : a BN and a speech-shaped noise (SN) of the same spectrum as the BN.

Material and methods

A general health screening, including hearing screening, is normally undertaken in all schools in France, for 5 years old children. This health screen involves pure tone audiometry and a neuropsychological screening battery for learning difficulties (BSEDS), including vocabulary test and attention test. Fifty-five children, 5.3 years old (+/- 1) from 3 different schools, from various socio-economic backgrounds, participated.
The Audimages test was presented on a computer tablet and the perception task consisted in identifying a word presented binaurally via headphones amongst 4 pictures. The pictures were specifically designed for young children to be recognized easily. Each word was presented in 2 conditions differing by difficulty level, based on phonological distance. Twelve sets of 4 words were combined, so that each block comprised 4x12 trials randomly presented. The answer of the child, by a tap on the screen, triggered the next trial. The children were instructed to guess the word heard or to choose at random if they couldn't identify the word.
First, a picture recognition test involving all the pictures in the test was performed. Then, after a training block of 6 trials, 4 different blocks of 48 trials were presented, differing by the type of continuous background noise (BN or SN), presented at +9 and +3 dB signal to noise ratios (SNR).

Results

All the pictures were easily recognized by the children, except one, that was recognized only at 50%. The average time taken for one block was 115 seconds (+/- 14). No significant correlation was observed between speech perception scores obtained with the Audimages and vocabulary scores.
With an SNR of 3 dB, highly significant differences between BN and SN (68.5% +/- 11.3 versus 76% +/- 11), and between difficulty levels were obtained ($F(1,43)=132$, $p<00001$, $\eta 2=0.75$), without significant interactions between noise type and difficulty level. The difference in scores between speech noise and cocktail party noise correlated significantly with age in months ($r=0.42$, $p<0.005$) in the difficult conditions, not in the easy condition ($r<0.1$, p ns). Speech in noise perception scores were lower for children identified with potential learning difficulties with the BSEDS.

Conclusion

The absence of correlation between Audimages scores and vocabulary test scores makes the Audimages a good tool to screen for speech in noise hearing difficulties independently from the child's lexical knowledge. The Audimages test is an easy and quick test to implement as a screening tool in 5 years olds. However, differential trajectories in SN and in BN with age, and in conditions linked to phonological distance, need to be taken into account to establish specific normative data for a tool for screening purposes.

Reference

Ginzburg, J., Fornoni, L., Aguera, P.E., Pierre, C., Caclin, A., Moulin, A., 2025. Development of auditory cognition in 5- to 10-year-old children: Focus on speech-in-babble-noise perception. Child Dev 96, 407–425. https://doi.org/10.1111/cdev.14178

Key-words

Speech-in-noise; Phonological distance; Speech language impairment; neuro-development; babble noise

236 - IDENTIFICATION AND TREATMENT OF DICHOTIC DEFICITS IN CHILDREN

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This presentation is a review of data from clinical and school-based assessment of dichotic listening performance with the Randomized Dichotic Digits Test and the Dichotic Words Test and treatment of children with significant deficits with Auditory Rehabilitation of Interaural Asymmetry (ARIA). Over 800 children were assessed with each dichotic test from which age-appropriate cut-off values were developed using non-parametric statistical methods. Cut-off values were applied to data from more than 1,500 children assessed with both tests to identify deficits from each test. Performance characteristics from each test were used to characterize amblyaudia, dichotic dysaudia, or amblyaudia plus, the three common dichotic deficit patterns. Children were identified with dichotic deficits when score patterns matched across the two tests. Percentile ranks for deficit scores across the two tests were used to rank the severity of dichotic deficits in each child. Prevalence rates of moderate and severe dichotic deficits from school testing typically developing schoolchildren and children referred for clinical auditory processing assessment will be discussed.

Children identified with significant dichotic deficits participated in one four-week session of ARIA conducted in an audiometric sound booth with stimuli presented from sound field speakers. Pre- and post-ARIA scores from dichotic tests and other behavi measures, including the Frequency Pattern Test, Words in Noise Test, LiSN-S, Forward and Backward Digits from the TAPS-4, and C-TOPP were analyzed for significant differences before and after therapy. Effects of deficit type and severity, site location, and age on behavi outcomes were analyzed.

Children demonstrated significant improvements in dichotic performance with many achieving age-appropriate scores after one four-week intervention with ARIA. Greater severity was linked to larger improvements, highlighting the adaptive nature of the treatment. Children also demonstrated significant improvements in other untrained measures, including listening in noise, working memory, and phonological processing.

Hearing healthcare can benefit from utilizing the principles behind precision medicine that direct clinicians to avoid a one-size-fits-all approach and to modify services to specifically identify and treat individual deficits in hearing and auditory processing. Our assessment with improved dichotic listening tests maps asymmetry and integration performance between the listener's two ears, creating a neural listening profile that captures the binaural integration pattern for each child. We then stratify children according to their specific dichotic deficit subtype derived from quantitative performance and match them with the most effective ARIA training protocol. The ARIA protocol is a targeted, deficit-specific auditory therapy that uses adaptive, contralateral suppression and constraint-induced tasks to strengthen binaural mechanisms in the brainstem neurophysiologic pathway of the auditory system. Intensity adjustments throughout training and task progression are personalized according to each child's performance characteristics. Our aggregate anonymized performance data across this large, multi-site cohort helps us identify developmental trajectories of binaural integration performance following participation in ARIA and monitor generalization of benefits across other untrained skills related to speech perception, working memory, attention, and phonological processing. Our laboratory is currently assessing and treating children across all grade levels in several schools where we will include pre- and post-ARIA standardized measurements of academic achievement and gather data from the state health department related to lead exposure. Our long-term goal is to demonstrate the benefits of precision identification and treatment of dichotic deficits and advocate for its universal implementation across the school-age pediatric population. This same approach may provide similar benefits among adults with complaints of difficulty understanding despite normal hearing, children with hearing aids and cochlear implants who are unable to move into mainstream education, and older adults with bilaterally symmetrical hearing losses who are dissatisfied with binaural amplification.

317 - AUDITORY HYPERSENSITIVITY IN AUTISM SPECTRUM DISORDER: SEX DIFFERENCES IN PERCEPTION AND BEHAVIORAL RESPONSES

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Background
Auditory hypersensitivity, often conceptualized as reduced sound tolerance, represents a clinically significant dimension of sensory functioning in individuals with autism spectrum disorder (ASD). While peripheral hearing is typically within normal limits, many children with ASD report discomfort or distress in response to everyday acoustic stimuli. These reactions may include both altered perceptual tolerance and distinct behavioral patterns. Understanding how auditory hypersensitivity manifests across sexes may contribute to more individualized diagnostic interpretation and patient-centered care within audiological and interdisciplinary settings.

Materials and Methods
This ongoing observational diagnostic study includes children with a confirmed diagnosis of autism spectrum disorder (ASD). The study does not involve therapeutic intervention.
All participants undergo comprehensive audiological assessment to exclude peripheral hearing impairment and to characterize sound tolerance. The audiological protocol includes pure-tone audiometry, immittance audiometry, and measurement of uncomfortable loudness levels (UCL) to evaluate perceptual tolerance to auditory stimuli.
In addition to objective audiological measures, auditory hypersensitivity is assessed using standardized questionnaires completed by parents or caregivers and, when feasible, by the child. These tools address everyday listening experiences, auditory discomfort, and functional impact in real-world environments.
A structured caregiver interview is conducted using a standardized form to obtain qualitative information regarding observable behaviors, coping strategies, and situational triggers related to sound intolerance. The interview complements questionnaire data and allows for a more nuanced characterization of behavioral expression in acoustically challenging contexts.

Results
Preliminary observations indicate that a substantial proportion of participants demonstrate reduced sound tolerance despite normal peripheral auditory thresholds. UCL measurements suggest variability in perceptual tolerance that is not explained by peripheral hearing status alone.
Behavioral responses to auditory stimuli appear heterogeneous. Sex-related patterns have been observed in the mode of behavioral expression. Girls more frequently demonstrate internalizing or avoidance-oriented reactions, such as withdrawal, covering the ears, or seeking proximity to caregivers. Boys more often exhibit externally expressive responses, including heightened motor activity or impulsive reactions when exposed to similar auditory conditions.
These findings suggest that perceptual tolerance and behavioral manifestation of auditory hypersensitivity may represent partially distinct yet interacting dimensions of auditory functioning.

Conclusions
Preliminary findings support the presence of heterogeneous auditory hypersensitivity profiles in children with autism spectrum disorder, with sex potentially influencing both perceptual sound tolerance and behavioral expression. Comprehensive audiological evaluation, including assessment of uncomfortable loudness levels alongside caregiver-reported and observational data, may enhance diagnostic accuracy and interdisciplinary understanding of reduced sound tolerance in this population. Final conclusions will be drawn following completion of recruitment and comprehensive statistical analyses.

Keywords:
auditory hypersensitivity; autism spectrum disorder; reduced sound tolerance; uncomfortable loudness level; sex differences

EPIDEMIOLOGY I

254 - EARLY CHILDHOOD HEARING IMPAIRMENT IN NORWAY: A NATIONWIDE EPIDEMIOLOGIC STUDY ON INCIDENCE AND PATIENT CHARACTERISTICS

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Background/rationale
Reported occurrences of hearing impairment (HI) in children varies widely, affected by differences in study populations and outcome definitions. Sampling methods may introduce bias, and unilateral cases are not always included. We aimed to comprehensively study the incidence of HI in children aged 0–5 years old both overall and stratified on patient characteristics, by making use of the potential in complete national health registry data in Norway.

Materials and methods
This cohort study included all children born in Norway 2013-2021 (n=521, 550). Using individual-level data linkage of the Norwegian population registry, Statistics Norway, and the Norwegian patient register, we studied the occurrence of HI in children based on their visits to specialized health-care services with a diagnostic code for HI (International Classification of Diseases, 10th Revision chapters: H90 Conductive and sensorineural hearing loss, H91 Other hearing loss, and Q16 Congenital malformations causing impairment of hearing). Our outcome was defined as having at least three health care visits for HI to avoid false positives. Children were included at birth and observed until their sixth birthday, death, emigration, or the end of our study period (2022), whichever came first. The minimum required observation time was one year. Cumulative incidence of HI was calculated overall, by type and laterality, and stratified on background variables sex, family income status, and parents' country background.

Results
Preliminary results show a total cumulative incidence of HI of 1.9 per 1000 (95% CI 1.8-2.0) children under six months old, and 4.3 per 1000 (CI 4.1-4.5) children under six years old. Sensorineural HI was the most common. Cumulative incidence was significantly lower ($p<0.01$) among girls than boys, with results under six years old at 3.8 (CI 3.5-4.0) vs 4.8 (CI 4.5-5.1) per 1000. It was also found to be lower for children with parents' country background from other European countries than in those with Norwegian background, with results under six years old at 3.4 (CI 2.9-3.8) vs 4.5 (CI 4.2-4.7) per 1000. No significant differences were observed by family income status.

Conclusions
This study is the first to comprehensively report on the incidence of early childhood HI in Norway. Our results correspond with studies from other highly developed countries. We hypothesize that no differences in incidence based on family income status is a sign of equal health care, as repeated screening and follow-up are parts of standard care and free to the patient in Norway. Further research is needed to better understand differences based on country background.

Keywords
childhood hearing impairment, incidence, identification, patient characteristics

188 - HEARING AID UPTAKE AND SOCIO-EMOTIONAL WELLBEING OVER TIME: EVIDENCE FROM A TARGET TRIAL EMULATION

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Background
Hearing impairment can negatively impact socio-emotional wellbeing. While hearing aids (HA) may improve hearing ability, communication, social participation, and emotional wellbeing, longitudinal studies are scarce and evidence quality is low. This longitudinal study examines the associations between (Research Question [RQ] 1) HA uptake and socio-emotional wellbeing, mediation by self-perceived hearing disability, and differences between subgroups, namely young-middle age adults (≤65 years) vs. older adults (>65 years), adults with tinnitus vs. no tinnitus, adults with hyperacusis vs. no hyperacusis, men vs. women; (RQ2) frequency of HA use (daily number of hours) and socio-emotional wellbeing; and (RQ3) duration of HA use (years of use) and socio-emotional wellbeing.

Methods
We used data collected in the Netherlands Longitudinal Study on Hearing from October 2006 until January 2024. This cohort study includes adults across the full range of hearing ability. Every 5 years, participants are invited to complete an online digits-in-noise hearing test and survey, which includes variables on HA use, psychosocial health, tinnitus, hyperacusis and self-perceived hearing disability. The current study emulated a randomized controlled trial. For RQs 1 and 2, cumulative data from three 5-year intervals (baseline to 5, 5 to 10 and 10 to 15 year follow-up) was compiled, based on eligibility for a HA at the beginning of the studied time interval but not using it at that time and either reporting HA use (HA uptake) or no HA use (no HA uptake) at follow-up (RQ1) and frequency of use (RQ2) at follow-up. Differences between those who adopted a HA versus those who did not were examined while controlling for pre-(non)uptake socio-emotional outcomes. After applying exclusion criteria, final samples included n=281 unique participants for RQ1 and n=280 for RQ2. For RQ3, participants with 5, 10, or 15 years of HA use were identified and analyzed to assess the impact of long-term use, with n=180 unique participants in the final dataset. Outcomes assessed for each RQ were depression, anxiety, distress, somatization, social loneliness, emotional loneliness, and total loneliness. Gamma regression models with Generalized Estimating Equations were performed to analyze all RQs. Directed Acyclic Graphs were constructed to correct for possible confounders like age, sex, educational level, health status and speech reception thresholds.

Results
Approximately 87% of participants were ≤65 years of age at T0. Among individuals without tinnitus, HA uptake was significantly associated with lower depression scores: -1 on a scale of 0 to 12 ($p<0.001$). Among those aged >65 years, HA uptake was significantly associated with lower total loneliness scores: -0.2 on a scale of 0 to 11 ($p<0.001$). No significant associations were found between HA uptake and anxiety, somatization, distress, and emotional loneliness. Self-perceived hearing disability did not mediate the relationship between HA uptake and socio-emotional wellbeing outcomes. No significant associations between duration of HA use and socio-emotional wellbeing outcomes were found. Frequency of HA use was not significantly associated with any outcome except somatization, where using a HA for 1-4 hours per day was significantly associated with lower somatization scores: -2.2 on a scale of 0 to 32 ($p=0.02$).

Conclusion
This longitudinal study contributes valuable evidence to the growing body of research on the psychosocial benefits of HAs, highlighting both the potential and the limitations of device use in improving wellbeing. Results suggest that audiologists might consider integrating psychosocial support as part of a comprehensive treatment approach beyond simply recommending HA adoption or increased usage.

Keywords: hearing aid, duration of use, frequency of use, mental health, loneliness.

62 - HIGH QUALITY ASSURANCE IN DUTCH NICU HEARING SCREENING: MORE THAN 25 YEARS OF EXPERIENCE

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Background/Rationale: Early identification of neonatal hearing loss (NHL) and timely interventions are important for optimizing developmental outcomes. We aimed to evaluate more than 25 years of quality assurance of the newborn hearing screening program (NHSP) in Dutch neonatal intensive care units (NICU).
Materials and Methods: In the Netherlands, following a successful implementation phase (October 1998–December 2002), hearing screening became standard practice in all NICUs from 2003 onward. Data from the nationwide two-stage Automated Auditory Brainstem Response (AABR) screening and diagnostic examinations were centrally registered and included in this analysis. Centralized registration enabled systematic screening, tracking, and follow-up. Outcome measures included the prevalence of NHL and trends in coverage rates and timeliness of follow-up corrected for gestational age across three periods: 1998–2002 (period 1, implementation phase), 2003–2013 (period 2), and 2014–2024 (period 3).
Results: Of 100,290 neonates, 92,817 survived the admission period. Unilateral NHL was diagnosed in 649 neonates (0.7%) and bilateral NHL in 1,773 (1.9%). From period 1 to period 3, coverage of first stage screening increased from 98.6% to 99.2%; second stage screening from 90.8% to 96.8%; and diagnostic examination from 92.2% to 95.2%. Timeliness of follow-up corrected for gestational age improved at later steps: the proportion receiving the first AABR within 1 month remained stable (95.7%-95.8%), while completion of the second AABR within 6 weeks increased from 79.4% to 87.4%, and diagnosis within 3 months from 59.7% to 75.1%.
Conclusions: Over more than twenty-five years, the NHSP in Dutch NICUs has achieved high and improving coverage and timeliness. Centralized registration, benchmarking, and annual national meetings for feedback, training and NICU quality awards have supported this progress. Adaptation in protocols and screening devices have likely further enhanced program quality.

Keywords: neonatal hearing screening, NICU, quality assurance, coverage, timeliness

95 - LIFE-COURSE SOCIAL FACTORS CONTRIBUTE TO IMPROVED HEARING IN SWEDISH 70-YEAR-OLDS ACROSS FOUR DECADES

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Background
With increasing life expectancy, age-related hearing loss is emerging as a growing public health concern. A Swedish population-based study has demonstrated substantial improvements in hearing among 70-year-olds over four decades, with the prevalence of hearing loss decreasing from 53% to 28% in men and from 37% to 23% in women. Improvements were seen at most frequencies, but the factors underlying these cohort differences remain unclear. The aim of this study was to investigate whether modifiable social, lifestyle, and health-related factors contribute to better hearing in more recent cohorts of Swedish 70-year-olds.
Materials and Methods
This repeated cross-sectional study used data from the Gothenburg H70 Birth Cohort studies and included two population-based cohorts of 70-year-olds, born in 1901–1907 (n = 674) and 1944 (n = 1114). Audiometric, demographic, and health data were obtained from examinations conducted in the 1970s and 2014. Hearing was assessed using pure-tone audiometry, with outcomes defined as PTA4 (pure tone average 0.5, 1, 2, and 4 kHz), PTA3 (pure tone average 0.5, 1 and 2 kHz), and high-frequency hearing in the better ear. Mediation analyses were used to quantify how much of the cohort difference in hearing could be attributed to cohort-related differences in modifiable factors. Educational level, occupational group, smoking habits, and systolic blood pressure were examined as mediators. Sex was included as a covariate, with additional sex-stratified analyses.
Results
After adjustment for sex, the 70-year-olds examined in 2014 had on average 6.2 dB better PTA4 hearing than those examined in the 1970s. Differences in educational level, occupational group, and smoking habits together explained 35.9% (2.2 dB) of this cohort difference, with educational level as the primary mediator (1.19 dB). For PTA3, cohort differences were slightly smaller but showed a similar pattern, with educational level and occupational group jointly explaining approximately one-third of the total effect. No significant mediation effects were observed for high-frequency hearing. In sex-stratified analyses, cohort differences in PTA4 were larger in men (7.7 dB), where occupational group explained approximately 10% of the difference, whereas in women cohort differences were smaller (4.8 dB) and educational level explained about one-third of the difference (1.6 dB).
Conclusion
Improved hearing among more recent cohorts of 70-year-olds appears to be partly explained by modifiable social and lifestyle factors, particularly higher educational attainment, more favorable occupational conditions, and reduced smoking. The relative importance of these factors differed by sex, with education playing a larger role among women and occupational group among men. These findings highlight the potential for life-course social and behavi factors to influence hearing in older age and support preventive strategies targeting education, working conditions, and smoking to promote healthy hearing across the lifespan.

Keywords: epidemiology, age-related hearing loss, socioeconomic factors, mediation analysis, smoking

208 - ACADEMIC PERFORMANCE AND PREDICTIVE FACTORS AMONG DEAF AND HARD OF HEARING PRIMARY SCHOOL CHILDREN: FINDINGS FROM A POPULATION-BASED COHORT

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Background: Children who are deaf or hard of hearing (DHH) are at elevated risk of poorer developmental and educational outcomes relative to hearing peers, despite widespread uptake of universal newborn hearing screening (UNHS) and improvements in early intervention. Evidence describing the population distribution of academic performance in DHH children and identifying factors associated with low achievement remains limited, with most studies based on selected clinical or educational samples. Population-based data are needed to inform surveillance, risk stratification, and service planning.
Objectives: To quantify academic performance in DHH children aged 9–12 years and to identify demographic, clinical, and educational characteristics associated with differences in academic achievement across domains.
Methods: We analyzed data from the Victorian Childhood Hearing Longitudinal Databank (VicCHILD), a population-based cohort enrolling children with permanent hearing loss in Victoria, Australia. Participants completed the Wide Range Achievement Test, fourth edition (WRAT-4) for Word Reading, Spelling, and Mathematics (mean=100, SD=15). Univariable linear regression estimated differences in mean WRAT scores by child characteristics (gender, prematurity, non-verbal IQ, comorbidities), hearing factors (degree, laterality, type of loss, device), educational variables (school setting, early intervention), and family characteristics (maternal education, language spoken at home, and socioeconomic disadvantage).
Results: Of the 1,300 VicCHILD participants, 217 were eligible for the final timepoint assessment and 148 completed the WRAT-4. The sample contained equal numbers of males and females (n=74 each), with a mean age of 11.2 years (SD 0.82). Most participants had bilateral hearing loss (76.8%) with a relatively even distribution across degrees of loss (mild: 24.5%; moderate: 25.9%; severe: 14.9%; profound: 26.5%). Nearly half used hearing aids (49.3%), 20.2% used cochlear implants, and 21.6% used no device. 69.4% attended mainstream school.
Mean scores across all WRAT domains were below normative expectations, with greatest difficulty observed in Mathematics. Almost half of participants (46.5%) scored more than one standard deviation below the normative mean on Mathematics, compared with 26.2% for Word Reading (26.2%) and 25.7% for Spelling. Non-verbal IQ was positively associated with all academic domains, with each one-point increase in IQ associated with higher scores in Spelling (0.62 point increase, 95% CI 0.43–0.81), Mathematics (0.55 point increase, 95% CI 0.41–0.70), and Word Reading (0.46 point increase, 95% CI 0.30–0.62). The mean WRAT score decreased with each additional comorbidity for Spelling (2.67 points lower, 95% CI −5.32 to −0.03) and Mathematics (2.34 points lower, 95% CI −4.32 to −0.36). Compared with mainstream settings, children attending specialist schools had substantially lower performance across all domains (reductions of 25-37 points in WRAT standard scores).
Degree of hearing loss, laterality, maternal education, early intervention participation, and hearing device type were not predictive of WRAT scores. Notably, children with moderate and severe hearing loss had, on average, higher academic scores than those with mild hearing loss, with mean differences of approximately 1–4 points for moderate loss and 2–6 points for severe loss across WRAT domains. This pattern aligns with literature suggesting that children with mild hearing loss may have unmet educational needs despite less clinical visibility and fewer support services.
Conclusions: In this population-based cohort, DHH children demonstrated lower academic performance than normative expectations, particularly in Mathematics. Predictors of low achievement included cognitive and developmental factors rather than audiological severity. Mild hearing loss may represent an under-recognised risk state for academic underperformance.
Implications for Public Health and Services: These findings indicate an unmet educational burden among DHH children despite early identification and contemporary management. Population-level monitoring of academic performance in DHH children, including those with mild loss, may enhance early detection of learning difficulties. Multidisciplinary developmental assessment and better integration between health and education services may support targeted interventions. Numeracy warrants particular attention within early educational and intervention pathways. Findings inform service planning, resource allocation, and strategies to reduce disparities in educational attainment for DHH children.
Keywords: population-based cohort; academic outcomes; risk factors; developmental epidemiology; deaf or hard of hearing children

112 - A NOVEL METHOD FOR ESTIMATING THE GROUP IN NEED OF HEARING AIDS

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In the recent world report on hearing the WHO estimates that about 20% of the world population suffers from hearing loss to some degree out of which mild hearing loss accounts for about 15 %. WHO has traditionally defined Disabling hearing loss as a loss worse than 40 dB PTA. In the paper "Global and regional needs, unmet needs and access to hearing aids" by A. Orji et al, (IJA 2020) the authors define that the group "in need" of hearing aids have moderate loss or worse (PTA>35). Both definitions leave out the very large group of people with mild hearing loss. In the paper "A model for estimating hearing aid coverage world-wide using historical data on hearing aid sales" by N. Bisgaard et al, (IJA 2021) it is shown that both definitions of "in need" leads to a coverage above 100 % for several countries primarily in North-Western Europe. From the EuroTrak surveys and work by L. Humes et al. (Trends in Hearing, 2024) it is known that some proportion of the group with moderate hearing loss are not using hearing aids while a fair amount of people with mild hearing loss do. It is even found that some proportion of people with "normal" hearing express a need for hearing aids
The question thus is how we can estimate the proper percentage of people in need of hearing aids. Worse than moderate hearing loss is a percentage too little and adding the total group with mild losses is probably too many. The EuroTrak surveys have for years reported what can be referred to as Self-Reported Hearing Loss (SRHL) that is assessed by asking individuals if they consider hearing loss one of their health problems. Across 18 countries, SRHL prevalence ranges from 5% to 12.5%, which is about half the prevalence of all hearing loss (from mild to profound). This suggests that only a portion of those with measurable hearing loss perceive it as a significant issue.
Hearing aid coverage against prevalence of SRHL in the EuroTrak surveys reach up to 60 % which seems reasonable given that many with a recognized need still refuse hearing aids as it can be deducted from the EuroTrak surveys.
SRHL is though influenced by cultural factors; for example, Japan, despite having the world's largest percentage of elderly people, reports only 10% SRHL. It is desirable to be able to couple the prevalence of SRHL or some other equivalent measure to more objective data such as demographic data or data on PTA hearing loss as it has been estimated globally by the Global Burden of Disease enterprise. This would also overcome the problem that consistent survey results are only available for a limited number of countries.

The presentation will show some preliminary analysis results on how to estimate the prevalence of people with a conscious need of hearing rehabilitation from various data sources.

Key words: hearing loss, subjective need, hearing aid uptake, survey data

Conflict of interest: the author has declared an industry affiliation

147 - CHARACTERISTICS OF HEARING LOSS AND REHABILITATION NEEDS IN MILITARY PERSONNEL AFTER COMBAT-RELATED BLAST TRAUMA: A RETROSPECTIVE ANALYSIS IN A UKRAINIAN SAMPLE

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Background. Modern warfare involving high-energy explosive weapons results in a high burden of polytrauma among military personnel. Limb injuries and amputations are increasingly common in Ukraine due to increased prevalence of blast exposure, delayed evacuation, and prolonged tourniquet use (Samarskiy et al., 2024), as well as infection and frostbite. Immediate traumatic amputations typically indicate close proximity to the explosion epicenter, whereas delayed amputations are often related to ischemic or tourniquet-associated complications and may not reflect blast intensity (Shapira et al., 2025).
The auditory system is highly vulnerable to blast overpressure, and hearing loss and tinnitus are among the most prevalent service-connected conditions in military populations, commonly presenting as high-frequency sensorineural hearing loss with functional and psychosocial consequences (Theodoroff & Konrad-Martin, 2020; Wells et al., 2015; Jain et al., 2024). Amputees undergo extensive surgical procedures, prolonged antibiotic treatment, and experience significant psychological and social burden. In this context, concomitant hearing loss or tinnitus may further impair rehabilitation, functional independence, and social reintegration.
Despite extensive research on both combat-related amputations and military-associated hearing loss, hearing outcomes are rarely evaluated in amputee populations. Consequently, it remains unclear whether immediate traumatic amputation is associated with distinct hearing loss characteristics, providing the rationale for the present study.
Objective. To compare the characteristics of hearing loss between patients with traumatic limb amputation due to blast trauma and those with limb salvage or delayed amputations and to determine their rehabilitation needs.
Methods. A retrospective review of the medical records of 682 soldiers with the diagnosis of combat-related blast injury treated at the Superhumans War Trauma Center, Ukraine in 2025 was conducted. The inclusion criteria were: active-duty military personnel, documented combat-related blast injury, available post-injury otologic examination and pure-tone audiometry; the exclusion criteria consisted of an absent audiogram, known hearing impairment before trauma, diagnosed chronic ear disease. For the purposes of analysis, the patient sample was divided into two groups: those with blast-related injuries who sustained immediate traumatic limb amputation at the time of injury, and the control group of patients with blast-related injuries without immediate limb amputation, including those who either did not undergo amputation or required delayed amputation during subsequent treatment. The traumatic amputation group included 274 male servicemen aged 20-61 years (mean age 37 ± 8.0 years). The control group comprised 235 male servicemen aged 20-64 years (mean age 37 ± 8.5 years). Clinical data, including history of hearing loss and tinnitus, otoscopic findings, and pure-tone audiometry results, were retrospectively reviewed from patients' medical records. Hearing rehabilitation strategies, such as surgical intervention and hearing aid fitting, were analyzed. Categorical variables were analyzed using the chi-square test of independence. Continuous variables were tested for normality and, due to non-normal distribution, were compared using the Mann-Whitney U test.
Results. No statistically significant differences were observed between the groups in the incidence of tinnitus (70.1% vs. 71.9%, p = 0.64), tympanic membrane perforations at least at one ear (38.7% vs. 41.7%, p = 0.51), laterality, degree or type of hearing loss. In contrast, a significantly higher proportion of patients in the traumatic amputation group required tympanoplasty (86.3% vs. 68.7%, p = 0,0003). Spontaneous tympanic membrane healing was lower in the traumatic amputation group compared with the control group (11.9% vs. 27.6%, p = 0,016). Conversely, the need for hearing aid fitting was higher in the control group (39.6% vs. 27.9%, p = 0.023).
Conclusion. These findings highlight that hearing impairment should not be overlooked in the context of severe limb trauma, particularly in patients with immediate traumatic amputations following blast exposure. Early and systematic otologic assessment should be integrated into multidisciplinary trauma care to optimize functional recovery. Further prospective studies are warranted to clarify underlying mechanisms and to develop tailored hearing rehabilitation pathways for military personnel following blast-related injuries.
Keywords: hearing loss, blast injury, military personnel, limb amputation, acoustic trauma.

242 - RISK FACTORS OF HEARING LOSS IN INFANTS ADMITTED TO NEONATAL INTENSIVE CARE UNITS: A SCOPING REVIEW

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Background/Objectives: Hearing loss is up to ten times more common among neonatal intensive care unit (NICU) and special care nursery (SCN, also known as special care baby units or level II neonatal units) graduates than in well-baby populations. Although numerous “risk factors” have been reported, the term is often used broadly and without clear definition, and the causal relevance of these factors remains unclear. As a result, little progress has been made in translating existing evidence into preventive strategies. Previous reviews have examined the aetiology of paediatric hearing loss, but no study to date has comprehensively synthesised all reported “risk factors” specific to NICU/SCN populations worldwide. As a first step toward understanding the causes of NICU/SCN related hearing loss and their effects, it is necessary to synthesise and critically examine the reported risk factors. This study aimed to (1) synthesise reported risk factors and their associations with hearing loss in NICU/SCN infants, (2) evaluate the strength of evidence supporting these associations, and (3) assess their causal relevance.

Methods: We conducted a scoping review in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR) guidelines. Embase, Medline, APA PsycInfo and Web of Science were searched from 1 Jan 2015 to 11 Mar 2025. We included studies of NICU/SCN graduates reporting hearing outcomes assessed by newborn hearing screening or diagnostic audiology from birth to <16 years, to capture late-onset (i.e. neonatal factors linked to progressive hearing loss and later detection). Reported factors were classified into a three-tier system: individual factors, categories and broad domains, based on subject matter knowledge to enable clear reporting and synthesis. We summarised associations from analyses that attempted to reduce confounding through study design or statistical adjustment, and we evaluated risk factors with causal support (defined as randomised controlled trials or cohort studies estimating causal effects). We also appraised the evidence of risk factors at category-level using criteria adapted from The Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework.

Results: Of 2,537 records screened, 96 studies met inclusion criteria, identifying 141 unique risk factors organised into six domains (environmental; genetic and structural; maternal; neonatal procedure; neonatal condition; ototoxic medication), with these domains further divided into 32 categories. All included studies reported risk factors among NICU graduates; no studies focused specifically on SCN cohorts. The most frequently studied domain was neonatal condition (79.2%). The five most examined categories were maturity and growth (45.8%), hyperbilirubinemia-related factors (39.6%), respiratory support (36.5%), perinatal hypoxia-ischemia (35.4%), and acquired infection (31.3%). The most studied specific risk factors were birthweight (38.5%), hyperbilirubinemia (25.0%), Apgar score (24.0%), sepsis (21.9%), and male sex (20.8%). Most studies were observational (87.5%) and commonly restricted to subgroups such as preterm or low-birthweight infants (67.2%). Nearly one-third (27.4%) reported on screening rather than diagnostic audiology outcomes. Reporting quality was variable: 44.2% presented descriptive analyses without inferential statistics, and 65.3% did not adjust for confounding. No adjusted analyses evaluated categories of NICU noise, care intensity, surgery, or non-bilirubin metabolic factors. Reported associations and effect sizes were heterogeneous within individual categories. Some causal support was identified for perinatal hypoxia-ischemia, neonatal encephalopathy with seizures, postnatal cytomegalovirus infection, and vancomycin dosing. Across risk-factor categories, studies using prospective/trial designs or analyses that addressed confounding were uncommon, and follow-up data were least frequently reported, limiting the credibility of evidence when synthesised across categories.

Conclusions: The contemporary evidence base on “risk factors” for hearing loss among NICU graduates is broad but methodologically heterogeneous, with the term “risk factor” often used in a broad and ill-defined manner, limiting confidence in reported associations and effect sizes. While many potential determinants have been identified, robust evidence for causal effects remains limited. Future research should prioritise causal inference approaches to estimate the effects of modifiable exposures on hearing loss in NICU/SCN graduates, and to guide preventive interventions for this high-risk population.

Keywords: Neonatal intensive care unit (NICU), Childhood hearing loss, Risk factors, Causal evidence, Prevention

EPIDEMIOLOGY II

263 - SCREENING OF PREGNANT WOMEN AND NEONATES FOR STORCH DISEASES IN SELECTED HIGHLY DEVELOPED COUNTRIES OF THE WORLD

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Background
STORCH diseases are a group of infections that are of particular importance during pregnancy due to the risk of transmission to the fetus. Infection with a STORCH disease can occur at any time in a person's life. Acquired infection often runs a mild or asymptomatic course, while congenital infection in the fetus can cause a number of serious consequences. Viral infections, particularly cytomegalovirus (CMV), cause up to 40% of all congenital hearing loss. Typically, STORCH diseases cause sensorineural hearing loss (SNHL).
Material and methods
The databases of PubMed, Google Schoolar and the official government websites of each country in obtaining information on STORCH disease infections were searched. Finally, 80 items were included in the analysis.
Results
Based on the collected material, the analysis was divided in terms of specific STORCH diseases. Countries that implement or have an existing screening program for a particular disease entity are presented.
Conclusions
Screening for STORCH diseases is important in prenatal care, but its implementation depends on a number of factors, such as the local epidemiological situation, availability of treatment, cost and effectiveness of screening. The introduction of a universal screening program for STORCH diseases and vaccination programs is an opportunity to reduce the number of newborns born with complications of these diseases.
Key words: • STORCH • screening programs • congenital infections

287 - ANNUAL CHANGE IN HEARING LOSS AND HEARING AID USE AMONG US MEDICARE BENEFICIARIES: RESULTS FROM THE NATIONAL HEALTH AND AGING TRENDS STUDY (NHATS)

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Background/Rationale: Falls and fear of falling (FoF) are common among older adults and contribute to increased morbidity, mortality, and healthcare costs. Hearing loss affects two in three people aged 70+ and has been linked to falls. However, the association of hearing loss with falls and FoF is not well-established as existing studies use heterogeneous measures for hearing loss (audiometry versus functional/self-reported), examine restricted age ranges within older adults, and frequently lack national representativeness.

Materials and Methods: We conducted a cross-sectional analysis of 4,708 adults ≥65 years from the National Health and Aging Trends Study (NHATS). Measured hearing loss was assessed by pure-tone audiometry (better-hearing ear's 4-frequency pure-tone average [BPTA] in decibels [dB], categorized as normal [≤25 dB], mild [26-40 dB], or moderate or greater hearing loss [>40 dB]). Functional hearing loss was defined by self-reported hearing difficulty during common activities. Fall-related outcomes included falls, recurrent falls, FoF, and activity limitation due to fear of falling. We used weighted logistic regression models adjusted for sociodemographic factors, health conditions including vision loss, and fall history to evaluate the association between hearing and fall-related outcomes.

Results: Overall, 56.9% had measured hearing loss, and 11.9% had functional hearing loss. Measured moderate or greater hearing loss was associated with recurrent falls (OR=2.53, 95% CI:1.57-4.07) and FoF (OR=1.50, 95% CI:1.14-1.98). Functional hearing loss was associated with falls (OR=1.40, 95% CI: 1.10-1.79), FoF (OR=1.68, 95% CI:1.26-2.22), and resulting activity limitation (OR=1.58, 95% CI:1.08-2.32). There were no associations between fall-related outcomes and hearing aid use among those with hearing loss. The association with falls was stronger with functional hearing loss in those aged 65-75 years and with measured hearing loss in those >85 years.

Conclusions: Measured and functional hearing loss are independently associated with fall-related outcomes with distinct age-related patterns. Integrating hearing assessments could inform targeted fall prevention strategies.

Keywords: Hearing loss; Falls; Fear of falling; Fall prevention; Older adults

288 - ASSOCIATION OF MEASURED AND FUNCTIONAL HEARING LOSS WITH FALLS AND FEAR OF FALLING: A NATIONALLY REPRESENTATIVE STUDY OF OLDER ADULTS IN THE UNITED STATES OF AMERICA

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Background/Rationale: Falls and fear of falling (FoF) are common among older adults and contribute to increased morbidity, mortality, and healthcare costs. Hearing loss affects two in three people aged 70+ and has been linked to falls. However, the association of hearing loss with falls and FoF is not well-established as existing studies use heterogeneous measures for hearing loss (audiometry versus functional/self-reported), examine restricted age ranges within older adults, and frequently lack national representativeness.

Materials and Methods: We conducted a cross-sectional analysis of 4,708 adults ≥65 years from the National Health and Aging Trends Study (NHATS). Measured hearing loss was assessed by pure-tone audiometry (better-hearing ear's 4-frequency pure-tone average [BPTA] in decibels [dB], categorized as normal [≤25 dB], mild [26-40 dB], or moderate or greater hearing loss [>40 dB]). Functional hearing loss was defined by self-reported hearing difficulty during common activities. Fall-related outcomes included falls, recurrent falls, FoF, and activity limitation due to fear of falling. We used weighted logistic regression models adjusted for sociodemographic factors, health conditions including vision loss, and fall history to evaluate the association between hearing and fall-related outcomes.

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Conclusions: Measured and functional hearing loss are independently associated with fall-related outcomes with distinct age-related patterns. Integrating hearing assessments could inform targeted fall prevention strategies.

Keywords: Hearing loss; Falls; Fear of falling; Fall prevention; Older adults

293 - HEARING LOSS AND TINNITUS ACROSS THE LIFESPAN: LONGITUDINAL ANALYSES OF ONSET AND CHANGE AND THEIR ASSOCIATED FACTORS IN THE BUSSELTON HEALTHY AGEING STUDY

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Introduction: With the ageing of the global population, disabling hearing loss and tinnitus represent major public health concerns. Although age and sex are well-established determinants, the progression of hearing loss and tinnitus over time, and their associations with general and environmental health factors, remain incompletely understood, particularly in middle-aged adults. Therefore, this study we aimed to (1) assess the incidence and longitudinal changes in hearing thresholds and tinnitus over time, and (2) examine their associations with demographic, ear-related, general health, and environmental factors.

Methods: We used data from the Busselton Healthy Ageing Study (BHAS), a population-based cohort in Western Australia. Adults aged 45–70 years at baseline (2010–2015) completed audiometric testing, physical examinations, and questionnaires on tinnitus, ear-related and general health, mental health, and environmental exposures, with follow-up after six years. Better-ear four-frequency pure-tone averages for 0.5–4 kHz (4FPTA) and 4 and 8 kHz (HFPTA) were calculated, and hearing loss was classified according to WHO criteria. Logistic regression was used to assess risk factors for incident tinnitus, multinomial logistic regression for changes in tinnitus impact, and linear mixed models for associations between health-related factors and longitudinal changes in hearing thresholds.

Results: Data of 3596 participants were used with reliable audiometry at baseline and follow-up (mean baseline age 57.9 years, 55% female). Over 6 years follow-up, the prevalence of mild-or-greater hearing loss increased from 14% to 26% (4FPTA) and from 53% to 71% (HFPTA). In univariate models, older age, male sex, higher BMI, smoking, tinnitus, chronic ear infection, noisy workplace exposure (particularly with inconsistent or absent hearing protection), hypertension, diabetes, and cardiovascular disease were significantly associated with faster hearing decline. The 6-year incidence of tinnitus was 12.1%. Onset of tinnitus was statistically significant associated with male gender, higher BMI, larger waist circumference, fair subjective health, hearing loss, occupational noise exposure with occasional use of hearing protection, hyperacusis, migraine, and diagnosed anxiety disorder. Among participants with pre-existing tinnitus, 21% reported an increase in tinnitus impact over time. Changes in impact were influenced by general health and ear-related health factors.

Conclusion: In this longitudinal population-based study of middle-aged Western Australians, hearing thresholds declined significantly over six years, with greater deterioration in men and at higher frequencies. Our findings indicate that hearing loss progression in midlife is influenced not only by age and sex, but also by metabolic and environmental health factors, underscoring the need to further elucidate their combined effects on hearing outcomes.

The high incidence of tinnitus and its substantial impact on daily life highlight the importance of understanding the broad range of risk factors associated with tinnitus onset and changes in impact. The multifactorial nature of these factors—including hearing-related, general health, and psychological components—reflects the complexity of tinnitus and supports the development of targeted prevention and intervention strategies for specific populations.

309 - EARLY MAGNETIC RESONANCE BRAIN SCAN INJURY AND NEURODEVELOPMENTAL OUTCOMES IN CHILDREN WITH PERMANENT CHILDHOOD HEARING IMPAIRMENT AFTER HYPOTHERMIA TREATMENT IN HYPOXIC-ISCHAEMIC ENCEPHALOPATHY

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Background/Rationale

Perinatal asphyxia is an important risk factor for permanent childhood hearing impairment (PCHI; ≥21 dB). Since 2010, therapeutic hypothermia (TH) has been routinely deployed in cases of moderate-to-severe hypoxic-ischaemic encephalopathy (HIE) because it improves neurological outcomes and reduces the risk of cerebral palsy. PCHI is known to have a high prevalence in children who had neonatal HIE even despite TH treatment. Yet there is limited data describing the pattern and extent of the permanent brain injury and associated neurodevelopmental morbidity associated with neonatal HIE in children who are diagnosed with later PCHI.

Our study aims were to describe the pattern and extent of early neonatal brain magnetic resonance imaging (MRI) abnormalities associated with a subsequent diagnosis of PCHI in a cohort of infants who received whole-body TH for suspected HIE in our tertiary-level centre between 2007 and 2017, and to describe their later associated neurodevelopmental outcomes at ~2 years of age.

Materials and methods

We reviewed the medical records of neonates who received TH for HIE between 2007 and 2017 in our neonatal intensive care unit at the Norfolk and Norwich University Hospital (NNUH). We identified neonates among this cohort with confirmed PCHI according to follow up audiology records. For all confirmed PCHI cases, we reviewed their early MRI brain scan findings reported by consultant radiologists and also the results of their reported neurodevelopmental assessment outcomes done at ~2 years of age. PCHI was defined as hearing thresholds in either ear of: mild (21-40 dB), moderate (41-70 dB), severe (71-95 dB) and profound (>95 dB). MRI reports were reviewed and brain damage classed according to injury pattern, using a system described by Rutherford M et al., (Lancet Neurol. 2010), categorizing as either ‘Severely abnormal’, or “Normal” – defined as “normal or less severe patterns of injury that are associated with normal or only mildly abnormal neurodevelopmental outcomes”.

Results

Of 218 babies who received TH for suspected HIE during the 10-year study period, 22 (10%) were excluded because they died before conclusive audiology testing was completed. Of the 196 surviving infants, hearing screening results were available for all. Of these, 183 (93.4%) did not have PCHI, and 13 (6.6%) were diagnosed with PCHI. MRI scans were done on median postnatal day 10 (range: 4 to 16 days). The clinical severity of their neonatal HIE (Sarnat-Sarnat classification) had been graded as mild (Grade 1) in two cases, moderate (Grade 2) in three cases, and severe (Grade 3) in eight cases. The newborn hearing screening results of the 13 infants diagnosed with PCHI had shown no clear response for 11 (3 unilateral referrals; 8 bilateral referrals); 2 could not be completed before discharge. Diagnostic ABR testing indicated that 11 infants had bilateral impairment and 2 had unilateral impairment. Severity of PCHI was classed as mild in n=2, moderate in n=9, and profound in n=2. Hearing aids were fitted to 7 (2 of these later required cochlear implants); 3 received advisory intervention but no amplification was required (these children have been actively observed with advisory input, including referral to specialist teachers for optimizing listening environments at nursery and school); outcome data were unavailable for 3 infants.

MRI scans were classified as ‘Normal’ for 5 cases and ‘Severely abnormal’ for 8 cases. Severely abnormal cases comprised: damage confined to thalamus, basal ganglia, and/or

By the time of the 2-year neurodevelopmental assessment: of the 13 PCHI cases, n=2 had died in later infancy; aside from any PCHI-related speech/language delay, n=3 had otherwise normal neurodevelopment, n=2 had mild/moderate neurodevelopmental delay, n=3 had severe neurodevelopmental problems (cerebral palsy diagnosed in 2 of them), and n=3 were lost to follow up.

Conclusions

Of newborns with HIE who--despite treatment with TH--were subsequently diagnosed with PCHI, the majority had severely abnormal early MRI findings of brain injury on their early scans, and among those surviving to age 2 years most had significant associated wider neurodevelopmental problems.

Keywords: Hypoxia-ischaemia, hypothermia, sensorineural, MRI, neurodevelopment

190 - RELATIONSHIP BETWEEN GESTATIONAL DIABETES AND TERM INFANT HEARING OUTCOMES, A CROSS-SECTIONAL DATA-LINKAGE STUDY

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Background
Congenital hearing loss can significantly impact a child's development, yet over half of affected infants have no identifiable risk factors. A potential link between maternal diabetes and congenital hearing loss has been suggested, but existing research is inconsistent. This study investigated the relationship between gestational diabetes mellitus and congenital hearing loss in term infants using population-level data from Queensland, Australia.

Methods
A cross-sectional data-linkage study was conducted using Queensland Perinatal Data Collection (PDC) and newborn hearing screening database (QChild) from 2014 to 2019. The cohort included term infants (>37 weeks) born in Queensland hospitals. Hearing data were matched and linked to corresponding maternal and infant perinatal data with multivariable regression used to adjust for known risk factors

Results
Among 330,778 mother-infant pairs, 11.8% were exposed to gestational diabetes. Congenital hearing loss was diagnosed in 0.3% of infants with 13.7% of those exposed to gestational diabetes. No significant association was found between gestational diabetes and congenital hearing loss (aOR 1.09 CI: 0.90, 1.31). However there were elevated unadjusted odds for severe (OR 5.82 CI: 2.89, 11.69), retrocochlear (OR 2.2 CI: 1.24, 3.91), and structural etiologies (OR 1.93 CI: 1.31, 2.85) of congenital hearing loss in exposed infants. Strong associations were demonstrated with known risk factors for hearing loss: craniofacial anomalies (aOR 36.6 CI: 26.67, 49.54), family history of hearing loss (aOR 14.3 CI: 11.61, 17.44), syndrome associated with hearing loss (aOR 13.83 CI: 8.80, 21.25), perinatal infection (aOR12.92 CI: 7.19, 21.72), neonatal asphyxia (aOR 8.43 CI: 5.11, 13.27), nursery admission >5 days (aOR 2.00 CI: 1.46, 2.68).

Conclusion
Gestational diabetes was not associated with congenital hearing loss in term infants in a large state-level population cohort with universal access to healthcare and universal screening for diabetes in pregnancy and congenital hearing loss, although phenotypic audiological heterogeneity within severe, retrocochlear and structural subgroups was suggested.

Keywords: Diabetes, neonate, hearing loss, Child, Infant, Newborn, Female, Pregnancy, Asphyxia, Cross-Sectional Studies, Diabetes, Gestational, Mothers, Queensland, Data Collection, Hearing Loss, Risk Factors, Delivery of Health Care, Hospitals, Hearing

239 - FIFTEEN YEARS OF PROGRESS: EVOLVING THE NATIONAL NEWBORN HEARING SCREENING PROGRAM (NHSP) THROUGH COORDINATION OF CARE AND CROSS-SECTOR COLLABORATION IN ISRAEL

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Background: While previously limited to select hospitals, the Newborn Hearing Screening Program (NHSP) was officially mandated nationwide in 2010 providing a systematic solution for early detection of permanent hearing loss. Grounded in the international "1-3-6" benchmark—screening by one month, diagnosis by three, and intervention by six—the program represents a massive logistical undertaking involving 31 maternity hospitals and four national Health Funds. While universal screening has been successfully established, the latest program evaluation has identified a critical systemic gap between hospital-based screening and community-based diagnosis and/or habilitation. This analysis highlights that the primary obstacle to a fully successful national program is not the clinical screening itself, but rather the failure of data to transition across health sectors, often resulting in delayed interventions.
Objectives:
1. To assess the longitudinal impact of the NHSP on the median age of diagnosis and entry into habilitation.
2. To identify socio-demographic disparities in program compliance.
3. To describe the current multi-disciplinary initiative to automate data channels between hospital Information Systems and the four national Health Funds via the Ministry of Health's Digital Technology and Data Division.
Methods: This analysis utilizes data from three distinct phases: Pre-NHSP, Study 1 (2011–2013), and Study 2 (2022), supplemented by preliminary 2024–2025 pilot data from the digital health initiative. The study tracks screening results via International Classification of Diseases' codes and aggregate reports. Additionally, it documents a qualitative process of inter-departmental collaboration involving the Division of Digital Technology and Data, hospital Information Systems (IS) staff, Communication Disorders Clinicians (CDCs) at 31 sites, and data coordinators at the four Health Funds. This collaborative effort aims to standardize the flow of "Failed Hearing Screen" notifications directly to the Health Funds responsible for follow-up invitations for diagnostic testing.
Results: Over 15 years, the NHSP has achieved a remarkable 99% national screening coverage. Median age at diagnosis plummeted from 9.5 months (pre-2010) to 3.1 months by 2022. Similarly, entry into habilitation improved from 19 months to 8.1 months. However, the data revealed a persistent red flag regarding health equity: in the most recent study, 57% of infants in specific socio-demographic sectors were still not diagnosed by the 3-month target, compared to 20% in the general population sector. Similarly, entry into habilitation for underserved subgroups occurred at a median of 13.2 months, just over double the national target.
Analysis revealed a 2% to 10% discrepancy between manual and electronic reporting, compromising data accuracy and increasing 'Lost to Follow-up' (LTF) rates. The current digital integration project—uniting CDCs, hospital IS, and the Division of Digital Technology and Data—has successfully begun mapping automated data channels. By ensuring that every failed hearing screen result in a hospital's clinical data system triggers an actionable record in the Health Fund's database, the program is moving toward a system where distance and socio-economic status no longer dictate the speed of intervention.
Discussion: The most recent longitudinal evaluation identified that the primary obstacle to program efficacy is the fragmentation of data between hospitals and follow-up care. By identifying this structural barrier, the program has shifted its focus toward systems integration and data continuity to ensure that screening results travel as efficiently as the patient. In Israel, the decentralized nature of hospital records vs. community health funds created a systemic bottleneck. By engaging the Division of Digital Technology and Data, we are transforming the audiological coordinator from a manual record-keeper into a strategic manager of a digital workflow. Specific technical hurdles were identified such as synchronizing coding systems and ensuring privacy-compliant data transfer to audiology coordinators at the four Health Funds.
Conclusion & Significance: Israel's 15-year journey demonstrates while universal screening is a vital first step, it is insufficient without a robust digital infrastructure to support the "3" and the "6" of the Early Hearing Detection and Intervention benchmarks. The current collaboration between CDCs, digital health experts, and Health Fund data managers serves as a model for using nationalized data systems to close the gap for vulnerable populations. The integration of hospital-based Information Systems with community-wide data channels ensures every child, regardless of physical distance from a medical center, receives timely, life-changing intervention necessary for linguistic, cognitive, and social-emotional development.
Key Words: hearing screening program, longitudinal impact, data channels

TINNITUS

104 - DOES USE OF THE MINDEAR APP REDUCE TINNITUS-RELATED DISTRESS IN PATIENTS AWAITING TINNITUS THERAPY?

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Study Aims
This study investigated whether using an app to assist with self-management of tinnitus (MindEar) is effective in reducing tinnitus-related distress amongst patients who are waiting to attend a tinnitus therapy appointment.
Introduction
In the United Kingdom, most tinnitus therapy is delivered within the National Health Service. Waiting times for appointments in specialist clinics are typically 7-12 months long. Without intervention, there is a risk that patients will fall into negative thinking patterns, which are associated with greater tinnitus distress (Cima et al, 2011, Handscomb et al, 2017). Cognitive behavioural therapy is well established as an effective intervention for tinnitus (Fuller et al, 2020, Landry et al, 2020) and evidence indicates this holds true when CBT is delivered via an internet program (Beukes et al, 2022) or an app (Bardy et al, 2024).
The MindEar app gives access to a CBT-informed chatbot as well as tinnitus information, relaxation routines, mindfulness exercises and therapeutic sounds. Bardy et al (2024) have demonstrated reductions in tinnitus-related distress after MindEar use amongst volunteers with tinnitus, but the current study is the first to investigate its use in a clinical population.
Methods
All adult patients who were referred for tinnitus therapy at a large London hospital between October 2024 and April 2025 were invited to participate, excluding urgent referrals, non-English speakers and those without email addresses.
Participants were allocated to one of two groups using matched pair randomization, to ensure similar baseline measures of tinnitus distress in each group. All participants filled in a set of questionnaires online, at enrolment and prior to their first tinnitus appointment (8-16 weeks later). The primary measure was the Tinnitus Functional Index (TFI). Secondary measures of cognition and emotional distress were also used.
Those in the app group were sent a code to access the full version of the MindEar app for free along with instructions to use it at least 10 minutes per day. Those in the control group remained on the waiting list with no intervention, as in usual clinical practice.
Changes in outcome measures from baseline over time were measured using ANOVA, and TFI using linear mixed effects model with a random intercept. Mixed models adjusted for age, sex, ethnicity, and hearing-loss status.
Results
There were 125 responses to the initial invitation, with 44 patients completing the full study. The app group contained 17 participants and the waiting list group 27.
A clinically significant reduction in TFI score (of 13 points or more) was shown in 52.9% of the app group, while only 14.8% of waiting list participants met this threshold. This difference was statistically significant ($X2= 7.80$, $p= 0.02$). Overall, a reduction in TFI score was shown in the app group of -12.2 (95% CI -20.14 - -4.25; $p=0.003$) compared to the WL group.
ANOVA indicated there was a significant effect of group on timepoint ($F=9.07$, $p=0.004$) with the largest effects being shown for the TFI subscales Intrusiveness, Sense of Control, Cognitive Function and Emotional Distress. There was also a significantly greater reduction in the app group for scores on the Tinnitus Cognitions Questionnaire ($F=6.00$, $p=0.019$). Depression and anxiety measures did not change significantly for either group from a relatively low baseline.
Conclusion
This study demonstrated that use of the MindEar app resulted in a reduction in tinnitus- related distress for just over half of app users. TCQ and TFI subscale results indicate that changes in cognition were partially responsible for this reduction. The app may indeed be helping people to move away from negative thought cycles. The drop-out rate was high, particularly amongst those in the app group. This is consistent with findings of other studies investigating online intervention (Demoen et al, 2023). It is also notable that most patients invited to participate did not respond. It is likely that the MindEar app only appeals to a subgroup of tinnitus patients and should not be seen as a replacement for in-person therapy. Nevertheless, our results suggest it could be a helpful recommendation to patients who are open to the idea of online intervention.
Keywords: tinnitus, online intervention

257 - EFFICACY OF TREATMENTS AGAINST TINNITUS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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Background/Rationale: Current guidelines only recommend cognitive behavi therapy (CBT) as an evidence-based option for tinnitus; however, alternatives have emerged, for which a comprehensive assessment is lacking.

Materials and Methods: We conducted a systematic review and meta-analysis considering an original search strategy to collect all randomized controlled trials (RCT) evaluating the efficacy of tinnitus treatments on tinnitus severity searching PubMed-MEDLINE, Embase and Cochrane Library until 9th June 2025. Following PRISMA guidelines, data were pooled using random-effects meta-analytic models. Heterogeneity was controlled using χ^2 test, inconsistency was measured using I^2 statistic. Risk of bias was checked using the Revised Cochrane risk-of-bias tool for randomized trials. Standardized mean differences (SMD) and 95% confidence intervals (95%CI) at 6 months post-treatment using mean scores of tinnitus severity scales.

Results: From 986 publications, 245 RCTs were eligible, including 126 with available information to derive SMDs, resulting in 10,393 randomized individuals with tinnitus. Overall, almost 80% of RCTs resulted with a high risk of bias. In included studies, tinnitus severity reduction was found for CBT, psychological and audiological, PTM, relaxation, and mindfulness (SMD:-1.58; 95%CI: -2.03,-1.13; 1 study for in person individually delivered CBT, n=100; SMD:-0.44; 95%CI: -0.78,-0.10; 2 studies for in person group therapy CBT, n=162; SMD:-0.31; 95%CI:-0.53,-0.08; 8 studies for digitally-delivered CBT, n=880; SMD:-0.39; 95%CI: -0.59,-0.19; 5 studies for tinnitus retraining therapy, n=872; SMD:-0.61; 95%CI:-0.96, -0.27; 2 studies for PTM, n=499; SMD:-0.60; 95%CI: -1.13,-0.08; 2 studies for relaxation, n=62; SMD:-0.43; 95%CI: -0.74,-0.11; 2 studies for mindfulness, n=161). Pharmacological interventions were shown effective for (SMD:-0.54; 95%CI: -0.92,-0.16; 6 studies, n=422), gabapentin (SMD:-0.77; 95%CI: -1.37,-0.17; 4 studies, n=305), acamprosate (SMD:-1.06; 95%CI: -1.40,-0.71; 3 studies, n=150), misoprostol (SMD:-0.41; 95%CI: -0.76,-0.06; 1 study n=130), intratympanic lidocaine (SMD:-2.04; 95%CI: -2.53,-1.56; 1 study, n=100) and sulodexide, an antithrombotic drug (SMD:-3.10; 95%CI: -3.62,-2.57; 1 study, n=124). Repetitive transcranial magnetic stimulation (SMD:-0.26; 95%CI: -0.49,-0.03; s=10, n=529) and transcutaneous electrical nerve stimulation (SMD:-1.25; 95%CI: -2.04,-0.46; s=3, n=171) were found effective. No efficacy was found for dietary supplements (s=8, n=680), complementary medicine (s=22, n=1,444), or sound treatments (s=15, n=1,160).

Conclusions: Considering the limited quality of evidence found, we confirm CBT efficacy in reducing tinnitus severity, and suggest that selected pharmacological and neuromodulation treatments require validation in large well-designed RCTs.

Keywords: Tinnitus; Randomized Trial; Epidemiology; Efficacy; Meta-analysis therapy,Acoustic analysis, Spectral features,Frequency-Amplitude modulation

305 - TOWARD BETTER SUBGROUPING IN TINNITUS: A PRELIMINARY TRIGEMINOCERVICAL FRAMEWORK

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Background/Rationale
Many treatments for tinnitus are available. Whereas in clinical practice, most seem to help some patients, clinical trials often fail to show consistent or significant effects. One possible reason is that very different patient types are studied together. Current subgrouping is mainly based on hearing loss or questionnaire scores. These parameters describe impact, but they do not adequately reflect underlying mechanisms. This presentation proposes a preliminary framework for subgrouping tinnitus based on pathophysiological logic, with attention to trigeminocervical involvement.
Materials and Methods
The proposal integrates results from recent publicatins on trigeminocervical–auditory interactions. Two main mechanisms are considered: tinnitus mainly related to hearing loss (deafferentiation) and tinnitus with a stronger trigeminocervical component. The framework introduces three practical dimensions for subgrouping:
(1) dominant type (hearing loss–dominant or trigeminocervical–dominant),
(2) stage (peripheral, centralised, mixed or tinnitus disorder), and
(3) mechanism (increased input/strain or increased output/sensitisation).
Subgrouping relies on structured history taking, clinical examination, audiometry, and when appropriate, temporary exploratory interventions used as diagnostic probes.
Results
The model states that tinnitus does not follow a single pathway. Stable tinnitus with clear hearing loss may reflect mainly deafferentiation. Stable tinnitus accompanied by the cluster of symptoms described in the Tensor tympani Syndrome, and variable tinnitus, may indicate stronger trigeminocervical involvement. Over time, peripheral symptoms may evolve into more central and persistent patterns. These categories are proposed as working hypotheses that require further validation.
Conclusions
This framework is presented as a first step toward structured subgrouping in tinnitus. Progress in tinnitus care may depend less on introducing new therapies and more on identifying meaningful subgroups in which existing treatments can be properly evaluated. Defining such subgroups may allow more targeted research and more rational clinical decision-making.

Keywords
Tinnitus; Trigeminocervical system; Subgrouping; Phenotyping; Treatment stratification

168 - TINNITUS AS A POSSIBLE CLINICAL INDICATOR OF SILENT HYPERLIPIDAEMIA

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Background / Rationale
Chronic subjective idiopathic tinnitus (CSIT) is a growing challenge, its prevalence is increasing, but its pathophysiological background is not fully understood, so its diagnosis and treatment are not resolved. The results of previous studies investigating the relationship between tinnitus and lipid metabolism are contradictory. The purpose of this study was to compare the prevalence of lipid metabolism disorders in patients with CSIT with official population-level data on dyslipidaemia in the adult Hungarian population, with additional age-stratified analyses to minimise age-related confounding factors.
Materials and Methods
This retrospective study included 231 adult patients diagnosed with CSIT and treated in the Department of Otolaryngology and Head and Neck Surgery of the Clinical Centre of the University of Debrecen. The levels of serum total cholesterol, triglycerides, LDL cholesterol, HDL cholesterol, apolipoprotein B (ApoB), apolipoprotein A (ApoA) and lipoprotein(a) [Lp(a)] were analysed. The prevalence of dyslipidaemia was compared with official epidemiological data, both in general and between age groups.
Results
The general prevalence of dyslipidaemia among patients with CSIT was 78.35%, which significantly exceeded the prevalence reported in the adult Hungarian population (16.51%). This difference remained consistent in age-stratified analyses, suggesting an association between CSIT and dyslipidemia, regardless of age.
Conclusions
Our results support the association between CSIT and dyslipidaemia and suggest that subjective chronic tinnitus may be an early clinical indicator of lipid metabolism disorders, even in younger adults. Therefore, routine lipidological examination of patients with CSIT may be warranted and may contribute to the early detection and prevention of lipid-related diseases, including atherosclerosis and its cardiovascular complications.
Keywords: tinnitus; subjective chronic idiopathic tinnitus; dyslipidaemia; lipid metabolism; hypercholesterolemia

306 - SENSORY TRIGEMINOCERVICAL MODULATION IN TINNITUS: EXPLORATORY OBSERVATIONS WITH BUPIVACAINE

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Background/Rationale
Clinical and experimental data suggest that the trigeminocervical system can influence auditory perception. Some patients report changes in tinnitus with jaw or neck movement, pressure, or sound exposure. We explored whether temporary sensory blockade of trigeminal and upper cervical regions modifies tinnitus and whether effects differ between tinnitus types.
Materials and Methods
In this retrospective case series, patients with subjective tinnitus received targeted injections of bupivacaine 0.5% in selected trigeminal and upper cervical muscles or dermatomes. Injection sites were chosen based on clinical modulation testing. Tinnitus was classified as continuous or variable (including somatosensory, reactive, or pulsatile forms). The degree and duration of perceived tinnitus change were recorded using predefined clinical categories.
Results
Temporary tinnitus reduction was mainly observed in patients with variable tinnitus. Patients with continuous tinnitus showed little or inconsistent change. Effects were not restricted to a single anatomical structure, suggesting that multiple sensory trigeminocervical pathways may contribute.
Conclusions
These observations suggest that sensory trigeminocervical input may play a role in selected tinnitus patients, particularly those with variable symptoms. The retrospective design and absence of placebo control limit causal interpretation. Nevertheless, the findings support further research to study whether this trial therapy may provide a diagnostic value.
Keywords
Tinnitus; Trigeminocervical system; Sensory modulation; Phenotyping; Subgrouping

307 - MOTOR TRIGEMINOCERVICAL MODULATION IN PAIN HYPERACUSIS: EXPLORATORY OBSERVATIONS WITH A COMBINATION OF BOTULINUM TOXIN AND CLOMIPRAMINE

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Background/Rationale
Pain hyperacusis is a condition in which everyday sounds cause physical pain. Treatment options are limited and outcomes are often inconsistent. Clinical observations suggest that the trigeminocervical motor system may contribute in some patients. We explored whether targeted motor modulation with botulinum toxin is associated with symptom change in pain hyperacusis.
Materials and Methods
In this exploratory case series, patients with pain hyperacusis received botulinum toxin injections primarily targeting tensor veli palatini and other trigeminocervical muscles when clinically indicated. Several patients received concomitant medication as part of routine care. Outcomes were based on patient-reported changes in sound-evoked pain and functional sound tolerance. A group of tinnitus patients treated in routine care served as a reference, although treatment protocols were not standardized.
Results
Several patients with pain hyperacusis reported meaningful improvement, including reduced sound-evoked pain and better tolerance of daily sounds. In contrast, patients treated for tinnitus alone showed limited or inconsistent changes. No serious adverse events were observed. The duration of benefit varied between individuals.
Conclusions
These observations suggest that motor trigeminocervical mechanisms may play a role in some patients with pain hyperacusis. The exploratory design, co-treatment, and absence of placebo control limit firm conclusions. However, the differential response pattern supports further controlled studies to clarify whether this represents a distinct and clinically relevant subgroup.
Keywords
Pain hyperacusis; Tinnitus; Trigeminocervical system; Botulinum toxin; Subgrouping

314 - HEARING PROTECTION BEHAVIORS AMONG MUSIC FESTIVAL ATTENDEES: A CROSS-SECTIONAL ANALYSIS OF USE, BARRIERS AND FACILITATORS

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Introduction: Given the limited uptake of hearing protection in recreational settings and the need for more effective strategies to promote their use to reduce noise-induced hearing damage, a better understanding of factors influencing hearing protective behaviors is needed. The current study examined the use, barriers and facilitators of hearing protective behaviors among festival attendees, as well as their perception of volume safety at festivals.

Methods: A total of 1325 attendees of a multi-day music festival filled in a questionnaire on hearing symptoms, the perception of music volume safety and hearing protective behaviors. Descriptive analyses were conducted and reported for different age groups and genders.

Results: Over 80% of participants perceived festival music volume as unsafe without hearing protection. The majority of participants reported using hearing protective strategies, including keeping distance from the speakers (77.05%) and wearing earplugs (70.41%), though consistent use was limited. Participants under 20 years old and men reported perceiving music as unsafe less often and engaged in fewer hearing protective behaviors. The primary reason for participants to wear earplugs was to protect their ears from damage (84.99%), and they mainly started wearing earplugs due to information they received about hearing loss or tinnitus (35.58%), due to people with hearing loss or tinnitus in their environment (27.55%) or because they developed hearing loss or tinnitus themselves (20.69%). Reasons for not wearing earplugs were more varied across the population, with notable differences between men and women.

Conclusion: While general awareness of the potential risks of loud music exposure at festival is high and the majority of participants engage in hearing protective behaviors, consistent use of hearing protection is more limited and should be addressed. Future research should focus on developing and evaluating the effectiveness of targeted intervention strategies tailored to specific demographic groups to promote hearing protection in recreational settings. By addressing the specific barriers and facilitators of these groups, such efforts can enhance the adoption of hearing protection strategies and ultimately contribute to the reduction of noise-induced hearing damage

342 - TINNITUS BURDEN AMONG YOUNG AND MIDDLE-AGED ADULTS IN THE U.S. AND NORWAY: THE NATIONAL LONGITUDINAL STUDY OF ADOLESCENT TO ADULT HEALTH (ADD HEALTH) AND THE TRØNDELAG HEALTH STUDY (HUNT)

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Objective: To estimate tinnitus incidence, prevalence, and risk factors among young and middle-aged adults followed longitudinally in two population-based cohort studies in the United States of America and Norway.
Methods: The National Longitudinal Study of Adolescent to Adult Health (Add Health) screened a nationally representative cohort of students (n>100,000) in grades 7–12 during 1994–1995. Participants in Wave 4 (2008; aged 24–32; n=15,701), Wave 5 (2016–2018; aged 33–43; n=12,300), and Wave 6 (2022–2025; aged 39–51; n=11,979) were asked "In the past 12 months, have you been bothered by ringing, roaring, or buzzing in your ears or head (tinnitus) that lasts for 5 minutes or more?" Hearing ability was classified as excellent, good, a little trouble, moderate trouble, a lot of trouble, or deaf, based on participants' description of their hearing without a hearing aid or other assistive device. The Nord Trøndelag Hearing Loss Study (NTHLS) was conducted as part of the Trøndelag Health Study (HUNT). HUNT2 (1996–1998; n=52,277; aged 20–98) asked participants directly whether they were bothered by tinnitus, the frequency of occurrence (almost always, daily, weekly, less often), and duration (<10 minutes versus longer). HUNT4 (2017–2019; n=28,339; aged 20–101) first screened for any tinnitus experienced in the past 12 months (<5 minutes versus longer) and then asked, if bothered, the frequency of occurrence. Hearing ability was classified as normal, unilateral, mild, or moderate or worse, based on pure-tone, air-conduction audiometric thresholds measured in each ear at 8 frequencies ranging from 0.25–8 kHz. Besides hearing loss, other potential risk factors examined were dizziness, general health, chronic headaches/migraine, head injuries, obesity, psychiatric and chronic illness conditions, noise exposure, history of recurrent ear infections, stroke, and visual impairment. We calculated incidence and prevalence using data from Add Health Waves 4, 5 and 6 and from HUNT2 and HUNT4. We used logistic regression, adjusting for socio-demographic factors, to estimate prevalence risk ratios (PRs) and 95% confidence intervals (CI) for participants aged 33–44 in Add Health Wave 5 (n=11,950) and HUNT4 (n=4,098) who reported tinnitus as either: (i) a small or no problem, or (ii) bothersome, a moderate or greater problem. Findings of association described below are for self-reported tinnitus as a moderate, big, or very big problem (Add Health) or bothersome (HUNT4) compared to individuals without tinnitus.
Results: Among the 8,846 participants completing all three Add Health waves, tinnitus prevalence in the past 12 months increased from 6.3% (males 6.7%, females 5.8%) in Wave 4 (mean age 29.0), to 10.7% (males 12.7%, females 9.2%) in Wave 5 (mean age 37.5), to 15.4% (males 17.4%, females 13.4%) in Wave 6 (mean age 44.2). In HUNT2 (mean age 42.9) and HUNT4 (mean age 64.1), the prevalence of tinnitus increased from 4.4% (6.8% males; 2.6% females) to 8.5% (11.7% males; 6.1% females), respectively. The prevalence of more bothersome tinnitus in Add Health Wave 5 (moderate or greater problem) was 2.8%, and in HUNT4 the prevalence was 3.1%. After adjusting for sociodemographic characteristics, significant risk factors for bothersome tinnitus were: age 41–44 vs 33–35 (PR=1.7 [Add Health]; 2.3 [HUNT4]), male sex (PR=1.4; 1.4), anxiety (PR=2.8; 2.7), chronic headaches/migraine (PR=2.7; 1.7), head injuries (PR=2.9; 1.8), fair-to-poor general health (PR=6.6, 6.2), current cigarette smoking (PR=1.5; 1.7), dizziness (PR=30.4; 2.8), and hearing loss (PR=11.5; 6.1). Other highly significant PRs in the Add Health Wave 5 study included low annual income <$20,000 (PR=5.9), depression (PR=2.6), military service (PR=6.6), post-traumatic stress syndrome (PTSD) (PR=5.9), and stroke (PR=3.7; 1.1), while in the HUNT4 study additional risk factors were occupational noise exposure >15 hours per week (PR=2.0), impulse noise exposure (PR=2.3), history of recurrent ear infections (PR=1.8), playing in a band (PR=2.0), obesity (PR=1.7), and severe vision impairment (PR=5.2).
Conclusions: Tinnitus is common in young and middle-aged adults and increases with age. The Add Health and HUNT longitudinal study cohorts provide insights about common risk factors that contribute to increasing prevalence of tinnitus among young and middle-aged adults. Our findings suggest interventions to reduce noise exposure, anxiety, depression, and smoking, while improving general and otologic health could decrease the impact of tinnitus in young and middle-aged adults. Focusing interventions on younger adults could reduce the burden of bothersome tinnitus in later life.
Keywords: Tinnitus epidemiology, prevalence, young and middle-aged adults

AI AND DATA-DRIVEN APPROACHES

320 - RETHINKING HEARING AID PRESCRIPTION: ARTIFICIAL INTELLIGENCE APPLICATION IN NEXT-GENERATION NAL-NL3 FITTING SYSTEM

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Background. Advances in artificial intelligence (AI) and machine learning offer significant opportunities to improve the clinical relevance and personalisation of hearing aid fitting prescriptions.
Objective: To describe how machine-learning–based optimisation methods were applied in the development of the NAL-NL3 combined with large-scale real-world clinical fitting data and clinician insights was used to address clinician identified limitations identified in current prescriptive practice.
Methods
NAL-NL3 Prescription uses a hybrid optimisation approach that combines broad exploration of possible gain settings with targeted refinement to arrive at clinically acceptable fittings. Global optimisation methods, including Differential Evolution, are used to explore a wide range of candidate gain solutions across different audiometric configurations, including high-frequency gain, reverse-slope losses, and mixed or conductive hearing losses and complex losses. These candidates are subsequently refined using local optimisation approaches, including gradient-based solvers and reinforcement learning–based refinement, to converge on solutions that maximise predicted speech intelligibility while remaining clinically and perceptually acceptable in terms of loudness, comfort, and compression. Machine-learning development was informed by large-scale real-world clinical datasets comprising over one million audiograms and real-ear measurements. Objective modelling assessed predicted speech intelligibility, loudness, sharpness, and compression behaviour, and clinician usability was evaluated through in-clinic fitting trials. Clinicians reported improved ease of matching targets and reduced need for post-fit fine-tuning.
Results
Relative to NAL-NL2, the NAL-NL3 Prescription demonstrated small but consistent improvements in predicted speech intelligibility, minimal changes in overall loudness, and modest reductions in predicted sharpness. Gain was redistributed from low- and high-frequency extremes toward mid-frequency regions (approximately 1–4 kHz) critical for speech understanding, while compression ratios remained within predefined limits. Clinicians reported improved ease of matching targets and reduced need for post-fit fine-tuning. Compared with NAL-NL2, the NAL-NL3 Prescription produced small but consistent improvements in predicted speech intelligibility, with minimal changes in overall loudness and modest reductions in predicted sharpness. Prescribed gain was redistributed away from low- and high-frequency extremes toward mid-frequency regions most critical for speech understanding. Compression ratios were maintained within predefined design limits.
Conclusion
NAL-NL3 illustrates how AI-driven optimisation and deep learning can be translated into clinically meaningful advances in evidence-based hearing aid prescription. This work demonstrates the potential of AI methodologies to enhance robustness, efficiency, and personalisation in real-world hearing care.

93 - THE EFFECT OF REVERBERATION AND ARTIFICIAL-INTELLIGENCE-BASED DEREVERBERATION ALGORITHMS ON SPEECH INTELLIGIBILITY FOR COCHLEAR IMPLANT USERS

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Objective: Cochlear implants (CIs) generally perform well in quiet conditions, but speech understanding in an environment with reverberations remains difficult. This study aimed to quantify the detrimental effects of reverberation on speech intelligibility for CI users and to minimize the reverberations in speech signal by using novel artificial intelligence-based algorithms created for use in CIs.

Methods: A prospective crossover study was performed that included 15 CI users, with each participant being their own control. The study consisted of two parts: in the first part, the effect of reverberation on speech intelligibility was investigated by creating psychometric functions using different reverberation times. Speech tests were streamed directly to the speech processor, and reverberation was added by a simulated room of 7×6×3.5 m with varying reverberation times. With these psychometric functions we could determine the reverberation threshold where 50% was repeated correctly (SRT) and use this as starting point for the second part of the study where two dereverberation algorithms were tested. The first was trained to minimize late reverberations (DNN-WPE) and another version with an additional post-filter was trained to minimize early and late reverberations (DNN-WPEPF). These two algorithms were tested by performing speech intelligibility tests in six conditions: clean speech (no reverberation), clean speech processed with both algorithms, reverberated speech, and reverberated speech processed by both algorithms. Additionally, subjective ratings were performed to assess how the participant perceived the processed sound. To this end, a graphical user interface was designed where pairwise comparisons of the aforementioned conditions could be compared in terms of three outcomes: listening effort, naturalness, and perceived speech intelligibility.

Results: The psychometric functions with reverberation yielded a median reverberation time of 1.1 s at the SRT for CI users (within a range of 0.8 s and 3 s) and a much longer reverberation time of 7.5 s for typical hearing participants. When reverberated speech was processed with DNN-WPE at the participants' SRT, an improvement of 11% was observed ($p < 0.001$) and when processed with DNN-WPEPF an improvement of 17% was observed ($p < 0.001$). The benefit of DNN-WPEPF was significantly larger than the benefit of DNN-WPE ($p = 0.018$). Both algorithms did not significantly affect speech intelligibility of clean speech ($p = 1.00$). Speech dereverberated with either algorithm was significantly preferred over reverberated speech for all three outcomes. Moreover, speech dereverberated with DNN-WPEPF was significantly preferred over speech dereverberated with DNN-WPE.

Conclusion: This study revealed that reverberation affects speech intelligibility for CI users more profoundly than for normal hearing participants. The DNN-WPE and DNN-WPEPF dereverberation algorithms resulted in substantial benefits for CI users regarding speech intelligibility and subjective ratings. These algorithms did not affect the clean speech, showing that they can be switched on permanently, even in the absence of reverberations. Further developments are required to implement the algorithms in real time on the CI processor and more research is needed to assess them under more realistic listening conditions.

73 - PITCH IDENTIFICATION IN PERIODIC COMPLEX WAVES: THE ROLE OF CONSECUTIVE HARMONICS IN A MUSICAL MODEL

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Musical signals are complex periodic waveforms composed of multiple frequency components. In a harmonic complex tone, the lowest frequency is defined as the fundamental frequency (F0), while the remaining components are termed harmonics, whose frequencies are integer multiples of the fundamental.
The perceived pitch of a sound is closely related to its fundamental frequency, even though F0 may not be directly audible in many listening conditions. In such cases, pitch can still be identified based on the presence of upper consecutive harmonics.
This study aimed to evaluate note identification in the absence of the fundamental frequency, relying exclusively on consecutive harmonics, and to investigate the influence of their distance from the fundamental frequency on pitch perception. Thirty normally hearing amateur musicians without absolute pitch participated in the study. Acoustic stimuli consisted of combinations of either four or two consecutive harmonics derived from middle-register piano notes. The correct identification rate ranged from 8% to 100%, with higher accuracy observed when a greater number of harmonics and lower-frequency components were present. These results confirm that musical pitch can be reliably identified solely on the basis of harmonics close to the fundamental frequency, particularly when frequencies remain below 2000 Hz.

216 - CLASSMATE OR CHATBOT: COMPARING SIMULATION MODALITY FOR DEVELOPING CASE HISTORY INTERVIEW SKILLS

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Background/Rationale: Empirical evidence supports that simulation activities, such as peer role play and virtual simulation programs, have shown to be effective in training healthcare communication skills, including those necessary for completing clinical interviews (Bosse et al., 2012; Fernandez-Alcantara, 2025). Relatedly, recent pedagogical evidence points to active learning techniques as an effective means to enhance student engagement and strengthen course performance (Freeman et al., 2014). The rapid development of generative artificial intelligence (GenAI) tools provides important opportunities to leverage the benefits of large language models (LLMs) into classroom simulations. Therefore, integrating GenAI tools in training the next generation of audiologists is a promising and ecologically valid pedagogical approach, as it may be reflective of future clinical practice, wherein GenAI-supported clinical tools are becoming increasingly common.

The emergence of low-cost, accessible, and customizable GenAI applications allows instructors to create custom case scenarios for student learning, practice, and assessment. One such application is OnMicro.AI (OnMicro.AI., 2026), a no-cost application which allows the user to harness GenAI technology to act as a simulated patient and respond to student inquiries in real-time. The application then guides students through a case simulation, elicits interpretation of test materials, or provides prompt and individual feedback to users. Therefore, there is value in investigating if simulation activities tailored for improving case history interviewing skills in audiology education are effective, especially when supported with active learning strategies, and to determine how simulations using GenAI tools compare with peer role-based simulations in meeting learning outcomes. The purpose of this study was to compare the effectiveness of peer role play simulation and GenAI simulation modalities in developing case history interview skills for undergraduate communication sciences and disorders (CSD) students.

Materials and Methods: Students registered for one of two course sections of an introductory audiology course prior to the start of the semester. Following enrollment, one section was randomly designated as the peer simulation group, in which students worked in groups of 3-4 and rotated clinician and patient roles towards completing audiologic case history interviews. The other section was designated as the GenAI simulation group, in which groups of 3-4 students interacted with a Gen-AI simulated patient chatbot (OnMicro.AI) for accomplishing the same task. Both sections were taught by the same instructor and followed an identical curriculum. A total of 62 participants completed both the pre- and post-intervention questionnaires over two successive course meetings across both course sections. Of these, 26 participants belonged to the peer-simulation group and 36 to the GenAI simulation group. We used a 2x2 mixed factorial design with one between-subject factor of instructional condition (GenAI-simulated patient vs. Peer role play) and one within-subject factor of time (pre-intervention vs post-intervention). Dependent variables were students' knowledge of case history interviewing (0 = incorrect, 1 = correct) and self-efficacy (rated on a 5-point Likert scale) for conducting case history interviews.

Results: Two 2×2 mixed factorial analyses of variance (ANOVAs) were conducted to examine the effects of time (pre- vs. post-intervention) and instructional condition (GS vs PS) on participants' knowledge and self-efficacy related to case history interviewing. For knowledge, the main effect of Time approached statistical significance, $F(1, 60) = 3.62$, $p = .062$, partial $\eta^2 = .06$, indicating a modest overall increase from pre- to post-intervention. In contrast, analysis of self-efficacy revealed a significant main effect of Time, $F(1, 60) = 18.15$, $p < .001$, partial $\eta^2 = .23$, reflecting a substantial increase in participants' confidence from pre- to post-intervention. Taken together, these findings indicate that while the simulation meaningfully improved self-efficacy and produced modest gains in knowledge, both instructional simulation modalities were comparably effective in supporting participants' learning and confidence in conducting case history interviews.

Conclusions: Overall, both peer simulation and GenAI simulation led to significant improvements in self-efficacy and modest improvements in knowledge, with no evidence that one approach outperformed the other. Self-efficacy demonstrated a large effect of time, whereas knowledge gains were smaller and likely constrained by high baseline performance. Given comparable performance, there is support for use of GenAI simulations in audiology education as an effective modality for improving case history interview skills.

Guided exploration of the GenAI tool and dissemination of student perspectives, including learner engagement measures, will be shared at the presentation.

Key words: artificial intelligence, simulations, pedagogy

109 - COCHLEAR IMPLANTATION IN POSTLINGUALLY DEAF ADULTS IS TIME-SENSITIVE TOWARDS POSITIVE OUTCOME: PREDICTION USING ADVANCED MACHINE LEARNING TECHNIQUES

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Background/Rationale: Given our aging society and the prevalence of age-related hearing loss that often develops during adulthood, hearing loss is a common public health issue affecting almost all older adults. Moderate-to-moderately severe hearing loss can usually be corrected with hearing aids; however, severe-to-profound hearing loss often requires a cochlear implant (CI). However, post-operative CI results vary, and the performance of the previous prediction models is limited, indicating that a new approach is needed.
Materials and Methods: For postlingually deaf adults (n de120) who received CI with full insertion, we predicted CI outcomes using a Random-Forest Regression (RFR) model and investigated the effect of preoperative factors on CI outcomes. Postoperative word recognition scores (WRS) served as the dependent variable to predict. Predictors included duration of deafness (DoD), age at CI operation (ageCI), duration of hearing-aid use (DoHA), preoperative hearing threshold and sentence recognition score. Prediction accuracy was evaluated using mean absolute error (MAE) and Pearson's correlation coefficient r between the true WRS and predicted WRS.
Results: The fitting using a linear model resulted in prediction of WRS with $r = 0.7$ and $MAE = 15.6 \pm 9$. RFR outperformed the linear model ($r = 0.96$, $MAE = 6.1 \pm 4.7$, $p < 0.00001$). Cross-hospital data validation showed reliable performance using RFR ($r = 0.91$, $MAE = 9.6 \pm 5.2$). The contribution of DoD to prediction was the highest (MAE increase when omitted: 14.8), followed by ageCI (8.9) and DoHA (7.5). After CI, patients with DoD < 10 years presented better WRSs and smaller variations ($p < 0.01$) than those with longer DoD. Better WRS was also explained by younger age at CI and longer-term DoHA.
Conclusions: Machine learning demonstrated a robust prediction performance for CI outcomes in postlingually deaf adults across different institutes, providing a reference value for counseling patients considering CI. Health care providers should be aware that the patients with severe-to-profound hearing loss who cannot have benefit from hearing aids need to proceed with CI as soon as possible and should continue using hearing aids until after CI operation.

SPEECH-IN-NOISE TESTING

298 - SPEECH RECOGNITION ABOVE THRESHOLD: THE RELATION BETWEEN CCOLSA RECOGNITION SCORES AND ACALES LISTENING EFFORT RATINGS

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In everyday life, speech mostly occurs at higher Signal-to-Noise Ratios (SNR) than lab measures of speech recognition (e.g., Speech Recognition Thresholds, SRT) usually apply. As a subjective measure for suprathreshold listening conditions, the method Adaptive CAtegorical Listening Effort Scaling (ACALES) is establishing increasingly (Krueger et al., 2017). This method adaptively determines SNR for which a listener rates the subjective listening effort (LE) with a certain category (e.g., extreme LE, moderate LE, or effortless) on a 13-step scale. Desirably, the subjectively perceived LE in such a method should reflect the individual cognitive processing effort. According to Lemke and Besser (2016) this is not necessarily the case, because both cover different concepts and their relationship is unclear. Lately, the Concurrent Matrix/OLSA test (CCOLSA) was introduced, that allows for measuring 50%-correct-responses thresholds at higher SNR in a multi-talker turn-taking situation (Heeren et al., 2022, 2023). Due to a dual-task design (speech recognition and call-sign detection), CCOLSA challenges cognitive capacity, and performance for different listening conditions (e.g., hearing aids) reflects cognitive-load effects. This contribution investigates the relationship between these two measures.
Two groups of elderly subjects, one with mild hearing losses (N2) and another one with moderate hearing losses (N3), performed both measures for four different hearing-aid conditions. Each group consisted of 20 subjects (balanced female/male) with a matched mean age of 70 years. The tests were conducted in a sound booth with a horizontal 16 channel loudspeaker setup using a diffuse cafeteria noise at 70 dB SPL. Measured individual SNRs for moderate LE and CCOLSA SRTs range from -5 to +8 dB and depend on the hearing-aid condition. Between the two measures, no statistically significant difference was found. ACALES results showed a significant hearing-aid effect for both groups, while CCOLSA results showed this only for the N3 group.
Although this close relation might seem logical, the match of the performance measure CCOLSA and the subjective measure ACALES was surprisingly precise. Results indicate that ACALES SNR for moderate effort (7 cu) are a good measure of processing effort, although the underlying concepts do not imply this.

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Keywords: listening effort, speech recognition, dual task, suprathreshold

Conflict of interest: one or more authors have declared an industry affiliation

67 - NEURAL SIGNATURES OF SPEECH DETECTION IN NOISE DURING INFANCY

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Background: Infants are known to have more difficulties detecting speech in the presence of a noisy background compared to adults. Most of the previous studies used behavi methods to assess this capacity, whereas electroencephalography (EEG) may provide objective neural markers of this ability. Our study aims to assess infants' speech detection abilities in a noisy background by examining the auditory event related potentials (ERP) using a passive listening procedure.
Methods: We recruited a group of 25 three-month-old infants with normal hearing and typical development, who were following-up at 10 months of age. We also recruited a group of 31 adults for comparisons. All listeners were awake throughout the EEG recordings and were presented with the syllables "ba" or "da" in a continuous stationary speech-shaped noise played at 65 dB SPL via two speakers in front of the listeners. The syllables were randomly played at four different signal-to-noise ratios (SNR = +3, -4, -8, -15 dB). A total of 52 trials per SNR was played while measuring ERPs for about 20 min. The ERP amplitude after syllable onset was averaged over five frontal electrodes and in the time window 400:600 ms, corresponding to the P300-like ERP response.
Results: A first analysis showed that for both infant groups and the adult group, only ERP amplitude obtained at the SNR -15 dB were not significantly different from the neural responses obtained during the noise inter-trial presentation (considered as the baseline response when no speech was presented). A second analysis using a linear-mixed model was run on the mean [400-600ms] ERP amplitude and revealed a significant effect of Age ($p = .008$), SNR level ($p < .001$) and interaction between these two factors ($p = .020$). Post-hoc analyses indicated that at 3 months of age, decreasing the SNR significantly decreased the ERP amplitude, while at 10 months of age the ERP amplitude differed significantly between the -15 and +3, -15 and -4, and -8 and +3 conditions, but not between any other pairs.
Conclusions These findings revealed, at both 3 and 10 months of age, an effect of SNR on the P300-like amplitude related to syllable detection in noise: the greater SNRs, the greater the ERP amplitude. This result is in line with adult studies showing that the P300 amplitude decreases as the difficulty of discriminating stimuli increases. Importantly, at 3 and 10 months, ERP responses were significantly different from neural noise, starting at SNR equal to -8 dB. This finding suggests that as for the adults, the infants' brain is able to detect syllable at this SNR level by 3 months of age. Our results are promising for objective clinical measures of speech-in-noise development during infancy.

64 - COCHLEAR IMPLANTATION IN CHILDREN WITH SINGLE-SIDED DEAFNESS: FUNCTIONAL HEARING OUTCOMES IN A DANISH COHORT

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Background

Research indicates that children with single-sided deafness (SSD) have poorer linguistic and academic skills than their normal hearing peers. Binaural hearing enables localization of sound and provides access to information needed to hear and understand speech in complex listening situations. Children with SSD lack binaural cues and may experience difficulties with speech perception in noise and sound localization compared to children with normal hearing. Cochlear implant (CI) in the deaf ear can partially restore binaural hearing, yet outcomes vary with age at implantation and device use.

Objectives

This study investigates auditory and functional outcomes in children with SSD and CI, compared to peers with bilateral CI and with normal hearing (NH).

We hypothesize that:

1. Children with SSD+CI localize sound and understand speech in noise (SiN) better with the CI on than off, perform below NH peers, but outperform bilateral CI users.

Methods

A comparative design includes 90 children (ages 2–17) across three groups: SSD+CI, bilateral CI, and NH. Sound localization is assessed using broadband target sound from a 9-speaker array, and SiN is tested using Dantale I in 4 spatial conditions. Data are analyzed using mixed-effects models. The children with SSD and CI will be divided into two subgroups regarding implantation age: 1) < 3 years and 2) >3 years. In addition, children with congenital hearing loss and late onset hearing loss will be analyzed separately.

Results

Results pending. Full analysis will be presented at the conference. This study will provide the first data on SSD+CI outcomes in a Danish pediatric cohort. Results will inform candidacy guidelines and rehabilitation strategies, contributing to clinical decision-making and future revisions of CI indications. Our data suggests that cochlear implantation in children with single-sided deafness restores access to sound from the deaf side. This provides clear benefits in localisation and in speech understanding when speech and noise are spatially separated.

In simple listening conditions, with both speech and noise from the front, these children perform similarly to their normal hearing peers — likely reflecting reliance on the good ear.

So, the implant doesn't normalise hearing in every situation, but it adds important spatial information that supports communication in real life.

Keywords:

Cochlear Implant, Single-sided deafness, binaural hearing, speech in noise

275 - MEASURING THE EFFECTS OF CLEAR SPEECH DURING CONVERSATIONS: SPEAKING EFFORT, LISTENING EFFORT AND SPEECH INTELLIGIBILITY

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During a conversation in presence of acoustic barriers (e.g., background noise, interfering talkers, reverberation), talkers adapt their speech production to enhance speech clarity, i.e., to produce “clear speech”. The literature indicates that clear speech is more intelligible than casual speech, also for hearing-impaired listeners. However, the evidence regarding the intelligibility of clear speech has been obtained in passive listening tests with listeners attending to pre-recorded stimuli, often produced by talkers in absence of an interlocutor, rather than in interactive conversations. Crucially, standard speech-intelligibility testing protocols utilize short target sentences, typically pre-recorded in quiet by a trained talker, and therefore do not allow for assessment of intelligibility with clear speech or in conversational settings. Furthermore, compared to casual speech, clear speech is known to require greater physical effort, but little is known about the cognitive demands needed to produce and listen to clear speech, particularly in unfavorable acoustic environments. Therefore, despite the substantial literature on the topic, certain aspects of clear speech are underexplored, mainly because of the lack or inadequacy of the available testing methods.
This study proposes a novel testing paradigm that aims to advance the investigation of clear speech produced in response to acoustic and auditory barriers, combining measures of speaking effort, listening effort and speech intelligibility, all within the framework of a conversational scenario. A novel visual task was designed to elicit a conversation between two participants, who were sitting in separate rooms and communicated with headphones and head-mounted microphones. The acoustic environments of the two participants were controlled separately, allowing the presentation of background noise as an acoustic barrier to none, one, or both participants. In each trial of the test, triggered by the visual task, a measure of speech intelligibility was embedded in the conversation through the visual presentation of a written Hearing in Noise Test (HINT) sentence to one participant, who had to read it, and their interlocutor had to repeat it back. Akin to standard speech-intelligibility tests, speech intelligibility was scored based on the repeated sentence by a researcher who administered the experiment. Pupil dilation was measured during the conversation and was associated with the speaking and listening activity of the interlocutors, providing separate proxy measures of speaking and listening effort. The physical component of speaking effort was measured in terms of a set of voice features (intensity, fundamental frequency and spectral tilt). This paradigm offers a tool for (i) testing speech intelligibility in a more ecological conversational environment compared to standard speech-intelligibility tests, (ii) measuring changes in the voices of the participants and the speaking effort required to produce them in response to acoustic barriers that can be controlled separately for the two interlocutors, and (iii) measuring how these voice changes affect speech intelligibility as well as listening effort. The experimental paradigm will be presented and preliminary test results will be discussed in terms of the relationship observed across the outcome measures of speech intelligibility, voice features, and pupil dilation during the speaking and listening activities.

KEYWORDS: clear speech, speech intelligibility, speaking effort, listening effort, conversations

Conflict of interest: one or more authors have declared an industry affiliation

167 - SUPPORTING SELECTIVE ATTENTION IN MULTI-TALKER ENVIRONMENTS: EVIDENCE FROM CONCURRENT OLDENBURG SENTENCE TEST (CCOLSA) USING DNN-BASED HEARING AID ARCHITECTURE

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Background
Understanding speech in multi-talker environments requires listeners to selectively attend to a target talker while suppressing competing, linguistically meaningful speech. For individuals with hearing loss, selective listening is particularly vulnerable, as degraded auditory input increases cognitive load and reduces the robustness of target–masker segregation, even when audibility is restored.
Capturing these challenges in a laboratory setting is difficult. Selective and divided attention in speech recognition are typically assessed by comparing single-task speech recognition (selective attention) with dual-task paradigms (divided attention), where listening conditions are derived from speech-recognition thresholds and masking effects. In this framework, cognitive load is added on top of an audibility-based baseline.
The Concurrent Oldenburg Sentence Test (CCOLSA; Heeren et al., 2022; Heeren et al., 2023) provides an alternative approach by using dual-task performance thresholds to determine listening conditions, effectively anchoring test difficulty to cognitive capacity rather than audibility alone. CCOLSA is a three-talker speech test with overlapping, continuously presented matrix sentences. The divided-attention version requires call-sign detection with turn-taking across talkers, whereas the selective-attention version requires sustained focus on fixed target talkers.
At the same time, premium hearing aids increasingly rely on deep neural network (DNN)-based processing to improve listening comfort and speech understanding in complex acoustic scenes. While these systems share a common goal, their signal-processing architectures differ substantially. Some DNN implementations primarily guide established technologies such as directionality and digital noise reduction, whereas others apply denoising directly within the signal path. Hybrid approaches combining DNN-based denoising with adaptive beamforming have emerged to further enhance target–masker segregation in group-conversation scenarios.
Given these architectural differences, evaluation paradigms sensitive to informational masking and attentional demands are critical for understanding how modern hearing aids support speech understanding in realistic multi-talker environments. Using CCOLSA, the present study compares multiple premium hearing aids employing distinct DNN-based noise-reduction strategies under conditions designed to reflect everyday conversational listening.
Methods
Twenty adults with moderate sensorineural hearing loss participated. Speech recognition was assessed using CCOLSA in babble noise presented at 70 dB(A). Four premium hearing aids with distinct DNN-based noise-reduction strategies were evaluated, including one hybrid DNN plus beamformer architecture (H-DNN) and three comparator devices (HA1–HA3). Speech recognition performance was quantified as percent correct. Data normality was confirmed using Shapiro–Wilk tests. Device-related differences were assessed using paired t-tests with effect sizes reported as Cohen's *d*. For non-significant comparisons, equivalence was evaluated using two one-sided tests (TOST).
Results
Device-related differences depended on attentional listening demands. In the divided-attention condition, mean differences between devices were small and did not reach statistical significance. Equivalence testing confirmed comparable performance across devices in this condition (TOST, $p > 0.05$ for all comparisons).
In contrast, the selective-attention condition revealed advantages for the hybrid DNN plus beamformer architecture. Median scores were 72.5% (H-DNN), 68.3% (HA1), 69.2% (HA2), and 70.1% (HA3). Statistically significant mean benefits of 6.3 percentage points relative to HA1 ($p = 0.0038$; Cohen's $d = 0.55$) and 4.8 percentage points relative to HA2 ($p = 0.046$; Cohen's $d = 0.42$) were observed. The mean benefit relative to HA3 (3.7 percentage points) did not reach statistical significance and was comparable. All datasets were normally distributed (Shapiro–Wilk tests, $p > 0.05$).
Conclusions
These findings demonstrate that device-related differences in speech understanding are most evident when selective auditory attention is required. While premium hearing aids showed equivalent performance under divided-attention demands, advantages emerged for DNN-driven architectures under selective-attention conditions characterized by competing speech.Selective attention appears to be a critical mechanism underlying successful communication in real-world multi-talker environments. CCOLSA is particularly sensitive to attentional support and target–masker segregation, suggesting that evaluation paradigms emphasizing selective-attention demands may better capture meaningful functional differences between modern hearing aid signal-processing strategies.
Key words: DNN, Speech-in-speech, CCOLSA

Conflict of interest: one or more authors have declared an industry affiliation

299 - METACOGNITION FOR LISTENING IN NOISE ACROSS THE LIFESPAN: EFFECTS OF AGE AND MILD HEARING LOSS

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Background

Listening in noisy environments poses significant challenges across the lifespan and is particularly relevant in older adulthood. Beyond sensory and cognitive processing, successful listening relies on metacognition—the ability to monitor one's performance, evaluate confidence, and hold beliefs about one's own abilities, such as self-efficacy and locus of control. Metacognitive processes are central to self-regulation and the selection of adaptive coping strategies. While age-related changes in metacognition have been documented in domains such as memory, little is known about metacognition for listening. Moreover, although hearing loss (HL) is known to affect communication, its impact on metacognitive beliefs and their relationship to strategy use in older adults remains unclear. In two studies we examined (1) the effect of healthy aging on metacognition for listening in noise, and (2) the additional impact of mild HL on metacognitive monitoring, beliefs, and compensatory strategy use.

Methods

Across the two studies, a total of 139 participants were tested. Study 1 included 30 younger adults and 30 older adults with typical hearing. Study 2 included 26 younger adults with normal hearing (NH), 26 older NH adults, and 27 older adults with mild HL who did not use hearing aids. Metacognitive monitoring was assessed using listening-in-noise tasks in which participants reported confidence in their performance after sentence recognition. Monitoring accuracy was evaluated by examining the correspondence between performance and confidence. Broader metacognitive constructs—including self-efficacy, locus of control, and knowledge about listening abilities—were measured via validated questionnaires. In Study 2, self-reported use of compensatory listening strategies (e.g., behavi and non-verbal strategies) was also assessed. Group comparisons were conducted using parametric analyses, and associations between metacognitive factors and strategy use were examined.

Results

Effects of Age (Study 1 and Study 2). Across both studies, healthy aging alone did not reduce metacognitive monitoring for listening in noise. Older adults demonstrated monitoring abilities comparable to younger adults. No age-related differences were found in locus of control, metacognitive knowledge, or general self-efficacy for listening. Together, these findings indicate that metacognitive abilities for hearing in noise remain largely intact in healthy aging.

Effects of Mild Hearing Loss (Study 2). In contrast to the limited impact of age alone, mild HL in older adults was associated with differences in metacognitive beliefs. Although older adults with HL showed preserved monitoring accuracy comparable to their NH peers, they reported significantly lower self-efficacy regarding their listening abilities. They also reported less frequent use of some behavi compensatory strategies. Perceived control and self-efficacy were significantly associated with reported strategy use, particularly among participants with HL. A more internal locus of control and lower self-efficacy were linked to greater use of non-verbal strategies, suggesting that metacognitive beliefs shape coping behaviors in the presence of auditory difficulty. Importantly, these changes were not indicative of impaired monitoring capacity. Instead, they appeared to reflect accurate awareness of listening challenges combined with altered beliefs about personal competence and control.

Conclusions

Taken together, these findings demonstrate that metacognitive monitoring for listening in noise is largely preserved across the lifespan and remains intact even in the presence of mild HL. Healthy older adults show monitoring abilities comparable to younger adults. However, mild HL influences metacognitive beliefs, particularly self-efficacy, and these beliefs are associated with the adoption of compensatory strategies. The dissociation between intact monitoring and altered self-efficacy in older adults with HL highlights the importance of distinguishing between different components of metacognition. While performance awareness remains stable, beliefs about one's capabilities may shift in response to sensory changes and may influence behavi adaptation. These results underscore the relevance of metacognitive factors in shaping listening behavior and coping strategies. Interventions targeting listening difficulties in older adults may benefit from explicitly addressing self-efficacy and perceived control, alongside auditory rehabilitation, to promote adaptive strategy use and support effective communication in noisy environments across the lifespan.

300 - AGING AND SPONTANEOUS ORIENTING TO SPEECH IN NOISE: AN EMBODIED PERSPECTIVE ON LISTENING ACROSS THE LIFESPAN

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Background

Understanding speech in noisy environments is particularly challenging in later adulthood and can negatively affect communication and social participation. Although speech perception is often considered primarily auditory and cognitive, effective real-world listening also relies on adaptive motor behaviours. One such strategy is spontaneously turning toward a speaker to access visual speech cues and optimize auditory input. While audiovisual integration remains beneficial with aging, it is unclear whether older adults spontaneously engage in orienting behaviours to the same extent as younger adults when listening demands increase.

Objective

To determine whether spontaneous head and trunk orienting toward a talker in noise differs between young and older adults with normal hearing, and to examine how this behaviour relates to speech intelligibility, confidence, and perceived listening effort.

Methods

Twenty-four young adults and twenty-four older adults, all with clinically normal hearing thresholds, were tested in an immersive 360° virtual reality environment. An avatar delivered short sentences from unpredictable locations around the participant (front and rear positions). Sentences were presented either in quiet or with background noise to manipulate listening difficulty, adjusted individually for each participant. Sentences were spatialised to the position of the virtual speaker. Participants were free to rotate their head and trunk without restriction, allowing spontaneous orienting strategies to emerge. Head and trunk kinematics were recorded to quantify movement amplitude and the angular distance maintained relative to the avatar during speech presentation. Primary measures included (1) frequency of orienting movements, (2) angular distance from the speaker, (3) speech intelligibility, (4) subjective ratings of listening confidence and perceived effort.

Results

Across both age groups, orienting behaviour increased as listening demands increased. When background noise was present, participants were more likely to turn toward the avatar. This adaptive behaviour was associated with higher speech intelligibility, greater self-reported confidence, and reduced perceived listening effort, confirming its functional value. Importantly, age-related differences emerged in the spontaneous engagement of this strategy. Compared to younger adults, older adults turned less frequently and maintained larger angular distances from the avatar, particularly when the speaker was positioned behind them. These differences were most pronounced when the virtual speaker appeared behind the participant, where audiovisual access would provide the greatest benefit. Crucially, when older adults did orient toward the speaker, their movement execution was largely comparable to that of younger adults in terms of amplitude and overall kinematic characteristics. This suggests that age differences may not only reflect motor limitations, but may also entail differences in the spontaneous decision to engage the strategy. Reduced orienting in older adults was associated with lower speech intelligibility. Lower intelligibility, in turn, predicted reduced confidence and higher perceived listening effort. Thus, underuse of an effective behavioural adaptation had measurable consequences for both objective performance and subjective listening experience.

Discussion

These findings demonstrate that listening in noise is an embodied process shaped by dynamic interactions between perception, action, and decision-making. Turning toward a speaker is not merely a motor response but a strategic behavior that modifies sensory input and influences cognitive load. While both young and older adults benefit from orienting, older adults appear less likely to spontaneously adopt this strategy under challenging conditions. The preserved quality of motor execution in older adults indicates that reduced orienting may not reflect physical constraints alone. Instead, it may also reflect altered cost–benefit evaluations, differences in listening engagement, or reduced initiation of compensatory behaviors with aging.

Conclusions:

Even in individuals with normal hearing thresholds, aging influences the spontaneous adoption of adaptive motor strategies that support speech understanding in noise. Reduced engagement in orienting behaviour is associated with poorer intelligibility and greater perceived effort. These findings highlight the importance of considering behavioural adaptations, alongside sensory and cognitive factors, in understanding communication across the lifespan and in developing approaches to support effective listening in older adults

328 - BILINGUALS' SPEECH PERCEPTION OF NOISE-VOCODED SPEECH

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Background: Speech perception in monolingual listeners can remain relatively robust under adverse listening conditions, including spectrally degraded speech (Yang et al., 2022). Given that a large proportion of the world's population is bilingual and that many cochlear implant (CI) users are also bilingual, it is important to understand how bilingualism may affect perception of processed speech. Noise-vocoded speech is commonly used to simulate aspects of CI listening. The aim of this study was to compare noise-vocoded speech perception in bilingual and monolingual listeners across two experiments.
Materials and Methods: Two experiments were conducted. Experiment 1 included Russian–Hebrew bilingual young adults and Hebrew-speaking monolinguals (mean age = 32.1 years). The bilingual group included 30 participants (17 early bilinguals, defined as L2 acquisition before age 7; 13 late bilinguals), and the monolingual group included 15 participants. Experiment 2 included Arabic–Hebrew bilingual young adults and Hebrew-speaking monolinguals (mean age = 24.8 years). The bilingual group included 30 participants (13 early bilinguals and 17 late bilinguals), and the monolingual group included 15 participants. In both experiments, participants identified monosyllabic words that were noise-vocoded through 12 channels and presented at four signal-to-noise ratios (SNRs): −2, +3, +8, and +13 dB.
Results: The two experiments yielded contrasting patterns. In Experiment 1, a significant group effect was found across SNR conditions ($F(1, 41) = 13.350$, $p < .01$), with Russian–Hebrew bilinguals outperforming monolinguals. In Experiment 2, a significant group effect was also found ($F(1, 41) = 30.864$, $p < .01$), but in the opposite direction: Hebrew-speaking monolinguals outperformed Arabic–Hebrew bilinguals.
Conclusions: These results are surprising and highlight heterogeneity within the bilingual population. We suggest that the different results of the two studies might stem from differences in second-language proficiency among the bilingual participants. These differences may become evident in speech perception tasks under challenging conditions, such as speech in noise or noise-vocoded speech. These results have clinical implications for the assessment and rehabilitation of bilingual adults with hearing loss who receive cochlear implants.

Keywords: Bilingual; Monolingual; Noise vocoded speech; Speech perception in noise

COGNITIVE DECLINE

15 - A MIXED METHODS APPROACH TO UNDERSTAND THE ASSOCIATIONS BETWEEN HEARING LOSS, COGNITIVE DECLINE, AND SOCIAL ISOLATION IN OLDER ADULTS

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Background: Age-related hearing loss is common among older adults and increasingly linked to cognitive decline and social isolation. While epidemiological studies suggest associations between hearing impairment and dementia, the mechanisms remain unclear. Social isolation is a proposed mediator, yet evidence is limited. This presentation synthesises findings from a mixed methods research program, including a longitudinal cohort study, systematic review and meta-analysis, and ethnographic investigation in residential care settings.
Methods: Three complementary studies were conducted. First, the Hertfordshire Ageing Study (HAS) examined whether baseline hearing thresholds predicted cognitive performance and social isolation scores ten years later. Hearing was measured via pure tone audiometry; cognition via the Mini-Mental State Examination (MMSE); and social isolation via the Medical Outcomes Study (MOS) Social Support Survey. Linear regression models adjusted for demographic, lifestyle, and clinical confounders.
Second, a systematic review and meta-analysis of longitudinal studies assessed the causal relationship between hearing loss and cognitive decline, and the role of social isolation as a mediator. Fifteen studies met inclusion criteria; five were included in the meta-analysis. Risk of bias was assessed using validated tools, and pooled hazard ratios calculated.
Third, an ethnographic study explored the lived experiences of older adults with hearing loss and dementia in two UK care homes. Data were collected through environmental audits, observations, and semi-structured interviews with residents, staff, and relatives. Grounded Theory and realist-informed analysis identified mechanisms contributing to social isolation.
Results: In the HAS cohort, hearing thresholds worsened by 10.5 dB over ten years. Higher thresholds were associated with lower MMSE scores (β = –1.02 per doubling of hearing threshold, 95% CI: –2.07 to 0.03) and lower social isolation scores (β = –0.37, 95% CI: –1.40 to 0.66), though not statistically significant. Confidence intervals suggest small but potentially meaningful effects.
The systematic review confirmed a dose-dependent association between hearing loss and cognitive decline. The pooled hazard ratio for cognitive impairment was 1.11 (95% CI: 1.06–1.15), and for incident dementia was 1.21 (95% CI: 1.11–1.31). Only one study formally tested social isolation as a mediator, without reporting indirect effects. Measurement inconsistencies and lack of longitudinal social isolation data were key gaps.
The ethnographic study revealed that social isolation was influenced more by communication ability than hearing loss severity. Internal barriers such as disordered language and external barriers including environmental noise, staff time constraints, and rigid care routines reduced opportunities for meaningful conversation. Residents with early-stage dementia and preserved expressive language were more socially engaged, while those with advanced dementia and disordered language experienced profound isolation. Staff prioritised physical care over communication, and systemic factors exacerbated isolation.
Discussion: Findings suggest hearing loss may contribute to cognitive decline and social isolation, but relationships are nuanced and mediated by multiple factors. The lack of significant associations in the HAS cohort may reflect underpowered analyses, measurement limitations, and selection bias. The review supports a causal link between hearing loss and cognitive outcomes but highlights the need for mediation analyses and standardised social isolation measures. Ethnographic insights emphasise the importance of communication quality, staff training, and environmental design in mitigating isolation.
Conclusion:
This mixed methods approach offers a comprehensive understanding of the associations between hearing loss, cognitive decline, and social isolation. While quantitative data suggest modest associations, qualitative findings reveal systemic barriers to communication. Future research should incorporate sensitive cognitive assessments, longitudinal social isolation measures, and mediation models. Interventions should prioritise communication training, environmental modifications, and integrated hearing care to support cognitive resilience and social engagement in older adults.

Keywords: hearing loss, cognitive decline, dementia, social isolation, mixed methods

253 - ASSOCIATION BETWEEN AGE-RELATED SENSORY AND METABOLIC HEARING LOSS AND COGNITIVE PERFORMANCE

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Background and Aim
The underlying mechanisms linking age-related hearing loss (HL) and cognitive dysfunction are not well understood. Both indirect mechanisms, such as social isolation (Livingston et al., 2020), and shared pathophysiological mechanisms, including inflammation, vascular dysfunction, or mitochondrial impairment (Kostrikov et al., 2025), have been proposed. Traditionally, age-related HL has primarily been attributed to damage to hair cells (i.e., the sensory component of HL); however, growing evidence suggests that alterations in the endocochlear potential (i.e., the metabolic component of HL) may also contribute.
Vaden et al. (2022) proposed a phenotype-based classification of audiograms that estimates the sensory and metabolic components of HL and may provide insight into the underlying pathology. The aim of this two-phase study was to investigate the association between sensory and metabolic HL and cognitive performance in older adults.

Methods
Phase 1 included 40 participants with mild cognitive impairment recruited through the Danish Dementia Research Centre and 60 participants recruited from the general public. Phase 2 included 83 adults with bilateral age-related HL recruited from the Department of Audiology at Bispebjerg Hospital, Copenhagen. In Phase 2, 42 participants were experienced hearing-aid users (>1 year of use), and 41 were new hearing-aid candidates. Inclusion and exclusion criteria ensured a focus on age-related HL and the absence of neurological or psychiatric disorders.
In both phases, participants underwent identical pure-tone audiometry and a comprehensive cognitive test battery assessing processing speed, executive function, episodic memory, and visuospatial memory. Sensory and metabolic components of HL were estimated using the age-related HL components model (Vaden et al., 2022). Associations between the HL components and cognitive outcomes were examined using linear regression models adjusted for age. In Phase 2, hearing-aid status and interaction terms were additionally explored.

Results
Across both phases, greater metabolic HL was significantly associated with poorer performance on tests of processing speed. In Phase 1, metabolic HL was also moderately associated with executive function, while in Phase 2, metabolic HL was associated with verbal fluency performance. In contrast, sensory HL was not significantly associated with any of the cognitive test scores in either phase. Analyses including hearing-aid status did not reveal any statistically significant moderation effects.

Conclusion
Across two independent cohorts, the metabolic component of age-related HL was consistently associated with reduced processing speed, whereas the sensory component was not. The absence of associations with episodic and visuospatial memory and the lack of interaction effects with hearing-aid status suggest that the observed relationships are specific to certain cognitive domains and not moderated by hearing-aid experience. These findings support continued investigation into shared biological mechanisms underlying metabolic HL and cognitive performance.

Keywords: Age-related hearing loss - Metabolic hearing loss - Sensory hearing loss - Processing speed - Cognitive performance

61 - ENVIRONMENTAL NOISE AND AIR POLLUTION AS RISK FACTORS FOR HEARING LOSS AND DEMENTIA: THE TRAMONTANA COHORT STUDY IN TARANTO, ITALY

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Introduction
Hearing impairment is a highly prevalent chronic condition, and those with hearing loss face elevated risks of hospitalization, falls, cardiovascular disease, and dementia compared to peers with normal hearing. Identifying modifiable risk factors for hearing loss is crucial, especially since hearing impairment is also recognized as a modifiable risk factor for dementia. Air pollution and environmental noise are widespread urban exposures that can induce systemic inflammation and auditory damage. Taranto, Italy – an industrial city with substantial emissions from steelworks – provides a unique setting to study the long-term impact of pollution on hearing and subsequent dementia risk, in the framework of the Horizon EU-funded MISTRAL Project.
Aim: We aimed to investigate the associations between long-term exposure to air pollutants (fine particulate matter, $PM_{2.5}$, and nitrogen dioxide, NO_2) and community noise (day–evening–night level, L_{den}) and the 10-year incidence of hearing loss. A secondary aim was to examine the effect of these environmental exposures on incident dementia in older adults (60+), and whether baseline hearing impairment modified the dementia risk associated with pollution exposures.
Methods: The Tramontana cohort study (2015–2025) is a Horizon EU-funded study (MISTRAL, doi: 10.3030/101095119) that followed 201,719 adult residents of Taranto retrospectively for 10 years. New-onset hearing loss was defined as a pure-tone average of 0.5–2 kHz in the better-hearing ear >45 dB HL, with 1,125 cases identified over follow-up. Incident dementia cases (n = 927) were ascertained among participants aged ≥60 years at baseline (younger individuals were excluded from dementia analyses). Daily mean exposure to $PM_{2.5}$ _and NO_2 _(in μg/m³) was estimated using a complex convolutional neural network model at the residential level of each participant with a resolution of 100x100 m (integrating mathematical dispersion model and machine learning) and long-term environmental noise (L_{den}, in dB) was estimated using retrospective urban measuring campaign using ten neighbouroods fo each year of observation. We fitted quasi-Poisson regression models to estimate incidence rate ratios (IRRs) and 95% confidence intervals (CIs) for hearing loss and dementia, adjusting for age, sex, socioeconomic status, and disability. In dementia models, baseline hearing loss was included as a covariate and as an interaction term with each pollution exposure to assess effect modification.
Results
Over 10 years, 1,125 participants (0.56% of the cohort) developed hearing loss. Higher long-term exposures to both air pollutants and noise were associated with greater hearing loss incidence. For example, each five μg/m³ increase in $PM_{2.5}$ _was associated with about a 10% higher rate of hearing loss (IRR ~1.10; 95% CI: 1.02–1.18). Similarly, NO_2 _exposure was associated with an increased risk of hearing loss (e.g., IRR ~1.06 per 10 μg/m³; 95% CI: 1.01–1.12). Chronic noise exposure showed a positive, dose-dependent association with hearing loss incidence (IRR ~1.08 per 5 dB L_{den}; 95% CI: 1.00–1.17). In the older subset (aged ≥60), 927 individuals developed dementia during follow-up. Baseline hearing impairment was significantly associated with higher dementia incidence (IRR ~1.5; 95% CI: 1.3–1.8, hearing loss vs. normal hearing). Long-term air pollution exposures were also associated with elevated dementia risk. In fully adjusted models, each five μg/m³ increase in $PM_{2.5}$ _corresponded to an IRR of approximately 1.12 (95% CI: 1.05–1.20) for incident dementia. Notably, we observed a significant interaction between hearing loss and air pollution: the association between $PM_{2.5}$ _and dementia was stronger in participants with baseline hearing loss (e.g., IRR ~1.20) than in those without hearing loss (IRR ~1.05, p_interaction < 0.05). A similar effect modification was seen for NO_2 _exposure. In contrast, associations of environmental noise with dementia were weaker and became non-significant after accounting for air pollution. These results were derived from a stratified analysis excluding participants younger than 60 years, ensuring that age-related dementia risk was appropriately accounted for.
Conclusions
In this large cohort from an environmentally polluted city, long-term exposure to air pollution and community noise emerged as significant risk factors for incident hearing loss. Furthermore, among older adults, air pollution was associated with an increased incidence of dementia, and this effect was amplified in those with pre-existing hearing impairment. Our findings suggest that environmental exposures not only contribute to hearing decline but also compound the risk of dementia in individuals with hearing loss. Mitigating air pollution and noise and promoting hearing health may be critical integrated strategies to reduce the burden of dementia in aging populations.

280 - HEARING CARE, SOCIAL CONNECTION, AND COGNITION: RESULTS FROM THE ACHIEVE TRIAL

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Background
The association between hearing loss and cognitive decline has received significant public attention over the last decade. However, there is limited evidence supporting the hypothesized mechanistic pathways linking hearing loss and cognition. An often-proposed pathway is that social connection mediates hearing loss and cognitive decline. However, few, if any, studies have used large clinical trial data with robust measures of hearing, hearing care, and social connection have examined the question. This secondary analysis of the Aging and Cognition Health Evaluation in Elders (ACHIEVE) trial examined whether hearing care impacts social connection and whether social connection functioned as a mechanistic pathway through which hearing intervention affected cognition among older adults.
Materials and Methods
ACHIEVE (United States of America, 2018-2022) was a multicenter, parallel-group, unblinded 1:1 randomized controlled trial of 977 community-dwelling older adults (70-84 years) with mild-moderate hearing loss that examined the effects of a best-practice hearing intervention (n=490) versus a health education control (n=487) on 3-year change in cognition. Participants were recruited from the ongoing Atherosclerosis Risk in Communities (ARIC) study (n=238) or de novo from the local community (n=739). Global cognition factor scores were derived from a comprehensive battery of ten neurocognitive tests administered at Year 3 follow-up. Social connection was measured using the Cohen Social Network Index and categorized into subdomains of social network size (number of people with regular contact), social network diversity (number of social roles with regular contact, e.g. spouse), and embedded networks (number of network domains with regular contact, e.g. family). Loneliness was measured using the UCLA Loneliness Scale (higher scores reflect greater loneliness). The intervention effect of hearing care on social and loneliness outcomes over 3 years were estimated using a 2-level linear mixed-effects model under the intention-to-treat principle. The Mediators were operationalized as the change in each domain of social connection from baseline to Year 3 while accounting for the time between assessments. Mediators were entered into separate causal mediation models to estimate indirect effects. Each indirect effect quantified the extent to which a mediator functioned as a mechanistic pathway between hearing intervention and cognition. Analyses were conducted among the full sample and stratified by recruitment source (ARIC or de novo). Missing data was addressed using multiple imputations by chained equations.
Results
Over 3 years, mean (SD) social network size reduced from 22.6(11.1) to 21.3(11.0) and 22.3(10.2) to 19.8(10.2) people over 2 weeks in the hearing intervention and health education control arms, respectively. In fully adjusted models, hearing intervention (vs health education control) reduced social isolation (social network size [difference, 1.05; 95%CI,0.01-2.09], diversity [difference, 0.19;95%CI,0.02-0.36], embeddedness [difference, 0.27;95%CI,0.09-0.44], and reduced loneliness [difference, −0.94 95%CI,−1.78 to −0.11]) over 3 years. Results were substantively unchanged in sensitivity analyses that incorporated models that were stratified by recruitment source, analyzed per protocol and complier average causal effect, or that varied covariate adjustment. A statistically significant indirect effect was detected for embedded networks (β=0.015;95%CI,0.001, 0.030, p=0.036) in the full sample, suggesting that hearing intervention may affect cognition in part through its impact on social connections. Indirect effects for social networks (β=0.012;95%CI,-0.001, 0.026, p=0.081), network diversity (β=0.015;95%CI,0.000,0.031, p=0.055), and loneliness (β=0.008;95%CI,-0.006, 0.022, p=0.280) were not statistically significant. When stratified by recruitment source, point estimates of the indirect effect were larger among participants recruited from ARIC compared to de novo participants, but none of the indirect effects were statistically significant.
Conclusions
Best practice hearing care resulted in the retention of 1 additional person in a social network over a 3-year period compared to a healthy education control. Participants who received intervention also had more diverse networks with higher quality interactions after 3 years. The effect on loneliness was statistically significant but not clinically meaningful. The effect of a best-practice hearing intervention on subsequent cognitive function was partially mediated by network embeddedness, which represents the depth of an individual's engagement in different social network domains. These results provide the first preliminary evidence suggesting that social connection functions as a mechanistic pathway through which hearing intervention may reduce cognitive decline in older adults with hearing loss. Further research in longitudinal observational cohorts and clinical trials is warranted to quantify the role of social connection in the relationship between hearing loss and cognitive decline.
Keyword: Hearing, Amplification, Epidemiology, Clinical Trial, Social Connection

Conflict of interest: one or more authors have declared an industry affiliation

319 - CHOIR SINGING AND SIGN-LANGUAGE LEARNING IN OLDER ADULTS WITH HEARING LOSS: A NONRANDOMIZED CONTROLLED TRAINING STUDY WITH COGNITIVE AND PSYCHOSOCIAL OUTCOMES

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Cognitive function and psychosocial wellbeing are improved in older adults who experienced both multilingual and musical activities cumulatively over their lifetime compared to peers who experienced only one or the other. Prospective randomized controlled training studies with confirmed benefits of one or the other domain training in normal hearing older adults. However, it is not clear whether similar benefit of these activities are experienced by older adults with hearing loss.

Hearing loss is highly prevalent in the older adult population, and hearing loss is a risk factor for both mild cognitive decline and feeling socially isolated. Thus, understanding whether musical or language-learning activities could prospectively improve cognitive function or psychosocial wellbeing is especially relevant to older adults with hearing loss. Moreover, despite the clear advantages of randomized controlled trials in diminishing potential bias effects, we previously experienced substantial participant attrition when participants were not allocated to an intervention to which they most wanted to be allocated. Therefore, this project aims to address these gaps by focusing on older adults with hearing loss while using non-randomized, self-selected training and control groups.

Specifically, we investigate whether participants can experience benefits to cognitive and psychosocial health from second language learning and musical training using a cumulative design. Over one year, participants will successively engage in a 3-month choir and 3-month sign language lessons. Before-, after, and follow-up testing for each activity will be compared with a do-nothing control group. Primary outcomes are (1) cognitive flexibility (as a proxy for cognitive function) assessed through the Color-Shape Switching Task, and (2) psychosocial wellbeing assessed through semi-structured interviews. Baseline measures include cognitive reserve (the Cognitive Reserve Index Questionnaire) and auditory processing (digits-in-noise test). Participants are older adults (60+yrs) with both treated and untreated hearing loss (PTA4 range: 20 – 60 dB).

In March 2026, 14 completed datasets (cohort 1) and another 7 baseline datasets (cohort 2) will be completed. Preliminary analysis of baseline metrics in cohort 1 show a moderate association (R = -.646, p = .013) between cognitive reserve and digits-in-noise scores, suggesting a relationship between lifetime cognitive enrichment and auditory processing in this sample. The complex interaction of cognitive function, psychosocial wellbeing and hearing loss will be assessed in training and control groups over the course of the study, specifically whether choir- or sign language activities can prospectively modulate cognitive flexibility or psychosocial wellbeing. Ultimately, this research aims to provide insight into whether new experiences that can be created in older adulthood can help to positively contribute to healthy aging in individuals with hearing loss.

Keywords
Age-related hearing loss; musical training; language learning; cognitive reserve; non-randomized controlled study

KEYNOTE LECTURE

89 - HEARING-INTERVENTION OUTCOME MEASURES IN ADULTS: CHANGING HOW MEANINGFUL CHANGE IS DETERMINED

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In 2025, a report from the U.S. National Academies of Science, Engineering, and Medicine (NASEM), entitled “Measuring Meaningful Outcomes for Adult Hearing Health Interventions”, recommended a core set of outcome measures following review of the literature. The recommended protocol relied heavily on the evidence base regarding hearing-aid wearer’s self-reported difficulties and listening experiences. In the end, NASEM committee felt that two outcome domains and three outcome measures had sufficient supporting evidence to recommend their inclusion in the core set. The recommended outcome measures in the NASEM report included two self-report measures, the Revised Hearing Handicap Inventory (RHHI) and the global score from the Abbreviated Profile of Hearing Aid Benefit (APHAB), and one SNR-based behavi speech-in-noise measure (the Words-In-Noise, WIN, test). The recommended hearing-aid outcome measures in the NASEM report will be reviewed briefly in this presentation, along with evidence supporting those recommendations. Some important holes in the evidence base were also identified in the NASEM report. These include, among others, the lack of established minimum clinically important differences (MCIDs) for the outcome measures included in the core set. Our recent efforts to provide such MCIDs for the outcome measures in the recommended NASEM core set will be reviewed and discussed.

Keywords: Hearing Aids, Outcome Measures, Aging

PANEL DISCUSSION

Over-the-Counter (OTC) Hearing Aids: Recent Findings and Future Directions

Organized by Larry E. Humes

83 - OVER-THE-COUNTER (OTC) HEARING AIDS: RECENT FINDINGS FROM THE P-CHAT RCT

Sumitrajit Dhar [1]

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Dhar will present on the motivation, design, and results of the recently completed P-CHAT RCT comparing outcomes for self- versus provider-fit hearing aids. The P-CHAT study enrolled 584 first-time hearing aid users in four study sites in the USA, enrolled, fit, and evaluated participants over a 6-month period using a combination of self-service and traditional audiological service delivery methods. All participants divided into three fitting groups were fit with the same high-end receiver-in-the-canal hearing aids, which the participants paid to purchase. The results demonstrate the primary and secondary outcome measures for the self-fit group to not be statistically inferior to those for the provider-fit group. However, a few interesting differences in outcomes between the groups was observed.

88 - OVER-THE-COUNTER (OTC) HEARING AIDS: LEARNINGS FROM A RECENT DOUBLE-BLINDED RCT

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In this section of Over-the-Counter (OTC) Hearing Aids: Recent Findings and Future Directions, Ricketts will present on a double-blinded RCT completed at the University of Iowa and Vanderbilt University Medical Center that included six parallel arms (factorial combinations of three service-delivery models and two levels of hearing aid technology). Service levels included self-service (OTC), limited service (OTC+) and Audiologist-based (AUD). Results from the 247 adults with mild-to-moderate hearing loss that completed the study demonstrated that all three service levels were efficacious. However, superior outcomes were found for the AUD service level compared to OTC and OTC+, as measured by the Ecological Momentary Assessment (EMA)-based primary and some secondary outcome measures. Findings from heterogeneity of variance analyses will also be briefly discussed.

85 - OVER-THE-COUNTER (OTC) HEARING AIDS: UNDERSTANDING CONSUMER HEARING HEALTHCARE CHOICES

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Over-the-counter (OTC) hearing aids were introduced to improve the accessibility and affordability of hearing healthcare. However a critical component to their acceptance and use are consumer attitudes towards these devices, which remains underexplored. This study surveyed over 1000 adults over the age of 50, who had no prior hearing aid experience. The objectives were to: 1) compare how consumer choices and attitudes towards OTC hearing aids have changed since a prior distribution of this survey in March 2022, and (2) identify emerging target group(s) that are more inclined to consider OTC hearing aids. Results showed a continued strong preference (83%) for provider-driven hearing healthcare. Insurance coverage, care journey stage, and consumer attitudes may influence HHC decisions. These findings suggest consistent demographic divides in hearing healthcare preferences.

SPECIAL SESSION
Hearing at work: costs and benefits of effortful listening
Organized by Adriana A. Zekveld

141 - PERSONALIZED CODED SPEECH ENHANCEMENT FOR FIRST RESPONDER COMMUNICATION

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First responders such as firefighters, police officers, and emergency medical staff rely on spoken communication to coordinate their work and ensure safety. In many systems, this communication is transmitted using low-bitrate “telephone-quality” speech codecs, such as the Adaptive Multi-Rate narrowband (AMR-NB) codec at 4.75 kilobits per second (kbps). These codecs are efficient and robust, but they reduce audio quality and limit the speech bandwidth. The resulting signals can sound less natural and harder to follow, and degraded speech has been associated with increased listening effort in previous research. In safety-critical occupations, greater effort and fatigue may compromise situation awareness, decision-making, and long-term well-being. Improving the quality of coded speech in occupational communication is therefore directly relevant to “hearing at work” and to the Hearing Across the Lifespan (HEAL) 2026 themes of listening effort and hearing in complex environments.
As part of the EASYLI project, we investigate ways to improve the sound quality of strongly compressed speech used in first-responder communication. Our system runs on the listener’s side: it takes the already transmitted and decoded signal and tries to reverse some of the distortions introduced by the codec, while restoring a wider and more natural-sounding speech bandwidth. The goal is to deliver speech that sounds clearer and more natural to the listener, without changing existing communication standards or equipment. As a non-personalized reference, we use HiFiGAN+, a neural network model that is used as a reference method for coded speech enhancement in the literature.
The main focus of this work is on personalizing the enhancement to the transmitting speaker. Voices differ in stable ways, for example in timbre and rhythm. Our hypothesis is that an enhancement system that can utilize such speaker-specific characteristics and support easier, less effortful listening. Technically, this personalization is based on compact numerical “voice fingerprints” (speaker embeddings) derived from recordings of each speaker. We investigate two ways of using these voice fingerprints. In speaker-embedding conditioning, a single enhancement model is used for all speakers, but it is given the current speaker’s fingerprint as an additional input so that its processing can adapt to that speaker. In cluster-based model selection, speakers with similar fingerprints are grouped into a small number of clusters, and one specialized enhancement model is trained per cluster. During use, a speaker is assigned to the most similar cluster based on their fingerprint, and the corresponding model is applied.
The different approaches are evaluated on a speech corpus where low-bitrate coding is applied and the original wideband recordings serve as clean references. We include both speakers who are part of the training data and completely unseen speakers. Objective performance is assessed with standard wideband speech-quality measures such as wideband Perceptual Evaluation of Speech Quality (PESQ-WB), Virtual Speech Quality Objective Listener (ViSQOL), and Log-spectral distance (LSD). Both personalized approaches yield consistently better objective quality scores than the non-personalized HiFiGAN+ baseline, for both seen and unseen speakers.
For the HEAL community and the Special Session “Hearing at work: costs and benefits of effortful listening”, this work provides a technical basis for future studies that directly link speaker-personalized coded speech enhancement to listening outcomes at work. The present results are based on objective measures only. Ongoing and planned work includes listening experiments with normal-hearing and hearing-impaired participants in simulated first-responder communication scenarios. These studies will assess whether the observed quality improvements translate into reduced listening effort and fatigue, and into benefits for safety, work performance, and long-term occupational health.

Keywords: coded speech enhancement; first responder communication; listening effort; speaker personalization; artificial intelligence

Conflict of interest: one or more authors have declared an industry affiliation

101 - THE SUBJECTIVE AND PHYSIOLOGICAL SIGNATURES OF LISTENING EFFORT

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When listening situations become increasingly challenging due to background noise, people often disengage from listening. Understanding the factors driving this disengagement can help explain how listeners decide whether exerting effort is worthwhile in noisy environments where effective communication is critical (e.g., certain workplaces). Based on previous research on physical and mental effort, we hypothesized that disengagement decisions reflect an interaction between task difficulty, potential reward, fatigue, and recent errors.
Twenty-five normal-hearing participants (18–65 years) completed an effort discounting paradigm in the laboratory. Each trial began with an offer specifying the difficulty (speech-to-noise ratio, SNR) and potential reward of an upcoming speech-in-noise repetition task, on which participants chose whether to work (perform the trial) to earn credits or to rest (skip the trial). Following each trial, participants provided a fatigue rating and received performance feedback. Each participant completed 126 trials covering nine difficulty–reward combinations (3 × 3). To individualize task difficulty, speech reception thresholds were measured, with the hardest level corresponding to the SNR at which 50% of sentences were correctly repeated.
Participants were less likely to engage in high-difficulty, low-reward trials. Engagement further decreased following higher fatigue ratings and repetition errors on preceding trials.
We performed a computational model comparison, which favored an effort discounting model in which the subjective value of reward is discounted by task difficulty, with the impact of difficulty scaled by fatigue and recent performance.
Pupillometry revealed a clear effect of task difficulty on pupil dilation, confirming the effectiveness of the task manipulation. Ongoing analyses of functional near-infrared spectroscopy data aim to identify cortical activation patterns related to speech intelligibility. These results will be discussed.
Keywords: Listening Effort, Pupillometry, fNIRS, Effort Discounting, Hearing at Work

Conflict of interest: one or more authors have declared an industry affiliation

128 - THE INTERPLAY BETWEEN LISTENING EFFORT, FATIGUE, AND OCCUPATIONAL WELL-BEING IN EMPLOYEES WITH HEARING LOSS

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We will present the results of two studies that investigated the impact of hearing loss on listening effort, fatigue, and occupational well-being in adults. The first study included a sample of 125 normal hearing and hard-of-hearing participants. Here, we observed that increased auditory demand in daily life was associated with higher levels of reported listening effort and fatigue, particularly among individuals with more severe hearing loss. Psychophysiological measures collected in the laboratory further revealed that those who reported higher work-related need for recovery in daily life, showed greater compensatory effort during listening to speech. This effect was stronger for individuals with more severe hearing loss.
A second study assessed occupational well-being in 98 cochlear implant (CI) users, 54 typically hearing individuals and 52 individuals with hearing loss but without CI. The results indicated that the occupational well-being of CI users and their need for recovery was comparable to that of typically hearing peers. CI users also reported better health, acceptance of hearing loss, and coping strategies than individuals with hearing loss without CI. These findings highlight the interplay between listening effort and work-related fatigue and may suggest that CI rehabilitation may facilitate better workplace adjustment.

Keywords: Listening effort, Need for recovery, Hearing loss.

137 - NEUROPHYSIOLOGICAL, SUBJECTIVE, AND BEHAVIOURAL ASSESSMENT OF LISTENING EFFORT IN VIRTUAL ACOUSTIC ENVIRONMENTS

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Background/Rationale: Standard audiometric methods typically assess hearing in static, low-realism environments that often fail to predict the fatigue and stress employees face in the modern workplace. They do not account for the cognitive resources required to navigate the complex; multi-source soundscapes found in occupational settings. To better understand the biological and psychological costs of listening, research must simulate the dynamic nature of everyday professional life. This study acts as a reference baseline by establishing a methodological framework that combines Virtual Acoustics (VA) with neurophysiological and subjective monitoring to assess listening effort in normal-hearing listeners.

Materials and Methods: We utilized the Toolbox for Acoustic Scene Creation and Rendering (TASCAR) to create three distinct virtual environments that appear dynamic to the participant but remain experimentally reproducible. The scenes were originally developed for general communication and social interaction research, such as conversations between seated individuals. By adding specific environmental elements inspired by real-life settings such as inclusion of crowds, building geometries, and distinct occupational roles, we changed the scope of these scenes to represent occupational realities. Specifically, the Pub scene positions the listener behind the counter to simulate service tasks; the Street scene focuses on a police patrol within an urban corridor; and the Subway scene incorporates the mechanical noises encountered by ticket checkers or security guards to probe auditory fatigue.

To maintain consistency, we developed a set of 36 context-congruent sentences relevant to these environments. These were generated using the ElevenLabs AI text-to-speech engine, allowing for precise control over voice sentiment while maintaining a balanced distribution of three male and three female voices. This approach provides a consistent delivery that minimizes unintended variations in speed or pitch. The 36 sentences were divided into two sets. For the 18 sentences assigned to the High Demand condition, we applied a Cycle-Consistent Generative Adversarial Network (CycleGAN) to inject Lombard features, such as spectral tilt and pitch elevation. This neural network was trained on public datasets to ensure the generated speech matches the vocal effort naturally produced in loud environments. Consequently, the High Demand condition consists of Lombard speech in continuous noise, while the Low Demand condition utilizes the remaining 18 neutral sentences in intermittent noise. It is worth mentioning here that the root-mean-square (RMS) levels of both neutral and Lombard stimuli were equalized to ensure that the High Demand condition, maintained at a target signal-to-noise ratio of -8dB to -12dB, relied on acoustic-phonetic changes rather than increased loudness.

The study uses multiple measures to quantify the impact of these conditions on a target group of 48 normal-hearing participants. Objective measure includes functional Near-Infrared Spectroscopy (fNIRS) to monitor oxygenated and deoxygenated hemoglobin levels in the dorsolateral prefrontal cortex, which serves as a marker for cognitive load. To ensure signal quality during tasks, an adaptive filtering pipeline using Recursive Least Squares (RLS) is employed to separate neural activation from motion artifacts. Subjective experience is
captured through the Adaptive Categorical Listening Effort Scale (ACALES) for perceived auditory exertion and the NASA Task Load Index (NASA-TLX) for broader workload assessment. Behavi measures include response accuracy and reaction times collected via a comprehension task.

Results: Technical validation of the experimental setup confirms that audio triggers and physiological acquisition are synchronized with a latency of less than 5ms. We hypothesize that all three occupational environments will elicit measurable hemodynamic responses in the prefrontal cortex compared to baseline conditions. We further expect to identify a correlation between the neurophysiological demand quantified through fNIRS, and the subjective effort reported through ACALES and NASA-TLX. Behavi markers, such as response accuracy and head movement patterns, will be used to validate the realism of the virtual simulations.

Conclusions: By adapting social communication scenes into occupational settings using VA and AI-generated Lombard speech, this research provides a tool for assessing the load of effortful listening in the workplace.

This study establishes a necessary physiological and behavi baseline for normal-hearing individuals, which will serve as a reference for future investigations involving hearing-impaired populations in occupational environments.

Keywords: Listening effort, Virtual Acoustics, fNIRS, CycleGAN

165 - INDIVIDUAL FACTORS CONTRIBUTING TO LISTENING-RELATED FATIGUE IN OCCUPATIONAL SETTINGS

Julia Thomas [(1)(2)(3)] - Gabrielle Saunders [(2)] - Dorothea Wendt [(1)(3)] - Sarah Rhodes [(4)] - Torsten Dau [(3)] - Rebecca Millman [(2)]

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Background

Effortful listening at work entails both costs and benefits, and evaluating these is a central aim of the EASYLI project, to which this presentation contributes. Excessive workplace noise, high listening effort, and elevated job demands can negatively affect stress levels, fatigue, and mental health. Individuals with hearing loss often expend greater listening effort than their normal-hearing peers to maintain workplace performance, potentially increasing their vulnerability to listening-related fatigue. Furthermore, the same acoustic environment can elicit substantially different levels of listening effort and fatigue across individuals. This work therefore aimed to identify individual factors associated with increased susceptibility to listening-related fatigue in occupational settings. Building on these findings, a follow up study explored how employees who use hearing aids experience fatigue at work, the coping strategies they rely on, and how they perceive the benefits and drawbacks of these strategies.

Methods

Participants (survey & interviews): UK residents aged 50 years or older who were employed at least part time.
Survey: A total of 1,007 participants completed an online survey designed to identify predictors of perceived listening-related fatigue. The primary outcome, listening-related fatigue, was quantified using the Brief Version of the Vanderbilt Fatigue Scale for Adults (Hornsby et al., 2023). Potential predictors included self-rated hearing status, assessed using the screening version of the Revised Hearing Handicap Inventory (Cassarly et al., 2020), as well as workplace characteristics and listening effort measured with a modified version of the Amsterdam Checklist for Hearing and Work (Kramer et al., 2006). Individual willingness to invest cognitive resources was assessed using the 6-item Need for Cognition Scale (Lins De Holanda Coelho et al., 2018). Demographic information, including age and the presence of fatigue-inducing health conditions, was also collected. Survey data were analysed using multiple regression.
Interviews: Additional inclusion criteria for the semi-structured interviews required participants to work in a job that relies heavily on communication, have hearing loss, and use hearing aid(s). Interviews addressed participants' typical working day, main listening activities at work, job control, the impact of hearing loss on workplace communication, work-related fatigue, coping strategies, perceived benefits and drawbacks of these strategies, and workplace support for employees with hearing loss. Interviews were conducted via Microsoft Teams, transcribed, and analysed using reflexive thematic analysis.

Results

Survey: Increased perceived listening-related fatigue was significantly associated with greater self-reported hearing loss, higher listening effort, reduced job control, increased job demands, and communication in a non-native language ($F(16,988) = 97.59$, $p < 0.001$, $R^2 = 0.613$, $R^2_{adjusted} = 0.606$).
Interviews: Most participants spontaneously referred to listening situations and listening effort when discussing tiredness at work, despite not being explicitly prompted to focus on listening related issues. Participants described a wide range of coping strategies, and their reflections on perceived benefits and drawbacks provided insight into why certain strategies were adopted while others were not.

Conclusions

Listening-related fatigue in occupational settings was significantly associated with hearing loss, listening effort, job demands, job control, and communication in a non-native language. Qualitative findings further demonstrated that fatigue experienced by employees with hearing loss is strongly shaped by listening demands and that coping strategies are selected based on individually perceived trade-offs. Together, these findings highlight the importance of listening-related fatigue in the workplace and underscore the need for appropriate accommodations and targeted education about effective coping strategies for employees with hearing loss.

Keywords: Individual differences, fatigue, hearing loss, coping strategies, occupational settings

Conflict of interest: one or more authors have declared an industry affiliation

SPECIAL SESSION
New Horizons in Auditory Training
Organized by Helen Henshaw

296 - NEW HORIZONS IN AUDITORY TRAINING: EVIDENCE FROM A SYSTEMATIC REVIEW AND META-ANALYSIS IN ADULTS

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Objective: This special session, *New Horizons in Auditory Training*, brings together international leaders to examine whether emerging evidence now supports auditory training as an effective component of adult hearing rehabilitation. The session opens with findings from a large, multidisciplinary systematic review and meta-analysis evaluating individual digital auditory training for adults with hearing loss. This evidence provides the foundation for examining mechanisms of benefit, individual variability, and future directions in intervention design and delivery.
Method: Registered via PROSPERO (CRD42024564338), this review synthesised evidence from randomised and non-randomised controlled trials, cohort studies, and repeated-measures designs incorporating at least one untrained speech perception outcome. Random-effects meta-analyses and narrative synthesis were conducted. Risk of bias was assessed using the Cochrane Risk of Bias tool, and certainty of evidence was appraised using GRADE. Outcomes included learning on trained auditory tasks and generalisation to untrained measures of speech perception, cognition, and self-reported communication and quality of life..
Results: Meta-analysis demonstrated reliable improvements in trained auditory task performance, confirming substantial auditory learning capacity in adulthood. Transfer to untrained speech perception outcomes was observed but varied across studies. Similarly, cognitive and quality-of-life benefits were inconsistent. Findings indicate that generalised benefits depend on training stimulus and design, participant engagement, and individual characteristics rather than exposure alone. Emerging neurophysiological findings suggest modifiable auditory and cognitive processing systems while underscoring the need to better understand mechanisms supporting generalisation.
Conclusion: This large-scale evidence synthesis shows that auditory training can reliably support auditory learning and improve outcomes for adults with hearing loss, while revealing important variability in real-world outcomes. The central challenge for the field has therefore shifted from demonstrating efficacy to determining how auditory training should be optimised and implemented to deliver consistent, meaningful benefits in clinical practice.

Keywords: Auditory training, hearing loss, adult aural rehabilitation, speech perception, cognition.

18 - SELF-DIRECTED COMPUTER-BASED AUDITORY TRAINING MAY IMPROVE SPEECH AND QUALITY-OF-LIFE OUTCOMES IN NEW ADULT COCHLEAR IMPLANT RECIPIENTS

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Objective: To review research on the effectiveness of computer-based auditory training (CBAT) in new adult cochlear implant (CI) recipients.

Methods: This session will review extant outcomes data from observational studies on over 100 patients who self-reported use or non-use of commonly available forms of CBAT over their first year post-CI. Additionally, preliminary data from an on-going randomized-controlled trial of the SoundSuccess™ CBAT platform will also be detailed with a focus on early (3-month post-CI) speech and quality-of-life outcomes

Results: CBAT, as used in a standard outpatient setting, may afford benefits for new adult CI recipients. In new adult CI users, self-reported CBAT use was associated with greater improvement in CNC words, AzBio sentences, and Cochlear Implant Quality of Life 35-Profile (CIQOL-35) scores at 3 months post-activation and greater CIQOL-35 benefit at 12 months compared to CI recipients who did not train or used other resources.

Data from a randomized-controlled trial of the SoundSuccess™ platform supports data from prior observational study. Namely, preliminary results show an improvement in CNC scores from preimplantation to 3 months post-CI of 57.0±9.3% correct in SoundSuccess™ users arm vs 43.9±14.2% in the control arm and an improvement in global CIQOL-35 scores of 13.4±9.7 in the SoundSuccess™ arm vs 9.4±4.9 in the control.

Conclusion: CBAT during the first-year post-activation may contribute to improvements in CI speech recognition and functional abilities in new implant recipients. Consideration of specific recommendations for the use of CBAT resources may be valuable, given the minimal risk, ease of access, and affordability of these programs.

Conflicts of interest: J Dornhoffer receives research support from Cochlear Ltd. and Advanced Bionics Corp.

Funding: Investigator initiated funding from Advanced Bionics Corps.

21 - PERSONALIZING AUDITORY TRAINING: UNDERSTANDING INDIVIDUAL FACTORS IN ADULT COCHLEAR IMPLANT USERS

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Although cochlear implants (CIs) restore sound access to adults with moderate-to-profound hearing loss, they do not guarantee successful real-world speech communication. To optimize communication outcomes, CI users can utilize numerous auditory training (AT) approaches, including patient-directed approaches (e.g., computer-based training programs) and clinician-guided interventions (e.g., in-person perceptual training with a speech-language pathologist). However, research on the benefits of AT in adult CI users remains limited, resulting in a critical gap in understanding the individual factors that drive variability in training outcomes.

As part of the Special Session "New Horizons in Auditory Training", this presentation synthesizes evidence on demographic, auditory, cognitive-linguistic, and psychosocial factors that influence responsiveness to AT. Given the well-documented influence of these factors on speech perception and hearing-related quality of life outcomes, we propose that a similar set of factors likely predict CI users' responses to AT interventions. Demographic measures, including age and duration of hearing loss, have shown mixed findings regarding their impacts on CI users' responses to AT. However, individuals with poorer baseline speech recognition performance tend to demonstrate the greatest impacts of AT. Work in second-language learners has suggested that better baseline auditory sensitivity to speech cues may support greater AT benefits, such that "pre-training" of auditory sensitivity might support greater AT gains. From a cognitive standpoint, incorporating training tasks focused on enhancing attention or working memory skills within a speech perception task may enhance overall AT benefits. Lastly, psychosocial factors including self-efficacy, motivation, listening anxiety, and social support, have been shown to impact long-term CI outcomes and likely also contribute to AT gains.

By understanding these individual differences among adult CI users, future AT interventions can be better tailored to the needs of each CI user, moving beyond a one-size-fits-all model. Insights will provide a foundation for more effective, personalized AT strategies that address the diverse needs of adult CI users.

Keywords: Auditory training; Cochlear implants; Individual differences; Speech perception

22 - PERCEPTUAL HEARING TRAINING IN UNSUPERVISED CONDITIONS EMPLOYING VIRTUAL ACOUSTICS AND GAMING

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Recent advances in virtual reality (VR) and mobile technologies have enabled the development of autonomous auditory training tools that can be deployed outside the clinic and used independently by patients over extended periods of time. In normal-hearing listeners, a growing body of evidence demonstrates that VR-based training can lead to measurable improvements in spatial hearing performance, supporting the idea that immersive and interactive environments can effectively promote auditory learning. However, the extent to which these approaches generalise to clinical populations, and the mechanisms underlying any observed benefits, remain open questions.

In this work, we present and discuss two complementary lines of research investigating autonomous hearing training in different populations and contexts. The first focuses on young bilateral cochlear implant (CI) users, for whom spatial hearing remains a major challenge despite technological advances in implant design and signal processing. Building on prior work in normal-hearing participants, we developed a set of VR-based auditory games designed to promote spatial listening skills through repeated, ecologically motivated interactions. The training was delivered via a head-mounted display (HMD) that was provided to participants for home use over a period of three months, enabling intensive and self-directed practice without the need for frequent clinical supervision. A longitudinal trial is currently ongoing, and while outcome data are not yet available, the study aims to assess changes in spatial hearing performance as well as user engagement and feasibility of long-term at-home VR training in this population.

The second line of work explores the co-design and evaluation of a mobile application targeting hearing and memory training in middle-aged adults with hearing loss who may be at risk of early cognitive decline. In this case, the intervention was developed in close collaboration with end users to ensure accessibility, usability, and relevance to everyday listening situations. The results of this study indicate partial improvements in targeted outcomes, suggesting that autonomous training may yield benefits, but that these effects may be limited in magnitude or specificity. These findings highlight the complexity of disentangling auditory, cognitive, and motivational factors in populations with heterogeneous profiles and comorbidities.

Taken together, these studies illustrate both the promise and the current limitations of autonomous hearing training approaches based on VR, mobile apps, or related technologies. While such systems offer clear advantages in terms of scalability, accessibility, and patient empowerment, several fundamental questions remain unresolved. In particular, it is still unclear to what extent observed improvements reflect genuine perceptual learning, as opposed to procedural learning or task-specific strategies, and whether gains acquired in virtual or gamified environments reliably transfer to real-world listening situations. Addressing these questions will be critical for the design of future interventions and for establishing robust evidence of clinical efficacy.

We conclude by outlining key directions for future research, including the need for carefully controlled longitudinal studies, outcome measures that capture real-world functional benefits, and experimental designs capable of separating perceptual adaptation from procedural learning effects. Such work will be essential to fully realise the potential of autonomous auditory training as a complement to traditional clinical rehabilitation.

59 - TRAINING FOR EVERYDAY LISTENING AND MULTITASKING IN LATER LIFE

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The Integrated Care for Older People (ICOPE: 2019; 2025) framework, advanced by the World Health Organization, identifies key intrinsic capacities including hearing, mobility, vision, cognition, mental health, and vitality. A central tenet of the ICOPE framework is that intrinsic capacities are interrelated, implying that age-related decline in one capacity (e.g., hearing) can affect functioning in other domains such as cognition or mobility. Age-related declines across multiple domains may further exacerbate the challenges experienced in everyday activities such as listening while walking, or conversing while driving.

Our research has focused on age-related hearing loss, ranging from sub-clinical declines to audiometrically significant impairment. We have examined the role of hearing ability in experiments, pairing auditory-cognitive tasks with mobility tasks such as walking, balancing, and driving to simulate everyday complex listening scenarios. Overall, we have observed reduced multitasking performance as a function of hearing loss severity. A common denominator in multitasking performance appears to be executive functions, such as dividing or switching attention and inhibition. Therefore, in training studies, we have targeted these executive functions using computerized programs, and have observed improvements in complex listening performance when comparing pre- and post-training levels. Specifically, in a study comparing middle-aged adults with normal hearing, older adults with normal hearing, and older adults with hearing loss who used hearing aids, we found that 12 weeks of executive function training was beneficial in different ways: Older adults with poorer hearing and cognition showed the most training-related improvement in their auditory working memory performance, but improved less than those with good hearing on a standing balance task performed concurrently (Mohanathas et al., in revision). Similarly, in a sample of older adults with mild cognitive impairment, we found that those with poorer hearing and poorer cognition improved in multitasking performance more so that those with better hearing and better cognition (Downey et al., 2026). In this second study, combining executive function training with exercise training was particularly beneficial compared to exercise training paired with sham cognitive training. Together, our approach of strengthening executive functions using computerized cognitive training and exercise training provides a promising avenue for improving complex auditory functioning in older adults. Notably, the computerized training is delivered visually, thus the observed benefits to complex listening performance indicate transfer of domain-free executive functioning. By using primary outcomes that approximate everyday auditory-cognitive-motor behaviour, we extend the scope of auditory training to address the functional capacity of older adults as outlined by the ICOPE framework and contemporary definitions of healthy aging.

Keywords: Executive function training, age-related hearing loss, mobility, multitasking

176 - CHARACTERIZING PATTERNS OF ADAPTIVE AUDITORY-COGNITIVE TRAINING PERFORMANCE

Charlie Fisher [1] - Michael Johns [2] - Lien Decruy [2] - Regina Calloway [2] - Jason Dunlap [3] - Jonathan Simon [1] - Samira Anderson [3] - Stefanie Kuchinsky [4]

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Auditory-cognitive training is an emerging method of improving speech-in-noise perception via targeting key systems that underlie speech recognition but which tend to decline even in healthy aging. While there is increasing evidence of improved outcomes with auditory-cognitive training, less is known about how varying cognitive load and individual factors may impact the benefits of training. Including more complex training designs also necessitates detailed, systematic techniques of analyzing training performance. To begin addressing these gaps, we implemented two variations of an adaptive auditory-cognitive training that differed in cognitive demand and characterized individual variation in training performance trajectories.

In this study, 23 older adults (60-83 years old with normal to near-normal hearing thresholds) underwent 10 sessions of either a more or less cognitively demanding auditory-cognitive training program. To evaluate far-transfer learning, behavi measures were collected pre- and post-training, which included untrained tasks on working memory, speech-in-noise perception, and nonlinguistic auditory stream segregation. Surveys probed satisfaction with the training as well as enjoyment of engaging in challenging tasks in daily life. Training performance was analyzed within and across sessions.

To evaluate these training programs, we describe a method of summarizing adaptive training performance within sessions and how those trajectories change across sessions. Other methods of summarizing adaptive training performance often average values over time (e.g., speech reception thresholds); though here, we investigate potentially important temp fluctuations by characterizing training performance patterns within and across sessions. Using the peak and slope of the training performance, we characterize training performance patterns into five different groups using k-means clustering. This method may provide deeper insight into the impact of cognitive demand over time and its consequences for training-related fatigue.

Our results show that the level of cognitive demand had a large impact on the trajectory of training performance. Importantly, we found that participants completing the more demanding training showed evidence of within-session fatigue, and the degree of fatigue may be partially explained by the individuals' general enjoyment of engaging in challenging tasks in their daily lives. Regardless of training group, participants improved in both the training task and in a far-transfer speech-in-noise task. Although far-transfer improvement did not differ between the two training groups, nevertheless, considering individual factors for training design may be a vital component for user adherence.

This study highlights the importance of analyzing the temp patterns of training performance within and across training sessions and how individual factors may influence training outcomes. Together, these results support the development of more personalized training programs and provide promising evidence for auditory-cognitive training as a means for improving speech-in-noise perception.

Keywords: auditory training, older adults, competing speakers, cognitive load

KEYNOTE LECTURE

336 - STATISTICAL AUDIOLOGY: FROM DIAGNOSTIC TEST BATTERIES TO AUDITORY PROFILES FOR TARGETED TREATMENT

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How can we achieve statistical audiology, i.e., data-driven approaches to increase the objectivity and reliability of diagnostics and treatment in rehabilitative audiology?
Audiological decision making (e.g., diagnostic inference from audiometric test results or the prescription and fitting of appropriate hearing devices) will in the future rely less on the individual professional experts opinion, but will increasingly be supported by data-driven automatic screening tools, audiologic patient profiles, and clinical decision support systems. As a prerequisite, a new culture of data sharing has to be achieved in our miserably organized field with scattered and siloed patient data, missing standards for functional auditory diagnostics, and commercial- (rather than science-) driven device innovations. We therefore need to push audiology into the digital age with open, evidence-based international standards not only for our procedures, but also our data structures and openness for sharing relevant data!
This talk will highlight major achievements and pitfalls on the way towards statistical audiology. It will start by reviewing the efforts of our Cluster of Excellence Hearing4All to standardize a battery of audiologic tests with openly available results for 581 adults (Jafri et al., 2025). Based on such rich records with audiometric as well as suprathreshold data, distinct auditory profiles can be generated and optimized via federated learning (i.e., merging of the evidence of the profile classes without simultaneously assessing all data sources, Saak et al., 2025). Once they are established, the correct diagnostic classification of a given patient into a diagnostic case related to a certain profile can be performed with little effort, using, e.g., the virtual hearing clinic via smartphone (Xu, 2025). Moreover, treatment recommendations can be derived via a clinical decision support system mapping diagnostic cases to specific treatment options (Buhl et al., 2022). The first trial and initial fitting of a hearing device can then be simulated using the open Master Hearing Aid (openMHA, Kayser et al., 2022) in connection with fitting modules of the virtual hearing clinic providing targeted self-fitting options.
Taken together, statistical audiology allows for a completely new hearing health service model which will put the patient in the drivers seat and largely builds on an open data, open software and open publication culture.

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COMPUTATIONAL & DIGITAL HEALTH APPROACHES

271 - PREDICTIONS AND EMPIRICAL FINDINGS OF THE LOMBARD GAIN IN TONAL LANGUAGES

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Introduction: In background noise, speakers adapt their speech production, giving rise to Lombard speech, which often improves speech intelligibility (SI). While the intelligibility benefits of Lombard speech have been extensively studied in non-tonal languages, it remains unclear whether spectro-temp cues, which are critical for encoding tonal contrasts, are necessary to predict both the Lombard gain (LG) (i.e., intelligibility improvement relative to plain speech) and absolute SI in tonal languages such as Mandarin Chinese and Cantonese. Furthermore, it is not well understood how hearing impairment influences the perceptual benefit of Lombard speech, nor whether hearing aids are able to restore the Lombard gain in hearing-impaired listeners.
Procedure: Predictions of two SI-models were compared, namely, the automatic speech recognizer (ASR)-based approach FADE using spectral or spectro-temp features, and the speech intelligibility index (SII)-based model using long-term spectral features. The predictions were evaluated with empirical SI data obtained from normal-hearing listeners. In addition, empirical results from hearing-impaired listeners, tested with and without hearing aids, were examined.
Results: For both models, spectral features alone are sufficient for accurate prediction of the LG. In contrast, predictions of absolute speech recognition threshold (SRT) were most accurate when spectro-temp features were included, capturing substantial inter-speaker variability. Empirically, hearing-impaired listeners without hearing aids showed better intelligibility for male than for female speech. With hearing aids, however, the LG was larger for female than for male talkers. In addition, better aided thresholds at 4 kHz were associated with lower (better) SRTs for plain male speech in different masker conditions.
Conclusions: Despite the tonal nature of Mandarin and Cantonese, spectro-temp features are not required to predict the LG. However, they are essential to predict the absolute SRTs to account for speaker-dependent differences.

285 - LOMBARD BENEFITS IN AIDED AND UNAIDED LISTENING

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Introduction: Acoustic changes in Lombard speech have been shown to improve speech understanding in noise for normal-hearing listeners. However, how well listeners with hearing loss benefit from Lombard speech has rarely been studied. The present study investigated the effects of talker gender, types of noise and hearing loss on Lombard effects, with and without hearing aids, using Mandarin Matrix sentences.

Procedures: Speech reception thresholds (SRTs) were measured using Mandarin version of the matrix test spoken by a female and a male talker. Speech stimuli were recorded in quiet and in noise to produce plain and Lombard speech, respectively; and presented in ICRA1 stationary noise, ICRA5 modulated noise and multiple-talker babble (MTB). 14 adults exhibiting bilateral mild to severe sensorineural hearing loss and have worn bilateral hearing aids for at least one year, participated. Hearing aids were at usual use settings, except with the noise reduction function turned off.

Results: Three-way analysis of variance (ANOVA) was performed to determine the main effects of and interactions among the test variables to examine SRTs and Lombard benefits in the aided and unaided conditions, separately. The variables consisted of two speech styles (plain, Lombard), two talker genders (male, female), and three noise types (ICRA1, ICRA5, MTB). Speech understanding was more difficult in multitalker babble, than in stationary and modulated noise, with and without hearing aids.
Lombard benefits were observed across all noise conditions, with and without hearing aids. Mean Lombard benefits varied with listening conditions and talker characteristics, ranging from about 0.4 dB to 2.2 dB. At the same time, male speech resulted in slightly greater Lombard benefits in multitalker babble than the female voice unaided. However, when hearing aids were worn, Lombard benefits were about 1 dB greater across all three types of noise when the talker was female. Aided Lombard benefits did not vary across different types of noise, although the female talker yielded better SRTs than the male talker, across all noise conditions. The exception was Lombard benefits in multitalker babble where hearing aids reduced Lombard benefits.
Better aided thresholds at 2-4k Hz were positively associated with SRTs obtained with Lombard speech spoken by talkers of either gender, in modulated noise and MTB (r = .572 to .759). In contrast, unaided audiometric thresholds did not correlate with Lombard benefits.

Conclusions: Lombard speech assisted speech understanding in noise, regardless of the gender of the talker, with and without hearing aids. Without hearing aids, greater Lombard benefits with male speech were realized in multitalker babble, compared to other types of noise, although informational masking made speech understanding more difficult. Interestingly, hearing aid processing enhanced Lombard benefits associated with female speech in all three types of noise while reduced Lombard benefits associated with male speech in multitalker babble. That is, while male speech yielded higher mean unaided Lombard benefits, compared to female speech, improvement in audibility due to amplification resulted in female speech yielding higher mean aided Lombard benefits. This improvement seems to be related to better aided hearing at 2k and 4k Hz, which facilitated the perception of high frequency tilt associated with Lombard speech. Despite distortions associated with hearing aid processing, Lombard effects still improved speech understanding.
Overall, although Lombard benefits are small, they facilitate speech understanding in noise, particularly when listening to female talkers. Future studies on speech perception should account for this factor.

Keywords: Lombard speech, Matrix test, modulated noise, multitalker babble, speech intelligibility, steady state noise

250 - TOWARDS A NOVEL CLASSIFICATION OF NOISE HATERS AND DISTORTION HATERS WITH A MOBILE MEASURE OF INDIVIDUAL LISTENING PREFERENCES

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Background: Proper hearing aid fitting is crucial for user's satisfaction and listening comfort. Therefore, individual traits of listening preferences should be considered during the fine-tuning stage. People have been shown to have variable preferences for setting noise reduction algorithms that improve signal-to-noise ratio (SNR) but introduce signal distortion. "Noise haters" prefer greater noise reduction, even at the expense of signal quality. "Distortion haters" accept higher noise levels to avoid signal distortion. So far, these preferences have been considered stable across time in laboratory test-retest measurements and individuals were classified based solely on their trait scores. This study aims at evaluating the psychometric quality of a novel mobile measure of listening preferences for noise vs. distortion. We will evaluate inter- and intra-individual variability of listening preferences over intensive longitudinal measures. Information on state-trait variance will improve the classification of noise haters and distortion haters.
Methods: A noise-distortion trade-off task was part of an Ecological Momentary Assessment (EMA) study with N=185 (106 f, M_{age}= 63.1, SD_{age}= 6.5) unaided individuals who reported subjective hearing difficulties. The mobile task compared individual preferences in three listening conditions: 1) simple linear gain vs. gain at the expense of clipping distortions with 2) general and 3) adaptive SNR ranges. Baseline assessment included questionnaires on sound preferences and hearing habits (SP-HHQ), noise sensitivity (WNSS) and personality (NEO-ffi). The same task was included in the EMA (2 weeks on workdays, morning and evening), along with measures of hearing performance (DTT). Latent State-Trait Autoregressive (LST-AR) modelling framework was used to evaluate the stability of listening preferences and explore temp dependencies between consecutive observations. The model has been extended to Mixture LST-AR for a data-driven classification of noise and distortion haters.
Results: Individual listening preferences show considerable state-related variance, which amounts on average to 77% of the overall variance observed. This large intra-individual variability is however non-systematic. Temp dependencies between consecutive observations (autoregressive effects) were nearly zero. Intra- and inter-individual variability was then used for a data driven classification by means of a Mixture LST-AR model. Three latent classes were identified based on the mean trait, in accordance with previous literature: noise haters, distortion haters and intermediate. In addition, we could further differentiate classes of individuals with stable versus unstable listening preferences. Individual factors that could explain the latent classes will be discussed, with a particular focus on the relationship with objective hearing performance and subjective reports of hearing preferences.
Conclusion: To our knowledge, this is the first study to use a mobile task to measure listening preferences for noise vs. distortion in everyday life over multiple days. The observed intra-individual variability provides novel insights into the classification of noise haters and distortion haters. Assessing individual listening preferences along the noise-distortion trade-off and accounting for their day-to-day variability could improve the individualisation of hearing aid fitting. Moreover, a more satisfying hearing aid experience could be facilitated by providing the user with mobile self-adjustment options that are informed by such preference measurements.

Keywords: listening preferences, noise-distortion trade-off, ecological momentary assessment, mHealth

20 - PROVISION OF A PREPARATORY INFORMATION VIDEO FOR PARENTS PRIOR TO AN INFANT'S DIAGNOSTIC AUDIOLOGICAL ASSESSMENT: A RANDOMISED CONTROLLED TRIAL

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Purpose To evaluate the impact of a preparatory information video on parent knowledge and anxiety. The video was viewed prior to infant diagnostic audiology, following referral from a universal newborn hearing screening program.

Methods Randomised controlled trial comparing the provision of an information video in addition to usual care (intervention) versus usual care only. Parents of infants who were referred to audiology by the Victorian Infant Hearing Screening Program between February and December 2024 were assessed for eligibility. Parent knowledge and preparedness about infant audiological testing was measured using a study designed questionnaire (score range 0-9) and anxiety was assessed using a standardised measure. Mean differences were compared between the groups. Number of appointments required to reach a complete diagnosis was also measured and parent feedback regarding usefulness of the video was sought.

Results The intervention group scored 2.1 (95% confidence interval 1.6-2.6) points higher on total knowledge score compared to the usual care group. Analysis of knowledge questionnaire items at an individual level showed the proportion of correct responses was up to 48% higher in the intervention group. No difference in anxiety scores or the number of appointments required to reach a complete diagnosis was observed. More than 94% of participants would recommend the video to other parents.

Conclusion Routine provision of preparatory video information prior to infant diagnostic audiology is recommended. In addition to usual care, video information embedded within clinical services can improve parent knowledge and preparedness, and support parent health literacy.
Trial ID ACTRN12623000886684

Key terms
Infant hearing; Video information, Diagnostic audiology, Congenital hearing loss, Health literacy

45 - A BIMODAL ADAPTATION OF THE RESTQ FOR INDIVIDUALS WITH HEARING IMPAIRMENTS

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Background: Individuals with hearing impairments constitute a heterogeneous population with substantial variation in access to spoken language and literacy competencies. Despite this heterogeneity, research on standardized diagnostic instruments suitable for this population remains scarce, thereby limiting the validity and comparability of psychological data. The lack of appropriate assessment tools represents a persistent methodological challenge in both psychological research and applied practice. Accordingly, the present study aims to address this gap by adapting the Recovery–Stress Questionnaire (RESTQ) into German Sign Language (DGS) and evaluating its psychometric properties in a sample of individuals with hearing impairments.

Methods: The adaptation process followed a structured procedure based on established guidelines for cross-cultural instrument adaptation. Using a cross-sectional design, data were collected from 101 participants (35% female). The adapted RESTQ was administered in a bimodal format, integrating written German items with synchronized DGS video translations. Additional measures included sociodemographic information and participant feedback regarding the comprehensibility and perceived usefulness of the sign language videos.

Results: The adapted RESTQ demonstrated overall acceptable internal consistency. Only two subscales yielded Cronbach's alpha values below .70, which is comparable to findings from the original RESTQ validated in hearing populations. Construct validity was examined using exploratory factor analyses with principal axis factoring and varimax rotation. The data met the assumptions for factor analysis (Kaiser–Meyer–Olkin values ≥ .80; Bartlett's tests of sphericity $p < .001$). The extracted factor solutions consistently reflected the two theoretically expected higher-order dimensions of stress and recovery.

Conclusions: This study contributes to accessible psychological assessment for individuals with hearing impairments by introducing a bimodal assessment model. The findings underscore the importance of responsive diagnostic tools and offer practical implications for both research and applied psychological work with clients with hearing impairments.

Keywords: Accessibility, German Sign Language (DGS), Inclusivity

185 - HEARCHOICE: A DIGITAL DECISION TOOL TO EDUCATE, ENGAGE AND EMPOWER ADULTS WITH HEARING LOSS

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Background

Despite a high prevalence of hearing loss and effective interventions, uptake of hearing healthcare is low. Factors include poor knowledge of how to seek help for hearing difficulties, and sub-optimal support for decision-making. These issues can be addressed through the provision of clear and accessible information, and guided support in decision-making.

HearChoice, an online, interactive, and modular decision-support intervention, was co-designed with people with lived experience together with other key stakeholders including representatives of professional bodies, hearing care professionals (HCPs), and advocacy groups.

This research aimed to (i) understand help-seeking and decison-making needs, (ii) co-develop HearChoice, guided by the COM-B behaviour change theory and implementation science, (iii) evaluate the effectiveness of HearChoice, and (iv) develop an implementation plan to sustainability and scale-up across Australia. The overall aim is to empower adults with hearing loss by offering them informed choice and control to assist in decision-making.

Materials and Methods

There were four work packages (WPs).

WP1: to conceptualise HearChoice, and understand barriers and enablers to help-seeking and decision-making among adults with hearing loss (AwHL). AwHL (*N* = 16) participated in semi-structured interviews, and HCPs (*N* = 9) in focus groups, to understand the barriers and enablers to help-seeking and decision-making. These were further examined in surveys with AwHL (n=300) and HCPs (n=43).

WP2: to co-develop the web-based app informed by WP1. Workshops and Think Aloud sessions with AwHL co-designed the wireframe and minimal viable products using a participatory, iterative approach. HCPs also provided iterative feedback and input. User-testing of a beta version was conducted with eight AwHL using interviews and usbility questionnaires.

WP3: to evaluate clinical-effectiveness of HearChoice via a three-timepoint, online RCT (n=841) across 3 months, and a process evaluation (n=18). The active control group was a one-page option grid in an online pdf format. Participants were recruited from a global research panel recruiting from Australia.

WP4: to co-design an implementation plan to facilitate future scale-up and sustainability. This includes realworld use in audiology clinics (n=5).

WPs 1-3 have been completed. WP4 and data analysis for WP3 is ongoing.

Results

WP1: key barriers and facilitators help-seeking (n=28) and decision-making (n=14) were identified, underpinned by the COM-B model, resulting in a conceptual framework. Key factors identified from AwHL were: knowledge of the signs of hearing loss, hearing management options, costs and funding (Capability); the ready availability of information and opportunities for help-seeking, and other health and personal issues (Opportunity); positive beliefs about hearing management (Motivation). The AwHL survey of adults with hearing loss confirmed that the findings from the qualitative study generalised to a larger audience. The most important pieces of information were cost and funding, with 86% of participants rating these as “extremely” or “very” important. Overall, 74% reported support for HearChoice.

WP2: key features of HearChoice are: information on the impact of hearing loss, benefits of hearing healthcare, a full range of hearing health options (n=11) including pros and cons, and an interactive, self-guided decision-making process. User-testing showed HearChoice to be usable (System Usability Scale = 93.4%), useful (Mobile User Rating Scale = 4.6/5), impactful (4.8/5), and rated as 4.5/5 stars. Unsolicited behaviour change in help-seeking and decision-making was shown. HearChoice adhered to the International Patient Decision Aid Standards, indicating it to be a valid decision aid tool that is high-quality, evidence-based and trustworthy.

WP3: Preliminary pre-post intervention analysis shows that both HearChoice and the Option Grid groups significantly impove decisional conflict ($p < 0.001$), hearing-related empowerment ($p<0.001$), and readiness for hearing healthcare in hearing healthcare ($p<.001$). HearChoice had better outcomes in those who used it as intended. Final analysis will be completed by April 2026. Ongoing research will be presented.

Conclusions
There is a clear need for additional support for active help-seeking and informed decision-making among adults with hearing loss. HearChoice has been shown to be usable, useful and impactful, and improve decisional conflict, empowerment readiness in adults with hearing difficulty.
HearChoice can provide support to adults with hearing loss, addressing issues of Capability, Opportunity, and Motivation, by enhancing knowledge, facilitating help-seeking, and addressing unhelpful beliefs. Ultimately, we anticipate the number of adults with hearing difficulties who seek help and make informed decisions about their hearing healthcare will increase.

Keywords: eHealth solution; Decision-making; Help-seeking; Empowerment; Co-design

KEYNOTE LECTURE

84 - GENETIC, EPIGENETIC & THE OMICS SCIENCES FOR DEAFNESS DIAGNOSIS & THERAPY

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Since the dawn of mankind, the search for the causes of diseases and their possible remedies has aroused particular interest. In the Assyrian-Hittite, Egyptian and Greco-Roman cultures, precise references have been found on the causes and possible treatment of deafness. But only between the end of the eighteenth century and the mid-nineteenth century were the foundations laid for an etiological knowledge of deafness; but above all then clinical and then molecular genetics have made a very important contribution to this knowledge. When in the late 1990s, notably through studies like a 1997 Nature article by Kelsell et al., the connexin 26 gene, known as GJB2, was identified as a significant cause of non-syndromic hereditary deafness, we clinicians were convinced that we had found the key to the problem: a small blood sample (and then saliva) was sufficient to establish the presence of deafness already in the prenatal period.
But the reality soon turned out to be more complex: the description of cases of children with homozygosity of the 35delG mutation, the most frequent in many Western countries, with medium-mild hearing loss or even normal hearing, became increasingly frequent. Therefore, the presence of the double mutation of the disease gene was not enough to cause deafness.
Scientists subsequently have turned their attention to epigenetics. Epigenetics is a branch of biology which studies heritable changes in gene expression that occur without alterations of the DNA sequence, regulating gene function through DNA and histone modifications, non-coding RNA expression, and chromatin remodeling. Epigenetic regulation influences various stages of cochlear hair cell (HC) life, such as differentiation, proliferation, and survival. It contributes to HC regeneration, playing a critical role in ototoxic drug-induced hearing loss, noise-induced hearing loss, and presbycusis. Epigenetic regulation is also crucial for inner ear HC regeneration, which offers an opportunity for hearing loss therapy.
Recently, there has been a lot of discussion about Omics Sciences, such as genomics, transcriptomics, proteomics, or metabolomics, and on the possible advantage of artificial intelligence (AI) for a better understanding of the causes and treatment of hearing loss. The suffix “-omics” is used to address the objects of study in fields, such as the genome, proteome, transcriptome, or metabolome, respectively.
Genomics is the discipline that studies the genome of living beings. It deals with the structure, content, function, and evolution of the genome, utilizing bioinformatics to process and visualize the enormous amount of data that is produced. Genomic technologies have transformed medicine in the post-genome era, promising personalized and precise healthcare based on DNA sequencing. The existing literature on this subject is extensive, with numerous reports continuously emerging, presenting new discoveries for a better understanding of various alterations and potential gene therapies.
Proteomics is defined as the science that explores the interactions, function, composition, and structures of proteins and their cellular activities. A proteome is a set of proteins produced in an organism, system, or biological context. Proteomics has proven effective in studying the inner ear. This approach aids in elucidating basic and pathologic mechanisms, diagnosing diseases, and treating hearing disorders. Notably, recent research has highlighted the role of sophisticated glutamatergic ribbon synapses with afferent neurons to transmit auditory information to the brain. Furthermore, the multi-C2 domain protein otoferlin has been analyzed, linking defects in the coding Otof gene to auditory synaptopathy.
Transcriptomics, utilizing technologies such as bulk microarrays and RNA sequencing (RNA-Seq), provides a comprehensive view of the transcriptional landscape of auditory research. Single-cell RNA-seq (scRNA-seq) technology has significantly contributed to the study of inner ear, offering accurate transcriptome information for hair cell regeneration and hearing recovery. It also provides dimensional insights into the auditory organ, complementing other technologies mentioned above and holding potential for future clinical applications.
Metabolomics, reflecting both genetic traits and environmental influences, plays a crucial role in understanding various forms of hearing impairment. Recent studies have reported consistent data on the predictive role of serum metabolic profiles in sudden hearing loss, noise-induced hearing loss, and the identification of markers for ototoxicity. Metabolomic investigations may pave the way for improved diagnostic strategies, personalized interventions, and targeted treatments, ultimately enhancing the clinical management of individuals affected by different causes of hearing loss.
The enormous amount of data that can be obtained from “Omics Sciences” can be integrated and analyzed by artificial intelligence and the resulting digital transformation of systems science. But this is a story still largely to be written.

GENETIC ISSUES

40 - THE GENETIC CAUSES OF AUDITORY NEUROPATHY: A SYSTEMATIC REVIEW

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Background/Objectives: Auditory neuropathy is a form of hearing loss characterized by preserved outer hair cell function and abnormal or absent auditory brainstem responses. It can impair speech and language development, cognitive functioning and lead to psychosocial consequences across the lifespan. Genetic factors play a significant role in its etiology with important implications for diagnosis, prognosis and treatment - particularly emerging gene-based therapies. This systematic review identifies the genetic causes of auditory neuropathy reported in the literature and determines the diagnostic yield of genetic testing in children and adults with auditory neuropathy.

Methods: A systematic search of MEDLINE, Embase, and PubMed was conducted to identify studies reporting genetic testing results of individuals with auditory neuropathy. Studies were only included if genetic testing results were reported with variant interpretation based on American College of Medical Genetics and Genomics criteria. A participant with auditory neuropathy was defined as having a genetic diagnosis if testing found pathogenic or likely pathogenic variants consistent with the mode of inheritance of the gene. Quality assessment was conducted using the Joanna Briggs Institute critical appraisal tools.

Results/Discussion: Of 5347 articles screened, 29 studies were eligible for inclusion. These studies involved 441 children and adults with auditory neuropathy. Of these individuals, 362 underwent genetic testing and a genetic diagnosis was confirmed in 195 out of 362 participants. This results in a diagnostic yield of 54%. After adjusting for study bias and new gene associations with auditory neuropathy, the diagnostic yield was 31%. For each of the 195 participants with a genetic diagnosis, their variant-level genetic data has been recorded in this study using Human Genome Variation Society nomenclature. Across all studies, 23 genes and 136 pathogenic and likely pathogenic variants were implicated, with both syndromic and non-syndromic presentations. Most articles used next-generation sequencing methodologies, particularly exome sequencing or next-generation sequencing based panel testing. Autosomal recessive inheritance accounted for 64% (125/195) of diagnoses across eight recessive genes. *OTOF* variants were the most common genetic cause of auditory neuropathy, responsible for 59% (116/195) of all diagnoses and 69% (116/168) of all non-syndromic cases. *AIFM1* variants were the second most common cause, accounting for 14% (23/168) of non-syndromic diagnoses. Syndromic hearing loss was identified or suspected in 14% (27/195) of cases, with *ATP1A3* the most frequently associated syndromic gene - seen in 26% (7/27) of syndromic auditory neuropathy cases. Most cases were of North-East Asian origin. Audiological profiles varied, but all auditory neuropathy cases with a genetic diagnosis presented with bilateral hearing loss, or lacked laterality data. Most *OTOF* cases had severe to profound, pre-lingual hearing loss and all nine temperature-sensitive auditory neuropathy cases were *OTOF*-associated.

Conclusions: This systematic review presents the genotypic spectrum of auditory neuropathy and diagnostic yield of genetic testing in auditory neuropathy. This has various clinical implications. The collation of gene and variant-level associations with auditory neuropathy is a valuable resource for aiding genetic testing and counselling and can help inform future development of gene therapies. The predominance of certain genes such as *OTOF*, *AIFM1* and *ATP1A3* underscores the need to include such genes in diagnostic panels. Additionally, the high diagnostic yield found here demonstrates the utility of genetic testing in auditory neuropathy and suggests that it should be considered early and routinely in the diagnostic pathway to support precision-based approaches to treatment. Understanding genetic causes can help predict the value of cochlear implantation as implant outcomes vary by the lesion site, which may be predicted based on genotype. Furthermore, the emergence of gene therapy, particularly for *OTOF,* makes early genetic diagnosis very useful in identifying suitable candidates for clinical trials.

Keywords: auditory neuropathy, genetic issues, genetic testing, early identification

170 - GENETIC SCREENING AND STRUCTURAL BIOINFORMATICS ANALYSIS OF CANDIDATE VARIANTS IN BRAZILIAN MENIÈRE'S DISEASE COHORT

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Ménière's Disease (MD) is a complex inner ear disorder, characterised by episodic vertigo, sensorineural hearing loss, tinnitus, and aural fullness. Despite the fact that its precise aetiology remains enigmatic, research suggests a combination of environmental and genetic factors. Although the prevalence of MD in European populations is estimated at 34-190/100,000, data on its epidemiology among Brazilians remains limited. The diagnosis of this condition is primarily dependent on clinical symptoms, though the considerable variability among patients complicates this process. In view of the scarcity of molecular studies carried out on Brazilian patients, the present study screened DNA samples from a cohort of 22 unrelated patients in order to identify genetic variants. In addition, in silico protein modelling was employed to assess their potential functional impact. Bioinformatic analysis identified rare variants in fourteen candidate genes (*OTOG*, *PCDH15*, *USH1G*, *ADGRV1*, *ESRRB*, *CDH23*, *AQP6*, *KCNH2*, *TNFRSF13B*, *SDHA*, *HRH4*, *ADD1*, *SLC25A35*, and *HMX2*). To assess potential functional impact, three-dimensional protein modelling was employed. Wild-type and mutant structures were generated using homology modelling (Modeller v10.7, Swiss Model) and artificial intelligence prediction (AlphaFold Server). Subsequent structural analysis and thermodynamic stability predictions were conducted utilising the PyMOL and DynaMut2 software tools, respectively. The modelling predicted significant structural alterations for several variants. The *AQP6* p.Arg127Gly variant was found to be associated with a -1.45 kcal/mol destabilisation and a local conformational change. The *TNFRSF13B* p.Cys104Arg variant, which disrupts a disulfide bond in the TNFR-Cys1 domain, was predicted to be destabilising (-1.08 kcal/mol). A frameshift variant in *SDHA* (p.Ala186Glyfs*9) was modelled to cause a severe truncation. It is noteworthy that a missense variant in the *OTOG* gene (p.Pro1240Leu) has been replicated in a Brazilian patient and in Spanish MD cohorts. Structural modelling of this and two other rare *OTOG* variants (p.Gly850Arg, p.Pro1129Leu) found in the same Brazilian patient indicated local structural perturbations, including the formation of new hydrophobic contacts and, for p.Gly850Arg, the promotion of a short alpha-helix. These in silico findings suggest a plausible structural basis for dysfunction in proteins critical for inner ear homeostasis and immune regulation. The replication of the *OTOG* variant in European MD patients is of particular significance in terms of establishing the cross-population relevance of this gene. Nevertheless, the study is subject to certain limitations. The cohort size is limited, and the absence of familial samples precludes segregation analysis and determination of cis/trans configuration for multiple variants. Furthermore, the presence of environmental confounders, such as ototoxic treatment in some patients, complicates the establishment of a genotype-phenotype correlation. Moreover, all functional data are inherently predictive in nature and thus lack experimental validation. In conclusion, this work provides a preliminary genetic and structural profile of MD in Brazilian patients, identifying candidate variants and generating specific hypotheses for experimental testing in larger, functionally validated studies.

Keywords: Ménière's Disease, Whole Exome Sequencing, Structural Bioinformatics, Precision Medicine.

191 - DIVERSE STAKEHOLDER PERSPECTIVES ON UTILITY AND IMPLEMENTATION OF MEDICARE-FUNDED DEAFNESS GENETIC TESTING IN AUSTRALIA

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Background/Rationale:
To understand the perspectives of Australian parents and young people about genomic testing for childhood hearing loss, and the barriers and facilitators for implementation of Medicare funded testing in Australia from the perspective of clinical and laboratory stakeholders.

Materials and Methods:
Semi-structured interviews were completed with 11 consumers (9 mothers and 2 adolescents), 6 scientists, 5 policy stakeholders, 4 ENTs, 5 genetics clinicians, 5 paediatricians and 2 each of speech pathologists and audiologists. Deductive content analysis was performed for clinical and laboratory stakeholders and thematic analysis for consumers.

Results:
For clinical stakeholders capacity and capability were discussed, clinical utility and barriers and facilitators. The primary barriers involve the Medicare rebate being insufficient to cover costs and for clinicians is confidence and time to perform consent and feed back results. Consumers reported that the services to help with hearing loss diagnosis are helpful and described some challenges they face particularly if their child had a syndromic hearing loss. They identified personal benefits that enhanced coping, helped understand the diagnosis. Uncertainty and ambivalence were also reported. Concern about possible Usher syndrome and challenges related to a diagnosis of Usher syndrome were described.

Conclusions:
This broad perspective from multiple stakeholders including consumers identifies barriers and facilitators for testing and personal benefits and will aid implementation of genomic testing for hearing loss into clinical practice in Australia.

Keywords: genetic testing, hearing loss, implementation

206 - GENOTYPE-PHENOTYPE CORRELATIONS IN CHILDHOOD HEARING LOSS: INSIGHTS FROM AN AUSTRALIAN STATEWIDE GENETIC TESTING AUDIT

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Background:
Paediatric hearing loss (HL) has been associated with diverse genetic causes for both syndromic and non-syndromic HL and variable audiological outcomes. The genomic landscape in Australia has not previously been characterised.

Materials and Methods:
We conducted a retrospective chart audit of children referred for genetic testing for HL through the statewide tertiary service, Genetic Health Queensland, and/or those who tested positive for **GJB2** between 2014–2024. Extracted data included demographics, newborn hearing screening outcomes, and 4-frequency audiograms (initial and most recent). Genetic testing modality (single gene testing, gene panels, whole exome sequencing, and whole genome sequencing) and results were recorded and classified as syndromic or non-syndromic. Audiograms were grouped by gene, plotted, and descriptively analysed for severity and configuration to identify genotype–phenotype associations.

Results:
Of 267 children tested, 104 had pathogenic variants across 48 causal genes with 44 (42%) diagnosed before age two. Paediatricians and ENT specialists identified an additional 206 **GJB2**-positive cases. Of phenotypes across the 310 positive cases, 236 (76%) were non-syndromic, 57 (18%) were syndromic, and 17 (6%) currently uncertain. **Usher syndrome** (14/57, 25%) and **Waardenburg syndrome** (14/57, 25%) were the most common syndromic conditions. The most frequently implicated genes were **GJB2, STRC, MITF, USH2A,** and **SLC26A4.** Audiological phenotypes ranged from mild to severe in **GJB2** and **USH2A**, while **STRC**-related HL was predominantly moderate.

Conclusion:
This first Australian genomic characterisation of paediatric HL outside the perinatal period shows proportions of syndromic and non-syndromic diagnoses consistent with international findings. Despite **GJB2** being the most commonly associated gene, substantial genetic heterogeneity exists, supporting the value of comprehensive genomic testing in guiding management of HL and associated features.

Keywords:
Genetics, childhood hearing loss, syndromic hearing loss, Child, Cross-Sectional Studies, Exome Sequencing, Queensland, Retrospective Studies, Usher Syndromes, Genetic Testing, Demography, Counseling, Phenotype, Referral and Consultation, Genomics, Hearing

240 - EXOME SEQUENCING IN INDIVIDUALS WITH AUDITORY NEUROPATHY: A COHORT STUDY

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Background: Auditory neuropathy (AN) is a disorder where outer hair cell function within the cochlea is normal, but inner hair cell and/or the auditory nerve function is disrupted. The emergence of gene therapy trials for otoferlin gene (*OTOF)*-mediated AN has heightened interest in the genetic architecture of AN and the clinical utility of genetic testing to identify candidates for future personalized treatments.
Aim: To identify genetic causes of AN.
Methods: Exome sequencing, with targeted analysis of deafness genes, was performed.
Participant Identification: Participants were identified by chart review, which evaluated the presence of bilateral SNHL and phenotypic diagnosis of, or consistent with, AN. Individuals who were born before 1989, and those residing outside Australia or who had prior exome sequencing, were not invited to participate.
Recruitment: Individuals were invited through the Victorian Childhood Hearing Longitudinal Databank, the Victorian Infant Hearing Screening Program, the University of Melbourne AN Research Database, and Royal Children's Hospital clinics (Melbourne, Victoria, Australia). A public expression-of-interest form was also circulated via audiology networks and social media.
Procedures: Participants received pre- and post-test face-to-face/telehealth genetic counselling. Demographic information and AN-associated risk factors were collected, including prematurity, low birth weight, hyperbilirubinemia/jaundice, ototoxic medication, hypoxia at birth, and consanguinity.
Genetic Testing: NATA accredited whole exome sequencing with targeted analysis of deafness genes was conducted at the Victorian Clinical Genetics Service. Pathogenic, Likely pathogenic variants, and Variants of Uncertain Significance with high clinical relevance were reported according to modified ACMG criteria.
Results: Of the 143 individuals invited to participate, 20 (14%) consented to exome sequencing. Median age was 7.4 years (range 0yr1m-26yr9m). Fifteen underwent trio sequencing, 3 had duo and 2 had singleton exomes. No participants were found to have pathogenic or likely pathogenic variants in the otoferlin gene (*OTOF*).
Three of the individuals that consented to exome sequencing (15%) received a diagnostic result, and one received a VUS with possible clinical relevance. Of the three diagnostic results: one participant was diagnosed with autosomal recessive Chudley McCullough syndrome; one participant was compound heterozygous for a pathogenic and a likely pathogenic variant in the MYO15A gene: and one participant had homozygous variants in the *DDX11* gene which is associated with autosomal recessive Warsaw breakage syndrome (WABS). One participant had a finding of uncertain significance, specifically a gene conversion event (VUS-3A) and a missense variant (VUS-3B) in *STRC*.
Sixteen sequencing results (80%) were non-diagnostic; 10 of those reported risk factors for AN.
The diagnostic yield was 15% (3/20) overall and 22.2% (2/9) among participants without AN risk factors. This is lower than yields reported for congenital SNHL (> 50%) and congenital AN (40%) in published cohorts (1, 2).
Discussion and Conclusion: Exome sequencing identified a genetic aetiology in a minority of individuals with AN. The relatively low diagnostic yield in this cohort may reflect the prevalence of environmental or perinatal AN risk factors, and it also raises the possibility that population-specific variation may limit current testing sensitivity. As gene therapy trials progress, better understanding of the genetic causes of AN will be critical for determining treatment eligibility and estimating potential benefit. Incorporating routine genetic testing into the diagnostic pathway for SNHL should be considered to more accurately identify children who may benefit from future targeted therapies.

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Key words: Auditory neuropathy; Exome sequencing; Sensorineural hearing loss; Genetic diagnosis; OTOF gene.

SPEECH AND LANGUAGE DEVELOPMENT

130 - FACTORS SUPPORTING TRAJECTORIES IN LANGUAGE AND READING FOR ADOLESCENTS WITH HEARING LOSS

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Many children with hearing loss (CHL) receive early intervention for hearing loss. Even with this early intervention, however, CHL are at risk for language delays relative to their same-age hearing peers due to reduced auditory-linguistic access. These challenges have cascading effects on literacy achievement because language plays a foundational role in reading. The aim of this presentation is to examine growth trajectories of vocabulary, morphosyntax, and reading from ages 5 to 18 years in CHL and age-matched typical-hearing children. We will also characterize factors that influence variation in individual growth trajectories for language and reading. Our hypothesis is that greater levels of auditory access in CHL will lead to supports steeper growth trajectories in multiple aspects of development. CHL and typical-hearing children participated in a longitudinal study for over 15 years (Outcomes of Children with Hearing Loss [OCHL] study). The two groups were well-matched on age, socio-economic status, and nonverbal ability. CHL had no additional significant disabilities and used spoken English as their primary communication mode. CHL had bilateral hearing loss in the mild to severe range. We constructed a linear mixed model to test for group (CHL vs typical-hearing children) and individual differences in growth trajectories while accounting for age and correlated observations. Group, age, and a group by age interaction were fixed effects, with a random intercept to account for within subject correlation. Results suggest that in CHL, higher levels of aided auditory access were associated with steeper growth trajectories in language, whereas lower levels of aided auditory access were associated with shallower growth trajectories in language. Age at confirmation of hearing loss was associated with growth trajectories for vocabulary, in that children who were identified at younger ages showed steeper growth in their vocabulary size. Maternal education levels also had a significant effect on individual growth trajectories. In addition, typical-hearing children showed significantly higher scores for language and reading compared to CHL at younger ages, but the effect size diminished over time. These results suggest that while CHL show initial deficits, some may be able to close the gap with their hearing peers over time. Early and consistent auditory access with well-fit hearing aids contributes to positive outcomes for CHL.

297 - HOW THE FACTORS INFLUENCING PAEDIATRIC COCHLEAR IMPLANT LANGUAGE OUTCOMES HAVE CHANGED OVER THE LAST 20 YEARS

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Background
Many of the factors (e.g. age at implant, aetiology) that affect the variability in speech and language abilities in infants with cochlear implants are known but the importance of the different factors and the interaction with other influencing factors change over the years and can be modified by changes in the healthcare system (e.g. introduction of newborn screening, changes in candidacy) and in society.

Methods
The goal was to determine how the patient profile of pediatric cochlear implant recipients changed over a 20-year period in an inner-city clinic and to understand how these changes were influenced by clinical practice and changes in society and to relate changes in patient profile to long-term language outcomes.
We conducted a retrospective analysis of children implanted between 1998 and 2019 and related demographic factors to longitudinal language outcomes from pre-implant to five-years post-implant. Demographic factors of home language, onset of severe-to-profound deafness (congenital, progressive, or acquired), age at implantation, and socioeconomic status were collected for the entire sample (414 children). Logistic regressions were conducted to understand factors predicting language outcomes.

Results
Over the 20-year period we observed: a significant increase in the percentage of children from non-native English-speaking families (24% to 67%), influenced by population migration, a significant increase in the percentage of children with progressive onset of deafness (8% to 45%), influenced by changes in audiometric candidacy criteria such that more children with progressive losses were eligible.
Age at implantation significantly decreased due to greater surgical confidence, increased awareness of the benefits of implanting babies under 12 months and the introduction of newborn hearing screening. There was a significant reduction in the Index of Multiple Deprivation (proxy for socio-economic status) believed to be related to recession, austerity, and population migratory trends.
Regression analyses suggested that onset of deafness, age at implantation, year of implantation, income deprivation and parental education were key predictors of five-year post implantation language abilities.

Conclusion
If this complex and dynamically changing landscape of influential factors is well understood, appropriate interventions can be introduced for families most in need of them to facilitate faster rates of language acquisition.

Keywords
Language, Paediatric cochlear implants, Predictors, Socio-economic status, Age at Implant

223 - LANGUAGE COMPREHENSION IN BACKGROUND NOISE - EFFECTS OF NOISE TYPE, TASK MODALITY, AND INDIVIDUAL DIFFERENCES

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Background/Rationale

Suboptimal acoustic conditions are common in classrooms and can hinder children's ability to comprehend language, not only when listening but also when reading. These background noise effects are not solely due to masking effects. Two common accounts used to explain background noise effects are the interference-by-process account and the renewed view of age-related distraction. Studies show that children's susceptibility to noise varies substantially, and that individual differences in language and cognition may be critical. However, it remains unclear whether the same individual factors support comprehension in noise across modalities (listening vs reading) and whether their role differs depending on whether background noise is intelligible (semantic) or unintelligible (non-semantic). Aim 1 was to investigate the influence of background noise type, as well as focal task modality on the effects of background noise on language comprehension in children, and if these patterns can be explained by the interference-by-process account, the renewed-view of age-related distraction or a combination of the two. Aim 2 was to examine how individual differences in cognition and language abilities are associated with the effects of noise on language comprehension, and whether these associations differ between listening and reading comprehension.

Materials and Methods

Participants were 122 children in Grade 5 (approximately 11–12 years old) from Swedish compulsory schools, with no reported hearing impairment, dyslexia, or neuropsychiatric diagnoses. Participants underwent language comprehension tests (listening and reading) under three conditions: silence, background noise without semantic content, and background noise with semantic content. For the listening comprehension task, the target speech and background noise had a speech to noise ratio (SNR) of +23 dB S/N(A) (~99.5% speech intelligibility score for children around age 11). Individual differences in language and cognition were measured in silence using standardized tests of receptive vocabulary, receptive grammar, working memory, selective attention, and sustained attention.

Results/Conclusions

For Aim 1, we found significantly lower performance for the semantic background noise condition compared to the silent condition. There was no significant interaction between task modality and background noise indicating that listening and reading comprehension were similarly affected by semantic noise. These results are broadly consistent with the interference-by-process account. Exploratory analyses further indicated slower reading speed in semantic noise compared with both silence and non-semantic noise. For Aim 2, preliminary findings suggest that vulnerability to background noise is moderated by individual resources, but that the relevant resources differ by **modality** and **noise type**. This indicate that children might use different strategies depending on wether the task is to listen or read, and depending on wether the background noise contains semantic information or not.

Keywords: Language comprehension, background noise, school, cognition, language

36 - INVESTIGATING RHYTHMIC DISCRIMINATION OF LANGUAGES IN INFANTS WITH HEARING LOSS WITH FNIRS

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At birth, newborns show sensitivity to the rhythm of their native language, i.e. the language they heard prenatally, being able to discriminate it from a rhythmically different language (May et al., 2018; Peña et al., 2003). A current hypothesis (Gervain, 2018; Nallet & Gervain, 2021) suggests that prosody provides the basis of early speech perception and helps infants discover other linguistic units after birth, when the full-spectrum speech signal is available. Prenatal experience is thus hypothesized to be foundational for language learning. But what happens when the prenatal and postnatal experience is disrupted? To investigate how hearing loss impacts the neural processing of speech during the first year of life, in the present study we tested the ability of 0-12-month-old infants with different degrees of hearing loss (HL) to discriminate their native language (Italian) from a rhythmically different unfamiliar language (English).

55 HL infants were tested in a simple block design paradigm. Sentences in both languages were presented forward and backward. Backward speech, with perturbed temporal features, is a standardly used non-linguistic control (Peña et al., 2003). A control group of 72 age-matched normal hearing (NH) infants was also tested. Infants' brain responses were recorded using fNIRS with a montage of 20 channels covering the frontal, temporal, and parietal regions, bilaterally. After preprocessing, 30 HL subjects and 47 NH subjects were kept for subsequent statistical analysis. We conducted cluster-based permutation analysis to identify clusters of channels in which a significant difference in concentration changes between the conditions was found. We then performed linear mixed-effects models over concentration changes in the spatial clusters identified by the permutation analysis, to investigate the role of specific predictors (Age, Hearing Threshold, Hemisphere, Condition).

Both HL infants and NH controls discriminated between the two languages and directions of presentation. However, the amplitude of the hemodynamic responses was reduced for the HL group compared to the NH one over bilateral temporal areas, similarly to what is found in premature babies (Bartha-Doering et al., 2025). Specifically, HL infants presented a weak pattern of activation to the native language (forward Italian), and deactivation to the other unfamiliar conditions. Moreover, the significant responses were shorter and peaking later than those of the NH group, suggesting a need for a longer time to process the auditory stimuli, as is also found in older hard-of-hearing infants (Abrahamse et al., 2025). While not significant, the hearing threshold was one of the best predictors of the brain responses in the HL group. In general, we found greater right hemispheric activation, especially in the NH group, suggesting that this type of rhythmic discrimination specifically tackles prosodic processing.

In conclusion, the current study showed that the residual hearing in our group of hard-of-hearing infants is enough to show linguistic and rhythmic discrimination abilities. However, compared to the control group, the HL group presents different neural responses in terms of peak amplitude and latency, as well as the lateralization and overall pattern of differential responses, suggesting different brain processes than those in typically developing infants. Lastly, the underlying brain mechanisms were revealed as more right lateralized, suggesting a right hemisphere specialization for prosody.

Keywords: speech perception, speech development, language, infants, Fnirs

162 - DEVELOPMENT OF NARRATIVE ABILITIES IN DUTCH SCHOOL-AGED CHILDREN WITH HEARING LOSS

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Background: Narrative ability determines the extent to which children can learn from interaction and sharing experiences verbally with others and is therefore related to cognitive and social-emotional development of school-aged children (Botting, 2002). Narrative tasks are well-established measures of linguistic proficiency (Norbury & Bishop, 2003; Duinmeijer et al., 2012). The most used oral narrative elicitation contexts are story generation and story retelling (Justice et al., 2006; Westerveld & Gillon, 2010). In children with a typical development (TD) narrative ability develops significantly between 4 and 9 years. As children grow older, they benefit more from the provided model story in the retelling condition (Bolk et al. under review). Narrative ability is important in diagnosis and rehabilitation of children with hearing loss (HL). The difference between story generation and retelling abilities is of particular interest for HL-children, as their hearing loss might compromise the benefits of the model story.

Aims: This study investigated story generation and story retelling in school-aged children with hearing loss to gain insight into their narrative development and associated difficulties.

Methods & Procedures: A total of 193 children aged 4–9 years, with mild to severe hearing loss participated. They were rehabilitated with hearings aids, bone conduction devices and/or cochlear implants. Unaided thresholds for the non-CI-ears ranged between 35 to about 105 dB HL. Children completed a story generation task (Frog Story Test, FST) and a story retelling task (Bus Story Test, BST). Narratives were analysed using Stein and Glenn's (1979) story grammar model (macrostructure: plot structure). Additional outcome measures were calculated at the sentence level (microstructure: sentence length, syntactic complexity, and grammatical accuracy). Cross-sectional developmental data were compared with normative data from 420 TD children (Bolk et al., under review) using linear regression analyses. The effect of elicitation method was examined using a repeated-measures linear mixed model. Relations between microstructure and macrostructure measures were analysed using multiple regression.

Results: Across the combined HL and TD sample, linear regression analyses revealed a main effect of age for all narrative outcome measures in both elicitation contexts. A main effect of diagnosis emerged only for grammaticality, with HL children showing reduced performance across the age range. An interaction between age and diagnosis was found for plot structure indicating a reduced age-related growth. In the repeated-measures mixed model, HL children again showed age-related improvement across all narrative measures. An interaction between age and elicitation method was found for sentence length: in HL children, development in the BST was less steep than in the FST. Interactions between age and elicitation method for syntactic complexity and plot structure as observed in TD children, were not found in the HL group. Finally, multiple regression indicated that in both elicitation contexts, MLU5 and grammaticality contributed to plot structure performance as was found in TD children.

Conclusions & Implications: In this group of HL-children, we find an age-related development for all outcome measures of narrative ability in both elicitation methods, as was found in normative age-matched data. Compared to TD-norms, the HL-children show reduced grammatical accuracy throughout the age-range and reduced development of plot-structure over the age-range. For several outcome measures, HL-children show less steep development in the story retelling elicitation context compared to story generation , where TD-children show benefit of retelling. The results indicate the differential impact of hearing loss on narrative abilities during school-age, and also on the use of the model story in a retelling task. Hearing loss impacts narrative competence through the age-range (4-9 years). Furthermore, our findings underscore the importance of taking age into account while comparing narrative abilities between clinical groups and children with typical development, as both show age-related development in the entire age-range.

Keywords: Hearing Loss, Linguistic proficiency, Narrative Development, Story Generation, Story Retelling

211 - THE IMPACT OF VESTIBULAR STIMULATION ON ATTENTION AND MEMORY IN DYSLEXIC CHILDREN

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Background/Rationale
A specific learning disorder (SLD) is defined as a deficiency in reading, language, writing and mathematical skills compared to those of individuals with normal development. SLD is essentially a neurodevelopmental disorder, divided into subcategories based on the difficulties experienced. People who struggle with maths are said to have dyscalculia, while those who struggle with writing are said to have dysgraphia. Those with reading and language difficulties are said to have dyslexia. However, dyslexia is not just a phonological disorder; it is a systemic condition involving sensory-motor and cerebellar dysfunction. According to the Cerebellar Deficit Hypothesis, skill automation problems in dyslexia originate in the cerebellum. Due to the extensive connections between the cerebellum and the vestibular system, it is thought that vestibulo-ocular reflex (VOR) disorders increase cognitive load. Current neuro-otological literature has revealed vestibulo-cortical pathways that extend to the prefrontal cortex and the hippocampus. These pathways demonstrate that vestibular input is crucial for attention and memory processes. This study investigates whether vestibular rehabilitation can improve 'top-down' cognitive processes in dyslexic children by providing 'bottom-up' stimulation.

Materials and Methods
26 participants took part in the study. All participants performed the Cawthorne–Cooksey Exercises for 30 minutes once daily over four weeks, either under researcher observation or by recording a video with their parents. The functional Head Impulse Test (f-HIT) was used to evaluate VOR gain and gaze stability before and after the exercises. The Stroop TBAG was used to assess skills such as selective attention and processing speed, and the Auditory Verbal Learning Test (AVLT) was used to measure memory and learning capacity.

Results
Statistically significant improvements in VOR gain were observed before and after exercise ($p < 0.05$). This indicates habituation and adaptation in the integration of the visual and vestibular systems. Statistically significant differences in reaction times and error rates were observed for Stroop 1 ($p = 0.006$), Stroop 3 ($p = 0.026$) and Stroop 5 ($p = 0.032$) in the Stroop TBAG results. Significant differences were also observed in the total number of characters marked (TN) ($p = 0.005$), the total number of correct characters (CP) ($p = 0.007$), test performance (TN-E) ($p = 0.001$), and the error percentage (E%) ($p = 0.007$) in the D2 attention test before and after exercise. Statistically significant differences were observed in all AVLT parameters ($p < 0.05$). This table shows that VOR development has a direct and positive effect on memory capacity. All findings reveal that Cawthorne-Cooksey exercises improved the attention and memory skills of dyslexic children, as evidenced by significant differences between the pre and post test results.

Conclusions
It has been concluded that Cawthorne-Cooksey exercises improve VOR in children with dyslexia and have positive effects on attention and memory. It is thought that adding vestibular rehabilitation exercises to the rehabilitation program for children with dyslexia will increase the effectiveness of rehabilitation.

Keywords: Dyslexia, Cawthorne-Cooksey exercises, Attention, Memory

LISTENING EFFORT

63 - RELIABILITY, STABILITY AND VALIDITY OF EMA MEASURES ASSESSING THE COSTS AND BENEFITS OF LISTENING EFFORT IN REAL-LIFE SETTINGS

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Listening effort and the resulting fatigue is among the main adverse consequences of hearing loss. We developed an Ecological Momentary Assessment (EMA) tool assessing the costs and benefits of listening efforts to monitor the effectiveness of interventions. A Delphi study was conducted to identify concepts reflecting listening costs and benefits, which were then translated into EMA items. Participants completed seven prompts per day over a week and repeated the same protocol two months later to test stability. Auditory demand was quantified using subjective (difficulty × importance) and contextual indicators (activity/social context). Active listening prompts were analysed using EFA and CFA to derive cost and benefit factors. Multilevel models examined within and between-person effects and group differences between hard of hearing and normal hearing participants. Stability (ICC) was assessed for mean listening cost and mean listening benefit scores. Listening benefits showed good stability (ICC = 0.713), while listening costs demonstrated excellent stability (ICC = 0.875). These findings support the stability of the EMA-based measures. While both groups showed high reactivity to auditory demand, hard of hearing individuals experienced higher baseline costs but comparable reactivity to demand changes, though a potential ceiling effect in listening benefit at high demand. Overall, these results highlight the value of EMA for capturing both the challenges and positive aspects of listening and support the utility of these measures for future clinical and intervention research.

91 - BEYOND LISTENING FATIGUE: AN INCLUSIVE ASSESSMENT OF EDUCATIONAL FATIGUE IN DEAF AND HARD OF HEARING STUDENTS

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Classrooms involve continuous cognitive, visual, auditory, and attentional demands that present unique challenges for students who are D/deaf or hard of hearing (DHH). The sustained effort required to attend simultaneously to auditory and visual information, often across multiple speakers for six hours a day, five days a week has compounding and long-lasting effects on educational, vocational and quality of life outcomes. These effects are particularly pronounced when supports that mitigate fatigue, such as classroom amplification systems, structured breaks or flexible instructional practices are denied, unavailable or underutilized.

Despite its prevalence, fatigue remains poorly understood by educators and DHH students. Educators frequently underestimate the impact of fatigue or misinterpret its manifestations as laziness or noncompliance. Recent research highlights overlapping symptomatology between fatigue and ADHD which has led to misattribution of fatigue-related behaviors and inappropriate interventions (Mattingly et al., 2023). These misunderstandings further exacerbate educational inequities for DHH learners.

Students themselves often fail to recognize fatigue as the underlying cause of their difficulties, and lack awareness of how fatigue may compromise learning. With limited coping strategies; students may mistakenly internalize responsibility for their fatigue, viewing it as a personal failing rather than a systemic issue. The cumulative effects of unaddressed fatigue include restricted educational and vocational choices, increased mental health concerns, and strained family and peer relationships (Rohatyn-Martin & Hayward, 2022). Increasing awareness and improving access to tools that identify and monitor fatigue in DHH students are therefore critically important.

Although a few fatigue measures exist, none adequately reflect the heterogeneity of the DHH population including spoken language, sign language, and dual/multi language users. Our research program addresses this gap through the development of the Fatigue in Educational Contexts (FEC) survey - an inclusive tool designed to support students, educators, parents, and professionals in recognizing and monitoring: (a) the extent to which fatigue affects educational success, (b) strategies to mitigate fatigue across the school day, and (c) changes in fatigue over time once supports are implemented. The FEC was developed with strong commitments to inclusivity and accessibility and incorporates direct input from DHH students, their families and educational teams. As such, it represents an innovative contribution that bridges content and accessibility gaps present in existing fatigue measures.

The goal of this presentation is to describe the design phases and key features of the FEC. *Phase 1* involved interviews with three expert groups: DHH post-secondary students; parents of DHH students; and DHH educational teams (teachers, audiologists, and speech-language pathologists). These groups provided complementary perspectives on how fatigue is experienced, interpreted and managed across educational contexts. Interview data informed the development of a draft FEC survey with parallel forms for students, parents, and educational team members. *Phase 2* involved pilot testing with grade 7-12 DHH students, their parents, and educational teams across schools in North America and occurred in two stages. Stage 1 involved think-aloud testing during which participants completed the survey while verbalizing their thought processes, followed by retrospective interviews. Stage 2 involved live testing in which participants completed the FEC survey as intended for use in educational settings followed by interviews to capture user experiences. Findings from both stages will inform revisions to enhance the credibility, reliability, and validity of the survey.

The FEC incorporates multiple accessibility features. First, it is hosted on a web-based platform enabling access across locations and allowing parallel forms to be completed by students, parents, and educational teams. This structure supports collaborative identification of fatigue, assessment of impact, implementation of mitigation strategies, and monitoring of change over time. Second, the survey includes inclusive administration options allowing questions and responses to be accessed through spoken English, written English and ASL. For students, visual supports are also included to reduce language-related barriers. Third, to address limited understanding of fatigue, brief preparatory videos depicting different types of fatigue are presented prior to survey completion. These features will be described and demonstrated during the presentation.

Fatigue has undeniable consequences for academic achievement, social-emotional well-being, vocational trajectories, and overall quality of life for DHH students. Its cumulative effects underscore the urgent need for systematic identification and targeted mitigation within educational contexts. Grounded in principles of inclusivity and shared understanding, the FEC contributes to more equitable educational practices and outcomes for DHH learners.

120 - THE IMPACT OF INTER-IMPLANT INTERVAL ON LISTENING EFFORT IN SEQUENTIAL COCHLEAR IMPLANT RECIPIENTS

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Background/Rationale: Historically, children with bilateral profound sensorineural hearing loss were rehabilitated with a single cochlear implant (CI). As clinical evidence increased and candidacy criteria expanded, simultaneous bilateral cochlear implantation became the standard of care. Consequently, many individuals implanted in early childhood later received a second, sequential implantation. While speech-perception outcomes after sequential implantation are well documented, its effect on listening effort remains insufficiently studied. The present study had two main objectives: (1) to examine whether bilateral CI use reduces listening effort compared to using only the dominant implant; and (2) to evaluate how the inter-implant interval affects listening effort across various behavioral and subjective measures.
Materials and Methods: Twenty-nine adolescents and young adults aged 13–28 years who received their first cochlear implant before age three participated in the study. They were divided into a short inter-implantation interval group (SIII, ≤5 years) or a long inter-implantation interval group (LIII, >5 years). Speech perception was tested using the Hebrew sentence test (HeBio), both in quiet with each implant separately and in noise with the dominant implant alone and with bilateral cochlear implants. Listening effort was measured under the same listening conditions through both behavioral and subjective assessments. A sentence-completion-in-noise task evaluated performance accuracy and perceived listening effort. Dual-task paradigms combined a primary task of monosyllabic word identification in noise with either a manual or a lexical secondary task. Dual-task performance was measured using the Dual Task Effect (DTE) and interpreted within the interference model of attentional resource allocation. Auditory fatigue during everyday listening was assessed with the Vanderbilt Fatigue Scale (VFS).
Results: The main findings of the study were as follows. In the sentence-completion-in-noise task, listening with two cochlear implants resulted in higher accuracy and lower perceived listening effort than using only the dominant implant in both groups, with overall better performance in the SIII group. In the dual-task paradigm, performance was measured using the DTE, with more positive values indicating less listening effort. In the manual dual-task paradigm, bilateral listening produced more positive DTE values for the secondary task as the inter-implant interval decreased. Additionally, both groups showed a shift from mutual interference to speech-priority trade-off strategies when listening with two implants, indicating more efficient allocation of cognitive resources. Conversely, in the lexical dual-task, bilateral listening did not consistently reduce listening effort. Although primary-task DTE values became more positive with shorter inter-implant intervals, patterns of mutual interference continued and, in some cases, increased when listening with two implants. On the VFS, fatigue levels for most participants in both groups were within or close to normative ranges during daily listening with two cochlear implants.
Conclusions: Listening with two implants reduces listening effort compared to using the dominant implant alone in sequential CI recipients, with greater benefits seen when the inter-implant interval is short. The findings also indicate that task characteristics affect listening-effort estimates, with manual secondary tasks being more sensitive than lexical secondary tasks, possibly due to shared linguistic resource demands. Overall, these results highlight the importance of using multiple complementary tools to assess different aspects of listening effort and auditory fatigue, which may be relevant for clinical evaluation.
Keywords: sequential cochlear implantation; listening effort; dual-task paradigms; auditory fatigue; cognitive resource allocation

357 - MULTIDOMAIN RESPONSES TO TASK DEMAND AND MOTIVATION AS MODULATORS OF LISTENING EFFORT IN SPEECH-IN-NOISE RECOGNITION

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Background: In individuals with hearing loss, common audiometric measures are not sufficient to fully assess the daily life experienced listening conditions. Individuals often report experiences of effort and fatigue that require assessment across different domains related to listening effort, including self-reported, behavioral, and physiological measures. It is also important to consider the different dimensions of listening effort, including not only input-related demands but also the motivation to understand speech.
Materials and methods: In this study, a two-way within-subject experimental design was used to investigate the effect of task demand and motivation on listening effort during a speech-in-noise recognition task. Five levels of task demand were defined using the individual speech reception threshold (SRT) as a relative reference. Two motivation conditions were included, based on the presence or absence of motivational content delivered through evaluative threat and visual feedback. The protocol consisted of 10 sub-blocks. Each sub-block included a baseline (resting) period, a test period with a 3-alternative forced choice speech recognition task using 25 vowel-consonant-vowel stimuli, and a self-report phase using the NASA-TLX questionnaire including six items on a 20 step scale: effort, frustration, perceived performance, mental demand, physical demand and temporal demand. The collected multimodal measures included self-reported, behavioral (reaction time and performance), and physiological responses, including cardiovascular and respiratory measures, skin conductance responses, and electroencephalogram (EEG) features. The sample consisted of 30 young adults with normal hearing. Features were extracted from preprocessed signals and compared with baseline values when necessary.
Results: Results showed that task demand was reflected in behavioral, subjective, and EEG measures. Motivation influenced EEG and non-EEG physiological responses, while the interaction between task demand and motivation emerged only in EEG features. The effort dimension of the NASA-TLX was strongly correlated with behavioral measures such as performance and reaction time, and it was moderately correlated with the Engagement Index derived from EEG activity in the frontal region. No significant correlations were found between behavioral and physiological measures.
Conclusions: These findings support the need for a multidimensional approach to listening effort, as different measures capture different aspects of the construct and respond differently to task demand and motivation. Moreover, the observed sensitivity of EEG features to both task demand and motivation, and their correlation to self-reported measures of effort may indicate the possibility to reduce the number of measures necessary to quantify and control listening effort in speech-in-noise recognition tasks.

Acknowledgment: This work was supported in part by the Italian Ministry of Research, under the complementary actions to the NRRP “Fit4MedRob - Fit for Medical Robotics” Grant (# PNC0000007).

Keywords: Listening effort, task demand, motivation, EEG, speech-in-noise

138 - LISTENERS READILY EXERT PHYSICAL ACTIONS TO AVOID EXPENDING LISTENING EFFORT

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Models of auditory functioning posit that physical behaviors (e.g., moving closer to a talker) and the effortful allocation of cognitive resources (e.g., listening effort), while each constituting specific costs, are both adaptive responses to adverse auditory conditions that may be readily substituted for each other as needed to maximize hearing success. We previously demonstrated that listeners will indeed readily exchange physical effort (repeated key-pressing) for opportunities to secure easier listening conditions (reduced background noise), and that their amount of physical exertion is directly affected by factors that vary the need to expend listening effort (initial levels of noise, predictiveness of sentence context). Here we extend this work using a yoked experimental design that allows a more direct assessment—in real time— of the correspondence between fluctuations in listening effort and physical behaviours aimed at securing easier listening condition.

Two groups (total N = 64) listened to engaging, spoken narratives lasting approximately 6-minutes each, with levels of background noise (range: no noise to -10 dB SNR) that varied within each of six, 1-minute sections of a given narrative. For the 'Key-press-to-reduce-noise Group', background noise gradually increased from the start of each section. Participants could reduce the noise in real time, if desired, by repeated key-pressing. A progressive-ratio responding schedule required an ever-increasing number of key-presses to obtain easier listening conditions across the six consecutive sections. Because each participant in this group had to decide whether/when to key-press, any resulting noise changes across time were unique to each participant. Each Key-press-to-reduce-noise participant was therefore yoked to a new participant who heard the exact same narrative sections with the exact same levels of noise as the original participant. However, rather than key-pressing to change the listening conditions in real-time, individuals in this 'Key-press-to-rate-effort Group' provided continuous ratings of subjective effort across the fluctuating listening conditions determined by their yoked counterpart. After each story, all participants completed thought-probe questions assessing boredom, attention, and engagement, as well as multiple-choice comprehension questions.

Compared to periods shortly before each noise change, the Key-press-to-reduce-noise participants significantly increased their key-pressing in the period thereafter, whereas their yoked Key-press-to-rate-effort counterparts had significantly higher ratings of subjective effort. In other words, on average, the same idiosyncratic noise changes that resulted in significantly higher feelings of subjective effort in one group also triggered decisions to significantly increase key-pressing to secure easier listening conditions in their yoked counterparts. A between-subjects correlation revealed a significant positive correlation between these increases in subjective listening effort and corresponding levels of physical exertion.

Physical behavior and cognitive effort may indeed be readily substituted for each other as needed to maximize hearing success. Our results converge with prior demonstrations that measures of physical exertion can therefore provide a quantitative index of listening effort. Ongoing dynamometer research suggests hand-grip force may be particularly useful. Such novel indices of listening effort—based on measures of physical exertion— therefore seem promising for inclusion in an audiologic outcome battery, given that they are efficient, easily administered, and require no specialized equipment.

Keywords: listening effort, auditory cognition, speech perception

Conflict of interest: one or more authors have declared an industry affiliation

200 - EFFORTFUL LISTENING IN DIGITAL WORK ENVIRONMENTS: A QUALITATIVE STUDY OF PARTICIPATION AND COMMUNICATION DEMANDS AMONG EMPLOYEES WITH HEARING LOSS

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Digital communication technologies, including video meetings, hybrid meetings, and remote collaboration tools, are now a routine part of working life. These tools are often presented as supporting flexibility, accessibility, and inclusive participation, yet they also create listening situations characterised by mediated speech, reduced acoustic control, and reliance on digital platforms and features. For employees with hearing loss, such conditions are commonly experienced as effortful listening, with consequences for fatigue, stress, and participation at work. Despite the central role of digital communication in contemporary workplaces, there is limited qualitative knowledge about how employees with hearing loss experience these digital communication practices in everyday work.

Previous research on effortful listening has mainly focused on controlled experimental tasks, while assumptions about the accessibility of digital communication tools are often based on the availability of technical features rather than on how communication unfolds in practice. This leaves open questions about how different forms of digital interaction, organisational routines, and workplace expectations influence the experiences of employees with hearing loss, including listening, communication demands, and opportunities for participation. Therefore, this study will explore how employees with hearing loss experience digital communication at work, with a particular focus on effortful listening, participation, and the conditions under which digital communication tools are experienced as supportive or challenging.
A qualitative design will be used, based on semi-structured interviews with employees who self-report hearing loss. Participants will be recruited through professional networks, healthcare services, and stakeholder organisations. Interviews will be conducted via digital platforms such as Teams and will focus on everyday work situations involving digital communication, including video and hybrid meetings and telephone calls. The interviews will explore participants' experiences of effortful listening and participation, factors that facilitate or hinder communication, comparisons between digital and face-to-face interaction, and the organisational conditions that shape digital communication practices at work.

At the conference, we will present preliminary results describing how employees with hearing loss experience communication demands and participation in digital communication tools, and how these demands are shaped by meeting formats, digital communication tools, and organisational practices. The preliminary analysis is expected to show why digital communication tools intended to support accessibility are not always experienced as reducing communication demands in everyday work, and how employees adapt to these conditions in practice. By focusing on employees' experiences of digital communication at work, we will provide rich, in-depth perspectives on effortful listening. The findings are expected to inform the development of practical guidelines and policy recommendations for more inclusive and sustainable digital communication practices at work, with relevance for hearing care, workplace design, and occupational health.

Keywords
effortful listening; hearing loss; digital communication tools; work participation; interviews

249 - LISTENING EFFORT IN CHILDREN WITH NORMAL HEARING AND COCHLEAR IMPLANTS: BEHAVIORAL, PHYSIOLOGICAL, AND SUBJECTIVE MEASURES

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Background: Adverse listening conditions, such as fast speech or speech in noise, increase cognitive demands and listening effort in children with normal hearing (NH) and hearing impairment. This study aimed to evaluate how children process compressed speech and speech in noise using behavioral, physiological, and subjective measures in cochlear implant (CI) users compared to NH children listening to either natural or vocoded speech.
Methods: Seventy-eight children (aged 8–12 years) participated: 25 NH children listening to natural speech, 26 NH children listening to 8-channel vocoded speech, and 27 children with CI. Participants listened to disyllabic words under three conditions: quiet, compressed speech, and speech in noise. Compression thresholds and signal-to-noise ratios (SNRs) were determined adaptively for each participant to achieve 50%-word recognition accuracy. Listening effort was assessed using reaction times (RTs), peak pupil dilation (PPD), and self-reported effort ratings.
Results: For compressed speech, both CI users and NH children listening to vocoded speech required more favorable compression thresholds than NH children listening to natural speech. In the noise condition, the vocoder group required the most favorable SNRs, followed by CI users, while NH children listening to natural speech required significantly lower SNRs than both groups.
RTs differed significantly across listening conditions in all three groups, with compressed speech producing the longest RTs, followed by speech in noise, and quiet conditions being the shortest. When intelligibility was individually matched across conditions, RTs did not differ between groups. However, in quiet, NH children listening to vocoded speech demonstrated longer RTs than those listening to natural speech.
Pupillometry revealed group-specific patterns. Across listening conditions, children with CIs exhibited smaller PPD compared to NH children listening to natural speech, with the vocoder group showing intermediate responses. For the NH listening to natural speech and CI groups, the noise condition elicited significantly larger pupil dilation than compression or quiet. In contrast, the vocoder group showed minimal variation in pupil dilation across conditions. Additional analyses controlling for each participant's threshold as a covariate eliminated these group differences in PPD.
Subjective effort ratings revealed significant condition effects only in the NH group listening to natural speech, where speech in noise was rated as more effortful than compression and quiet. In contrast, CI users and the vocoder group did not show significant differences in subjective effort between the noise and compression conditions, suggesting that both degraded listening conditions were perceived as similarly demanding by these groups.
Conclusions: These findings suggest that when task difficulty is individually matched, children with CIs demonstrated comparable behavioral performance to NH listeners: RTs did not differ between groups, indicating that post-perceptual decoding capacity is intact regardless of hearing status. Similarly, the smaller pupil responses initially observed in children with CIs may not reflect inherently reduced cognitive engagement but rather are explained by the different noise levels delivered to each group. Once individual thresholds were controlled as a covariate, PPD did not differ between groups. Subjective ratings further revealed that CI users perceived noise and compression conditions as similarly demanding, unlike the NH group listening to natural speech who differentiated between conditions.
These findings support a multidimensional model of listening effort in which different measures capture distinct dimensions: RTs reflect post-perceptual decoding demands, as indicated by the longest RTs in the compressed condition; pupil dilation indexes cognitive load during online processing, with the largest responses in the noise condition; and subjective ratings capture the perceived difficulty. These findings highlight the importance of controlling for individual task difficulty when comparing measures of listening effort across listener groups, and underscore the value of combining behavioral, physiological, and subjective measures to comprehensively characterize listening effort in CI users.

Keywords: *Listening effort, Pupillometry, Cochlear Implants, Speech in noise, Compressed speech*

QUALITY OF LIFE AND HEARING LOSS I

274 - SOCIAL COGNITION AND SOCIAL COMMUNICATION IN SCHOOL-AGED CHILDREN WHO ARE DEAF OR HARD OF HEARING COMPARED TO PEERS WITH TYPICAL HEARING

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Introduction:
Children who are deaf or hard of hearing (DHH) often experience poorer peer relationships and poorer quality of life than peers with typical hearing (TH). These problems may result from difficulty perceiving and processing emotional and social information – two skills that contribute to social competence. While previous research shows neurotypical children acquire emotion recognition and social information processing naturally, children with developmental differences such as a diagnosis as DHH can show significant delays in attaining these skills, even with intervention such as hearing aids or cochlear implants. This project explores the effect of hearing status (DHH vs. TH) on social competence skills in school-aged children (7-12 years) and the relationship between social competence and social well-being.
Methods
Data collection is ongoing, but currently the sample includes 7 diagnosed as DHH (5 with bilateral cochlear implants, 2 with bilateral hearing aids) with a mean chronologic age of 9.3 years and 14 with TH (M=9.9 years). Parents completed a form querying sociodemographic characteristics and audiologic history. All participants completed subtests from the Test for the Evaluation of Emotions and Socialisation (TEEMS), a dynamic assessment aimed to identify children who may be at risk for social challenges by presenting scenarios, photographs and video clips. Subtests included social cognition tasks (i.e., emotion perception, emotion recognition) and social communication (i.e., social perception). Parents also rated items about social relationships (i.e., peer rejection, positive peer interaction, social withdrawal) from the emotional domain of the NIH Toolbox.
Results
The TH and CI groups performed similarly on the emotion perception task (M>80% correct) in which they matched an illustrated face to a target emotion. Children with TH outperformed children in the DHH group on the emotion recognition task, in which they selected one of four photos of a person showing a different emotion. The TH group also exhibited better social perception skills than the CI group on a task in which they identified one of four photos showing a different social theme (e.g., bullying). Parents of children in the DHH group reported more peer rejection, less positive peer interactions, and more social withdrawal than parents of children with TH. Preliminary data support a trend to correspondence between social competence and social well-being such that those with better social skills have better parent-reported social well-being.
Conclusion
The DHH group showed poorer emotion recognition, social perception, and social well-being compared to the TH group. Both groups show a relationship between social competence and social well-being, indicating the importance of social skill intervention, especially in those diagnosed as DHH, which can enhance social well-being and overall quality of life.

301 - EARLY DETECTION AND HEARING INTERVENTION IN INFANTS WITH BILATERAL MODERATE HEARING LOSS: BASED ON A NATIONWIDE INFANTILE HEARING AID SUPPORT PROGRAM

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Background: The aim of this study is to review data on infants who received hearing aid support through the Infantile Hearing Aid Support Program after the settlement of universal newborn hearing screening (NHS) in the country over the past five years. This study seeks to identify the characteristics of infants with bilateral moderate hearing loss and to explore effective strategies for auditory rehabilitation by analyzing the timing of hearing aid interventions and regional disparities.
Methods: We analyzed the National Health Insurance Service (NHIS) records and the Infantile Hearing Aid Support Program database between January 2019 and December 2023. Our analysis included the NHS performance rate, NHS results, diagnostic hearing test outcomes, types of hearing loss, and the relationship between NHS results and hearing loss risk factors. Additionally, we examined the submission dates for the program, hearing aid purchase dates, types of hearing aids, and whether the residential area, prescription area, and hearing aid purchase areas matched.
Results: In this period, a total of 1,318,551 neonates were born and 540 bilateral moderate hearing loss infants registered for the Infantile Hearing Aid Support Program. The NHS performance rate increased to 95.4% by 2023, while the proportion of infants receiving diagnostic hearing tests within three months was 46.2%. The rate of infants receiving hearing aids within six months for auditory rehabilitation was 22.4%. Although no correlation was found between risk factors for hearing loss and NHS results, it was observed that infants admitted to the NICU or with other syndromes had a higher likelihood of being diagnosed with moderate hearing loss, even if they passed the NHS. Finally, there were regional disparities in access to hearing aid prescriptions and rehabilitation.
Conclusion:
Our findings suggest that auditory rehabilitation achieves greater focus following the implementation of NHS. This study also provides valuable insights into the hearing status and rehabilitation outcomes of infants with moderate hearing loss. Furthermore, we anticipate that these results will contribute to informing policies aimed at reducing regional disparities in access to auditory rehabilitation services.
Keywords: Newborn hearing screening, Early intervention, Moderate hearing loss, Hearing aid, Support program, Korea

335 - HEARING CARE THROUGH A LIFECOURSE- THE CASE FOR A HOLISTIC APPROACH

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This presentation presents a personal, longitudinal perspective on living as a hard of hearing woman who has worn hearing aids since early childhood. Drawing on lived experience across childhood, adolescence, and adulthood, it explores how perceptions of hearing loss, hearing aid use, and professional support have evolved over time. Early experiences were characterized by intensive speech therapy, repeated testing, and a medicalized focus on “fixing” hearing loss, often without sufficient attention to emotional impact, agency, or age-appropriate communication. As a child, hearing aid fittings were frequently uncomfortable and confusing, with limited opportunity to express needs. In adulthood, hearing aids became essential for academic and professional success, and collaborative partnerships with audiologists—marked by adequate time, careful listening, and nuanced sound adjustments—proved critical.

The paper also addresses the challenges of continuous hearing aid use, including the need for auditory rest and the reality of hearing-related exhaustion. Advances in hearing aid technology and assistive tools over the past decade—such as improved sound quality, speech-to-text services, subtitling, induction loops, and real-time text—have significantly enhanced access and participation, while also highlighting missed opportunities in earlier educational settings.

The discussion emphasizes that hearing aids alone are insufficient and argues for a holistic, person-centered approach to hearing care. Audiologists, audio technicians, and ENT specialists must strengthen their listening skills and move beyond hierarchical “white coat” models toward genuine partnership. Empowering hard of hearing individuals to question, advocate, and insist on collaborative care is essential to enabling effective communication, autonomy, and a high quality of life across all stages.

Lifetime Support and hearing care

353 - SENSORY PROCESSING AND QUALITY OF LIFE AMONG CHILDREN WITH HEARING IMPAIRMENT

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Introduction:
Hearing impairment is the most common sensory disability in childhood and is widely associated with challenges in communication, participation, and wellbeing. However, growing evidence suggests that the impact of hearing impairment extends beyond auditory functioning. Children with hearing impairment may demonstrate atypical sensory processing patterns across multiple sensory modalities, which may further influence their daily functioning and overall quality of life.
Within the framework of the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY), sensory processing represents a body function that interacts with activity and participation to contribute to health-related outcomes. While quality of life has become a central outcome in hearing research and rehabilitation, limited research has examined the contribution of sensory processing patterns to quality of life among children with hearing impairment.
Understanding this relationship may enhance understanding of the mechanisms contributing to lower quality of life in this population and guide the design of more comprehensive intervention approaches.
Objectives:
This study aimed to:

1. Examine differences in sensory processing patterns and quality of life between children with hearing impairment and children with typical hearing.
2. Investigate associations between sensory processing patterns and quality of life within the hearing impairment group.
3. Examine the contribution of sensory processing to the prediction of quality of life among children with hearing impairment.

It was hypothesized that children with HL would demonstrate more atypical sensory processing patterns and lower quality of life compared to peers with typical hearing; that greater sensory processing difficulties would be associated with poorer quality of life; and that sensory processing would significantly predict quality of life outcomes.
Method:
Participants included 90 children aged 7–11 years: 45 children with hearing impairment and 45 children with typical hearing.
Parents completed the Short Sensory Profile (SSP) to assess sensory processing patterns and the Pediatric Quality of Life Inventory (PedsQL) to evaluate health-related Quality of life across physical, emotional, social, and school domains. Demographic and hearing-related data were collected.
Group differences were analyzed using multivariate analyses. Within the hearing impairment group, correlations examine associations between sensory processing and quality of life domains. Hierarchical regression analyses were conducted to assess the predictive contribution of sensory processing to quality of life outcomes.
Results:
Children with hearing impairment demonstrated significantly more atypical sensory processing patterns compared to controls.
They also reported significantly lower overall quality of life.
Within the hearing impairment group, greater sensory processing difficulties were significantly associated with lower overall quality of life. Sensory processing patterns significantly predicted quality of life.
Conclusion:
Findings suggest that reduced quality of life among children with hearing impairment may not be attributable solely to auditory limitations, but also to broader sensory processing differences that shape daily functioning.
These findings highlight the importance of incorporating sensory processing assessment into clinical evaluation and intervention planning for children with hearing impairment.
Addressing sensory processing challenges may enhance emotional regulation, school engagement, and overall quality of life, supporting a more holistic approach to pediatric hearing care.

354 - PARENTING UNDER STRESS: PARTICIPATION OUTCOMES AMONG CHILDREN WITH HEARING IMPAIRMENT IN DAILY CONTEXTS

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Introduction:
Parental stress is a key environmental factor shaping children's developmental trajectories, particularly in families raising children with disabilities. From a cross-cultural developmental perspective, parenting experiences and participation opportunities are influenced not only by child characteristics but also by sociocultural expectations and family roles. Hearing impairment, one of the most common sensory disabilities in childhood, represents a significant life event for families and may alter daily routines, parent–child interactions, and educational participation. Despite growing interest in participation-focused outcomes, limited research has examined how parental stress relates to children's participation within culturally diverse contexts.
Objectives:
The present study aimed to: (1) compare parental stress and participation patterns between children with HI and peers with typical hearing; (2) examine associations between parental stress and participation within the hearing impairment group; and (3) explore the predictive contribution of parental stress to participation outcomes.
Method:
Participants included 90 children aged 7–11 years: 45 with hearing impairment and 45 with typical hearing enrolled in mainstream education. Parents completed the Parenting Stress Index–Short Form (PSI-SF) and the Participation and Environment Measure for Children and Youth (PEM-CY), assessing participation across home, school, and community contexts.
Results:
Results indicated that parents of children with hearing impairment reported significantly higher levels of stress compared to parents of children with typical hearing. Children with hearing impairment demonstrated lower participation across daily environments. Within the hearing impairment group, higher parental stress was associated with reduced participation, particularly in contexts where parents act as primary participation facilitators, such as home and community settings. Furthermore, parental stress emerged as a significant predictor of participation outcomes.
Conclusion:
These findings highlight parental stress as not only a psychological experience but also a functional environmental factor influencing children's developmental participation. From a cross-cultural psychology perspective, understanding how family roles, expectations, and support systems shape parental experiences may inform more culturally responsive interventions. Integrating parental stress assessment into educational and rehabilitation practices may support family wellbeing and promote inclusive participation. Interventions that combine participation-focused approaches with parent-centered support strategies may enhance children's engagement in everyday life and contribute to improved developmental outcomes across diverse cultural contexts.

28 - THE IMPACT OF UNILATERAL AND BILATERAL SEVERE HEARING LOSS ON WORK PRODUCTIVITY AND THE NEED FOR RECOVERY AFTER WORK

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Objectives The impact of unilateral and bilateral severe hearing loss on work productivity remains an under-researched area. It is hypothesized that the communication difficulties experienced by this population will result in a decline in work productivity and a consequent economic burden due to hearing loss. Therefore, the primary objective of this study is to investigate work productivity in a cohort of patients with severe acquired hearing loss. Furthermore, cognitive functioning was examined to control for the potential intermediate effect of cognitive functioning on work productivity.
Design The present study presents an analysis of observational data from 100 patients with severe hearing loss, including 50 with unilateral and 50 with bilateral severe hearing loss. The Work Limitations Questionnaire (WLQ), the Work Productivity and Activity Impairment Questionnaire (WPAI), and the need for recovery subscale of the Dutch Questionnaire on the Experience and Evaluation of Work (Dutch Vragenlijsten Beleving en Beoordeling van de Arbeid (VBBA)) were used to assess work productivity and the short-term effects of fatigue resulting from work activities. To evaluate the risk of long-term sick leave among participants currently on sick leave, a Quickscan Questionnaire was administered. Cognitive functioning and visuospatial short-term memory were assessed using the Repeatable Battery for the Assessment of Neuropsychological Status, adjusted for hearing-impaired individuals (RBANS-H), and the Corsi-Block tapping task.
Results Patients with severe hearing loss reported a decline in self-reported work productivity and an increased need for recovery after work. Compared with healthy controls and the general population, as reported in previous literature, patients with severe hearing loss reported higher work productivity losses. Our study participants reported a greater need for recovery after work than normal hearing controls. No significant differences were found between the unilateral and bilateral hearing loss groups. The impact of severe hearing loss on cognitive functioning was limited.
Conclusion Patients with severe hearing loss reported a significant impact of their hearing loss on work productivity and the need for recovery after work. Patients with unilateral and bilateral severe hearing loss did not differ significantly. Further research is required to corroborate these findings and to investigate the effects of varying degrees of hearing impairment and hearing rehabilitation on work productivity and the need for recovery.
Key words Severe Hearing Loss, Productivity, Work Performance

EFFECT OF NOISE

290 - RECREATIONAL NOISE EXPOSURE AND AUDITORY OUTCOMES: RESULTS OF A SCOPING REVIEW OF THE LITERATURE

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Aims To create an overview of current scientific work and outcomes on the association between recreational sound exposure and auditory outcomes. The focus was on identifying contexts that researchers consider potentially risky for noise-induced hearing loss, tinnitus or other auditory outcomes, as well as on the scientific methods applied to study this association.
Methods A scoping review was performed. PubMed and Embase were search for empirical, peer-reviewed articles in English or Dutch, that evaluated relationships between recreational sound exposure from amplified sound and auditory outcomes (e.g., hearing loss, tinnitus). Two researchers independently screened the literature and extracted study data after inclusion. Outcomes extracted included type of context, study design, population, auditory outcomes, and reported exposure parameters (sound intensity, duration, frequency).
Results 149 articles were included (111 cross-sectional, 38 longitudinal studies). Most studies examined the context of portable music players (PMPs; 40% of the cases), followed by various contexts together ('total leisure noise'; 31%), discotheques (9%), concerts (7%), festivals (2%) and sports (2%). Of the longitudinal studies, most had an experimental design (68%), often focusing on short-term effects. Most included teenagers or young adults. Hearing loss measured via pure tone audiometry was most often reported (29%), followed by self-reports of tinnitus or hearing impairment, or oto-acoustic emissions. The parameters were often measured subjectively, or were (partly) estimated.
Discussion Studies on the potentially risky contexts of sports, gaming, cinema, and festivals as well as on a young age group <12y were scarce and indicate a need for studies focusing on recreational sound in the wide context. Longitudinal studies using objective and standardized outcomes are needed to shed more light on both short- and long-term effects of noise exposure and be able to advance the field on prevention from auditory damage.

82 - ASSOCIATION BETWEEN EARPHONE USE AND HEARING THRESHOLD : A POPULATION-BASED STUDY USING KOREA NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY

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Background
The widespread use of earphones has raised concerns regarding potential noise-induced hearing impairment, particularly among young adults. However, population-based evidence on the association between earphone use and hearing thresholds remains limited. This study aimed to investigate the relationship between earphone use and hearing thresholds using nationally representative survey data.

Material and methods
We conducted a cross-sectional analysis of participants aged ≥12 years from the Korea National Health and Nutrition Examination Survey who underwent pure-tone audiometry and completed questionnaires on earphone use in noise environments. Hearing outcomes included speech-frequency pure-tone average (PTA, 0.5–4 kHz), low-to-mid frequency PTA (0.5–2 kHz), and high-frequency PTA (4 and 8 kHz). Complex-sample analysis accounting for survey weights and design was performed. Associations between earphone use and hearing thresholds were assessed using complex-sample analysis of covariance (ANCOVA) with stepwise adjustment: Model A adjusted for age and sex; Model B additionally adjusted for household income and chronic otitis media; and Model C further adjusted for smoking status, diabetes, and dyslipidemia. Among earphone users, additional analyses evaluated the association between earphone use duration and speech-frequency PTA using both continuous and quartile-based exposure models.

Results
Earphone users were younger and had higher socioeconomic status and fewer metabolic comorbidities than non-users. After adjustment for covariates, earphone use remained significantly associated with higher hearing thresholds across all frequency ranges. In fully adjusted models, earphone users had higher speech-frequency PTA (β = 1.92 dB, 95% CI 1.10–2.74), low-to-mid frequency PTA (β = 1.62 dB, 95% CI 0.90–2.34), and high-frequency PTA (β = 2.61 dB, 95% CI 1.26–3.95) compared with non-users (all $p < 0.001$). Interaction analyses indicated that the association between earphone use and hearing thresholds varied by age, with a stronger association observed in younger participants. Among earphone users, earphone use duration was significantly associated with high frequnecy PTA when treated as either a continuous variable or quartiles, after adjustment for age and sex.

Conclusion
In this nationally representative analysis, earphone use was independently associated with elevated hearing thresholds across multiple frequency frequency ranges after comprehensive adjustment for potential confounders. The association was more pronounced in younger individuals, suggesting increased vulnerability or cumulative exposure effects in this population. Additionally, longer earphone use duration among users was specifically associated with worse high-frequency hearing thresholds. These findings provide population-level evidence supporting concerns that earphone use in noisy environments may contribute to early, subclinical hearing impairment, underscoring the need for targeted public health strategies and hearing conservation education, particularly for adolescents and young adults.

Keywords: earphone use, hearing threshold, noise-induced hearing loss, population-based study

151 - HEARING STATUS OF PROFESSIONALS USING COMMUNICATION HEADSETS

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Background
An increasing number of occupational settings and work-related tasks, such as teleconferencing and customer service activities, require the use of communication headsets. The sound exposure conditions in these environments, or during these tasks, are not representative of those typically associated with acoustic trauma or noise-induced hearing loss. Nevertheless, ear- and hearing-related symptoms—including tinnitus, sound hypersensitivity, and sensations of aural fullness—are frequently reported by professional groups who rely on headsets to perform their duties.
Conference interpreters are no exception to this phenomenon. For example, a report published by the International Association of Conference Interpreters (2020), based on a survey of 1,035 members, showed that tinnitus and sound hypersensitivity each affected 42% of respondents, while 37% experienced pain in and/or around the ear. One hypothesis proposed in this report to account for the prevalence of these symptoms is the possible presence of *acoustic shock syndrome*. Acoustic shock syndrome (ASS) refers to a cluster of symptoms – following exposure to a sudden, brief, and unexpected sound transmitted through headphones or headsets, such as a Larsen effect. However, many professionals having to use communication headsets for their duties and experiencing persistent ear-related symptoms, do not recall a specific sound incident
Despite the prevalence of these functionally limiting symptoms across various professional groups, relatively few studies have examined the potential risk of ear- or hearing-related damage associated with prolonged or repeated use of telecommunication headsets. It therefore remains unclear whether these symptoms reflect subtle hearing impairment associated with occupational sound exposure via headsets, or whether they are related to other otological or neurophysiological mechanisms.
The primary objective of this study was to assess the hearing health of conference interpreters employed by the Translation Bureau of Canada (TBC), with particular attention to the potential presence of ear-related injury associated with the occupational use of telecommunication headsets.

Methods
Thirty-nine (39) conference interpreters employed by the TBC, with more than five years of professional experience in the field and no history of significant noise exposure during leisure activities or previous employment, participated in this study. The sample included 31 female and 8 male participants, ranging in age from 33 to 60 years (mean age: 45 years), with an average of 15 years of professional experience as conference interpreters.
Participants were invited on two occasions, one year apart, to complete a series of questionnaires and undergo a comprehensive audiological test battery. The study was conducted at the Hearing Research Laboratory of the University of Ottawa (Canada).

Results
Results indicated that a high proportion of participants (86%) reported experiencing at least one ear-related symptom a few times per month, such as tinnitus, sound hypersensitivity, or aural fulness, with many participants reporting more than one symptom.
Tympanometric measures were within normal limits for most participants. Speech recognition thresholds in noise were within normal limits for 74% of the sample. Pure-tone audiometric thresholds between 250 and 8,000 Hz were also within normal clinical limits (≤ 20 dB HL) in both ears for the majority of participants (66%). Comparisons of thresholds obtained during the first and second testing sessions, for both pure-tone audiometry and speech recognition, revealed no observable differences over time.
Hearing thresholds measured at four extended high frequencies (EHF)—namely 9, 10, 11.2, and 12.5 kHz—were below 20 dB HL in both ears for a smaller proportion of participants (33%). Although not statistically significant, a slight increase (i.e., deterioration) in EHF thresholds was observed between the two testing sessions in the left ear.

Conclusions
Although several variables remain unknown—such as the sound dose experienced by conference interpreters during their professional activities—the high proportion of individuals reporting ear-related symptoms underscores the need for further investigation. The findings of this study will be discussed in relation to a *possible* association between occupational communication headset use and auditory injury, without implying a direct causal relationship.

The limitations associated with the use of dB HL units to evaluate hearing damage, particularly for extended high-frequency thresholds, will also be addressed, along with the importance of applying age-specific normative data when interpreting audiological findings. Finally, the next steps of this research program will be presented.

Keywords: Communication headsets, acoustic shock, extended high frequency, conference interpreters

68 - AUDIOLOGICAL AND MIDDLE EAR OUTCOMES IN UKRAINIAN SOLDIERS WITH POST-EXPLOSION PERFORATION OF THE TYMPANIC MEMBRANE

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Introduction

The current war in Ukraine is accompanied by the widespread use of explosive devices. Up to 95% of all injuries among military personnel are caused by explosives. Primary blast injuries most often affect air-containing organs, including the ears. This manifests itself in hearing loss, tinnitus, and acute balance disorders. Two components of an explosion are most dangerous to the ear: a sound wave exceeding 160 dB, which causes damage to the cells of the inner ear, and a sudden change in atmospheric pressure, which causes rupture of the eardrum and ossicles. Acute trauma of the inner ear needs to be treated as soon as possible. Injuries of the middle ear are usually monitored for 3-6 months, as most perforations of the eardrum heal on their own during this time. The injury can cause conductive or mixed hearing loss.

Material and Methods

The study is based on a retrospective analysis of 70 patients with tympanic membrane perforations caused by explosions during combat operations in Ukraine between July 2024 and March 2025.

Hearing was assessed using otoscopy and pure-tone audiometry (PTA), and the condition of the middle ear was analysed intraoperatively.

Fifty-nine preoperative PTA and 19 postoperative PTA were used for analysis. Two patients with preoperative deafness were excluded from the analysis.

The indications for surgery were persistent perforation up to 5 mm in the largest measurement that did not close, and visible complications in the middle ear.

The condition of the middle ear structures, complications detected during surgery, the location of the tympanic membrane perforation, and the hearing status with these changes were assessed, followed by postoperative hearing results.

Results

Intraoperative evaluation was performed in 70 patients, with a mean age of 37.2 years.

Perforation in the largest dimension of 2 mm was found in 6%, 3 mm in 37%, 4 mm in 37%, and 5 mm.
in 31%.For the preoperative audiogram, the mean bone conduction was 14.3dB, air conduction- 35.4dB; for the postoperative, the bone conduction was 15.8dB, air conduction- 24.1dB

60% of the patients had perforations in 2 quadrants; their mean air-bone gap was 21.2dB. In 40%, perforations were present in just 1 quadrant, with a mean air-bone gap of 13.7dB.

In 60% of the ears additional lesions were detected intraoperatively—squamous epithelium lesions of the middle ear, such as cholesteatoma, epidermal layering, ingrowth into the walls of the tympanic cavity and ossicles, and wrapping of fragments of the tympanic membrane into the tympanic cavity and advanced adhesions of connective tissue and ossicular chain lesions.

Conclusions

Tympanic membrane perforations are the most common combat injury to the middle ear, mostly occurring in 2 quadrants, which leads to greater hearing loss and a larger air-bone gap. The difference in ABG between pure-tone audiometry results with perforations in 1 quadrant versus 2 quadrants was statistically significant. There was no difference in ABG in the anterior and posterior quadrants. Persistent perforations of the tympanic membrane may be accompanied by several pathological lesions, including epidermal complications of the middle ear. The incidence of those complications may be higher than reported.

Keywords: Blast Injuries, Hearing Loss, Tympanic Membrane Perforation, Cholesteatoma

30 - MEASUREMENTS OF SOUND SENSITIVITY: LESSONS FROM A CITIZEN SCIENCE PROJECT

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Introduction: Environmental noise is recognized by the World Health Organization as a significant public health concern, negatively impacting human health and well-being. To address and better understand these effects, the citizen science project “De Oorzaak” was initiated in Flanders, Belgium.

Objective: This citizen science project aims to assess the effects of environmental noise on health, stress, and sleep among the Flemish population. It also seeks to explore the role of sound sensitivity in noise pollution. This study focused on comparing the different measures for sound sensitivity within the project.

Material and methods: A subset of 101 citizens from Antwerp underwent an extensive audiological test battery. This included self-report questionnaires, audiometry, uncomfortable loudness levels (ULLs) and a newly developed diagnostic tablet test for hyperacusis utilizing natural sounds. Participants were categorized into two groups based on their scores from the Hyperacusis Questionnaire (HQ): with or without hyperacusis.

Results: The average HQ score for the hyperacusis group was 27/42 and for the control group was 13/42. While there was a trend for lower uncomfortable loudness levels (ULLs), this was not significant ($p = 0.12$). The tablet test did not differ between the two groups ($p= 0.57$). The three measures for hyperacusis did not show a good agreement, with weak correlations between the measures.

Conclusions: The limited agreement between the Hyperacusis Questionnaire, the uncomfortable loudness levels, and the tablet-based test suggests that sound sensitivity is a multidimensional phenomenon, in which subjective experience, auditory tolerance, and perceptual processing each play a distinct role. This implies that sound sensitivity cannot be reduced to a single score or threshold. This study thus provides an important methodological basis for the further development and refinement of measurement strategies for sound sensitivity.

Keywords: hyperacusis, citizen science, measures

AUDITORY NEUROSCIENCE

97 - CORTICAL MARKERS OF SPECTRAL DISCRIMINATION IN INDIVIDUALS WITH NORMAL AND IMPAIRED HEARING

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Spectro-temporal cues are essential for effective speech understanding as they allow listeners to detect and process the suprathreshold acoustic details of speech, particularly in challenging listening environments such as noise or reverberation. Studies have shown that reduced sensitivity to spectro-temporal modulations is strongly associated with poorer speech-in-noise performance, making these cues highly relevant for clinical assessment and intervention.
There is, therefore, growing interest in developing and refining cortical physiological measures that reflect how individuals process suprathreshold spectro-temporal information. Such objective measures could support more accurate diagnosis of suprathreshold auditory deficits, guide the optimization of hearing-aid settings, and provide valuable proxies for speech-processing ability in individuals who cannot reliably perform behavioral tests (e.g., infants, patients with developmental disorders, or individuals with cognitive impairment).
However, changes in spectro-temporal content may also lead to changes in loudness, which presents a challenge for interpreting cortical responses. It is therefore essential to understand whether cortical electrophysiological measures can distinguish between neural responses driven by changes in spectral shape and those driven primarily by changes in loudness. Clarifying this distinction will improve the reliability of physiological assessments and support their translation into routine clinical practice.

The present study investigates how stimulus characteristics influence cortical responses of spectral discrimination, as measured through the auditory change complex (ACC).
Using electroencephalography, we recorded ACC responses to a range of stimuli in normal-hearing (NH) and hearing-impaired (HI) adults. Stimulus parameters were systematically manipulated to assess their contribution to the neural encoding of spectro-temporal changes. Specifically, we varied (1) the transition rate of the acoustic change, (2) the type of cue eliciting the response—including spectro-temporal modulations (STMs), pure spectral changes, and intensity changes—and (3) the contrast level (CL), which determines the perceptual salience of spectro-temporal transition.
To disentangle spectral cues from intensity-related contributions in the ACC, we implemented an adaptation-inspired paradigm based on temporal amplitude roving. This approach reduces the reliability of intensity cues and enables clearer isolation of cortical responses driven by spectro-temporal transitions.
The findings reveal four key effects. First, slow transition rates produced significantly larger ACC responses than rapid transitions. Second, pure spectral changes elicited substantially stronger ACC responses than STM-based cues. Third, intensity-driven ACC components were markedly suppressed under amplitude-roving conditions, confirming effective reduction of intensity contributions. Fourth, NH participants demonstrated significantly larger ACC amplitudes than HI participants, particularly at lower CLs, indicating reduced cortical sensitivity to spectral cues with hearing impairment. Importantly, when intensity cues were diminished through amplitude roving, ACC responses to pure spectral transitions correlated with behavioural STM discrimination thresholds obtained using the auditory contrast threshold (ACT) test.
Together, these results demonstrate that the ACC provides a robust and objective neural marker of cortical spectral discrimination. The ability to isolate spectral encoding from intensity-related activity suggests that ACC-based paradigms may offer valuable tools for assessing suprathreshold auditory processing relevant to speech perception, particularly in populations with hearing impairment.

Keywords: auditory cortex | adaptation | spectro-temporal modulations | cortical | ACC

Conflict of interest: one or more authors have declared an industry affiliation

123 - PERCEIVING THE FEELINGS IN SPEECH: EFFECTS OF HEARING LOSS AND HEARING AID AMPLIFICATION ON EMOTIONAL PROSODY

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Background/Rationale: Speech prosody is an essential component of social interaction that conveys a talker's emotions and attitudes. Hearing loss, a growing health concern, restricts access to speech components, yet prosodic cues are often overlooked in the clinical assessment and rehabilitation of hearing-impaired individuals. This study examined how hearing-impaired individuals process emotional speech at both neural and perceptual levels, and whether they allocate the same extent of cognitive effort to process emotions as normal-hearing individuals. In addition, the study assessed the effect of hearing-aid amplification on the restoration of emotional information in hearing-impaired individuals, as well as its impact on the cognitive demands associated with emotion perception.

Materials and Methods: Normal-hearing participants underwent an emotion identification test paired with a secondary free-recall task. Hearing-impaired participants completed the same experiment twice, once in the unaided condition and once in the aided condition. Their performance was measured by response accuracy, reaction time, and the number of words recalled. In addition, the neural tracking of time-varying fundamental frequency (F0) contours underlying speech prosody was examined using speech-evoked frequency-following responses (FFRs) in normal-hearing participants as well as in hearing-impaired individuals assessed in unaided and aided conditions. Using a pitch-tracking algorithm, F0 tracking accuracy was quantified via Root Mean Squared Error (RMSE) and an accuracy percentage (5% accuracy).

Results: Participants with hearing loss were less accurate at identifying emotions in speech, with some emotions being more difficult than others to perceive. Their lower number of recalled words further suggested greater cognitive effort during emotional speech perception compared to normal-hearing participants. While amplification slightly improved outcomes, this effect was not statistically significant, and performance remained below normal-hearing levels. FFR recordings further indicated that hearing loss was associated with degraded neural representation of the F0 contours in emotional prosody, reflected by lower 5% accuracy and higher RMSE values in hearing-impaired individuals; however, amplification restored it partially to the range of normal hearing. The significant correlation between FFR responses and accuracy scores in the emotion identification test raised the possibility that challenges in encoding prosodic cues may be indicative of difficulties in prosody perception. However, when amplification enhances neural tracking of F0 contours, this may not necessarily guarantee improved perceptual performance, reinforcing that successful emotion perception could depend not only on acoustic fidelity but also on higher-order stages of auditory processing that engage cognitive and non-auditory resources.

Conclusions: Considering the disruption of emotional speech processing by hearing loss and the partial neural-level compensation provided by amplification, this study highlights the value of incorporating prosody perception into both diagnostic protocols and rehabilitative strategies for hearing-impaired individuals.

Keywords: speech prosody, Hearing loss, Hearing aid, Emotion, Frequency Following Response (FFR)

179 - PERSPECTIVES AND CHALLENGES OF AUDIOVESTIBULAR MEDICINE CONSULTANTS MANAGING PATIENTS WITH ADULT-ONSET AUDITORY NEUROPATHY SPECTRUM DISORDER: A QUALITATIVE STUDY

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INTRODUCTION: Auditory neuropathy spectrum disorder (ANSD) is an umbrella term employed to describe a condition whereby a patient's otoacoustic emissions (OAE) are (or were at some point in time) present, coupled with abnormal or absent auditory brainstem responses (ABR). There exists broad variation amongst patients with ANSD pertaining to factors such as time of onset, underlying pathophysiology, genetics, risk factors, as well as change and fluctuation in symptoms with time. Prevalence of ANSD has been reported as higher in paediatric populations but is probably underdiagnosed in adults. The latter group of patients has been understudied, as reflected by the lack of available literature of relevance in comparison with paediatric counterparts. There is often uncertainty around management of adult-onset patients and although there are already available guidelines for management of paediatric ones, those are often extrapolated and might not be always appropriate for the former group, due to clinical idiosyncrasies.
OBJECTIVE: The aim of this study was to explore the perceptions and lived experiences of Audiovestibular Medicine (AVM) consultants with adult-onset ANSD patients, in view of the associated complexity, uncertainty and heterogeneity of the condition, with scarcity of available pertinent literature.
DESIGN: Qualitative study using semi-structured interviews and interpretive phenomenological analysis.
SAMPLE: Five AVM consultants actively practising in the United Kingdom with a range of seniority in terms of years of service, number of cases of adult-onset ANSD patients encountered, as well as areas of practice and geographical distribution within the United Kingdom. Purposive sampling was employed in view of the niche research topic and aim to capture the unique perspectives of participants with specific demographic characteristics and professional backgrounds.
RESULTS: Six major themes were identified through an iterative process, which were highly interconnected, each reinforcing and supporting the others. Those included: diagnostic and management conundrums; variability in clinical practice; communication; perceptions of multidisciplinary collaboration; advocacy for guidelines and standardisation and; call for research and evidence base generation. These themes highlight the multidimensional nature of adult-onset ANSD.
CONCLUSIONS: The results of this study offer unique insights into challenges, barriers and the complex interplay of various aspects of adult-onset ANSD, not previously explored in literature. They are of relevance to the wider multidisciplinary team and underscore the necessity for development of guidelines and further research into this understudied condition.

KEY WORDS: Auditory Neuropathy Spectrum Disorder, Audiovestibular Medicine, Management, Challenges

53 - EYES ON THE MOUTH: INFANTS' BRAIN AND GAZE RESPONSES TO DEGRADED SPEECH

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Language acquisition typically occurs in rich audio-visual, face-to-face interactions, often under suboptimal listening conditions. Yet, much research on early language development has relied on auditory-only paradigms in ideal listening environments. In this study, we investigated how infants process audio-visual speech when intelligibility is reduced, examining both behavioral responses and neural activity.

We tested 47 infants aged 7–9 months, a developmental period characterized by a shift in visual attention from the eyes to the mouth during speech perception. Infants viewed 28 videos of a woman producing continuous infant-directed speech (23–30 s each) with either intact audio or degraded audio (8-band vocoding). During a 12-min session, gaze behavior and neural activity were recorded simultaneously. Eye tracking was used to assess visual attention to the mouth over the eyes of the speaker, while brain responses were measured using functional near-infrared spectroscopy (fNIRS) to index hemodynamic changes in fronto-temporal regions and electroencephalography (EEG) to quantify neural-speech synchrony using cortical tracking analysis.

We hypothesized that reduced speech intelligibility would: (1) Increase infants' attention to the mouth of the speaker; (2) Increase hemodynamic activity in brain areas related to executive functions and processing effort, such as the prefrontal cortex; and (3) Decrease cortical tracking of speech. We also predicted that infants who focused longer on the mouth than on the eyes of the speaker under degraded audio conditions, would show stronger cortical tracking and lower processing effort, as a reflection of more efficient use of audio-visual correspondences.

Behavioral results showed that infants significantly increased looking time toward the speaker's mouth when speech was degraded, suggesting an early compensatory strategy similar to that observed in adults. Analysis of the fNIRS and EEG data is still ongoing, with completion planned before the conference. This research aimed to establish objective measures of speech intelligibility in young listeners, with potential applications for infants with hearing loss.

Audiovisual speech-in-noise perception; Eye-tracking; fNIRS; EEG; Developmental auditory neuroscience;

EARLY IDENTIFICATION TECHNIQUES AND METHODS I

25 - PATIENT NAVIGATION PROMOTES TIMELY PEDIATRIC HEARING HEALTH CARE: A COMMUNITY-BASED RANDOMIZED CONTROLLED TRIAL

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Background: Infant hearing loss is the most prevalent neonatal sensory disorder and without early identification and intervention, infants with hearing loss face speech and language impairments and educational challenges. Despite Early Hearing Detection and Intervention (EHDI) guidelines recommending diagnosis of infant hearing loss by 3 months of age, many infants are lost to follow-up and do not receive timely hearing healthcare. To address these delays and difficulties, we developed a community-based patient navigation (PN) program to support families and to decrease non-adherence of infant diagnostic hearing testing at state-funded pediatric clinics. The objective of this research is to evaluate the effectiveness of a patient navigation intervention program to decrease non-adherence rates of diagnostic EHDI testing through a stepped wedge randomized controlled trial.

Methods: Over the course of four years, infants-parent dyads were included in the study as participants as they were referred to one of ten eligible state-funded clinic sites for EHDI diagnostic hearing testing following abnormal hearing screening tests at birthing hospitals. Over the course of the study, the intervention was launched at each of the ten clinics in a progressive stepwise fashion separated by 6-month intervals, based on an a priori randomized schedule, and the intervention was offered to all subsequently referred infant-parent dyads. Following the launch of the intervention at each respective clinic, infant-parent dyads that were referred to the clinic were recruited by study staff for participation into the study. Non-adherence to follow-up for diagnostic testing by 3 months of age was assessed of all referred infants and represented the primary outcomes. Additional parental sociodemographic data were evaluated as secondary outcomes as predictors of non-adherence.

Results: Based on the stepped wedge design, 979 infants were referred to study clinics during the control condition period and 1,720 infants were referred to study clinics during the PN intervention period (total sample size = 2,699). During the intervention period, a total of 213 infant-parent dyads were recruited and received the intervention and 2,486 infant-parent dyads did not receive the intervention (from both the control condition and unrecruited dyads during intervention period). Over the course of the study, the PN intervention did not significantly reduce non-adherence on a clinic-level during the intervention period compared with control period (aOR 0.785, p=0.34, 95% CI=0.46-1.35); however, only 12% of eligible dyads were able to be enrolled to receive the intervention. Of those dyads that received the PN intervention, the odds of non-adherence were significantly reduced by 59% compared with those that did not receive PN (aOR=0.41, p=0.0002, 95% CI=0.30-0.58). Independent of the intervention, the strongest sociodemographic predictor of non-adherence to infant diagnostic testing was maternal education level with each level of educational attainment having lower odds of non-adherence. Infants of mothers with a graduate degree had an 85% lower of non-adherence (aOR=0.15, p<0.0001, 95% CI=0.09-0.27).

Conclusions: Infant-parent dyads that receive patient navigation are less likely to be non-adherent to EHDI-recommended diagnostic testing within 3 months after birth. Patient navigation can provide critical information and support of EHDI guidelines and recommendations in a patient-centered and culturally acceptable fashion. The role of PN deserves further attention throughout the diagnosis and treatment process to decrease non-adherence and promote positive hearing and speech outcomes.
Keywords*:* Infant hearing, newborn hearing screening, diagnostic testing, patient navigation

39 - ASSESSING THE EFFECTIVENESS OF A TABLET-BASED HEARING SCREENING DEVICE FOR SCHOOL HEARING SCREENING

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Introduction: Environmental noise is recognized by the World Health Organization as a significant public health concern, negatively impacting human health and well-being. To address and better understand these effects, the citizen science project “De Oorzaak” was initiated in Flanders, Belgium.

Objective: This citizen science project aims to assess the effects of environmental noise on health, stress, and sleep among the Flemish population. It also seeks to explore the role of sound sensitivity in noise pollution. This study focused on comparing the different measures for sound sensitivity within the project.

Material and methods: A subset of 101 citizens from Antwerp underwent an extensive audiological test battery. This included self-report questionnaires, audiometry, uncomfortable loudness levels (ULLs) and a newly developed diagnostic tablet test for hyperacusis utilizing natural sounds. Participants were categorized into two groups based on their scores from the Hyperacusis Questionnaire (HQ): with or without hyperacusis.

Results: The average HQ score for the hyperacusis group was 27/42 and for the control group was 13/42. While there was a trend for lower uncomfortable loudness levels (ULLs), this was not significant ($p = 0.12$). The tablet test did not differ between the two groups ($p= 0.57$). The three measures for hyperacusis did not show a good agreement, with weak correlations between the measures.

Conclusions: The limited agreement between the Hyperacusis Questionnaire, the uncomfortable loudness levels, and the tablet-based test suggests that sound sensitivity is a multidimensional phenomenon, in which subjective experience, auditory tolerance, and perceptual processing each play a distinct role. This implies that sound sensitivity cannot be reduced to a single score or threshold. This study thus provides an important methodological basis for the further development and refinement of measurement strategies for sound sensitivity.

Keywords: hyperacusis, citizen science, measures

Conflict of interest: one or more authors have declared an industry affiliation

17 - UTILITY OF BONE-CONDUCTION AUDITORY BRAINSTEM RESPONSES IN NEONATES WITH SUSPECTED CONDUCTIVE HEARING LOSS FOLLOWING NEWBORN HEARING SCREENING

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Bone-conduction auditory brainstem responses (BC-ABR) offer a valuable diagnostic alternative for differentiating conductive from sensorineural hearing loss in neonates who fail newborn hearing screening. This ongoing observational study aims to evaluate the utility of BC-ABR in infants presenting altered air-conduction ABR findings suggestive of conductive involvement. The study population includes neonates referred from multiple maternity hospitals across Catalonia after failing the two-stage screening protocol.

Eligibility is based on air-conduction ABR patterns characterized by prolonged peripheral response times, particularly delayed wave I latencies, or a mildly delayed wave V with otherwise preserved morphology—findings frequently associated with middle-ear dysfunction. All participants undergo clinical otological assessment, including otoscopy and high-frequency (1000 Hz) tympanometry. The presence of type B tympanometric curves or other abnormal middle-ear indicators raises the suspicion of otitis media with effusion, one of the most common causes of transient conductive hearing loss in early infancy.

At approximately two months of chronological age, infants are scheduled for diagnostic BC-ABR testing. Bone-conduction stimuli are delivered using standard pediatric transducer placement, and thresholds are recorded following established normative criteria. When BC-ABR responses fall within normal hearing levels (≤20 dB nHL), the findings are interpreted as confirming conductive hearing loss. In these cases, additional diagnostic procedures such as imaging or extended electrophysiological testing are deemed unnecessary, thereby reducing the risk of over-diagnosis of sensorineural pathology and avoiding unnecessary parental anxiety.

Data collection and analysis remain in progress. However, preliminary expectations, based on previous literature and early clinical impressions, indicate that a substantial proportion of neonates with abnormal air-conduction ABR and middle-ear dysfunction will demonstrate normal BC-ABR thresholds. This result supports the hypothesis that many infants failing newborn screening do so due to transient conductive factors rather than permanent hearing loss. The integration of BC-ABR into the diagnostic workflow thus provides a more reliable differentiation between conductive and sensorineural components, particularly in cases complicated by otitis media where air-conduction responses alone may be misleading.

The systematic application of BC-ABR in this population has important implications for early hearing detection and intervention (EHDI) programs. First, it enhances diagnostic specificity, reducing the number of infants incorrectly categorized as having sensorineural hearing loss. Second, it allows clinicians to tailor follow-up and management more accurately, reserving intensive audiological surveillance for cases with confirmed or suspected sensorineural impairment. Third, it contributes to more efficient use of healthcare resources by avoiding unnecessary procedures and referrals.

In conclusion, BC-ABR represents a robust and clinically valuable tool for confirming conductive hearing loss in neonates who fail newborn hearing screening and exhibit middle-ear dysfunction. Its incorporation into routine diagnostic protocols improves the accuracy of early audiological assessments, minimizes diagnostic uncertainty, and supports better-informed decision-making within EHDI programs. As data collection continues, further analysis will determine the sensitivity and specificity of this approach and may help refine future guidelines for neonatal hearing assessment.

Keywords: Bone-conduction auditory brainstem response; conductive hearing loss; newborn hearing screening; otitis media; tympanometry.

358 - IS TARGETED SURVEILLANCE WORTH IT? EVALUATING THE CLINICAL AND RESOURCE IMPACT OF TARGETED SURVEILLANCE IN THE NEWBORN HEARING SCREENING PATHWAY.

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The main aim of newborn hearing screening programme (NHSP) is to enable early diagnosis of hearing loss via screening within the first few weeks of life. This is vital for timely intervention, helping children develop speech, language, and communication skills, and giving families the reassurance and support they need. It is widely recognised that without appropriate exposure to language from an early age, children are unable to develop in line with their hearing peers in areas including communication, language, speech, cognition, reading, and social-emotional development (JCIH 2019).

At implementation of the NHSP in England, identification of later onset hearing loss was of concern and there was limited evidence relating to both the risk factors which may identify later onset hearing loss and the optimal age at which to offer the test (Wood 2013). A pragmatic list of twelve risk factors were identified and an appointment at eight months of age (corrected) was set for this targeted surveillance. In 2013, Wood, Davis, and Sutton used evidence from the national IT system for NHSP in England to assess the effectiveness of the twelve risk factors and reduced the list to 4 with data continuing to be collected relating to the initial list. In 2023, Wilding, M. R. *et al.* (2023) reviewed the evidence again and reported that most babies with PCHI and an NHSP risk factor prompting targeted surveillance are identified through the immediate screening pathway.

Follow-up assessments at eight months, although routine, are high in resource and depend on the child's ability to cooperate with behavioural tests. Challenges such as limited attention, behavioural conditions including autism, and middle ear congestion often affect the reliability of results. Consequently, many children need more than one appointment to establish accurate hearing levels before discharge or identification of hearing loss.

Wilding, M. R. *et al.* (2023) found that the targeted surveillance pathway in its current format is costly with low levels of attendance and low yield. The work presented here builds upon the foundations of this earlier research, further developing and refining the evidence base. In this study, the hypothesis being tested is that there is no difference in hearing outcomes between babies offered a targeted surveillance appointment because of nationally recognised risk factors and those not offered targeted follow-up.

Methodology

Detailed statistical analysis of six years of NHSP data from all babies in England to identify three cohorts

1. Those who meet the requirement for targeted surveillance because they have a national risk factor, but they refer from the screen as an immediate follow up labelled 'immediate- pathway'
2. Those who pass the NHSP but have a national risk factor requiring targeted surveillance labelled 'TFU pathway'
3. Those referred for a targeted follow up who do not meet the national targeted surveillance criteria, those who did not participate in the pathway and those who met the criteria of cohort's 1 or 2 but did not participate in the pathway were labelled as 'no pathway'

Findings

The analysis showed no significant difference between the babies within the targeted surveillance pathway with different groups of risk factors.

Between the 3 different pathways, we showed that there is a statistical difference. However, there is little effect on the rate of PCHI identification when comparing the targeted surveillance pathway and no pathway groups.

The targeted surveillance pathway used 6.6% of paediatric audiology activity recorded in the national IT system for NHSP and currently costs approximately £290,000 per year across England.

Recommendations

At a time when paediatric audiology services across England are experiencing a significant workforce crisis characterised by shortages of qualified paediatric audiologists, high vacancy rates and increasing clinical demand the pressure on departments has never been greater. With referral numbers continuing to rise, discontinuing the targeted surveillance pathway could release essential clinical capacity and financial resource that could be redirected to areas of greatest need within paediatric audiology. In addition, removing the TFU pathway would reduce the administrative burden on NHSP teams by eliminating the referral management processes required for targeted surveillance appointments, thereby freeing further operational resource.

Keywords: Newborn Hearing Screening, Targeted Surveillance, Paediatric Audiology

EARLY IDENTIFICATION TECHNIQUES AND METHODS II

79 - HEARING SCREENING AT THE CITIZENS' REGISTRATION OFFICE – A MULTICENTER PILOT STUDY

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Introduction: Although hearing loss is among the most common chronic diseases, it is often undetected for a long time. While the WHO recommends regular hearing tests for adults, Germany currently lacks a structured hearing screening program for adults, similar to the established program for newborns. Given the increasing aging of the society and the shrinking public funds, this study aimed to evaluate the feasibility of a cost-effective, rapid hearing test at the citizens' registration office within a multicenter pilot study.
Materials and Methods: From November 2025 to February 2026, visitors at the citizens' registration office at 3 different locations in Germany (Bochum, Frankfurt and Hannover) were offered the opportunity to participate in a free hearing test. The test stimuli were presented by circumaural headphones via app. Air conduction thresholds were recorded separately for each ear. The test was self-administered by the participants following instructions. Participants with an abnormal test result (defined as a hearing loss >35 dB HL) were referred to an ENT specialist or a hearing aid acoustician. Eight weeks after the test, participants were surveyed to determine whether they had followed the recommendation. Other outcome measures included the ambient noise level and the test acceptance rate.

Results: By January 21th 2026, interim results of 254 participants (92 men, 161 women, 1 non-binary) aged 38.7 (16.76 SD) were available. The average test duration was 5 minutes. The background noise level was LAeq = 64.6 dB(A). Most participants were able to complete the test without any problems or assistance and found the test easy to use. 23.22 % of the participants had an abnormal test result and were advised to consult an ENT specialist. 57.87 % of all participants had never had a hearing test as an adult before.
Discussion: The present data demonstrate the feasibility of a hearing screening test at the local citizens' registration office. Advantages include high acceptance, low costs and the ability to include participants from different age groups and nationalities.

Keywords: age related hearing loss, screening for adults, feasibility

Conflict of interest: one or more authors have declared an industry affiliation

110 - IMPLEMENTATION OF AUTOMATED AUDITORY BRAINSTEM RESPONSE (AABR) SCREENING IN NEONATAL INTENSIVE CARE UNITS IN POLAND: PRELIMINARY OUTCOMES OF A NATIONAL PROGRAM

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Title: Implementation of Automated Auditory Brainstem Response (AABR) Screening in Neonatal Intensive Care Units in Poland: Preliminary Outcomes of a National Program
Background: The Polish Universal Newborn Hearing Screening Program has traditionally relied on otoacoustic emissions (OAE) as the primary screening method. However, in accordance with recommendations from the National Institutes of Health, Automated Auditory Brainstem Response (AABR) screening is advised, particularly for preterm infants and newborns with additional risk factors. In response to these guidelines, AABR screening was introduced in neonatal intensive care units (NICUs) for all infants hospitalized for more than seven days.
Methods: A pilot phase was initiated in June 2024, involving 54 NICUs and a total of 349 AABR screenings. Full nationwide implementation began on January 1, 2025. Data were collected on screening outcomes, referral rates, and confirmed cases of hearing impairment.
Results: During the full implementation phase, 2,706 AABR screenings were conducted, resulting in a total of 3,055 screenings since the start of the pilot. Among 490 infants referred for further diagnostic evaluation, 76% presented with additional risk factors beyond prolonged NICU stay. Four cases of confirmed hearing loss were identified, corresponding to a prevalence of 6.2 per 1,000 screened infants, substantially higher than in the general newborn population.
Conclusions: AABR screening proved to be a critical tool for the early detection of hearing disorders, particularly in high-risk newborns. The method enables identification of conditions not detectable through OAE alone, including auditory neuropathy and lesions along the central auditory pathway. Preliminary clinical data demonstrate high diagnostic value, supporting the continued development, systematic monitoring, and further optimization of the national screening program. The integration of AABR aligns the Polish program with international standards and significantly enhances the precision and effectiveness of early hearing loss detection.
Hearing screening, AABR, IT, newborn

129 - NEW CHALLENGES, NEW DIRECTIONS: THE FUTURE OF NEONATAL HEARING SCREENING IN POLAND

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For over 22 years, the Polish Universal Neonatal Hearing Screening Program (PUNHSP) has operated nationwide and plays a central role in early hearing detection and intervention in Poland. The program currently includes 313 maternity and neonatal care centers and 90 laryngology and audiology centers, with a centralized database covering approximately 96% of the newborn population. By January 29, 2026, a total of 8,038,019 children had been registered in the system. On average, 8.8% of children screened at the first level were referred for further audiological diagnostics, with a median age at diagnosis of 89 days.

Currently, permanent hearing loss greater than 20 dB has been identified in 18,439 children, corresponding to an estimated prevalence of approximately 2 per 1000 live births. Bilateral sensorineural hearing loss accounts for 65.2% of cases, while conductive and mixed hearing loss represent 22.2% and 12.6%, respectively. All diagnosed children are referred to third-level centers for intervention, including hearing rehabilitation, hearing aid fitting, or surgical treatment.

Over the years, the program has undergone significant organizational, technological, and procedural changes. One of the most important changes introduced in recent years was the implementation in 2025 of an AABR-based screening program for infants hospitalized in neonatal intensive care units for more than 7 days in level III neonatal reference centers. At the same time, the program must address the challenge of a decreasing number of maternity and neonatal care centers, resulting from the closure of hospital units associated with the sharply declining birth rate in Poland.

In the near future, the PUNHSP requires the further expansion of AABR screening across all neonatal intensive care units, as well as improvements in follow-up processes at the diagnostic level through structured reminder systems to support timely attendance at diagnostic appointments.

Keywords:
Newborn hearing screening, AABR, follow-up, NICU, early hearing detection and intervention

181 - 20 YEARS OF NEONATAL HEARING SCREENING BY CHILD HEALTH SERVICES IN THE NETHERLANDS

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In 2026, the Netherlands celebrates the 20th anniversary of neonatal hearing screening (NHS) by Child Health Services (CHS). The NHS was initially implemented by the Dutch Foundation for the Deaf and Hard of Hearing Child (NSDSK) and Netherlands Organisation for Applied Scientific Research (TNO) from 2002, reaching nationwide coverage in 2006. The Dutch National Institute for Public Health and the Environment (RIVM) is responsible for national coordination.
The NHS is offered to every newborn in the Netherlands. Only infants admitted to Neonatal Intensive Care Units (NICU; ca. 4,000 patients/year) are screened according to a separate protocol. This NICU program was implemented in 1998 by the Isala Clinics and TNO.
Funded by Dutch municipalities, the NHS by CHS is provided free of charge to families. The aim is to facilitate early identification of permanent hearing loss (≥40 dB) in one or both ears, enabling timely intervention before six months of age.
The Dutch protocol consists of a three-round screening. The OAE (OtoAcoustic Emission) method is used during the first screening round, which ideally takes places when the newborn is about 4 to 7 days old. If the first test fails to demonstrate sufficient hearing, the OAE-test is repeated after a week (second round). If the second test also fails, the AABR (Automated Auditory Brainstem Response) method is used in round three. Infants who do not pass all three rounds are referred to an audiological center (AC) for diagnostic assessment.
The initial screening is predominantly conducted during home visits by CHS professionals, often combined with the newborn bloodspot screening (NBS). In some regions, NHS is offered at the well-baby clinic (WBC) when the child is a few weeks old, but the number of organizations following this approach is declining.
The performance and quality of the NHS program is yearly monitored by TNO. Adding up the results over the past two decades, over 3 million newborns have been screened by CHS (about 160,000 annually) for hearing loss in the Netherlands, with over 150,000 newborns undergoing a second screening, 50,000 a third, and almost 12,000 referred for further assessment. More than 4,000 cases of hearing loss (60% bilateral, 40% unilateral) have been identified.
In 20 years, the Dutch NHS program has achieved several notable successes. Participation rates have remained exceptionally high. Since 2006, program coverage has consistently exceeded 99%. The unique implementation of home-based screening combined with NBS, in contrast to the clinic-based approaches commonly used in other countries, has not impeded coverage or follow-up; nearly 100% of children referred by the screening program have attended an audiological center for further assessment.
The program benefits from a well-functioning network of approximately 30 regional coordinators who manage and support the screening teams across the country, ensuring consistent and high-quality performance. National coordination and uniform protocols, training and public information further support the program's quality and effectiveness. Additionally, the NSDSK acts as a national center of expertise for screening equipment, contributing to the program's operational reliability and standardization.
However, the program has also faced some challenges. In 2020, the screening was temporarily suspended due to the COVID-19 pandemic, forcing a large-scale catch-up campaign. Child Health Services responded rapidly and effectively, successfully addressing the backlog within a short period. In recent years, shortages of screening equipment have posed additional operational difficulties, requiring ongoing efforts to ensure the continuity of the program.
The success of the Dutch NHS program is the result of the dedication and collaboration of professionals across the Dutch hearing healthcare field. The strong organizational structure and continuous professional development at both national and regional levels have played a vital role in ensuring the program's sustained effectiveness. Continued evaluation and research will be essential to identify opportunities for further optimization and to ensure the program's sustained effectiveness in the years to come.

Keywords: Neonatal hearing screening, 20-year anniversary, the Netherlands, Child Health Services, Evaluation

331 - CHARACTERIZING COCHLEAR OFF-PLACE RESPONSES WITH NARROWBAND CHIRPS AND TONEBURSTS USED IN AUDITORY BRAINSTEM RESPONSE AUDIOMETRY

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Background: Narrowband (NB) chirps have entered routine clinical use during Auditory Brainstem Response (ABR) audiometry. However, their wider effective bandwidth compared with traditional toneburst signals has led to concerns that responses from relatively remote regions of the cochlea might lead to underestimation of audiogram severity, particularly with precipitously sloping losses or notched/cookie-bite. In other words, a hearing loss in one cochlear region might be unrecognized or underestimated if ABRs were triggered by much better hearing in an adjacent region.
Purpose: This study aimed to compare ABR amplitudes and response detections to NB chirps and tonebursts from remote cochlear regions i.e. with characteristic frequencies ≥ 1 octave away from the signal center frequency**.**
Research Design: ABRs elicited by 2 kHz NB chirps and tonebursts were recorded in a counterbalanced within-groups design. The high pass masked/derived band technique was used to isolate responses to these sounds arising from a range of cochlear regions.
Study Sample: Twelve healthy adults (8 female; 22-34 years) with no history of hearing, balance, or neurological disorders, and normal hearing sensitivity.
Data collection and analysis: ABRs were triggered by delivering each signal to the right ear via an Etymotic ER-3A insert phone at 40 dB nHL. Along with a not-masked condition, three high-pass filtered pink noises were used to mask successive cochlear regions (filter cut-offs set to 2, 2.8 and 4 kHz, 96 dB/oct). This enabled derived band ABRs reflecting responses in the 2-to-2.8 kHz range (up to 0.5 octaves above the center frequency), in the 2.8-to-4 kHz range (from 0.5 to 1 octave above center frequency), and from 4 kHz and above (≥ 1 octave above center frequency). Along with Wave V-V′ amplitudes, the SNR and response presence was determined using the Fmp statistical response detector.
Results: There was a significant main effect of signal, showing mean wave V-V′ amplitudes were greater for the chirp (M = 0.086 µV) than the toneburst (M = 0.075 µV; p = 0.012). Importantly, both signals at this level triggered small responses in the most remote derived band (mean 0.056 µV (SD = 0.017) for the toneburst and mean 0.077 µV (SD = 0.021) for the NB chirp). However, using a significance threshold of 2.25 (false detection rate of 5%), the associated Fmp values show a similar proportion of these ABRs were positively identified at the individual level (4/12 in the chirp condition and 3/12 in the toneburst condition), with no difference revealed by McNemar's test (p > 0.05).
Conclusions: Our results indicate that both NB chirps and tonebursts elicit responses from relatively remote cochlear regions with this signal level, frequency and transducer combination and the amplitudes of these remote responses are slightly larger with the NB chirp. This fits with the design characteristics of the signals so it perhaps not surprising.
Clinical Relevance: The mean differences do not seem to translate to a clinically relevant effect or concern because there was a similar proportion of clearly detectable ABRs with both signal types at the individual level. In other words, although the remote chirp responses are slightly larger, they are not large enough to create real-world concern about misdiagnosing severity of hearing losses using the ABR.

Keywords: Auditory Brainstem Response, audiometry, chirps, tonebursts, derived band

160 - QUALITY IMPROVEMENT OF CMV TESTING IN NEWBORN HEARING SCREENING UNDER THE AUSPICES OF THE NORWEGIAN HEARING REGISTER FOR CHILDREN

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The Norwegian Directorate of Health approved the Norwegian Hearing Register for Children (NHRC) in 2022. The main objective of the register is to improve the quality of diagnostics and treatment for children with permanent hearing loss, by measures, follow-ups and monitoring the quality and results of the health care system.
Inclusion criteria are children who do not pass universal Newborn Hearing Screening (NHS) and/or children with permanent hearing loss < 18 years of age. Hearing loss is defined as pure-tone audiometry threshold of (PTA4) > 20dB in at least one ear. Electronic registration is performed at the ear, nose and throat departments (ENT). Data are registered at inclusion and at follow-ups at the age of 3, 6, 10 and 15 years, and include Patient Reported Outcome Measures (PROM).
There are defined quality indicators in the NHRC that are used to measure quality in selected areas. Quality indicators are important tools to evaluate whether the health care provided meets the requirements of good quality care, reflecting the national guidelines and best practice. The NHRC can also be used to induce quality improvements.
The quality indicator *The proportion of children tested for congenital CMV (cCMV) within 3 weeks of age in children with referred newborn hearing screening* is chosen because CMV has a larger impact than previously recognized, being the most common cause of non-hereditary sensorineural hearing loss in children. In Norway, a selective CMV screening is performed within 3 weeks of age in newborns who do not pass the NHS to differentiate cCMV from postnatal acquired CMV, which is not associated with childhood hearing loss.
Results from the NHRC for 2023 show that among newborns who did not pass the NHS, 65% are registered with a completed CMV test within 3 weeks, and 7% with a non-completed CMV test within 3 weeks. For 28% of newborns who did not pass the NHS, the ENT departments lack information on whether the test was performed. The quality indicator for CMV testing taken within 3 weeks of age shows significant variation in achievement among different units (high achievement ≥95%).
This indicated that despite the existing national guidelines, selective CMV screening of newborns is not fully implemented in clinical practice. Thus, in December 2024, the NHRC initiated a quality improvement project with the overarching goal to increase the proportion of newborns who undergo a CMV test within 3 weeks after birth among those who do not pass the NHS. Using data from NHRC the project aims to improve routines for sampling, documentation, and communication of results between the neonatal care units and the ENT departments, thereby enhancing the achievement of the quality indicator for CMV testing within 3 weeks of age.
Departments with goal achievement below 90% on the indicator were invited to participate in the project, 6 hospitals accepted. Following this, workshops with the participating ENT, maternity and newborn intensive care units were conducted, routines from departments with higher goal achievement for the indicator were presented, and local action plans for the various hospitals were developed. Throughout the project period, there were regular follow-ups from the NHRC regarding the implementation of changes at the different hospitals, including the use of reports sent out every three months.
The project is ongoing, and final evaluation will be conducted in June 26. Results will be presented orally at the conference.

Key words: National medical quality register, Newborn Hearing Screening, Hearing loss, Congenital cytomegalovirus, Quality improvement

IMPLANTABLE DEVICES I

220 - A NEW PATIENT-REPORTED OUTCOME MEASURE TO ASSESS NOVEL PERSONAL FACTORS FOR ADULTS LIVING WITH COCHLEAR IMPLANTS: THE LIVCI

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Background
Cochlear implant (CI) success is typically assessed using performance-based measures, such as speech intelligibility. Various patient-report outcome measures (PROMs) of personal outcomes, such as quality of life, are available but used infrequently, particularly in clinic. The overall aim of this research was to develop a PROM for those considering or living with cochlear implants (LivCI), using best practice COSMIN principles to measure the personal factors. There are three specific objectives:

1. Generation of items representing personal factors
2. Evaluation of content validity of the LivCI
3. Assessment and validation of the psychometric properties, construct validity, and internal consistency of the measure.

Materials and Methods
Items (n=87) were generated and mapped onto five themes: psychosocial wellbeing (PW), stigma and identity (SI), visibility and aesthetics (VA), function and participation (FP), and convenience and management (CM).
Content evaluation comprised two methods: First, cognitive interviews with 7 adult CI users and 7 adult CI candidates to refine and revise the items. This ensured items were meaningful, clear and relevant. Second, a subject matter expert panel of Australian and international CI clinicians and researchers (n=15) rated the relevance, clarity, and dimension for each item from 1 (does not fulfil criterion) to 4 (fulfils criterion).
The psychometric evaluation by CI users and candidates (n = 267) rated the 61 items on a Likert scale (strongly agree to strongly disagree) via an online survey of Australian CI clinics. Rasch analysis iteratively reduced items based on Rasch model fit, local independence, monotonicity, and unidimensionality. Validation used classical test theory (n=145).

Results
Following revisions by the research team and content evaluation, 61 items remained across five themes: PW (*n*=18), SI (*n*=16), VA (*n*=9), FP (*n*=10), and CM (*n*=8). Content evaluation showed a final mean score of the relevance, clarity and dimension for each theme: PW=3.87, SI=3.80, VA=3.87, FP=3.8, and CM=3.78. High mean ratings for each theme indicated items were relevant, clear and appropriate following content evaluation. Rasch analysis resulted in 22 items. The domains showed good fit with the Rasch model without local dependence and with ordered thresholds, resulting in a 4-point response scale. Internal consistency reliability was high (α=0.81-0.94) for all scales except Aesthetics and Management, which was slightly lower (α=0.638). Overall, construct and criterion validation was good.
The overall LivCI was not unidimensional, as predicted, but each final theme (Psychosocial and Wellbeing, Stigma, Device Aesthetics and Management, and Participation) was unidimensional and sensitive to individual responses scores.

Conclusions
The LivCi is a 22-item PROM developed using best practice principles to measure personal factors influencing CI use across four themes (Psychosocial and Wellbeing, Stigma, Device Aesthetics and Management, and Participation). The LivCi can be used with potential and current CI users in either clinical practice or research. Given the paucity of well-developed PROMs for assessing personal factors in CI users, the LivCI has the potential to be a useful clinical and research outcome measure to help better understand the personal needs of CI users and benefits of CIs.

Keywords: Personal factors; Cochlear Implants; Patient-reported Outcome Measure; Pyschometric evaluation; Best practice

27 - PREDICTING ADULT EARLY COCHLEAR IMPLANT OUTCOMES: USING MACHINE LEARNING TO IDENTIFY KEY PREDICTORS

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Cochlear implants (CIs) have become the standard of care for adults with moderate-to-profound sensorineural hearing loss who derive limited benefit from hearing aids. However, speech recognition outcomes following implantation, typically measured using CNC word recognition and AzBio sentence recognition scores in the United States of America, vary considerably among post lingually deaf adults. Several preoperative factors are known to influence postoperative outcomes, including preoperative hearing and speech perception abilities, age, duration of deafness, and cognitive and linguistic abilities. However, we are currently unable to accurately predict speech recognition outcomes after cochlear implantation or clarify each predictive factor's relative impact on those outcomes. These gaps in our knowledge limit our ability to effectively counsel patients and to identify individuals who are "at risk" for suboptimal speech recognition outcomes following cochlear implantation.

This research assessed predictive performance of machine learning (ML) models in classifying 1-month post-CI activation speech recognition. ML models were trained on a large and varied set of preoperative demographic, audiologic, linguistic, and cognitive variables. ML models are unique in providing analytic approaches for identifying complex and insightful relationships between preoperative variables and postoperative outcomes. Unlike prior studies that focused mainly on demographic and audiologic factors, we examined whether incorporating preoperative linguistic and cognitive variables improves predictive performance of the models.

Data were collected from 42 adult postlingual CI candidates with bilateral moderate-to-profound sensorineural hearing loss. Preoperative variables included age, sex, side of implant, brand of implant, duration of hearing loss, better-ear pure tone average, baseline AzBio sentence recognition in quiet, general cognition using the Mini Mental State Examination (MMSE), word reading on the Wide Range Achievement Test, speed of lexical and phonological access on the Test of Word Reading Efficiency (TOWRE), nonverbal reasoning (Raven's progressive matrices), and inhibition-concentration abilities using a visual Stroop color-word test. Multinomial logistic regression models with least absolute shrinkage and selection operator (LASSO) regularization and k-nearest neighbors (KNN) classifiers were fit to classify 1-month post-CI activation CNC and AzBio scores into high, medium, or low performance groups. LASSO regularization performs feature selection as part of the model-fitting process, providing information about the relative predictive influence of the preoperative variables.

The logistic regression models demonstrated moderate discriminative ability in ranking individuals into high-, medium-, and low-outcome groups, achieving macro-averaged area-under-curve (macro-AUC) values of 0.657 for CNC word recognition and 0.686 for AzBio sentence recognition. The KNN classifiers showed worse discriminative ability with macro-AUC values of 0.428 for CNC word recognition and 0.656 for AzBio sentence recognition. Feature selection in the logistic regression models demonstrated that brand, sex, side of CI, and word reading abilities were frequently excluded as predictors, while preoperative AzBio sentence recognition and MMSE were among the most frequently included predictors. These results suggest that preoperative AzBio sentence recognition and MMSE are more informative of postoperative outcomes than implant brand, sex, and side of CI. Further, speed of lexical access on the TOWRE and preoperative pure tone average contributed more to word recognition than sentence recognition.

This research demonstrates that ML approaches, including LASSO-regularized logistic regression and KNN classifiers, may enable reliable prediction of adult early post-CI outcomes from preoperative measures while also illuminating the relative influence of those preoperative measures. Findings demonstrate that linguistic and cognitive measures–general cognition and speed of lexical and phonological processing–are influential predictors of postoperative outcomes. These findings challenge prior CI outcome studies focused primarily on demographic and hearing-related predictors and suggest that assessing cognitive-linguistic abilities preoperatively may improve counseling and prediction of speech recognition outcomes. Future work is needed to investigate the roles of these predictors in larger samples and to validate these predictors in more diverse samples of adult CI recipients.

Keywords: Cochlear implants; Individual differences; Machine learning; Speech perception

72 - EVALUATION OF COCHLEAR NERVE FUNCTION FOR IMPLANT CANDIDACY USING A FORWARD MASKING SUBTRACTION (FWMS) TECHNIQUE FOR ARTIFACT CANCELLATION OF ELECTRICALLY ELICITED AUDITORY BRAINSTEM RESPONSES

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Background: Around one million people globally have received cochlear implants (CIs), but performance varies depending on anatomical and pathological factors. Accurate assessment of cochlear nerve viability is crucial for CI surgery, especially in cases like pediatric temporal bone malformations, prolonged adult deafness, acoustic neuroma or neurofibromatosis type 2 patients, and those unable to participate in behavioral audiograms.

Electrically evoked auditory brainstem responses (eeABR) reflect the peripheral auditory system but are typically obscured by a significant artifact from electrical stimulation. A subtractive forward masking technique can reduce this artifact, making eeABR more reliable for clinical populations.

Methods: In this study, a subtractive forward masking technique was applied in real-time using the IHS Duet system. A standard biphasic electrical stimulus was presented via a transtympanic needle electrode, interleaved with a forward masker and standard electrical stimulus. The responses were subtracted to eliminate the artifact. This subtraction method, based on de Sauvage et al. (1983), exploits the auditory nerve's refractory properties. Optimization experiments were conducted on 20 Norwegian brown rats. Rats were deafened using neomycin (40mM) and euthanized using Isoflurane. In order to validate the source of the electrically induced responses, Vecuronium Bromide (10mg/ml) was used as a muscle block or the auditory nerve was cut in some animals.

Results: The forward masking technique successfully eliminated most or all of the electrical stimulus artifacts in, enabling the detection of early components previously obscured by the electrical artifact. A timing difference between the forward masking and eliciting electrical stimulus of approximately 5 ms was found to be optimal for artifact cancellation. Auditory ABRs conducted before and after electrical stimulation also demonstrated that the electrical stimulation did not cause any damage to the auditory system.

Conclusion: Advanced processing techniques for eeABR recording will improve objective evaluations for CI candidacy.

Reference: de Sauvage RC, Cazals Y, Erre JP, Aran JM. (1983). J Acoust Soc Am. 73(2), 616-627.

Conflict of interest: one author has declared an industry affiliation

221 - DEVELOPMENT OF A CORE OUTCOME SET TO EVALUATE REMOTE TECHNOLOGIES FOR COCHLEAR IMPLANT USERS

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Background
Remote technologies for cochlear implant (CI) services have the potential to facilitate improvements in personalisation, efficiency, effectiveness, and equity of CI services. Relevant and sensitive outcome measures that evaluate CI services delivered via remote technologies allow stakeholders to make informed decisions about the best methods of patient care.
The overall aim was to develop a core outcome set (COS) to evaluate remote technologies used to deliver CI services. There were three specific objectives:

1. Synthesise existing evidence on remote technologies and associated outcome measures for adults receiving CI services.
2. Identify a core outcome domain set (CODS).
3. Identify and agree on outcome measures to form the COS.

Materials and Methods
Population: Adult CI users and providers of adult CI services from Australia, the United Kingdom and the United States of America of America.
Phase 1: Systematic review, and online workshops (n=3) with key stakeholders (CI users, CI professionals) identified core outcome domains.
Phase 2: Two three-round parallel online Delphi reviews were conducted for CI users, and CI professionals, separately. These comprised statements about outcome domains of potential importance to CI outcomes, rated on a 5-point Likert scale from Extremely important to Not important. Consensus was set *a priori* at ≥80%. N=114 adult CI users and N=74 CI clinicians and professionals completed round 1.
Phase 3: An online survey of Australian clinical CI audiologists identified core outcome measures specific to the CODS. Audiologists indicated their awareness, use of, and perceived value, of each of the proposed outcome measures.
Results
Phase 1: Nine core areas (e.g. Physiological and Clinical; Emotional Wellbeing; Delivery of care; Adverse Events) were identified, with 58 outcome domains.
Phase 2: Domains were grouped into 3 supra-domains; Service, Clinical and Self-Report.
For Service, agreement was reached across both groups for the top 3 domains - Reliability, Usability, and Accessibility.
For Clinical, Speech Discrimination was the only domain within the top 3 for both participant groups. Speech Recognition in Noise and in Quiet were identified as important for CI users, and Device Integrity and Device Use for CI professionals.
For Self-report, there was no between-group agreement, with many domains ranked highly by CI users ranked far less important by professionals.
Phase 3: Adaptive speech in noise testing should be prioritised to avoid ceiling effects and to minimise the number of speech tests. Self-report measures of hearing-related quality of life, satisfaction and mental health and wellbeing are all important domains.
Conclusions
A pragmatic COS was developed, with some interim measures that are commonly used (e.g. SSQ-12), with a view to also including more specific measures not widely used or recently developed:
Service: Reliability, Usability and Acceptability in a single-item, Likert-response format for each domain.
Clinical: CNC/CVC, adaptive Digit Triplet Test (DTT) in noise, device integrity device use, and adverse events.
Self-report**:** SSQ/SSQ-12, Cochlear Implant Quality of Life (CIQoL Profile) or Living with Cochlear Implants (LivCI), Satisfaction in single-item Likert-response format.
The new Digital Literacy-2Q measuring digital skill and confidence is recommended to provide a quick assessment of digital literacy prior to CI users using remote technologies. Outcome domains relating to remote technologies of importance to CI users and CI professionals often do not align. Furthermore, outcome measures important for remote services are similarly important for in-person services.
Keywords: Core Outcome Set; Cochlear Implants; Remote technologies; Best Practice; Participatory design

171 - CHARACTERISTICS OF MEDIAL AND LATERAL WALL COCHLEAR IMPLANT ARRAYS DEMONSTRATED WITH CONE BEAM CT AND EVOKED ELECTRICAL AUDITORY BRAINSTEM RESPONSES

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Background/Rational: Cochlear implants (CIs) have revolutionized auditory rehabilitation, yet optimizing electrode placement remains crucial for improving speech perception and pitch discrimination. Array designs influence electrode proximity to neural structures, impacting neural stimulation efficacy.

This study investigates how electrode array types— straight versus perimodiolar—affect cochlear implant (CI) placement (i.e. modiolar proximity and angular depth) and outcomes using cone beam computed tomography (CBCT) and evoked electrical auditory brainstem responses (eABR).

Methods: We analyzed 108 patients using CBCT to compare straight and perimodiolar electrode arrays (each with 22 electrodes) in terms of angular depth, spiral diameter, electrode to modiolus distance, wrapping factor and intracochlear positioning index (ICPI). A subset of 50 patients underwent eABR assessments across cochlear regions.

Results: Significant differences were found between array types. Straight arrays showed less variability with consistent lateral placement compared to perimodiolar arrays. Measurements revealed differences for perimodiolar and straight arrays: wrapping factor ($M = 0.692$ vs. 0.826; $t(11) = 8.104$, $p = 0.000$), angular depth ($M = 351.2°$ vs. 437°; $t(11)=4.527$, $p = 0.000$), spiral diameter ($M = 3.24$ mm vs. 5.027 mm; $t(11) =11.1$, $p = 0.000$), and modified ICPI ($M = 0.628$ vs. 0.783; $t(11) =9.742$, $p = 0.000$).

Wave V eABR results showed larger average amplitudes with straight arrays in basal and mid regions ($p < 0.05$), suggesting potentially enhanced neural stimulation and a more focused stimulation with perimodiolar arrays. Direct measures of electrode position correlated more strongly with eV ABR amplitudes. In contrast, derived measures show no correlation with electrophysiology.

Conclusion: Our findings indicate the importance of electrode array type in CI outcomes, emphasizing the need for precise positioning to optimize neural stimulation and clinical outcomes. Personalized array selection based on CBCT assessments may lead to improved speech perception, pitch discrimination, and overall auditory function. Future research should aim to refine stimulation strategies to maximize CI benefits, particularly where direct measurements strongly correlate with clinical outcomes compared to derived measurements.

Key Words: Cochlear implant, Electrode design, Electrode-Neural Interface.

174 - OPTIMIZING COCHLEAR IMPLANT OUTCOMES: A COMPARISON OF LATERAL WALL AND PERIMODIOLAR ELECTRODES AT NEXTSENSE COCHLEAR IMPLANT CENTRE, SYDNEY, AUSTRALIA

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BACKGROUND/Rational: Preserving residual low-frequency hearing has become a crucial goal in cochlear implantation, particularly for candidates eligible for electro-acoustic stimulation. Electrode array design is thought to influence the degree of cochlear trauma and hearing preservation, but direct comparisons between slim perimodiolar (PM) and lateral wall (LW) electrodes remain limited.

This study aims to compare hearing preservation outcomes between new generation PM and LW electrodes in adult cochlear implant recipients and identify clinical predictors associated with successful preservation.

METHODS: A retrospective cohort study was conducted at the NextSense Cochlear Implant Centre, Sydney, involving 333 adults implanted between 2015 and 2021. All had normal cochlear anatomy and preoperative low-frequency four-frequency pure-tone averages (FFPTA) ≤80 dB HL. Patients received either LW (CI522/622, n=244) or PM (CI532/632, n=89) arrays. Hearing preservation was defined as a postoperative threshold shift ≤20 dB at FFPTA or 250 Hz, or any measurable hearing. Regression and ROC analyses were used to identify predictors.

RESULTS: Hearing preservation rates, defined as a ≤20 dB postoperative shift in the four-frequency pure tone average (0.25, 0.5, 1, and 2 Hz), were similar between groups (36.3% LW vs. 36.4% PM, P =0.992). Both groups experienced significant threshold shifts at 250 Hz (LW: 33.2 dB; PM: 31.2 dB; P <0.0001). Age was a significant negative predictor of hearing preservation in the PM group (P=0.0079) but not in the LW group. Poorer preoperative FFPTA was positively associated with preservation in both groups.

CONCLUSIONS: Hearing preservation is achievable with both PM and LW electrodes, with comparable outcomes. Age and baseline thresholds influenced preservation, highlighting the need for individualised electrode selection.

Key Words: Cochlear implant, Hearing preservation, Electrode design, Sensorineural hearing loss

IMPLANTABLE DEVICES II

256 - EARLY SIGNS OF SPATIAL HEARING RECOVERY IN ADULTS WITH SEQUENTIAL BILATERAL COCHLEAR IMPLANTS: A LONGITUDINAL PROSPECTIVE COHORT STUDY

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Background: Bilateral cochlear implantation (BCI) provides well-established benefits for spatial hearing, including improved sound localization and speech perception in complex acoustic environments. However, most evidence derives from cross-sectional studies or long-term outcomes, leaving the early trajectory of spatial hearing recovery after sequential bilateral implantation insufficiently characterized. In particular, it remains unclear when the earliest objective and subjective signs of recovery emerge, how they relate to one another, and whether spontaneous head movements facilitate early spatial recalibration.
Objective: To characterize the earliest stages of spatial hearing recovery in adults receiving sequential bilateral cochlear implants (CIs), to compare the time course of objective and subjective measures, and to evaluate the impact of spontaneous versus restrained head movements on sound localization performance.
Design, Setting, and Participants: This longitudinal prospective cohort study enrolled 23 adult candidates for sequential BCI (mean age 35.6 ± 16.3 years). Participants were assessed before second implantation (baseline) and at 1, 3, and 8 months following bilateral implantation. All participants had prior experience with a first CI, and duration of unilateral CI use was examined as a potential moderator of recovery trajectories.
Methods: Spatial hearing was evaluated using an immersive virtual reality environment combined with motion tracking to quantify head movements during sound localization tasks. Objective performance was assessed using absolute localization error (accuracy) and signed error (bias toward the first-implanted ear). Subjective measures included self-reported localization confidence and perceived listening effort collected immediately after task performance. Everyday listening abilities were measured using the Speech, Spatial, and Qualities of Hearing (SSQ) questionnaire, assessing spatial hearing, speech perception, and sound clarity/discriminability, as well as the WHOQOL_BREF for quality of life. Linear mixed-effects models were applied to evaluate longitudinal trajectories and the influence of head-movement condition and duration of first CI experience.
Results: Early signs of spatial hearing recovery emerged within 1 month of bilateral implantation. Signed localization error demonstrated a reduction in bias toward the first-implanted ear ($p < .001$), indicating rapid rebalancing of the auditory field. Absolute localization error also improved by 1 month ($p = .02$), reflecting enhanced spatial accuracy. These early objective gains were paralleled by subjective changes. By 1 month, participants reported increased confidence in their localization judgments ($p < .001$) and reduced listening effort ($p = .04$). Thus, perceptual recalibration and improved performance were accompanied by greater perceptual assurance and reduced cognitive demand during spatial tasks. Self-reported everyday listening abilities followed a staged recovery profile. SSQ spatial hearing scores improved significantly by 1 month ($p = .008$), consistent with laboratory-based spatial performance gains. Improvements in speech perception in daily life emerged by 3 months ($p = .02$), while enhancements in sound clarity and discriminability were observed by 8 months ($p = .02$). This temporal dissociation suggests that spatial recalibration may precede broader perceptual refinements in speech and sound quality. Head-movement condition significantly influenced localization outcomes. Allowing spontaneous head movements, compared with restrained head positioning, resulted in improved localization accuracy ($p = .02$) and increased confidence ($p < .001$). Moreover, listening condition modulated the trajectory of confidence over time. Duration of experience with the first CI significantly modulated longitudinal trajectories of localization bias, confidence, and effort. Individuals with longer unilateral CI experience exhibited distinct adaptation patterns, suggesting that prior auditory history shapes bilateral integration and perceptual recalibration processes.

Conclusions: Adults receiving sequential bilateral cochlear implants demonstrate measurable recovery of spatial hearing as early as 1 month after second implantation. Early changes include rapid reduction of unilateral bias, improved localization accuracy, increased subjective confidence, and reduced listening effort. Laboratory-based improvements are mirrored by self-reported gains in spatial hearing in everyday life within the first month, with subsequent improvements in speech perception and sound clarity emerging over longer time scales. Spontaneous head movements enhance both objective localization performance and subjective confidence, underscoring the importance of active listening strategies in early rehabilitation. Furthermore, prior duration of unilateral CI use influences recovery trajectories, highlighting the need for individualized clinical counseling and follow-up.
Clinical Implications: Early assessment of spatial hearing—using both objective and subjective measures—should be incorporated into post-implant care as soon as 1 month after bilateral implantation. Recognizing and supporting early spatial recalibration may optimize patient guidance, rehabilitation strategies, and the development of effective bilateral listening experience.

262 - RESULTS OF COCHLEAR IMPLANTATION IN PATIENTS WITH CONGENITAL RUBELLA- RETROSPECTIVE STUDY

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Background

Congenital rubella syndrome (CRS) is an infection caused by rubella virus transmitted to the fetus during pregnancy, which can cause congenital hearing loss. Cochlear implant can be an effective therapy in patients with severe to profound bilateral hearing loss. The aim of this study was to evaluate the benefits of cochlear implantation in patients with profound hearing loss caused by congenital rubella syndrome.

Material and methods

In total, 38 patients with profound hearing loss caused by intrauterine rubella virus infection were considered for cochlear implantation. Patients ranged in age from 8 to 72 years on the day of surgery, with a mean age of 27 years and median of 25 years (*SD* = 13.2). Preoperatively, all patients underwent pure-tone audiometry, and free-field speech audiometry was conducted in a quiet environment with the patient wearing a fitted hearing aid. Postoperatively, patients underwent pure-tone audiometry to assess residual hearing, and free-field speech audiometry was conducted when the patients had an active implant.

Results

The average preoperative hearing threshold (averaged across the seven frequencies from 0.125 to 8 kHz) was 99.2 dB HL (*SD* = 6.79), while the average postoperative hearing threshold was 103.4 dB HL (*SD* = 5.74). Twelve months after the operation, patients achieved a WRS in quiet scores ranging from 10% to 90%, with an average of 59.1% and median of 70% (*SD* = 25.8).

Conclusions

Rubella during pregnancy can lead to severe congenital defects, with sensorineural hearing loss being the most common. Cochlear implants appear to be an effective treatment for profound hearing loss caused by congenital rubella syndrome.

Key words: • Rubella • cochlear implants • hearing loss

272 - HEMIFIELD-BASED LOCALIZATION ANALYSIS DEMONSTRATES CI-SIDE RECOVERY IN SINGLE-SIDED DEAFNESS

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Background/Rationale
In single-sided deafness (SSD), spatial hearing is characterized by strong unilateral dominance toward the normal-hearing side. Cochlear implantation has been reported to improve sound localization in SSD; however, localization outcomes based on root mean square (RMS) error have shown variability across studies and stimulus conditions. Because RMS reflects overall angular deviation, it may not fully describe hemifield-specific spatial changes. We therefore examined whether CI-side localization recovery could be detected using a hemifield-based metric alongside conventional RMS analysis.
Materials and Methods
Twenty-nine patients with SSD who underwent unilateral cochlear implantation were retrospectively analyzed. Sound localization was assessed using a seven-speaker array (−90° to +90°) at 500 Hz (65 dB) and 4 kHz (65 dB) under CI-off and CI-on conditions. RMS error was calculated in degrees.
Hemifield-based CI-side localization accuracy was evaluated using targets at ±60° and ±90°. Responses directed toward the CI hemifield were considered correct. The localization recovery ratio (LRR) was defined as the change in CI-side localization accuracy between CI-on and CI-off conditions. Paired comparisons were performed using Wilcoxon signed-rank tests, and effect sizes were calculated as Cohen's dz. Associations between LRR and post-implant CI-side word recognition score (WRS) were assessed using Spearman correlation analysis.
Results
RMS error showed numerical but non-significant improvement with CI activation (mean 88.6° to 86.5° at 500 Hz, p = 0.269; mean 83.1° to 79.6° at 4 kHz, p = 0.101).
In contrast, hemifield-based CI-side localization accuracy significantly improved. At 500 Hz, accuracy increased from 0% (IQR, 0–0) to 25% (IQR, 0–50), with a median LRR of 0% (IQR, 0–25; p = 0.007; dz = 0.565). At 4 kHz, accuracy increased from 0% (IQR, 0–0) to 25% (IQR, 25–50), with a median LRR of 25% (IQR, 0–50; p = 0.00015; dz = 0.953).
LRR at 4 kHz was significantly correlated with post-implant CI-side WRS (ρ = 0.440, p = 0.017), whereas RMS change was not.
Conclusions
Conventional RMS analysis did not detect significant spatial improvement after CI activation in SSD. However, hemifield-based analysis demonstrated substantial CI-side localization recovery, particularly at 4 kHz (65 dB), and this recovery was significantly associated with post-implant speech performance. Hemifield-based metrics may therefore provide clinically meaningful information that complements conventional RMS measures.

Keywords
Single-sided deafness; Cochlear implantation; Sound localization; Root mean square error; Localization recovery ratio

281 - CLINICAL AND COST-EFFECTIVENESS OF UPGRADING COCHLEAR IMPLANT SOUND PROCESSORS IN OLDER ADULTS: OUTCOMES FROM A LARGE MULTICENTER STUDY.

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Background: Many older Australian adults with cochlear implants (CI) lack funding for replacement sound processors, risking complete device failure and reduced quality of life. Objectives: We aimed to investigate the clinical- and cost-effectiveness of upgrading obsolete CI sound processors in older adults.

Methods: This prospective, mixed methodology study was embedded in a clinical sound processor upgrade program funded by the Australian Government. The design incorporated inclusive recruitment strategies and measured core outcome domains to capture benefits beyond traditional clinical upgrade metrics.

Results: The study started on May 20, 2021, and closed on April 21, 2023. Recruitment occurred from June 2021 to May 2022. A total of 358 adults were screened, with 320 recruited and 304 enrolled. Across 15 sites in Australia (NSW, QLD, SA, TAS, VIC, WA). A total of 340 sound processors were upgraded in 304 participants. The cohort had a mean age of 77·4 years (SD 6.6), 147 (48.5%) were female, 157 (51.5%) were male. The age of onset of hearing loss was 30.0 (SD 21.0) years and the duration of CI use was 12.0 (SD 6.2) years. Outcomes showed significant improvements in speech understanding in noise and reduced communication difficulties and listening effort. Semi-structured interviews with 22 upgrade recipients and their families revealed that upgrades addressed fears and anxiety about sudden device failure. The health economic analysis found that cost-effectiveness of upgrading sound processors came from preventing total device failures, which avoids significant decreases in users' health-related quality of life, rather than access to newer technology features.

Conclusion: This study provides evidence that upgrading sound processors offers significant benefits for the individual and is economically sound in cases where it avoids someone losing access to sound completely due to a total device failure. The study also provides new insights into client-focused benefits of CI technology in domains beyond traditional clinical measures of benefit. The study findings can be used to inform policy in Australia and globally.

Keywords: bsolescence, Cochlear Implants, Upgrades

54 - VESTIBULAR SCHWANNOMA AND SIMOULTANEOUS COCHLEAR IMPLANT: INDICATIONS AND HEARING RESULTS

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Objective: To study the auditory outcome of simultaneous trans labyrinthine vestibular schwannoma (VS) resection and cochlear implantation (CI) after successful cochlear nerve preservation.
Study Design: A retrospective case series and patient questionnaire.
Setting: Quaternary referral center for skull base pathologies.
Patients: Patients with small (<2cm) sporadic or Neurofibromatosis 2 (NF2) related tumors were included in this study.
Intervention: Vestibular schwannoma resection + simultaneous cochlear implantation.
Main Outcome Measure: Audiological performance post-implantation and perceived patients' benefits.
Results: Forty-one patients were included. Thirty-three were sporadic VS and 8 were NF2. Auditory perception post-implantation was achieved in 33 patients (80.5%), At the last follow-up, 20 patients (48.8%) were users and 21 (51.2%) were non-users. In the users' group, and after 1 year of implant activation, vowel identification was 75.3%, disyllabic word recognition 54%, sentence recognition 60.7% and common phrase comprehension 61%, whereas in the non-users' group and after 1 year of implant activation, vowel identification was 22.9%, disyllabic word recognition 14.8%, sentence recognition 15.3% and common phrase comprehension 14%. Sixteen users were classified into 10 high performers, 3 intermediate performers and 3 poor performers. In the user' group, the mean Post-implantation pure tone average (PTA) was 63.4 dB and the mean Speech discrimination score (SDS) was 63.7%. Conclusions: Simultaneous Cochlear implant (CI) and VS resection is a viable option with many patients achieving auditory perception and nearly half the patients are CI users at long follow-up.

Keywords: Vestibular Schwannoma, Cochlear Implant, Hearing results

QUALITY OF LIFE AND HEARING LOSS II

195 - ASYMMETRIC HEARING LOSS IN ADULT COCHLEAR IMPLANT RECIPIENTS: QUALITY OF LIFE RESULTS FROM A MULTI-SITE PROSPECTIVE CLINICAL TRIAL

Jill Firszt [(1)] - Ruth Reeder [(1)] - Laura Holden [(1)] - Noel Dwyer [(1)] - Michael Strube [(2)]
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Objective: A prospective multi-site clinical trial was conducted to quantify communication and psychosocial effects of asymmetric hearing loss (AHL) in adults who received a cochlear implant (CI). Quality of life (QoL) measures were collected from participants and their significant others (SOs). Hypotheses were: 1) participants will report improved QoL after implantation of the poor ear, 2) SOs will perceive less disability for the participant and reduced impact of AHL on themselves after implantation, 3) QoL measures that aim to evaluate similar effects will relate to each other, and 4) QoL measures that indicate less perceived disability will correlate with higher performance on measures of speech perception. Furthermore, the study addressed the predicted time course of improvement from pre- to post-implant for QoL measures. Potential modifiers in planned comparisons included age, better ear hearing thresholds, and length of deafness (LOD) in the poor ear.

Design: Forty adults with AHL from four CI centers participated. QoL measures were administered pre-implant and at 6- or 12-months post-implant. Participant questionnaires were the Speech Spatial and Qualities of Hearing Scale (SSQ), the Hearing Handicap Inventory for the Elderly (HHIE), the Satisfaction with Amplification in Daily Life (SADL), the Glasgow Benefit Inventory (GBI), and the Health Utilities Index Mark 3 (HUI3). Questionnaires for SOs were the Communication Profile for the Hearing Impaired (CPHI) and the Hearing Impaired Impact – Significant Other Profile (HII-SOP). Relationships were examined among QoL measures and between QoL measures and speech perception outcomes.

Results: A hierarchical nonlinear analysis predicted significant improvement in QoL after cochlear implantation for AHL participants. Moreover, QoL improved for SOs. For several questionnaires, significant changes were predicted to occur well before 6-months post-implant. The time course and degree of improvement varied across measures and across domains or subscales within the assessments. An SSQ subscale analysis indicated that pre-implant, the Listening Effort subscale had one of the lowest ratings but also showed the greatest improvement at 12-months post-implant. Results from the GBI physical health subscale and the HUI3 suggested no detriment to health areas after cochlear implantation with concurrent benefit to hearing. For the participant (HHIE results) and SO (HHI-SOP results), improvements were predicted in areas of communication, and social and emotional well-being. Significant moderators were age (SSQ Speech Domain), better ear hearing thresholds (SSQ Qualities Domain) and LOD (HHIE Emotional well-being), reflecting positive effects of younger age, better ear hearing, and shorter LOD. Significant correlations among questionnaires were observed. QoL measures showed some relationships with speech perception and localization; the strongest correlations were with challenging listening environments (soft speech, speech in noise).

Conclusions: Results revealed significant improvements in QoL for participants with AHL because of obtaining a CI. Moreover, participant' SO also reported improved QoL. Improvements in communication identified by participants were also identified by SOs. CI outcomes extend beyond speech perception; QoL measures are needed to provide a holistic patient care approach. Results can be used to counsel CI candidates and to monitor post-implant performance and inform rehabilitation efforts. Study findings may guide a clinician's choice of assessment tools for individual patients, e.g., measures that reflect communication experiences, listening effort or psychosocial aspects. Further research is needed to study the impact of AHL on QoL including social and emotional well-being. Clinically, it is important to remember that improving an individual's overall QoL is the goal of CI treatment. Funded by the NIH/NIDCD.

Key words: Asymmetric hearing loss, Quality of life, Cochlear implant

114 - EXPERIENCES OF THE TRANSITION TO REMOTE WORK AND DIGITAL COMMUNICATION IN THE WORKPLACE BY INDIVIDUALS WITH HEARING LOSS

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Background/Rationale
The COVID-19 pandemic resulted in an increase in remote working and in the use of digital communication at work. While it is well established that adults with hearing loss (HL) experience the traditional workplace differently from those without HL, relatively little is known about how people with HL experienced the shift to digital work and its enduring consequences. As such, we conducted a qualitative interview study aiming to gain an understanding of how adults with hearing loss experienced the shift to digital communication and remote work during and after the pandemic, to explore barriers to and facilitators of a smooth transition, and to identify unmet needs.

Materials and Methods
Semi-structured interviews were conducted individually with 27 participants, aged between 40 and 69 years old, who reported having hearing difficulties and working during the pandemic. Participants held a variety of jobs, with the majority being primarily office based, albeit commonly with time also being spent in other environments (clinics, classrooms etc). The interview guide included questions on hearing, work, digital communication at work, perceived barriers and facilitators.

Results
Interview data were analysed using reflexive thematic analysis. The analysis resulted in three themes: “not just hearing”, “it’s all on me”, and “pandemic = relief”, with subthemes focused on withdrawal, responsibility, strategies, technology, and working conditions.

Conclusions
The findings of this study suggest that adults with HL are largely positive towards digital communication at work, with digital meetings often preferred to physical meetings. However, some common practices were identified as barriers to successful communication and participation. To facilitate a digital communication environment that is most likely to be advantageous for adults with HL, important factors include the appropriate use of technology, clear meeting etiquette (including clarity on who is to enforce any breaches of this etiquette), and avoiding hybrid meetings. Furthermore, it is important for managers and colleagues to recognize that the impact of HL is not limited to difficulties in speech recognition, but is associated with tiredness, stress, and negative psychosocial effects. As such, it is important that the needs of adults with HL in the workplace are considered and that responsibility for meeting these needs is shared.

113 - QUALITY OF LIFE OUTCOMES IN EARLY SCHOOL-AGED DEAF AND HARD-OF-HEARING CHILDREN AND THEIR ASSOCIATED PREDICTIVE FACTORS

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Background: Despite advances in early diagnosis and hearing assistive technologies, deaf and hard-of-hearing (DHH) children may experience suboptimal quality of life (QoL) compared to children with normal hearing.
The Paediatric Quality of Life Inventory (PedsQL) is the most widely used tool for measuring QoL in children and adolescents. A variety of biopsychosocial factors have been linked with reduced QoL scores in DHH children such as the presence of additional health needs. However, there are numerous factors that have not been explored.

Aims: We aimed to describe QoL outcomes in a community cohort of 5-7 year old DHH children in Victoria using the PedsQL, and to explore known and potential predictors of QoL.

Method: This study utilised data from The Victorian Childhood Hearing Impairment Longitudinal Databank, which recruits children with permanent hearing loss state-wide through The Victorian Infant Hearing Screening Program and from clinical services at The Royal Children's Hospital. Participants were aged 5-7 years with PedsQL Generic Core Scale Parent Proxy-Report data collected between May 2005 and May 2018.
Known predictors of poor QoL were identified on literature review, and others were postulated based on prior paediatric clinical experience (such as behavioural difficulties and parental mental health). QoL was measured using the Peds QL, consisting of 8 physical and 15 psychosocial items that are added to form a total score. We reported descriptive statistics and used linear regression to determine factors predictive of poorer QoL.

Results: Caregivers of 367 participants (mean age 6.8 years, SD 0.8) completed the PedsQL. The mean psychosocial QoL score was 69.1 (SD 18.1), the mean physical QoL score was 77.9 (SD 29.5), and the mean total QoL score was 72 (SD 19.6). Behavioral difficulties, additional health challenges, specialist education and poor parental general/mental health were the most predictive of poor QoL. Factors such as parental hearing loss and birth order were not predictive.

Conclusion: This study highlighted the various predictors of poorer QoL life in DHH early school-aged children, the strongest being psychosocial factors. Therefore, targeted wellbeing strategies may improve QoL and overall health outcomes.

108 - EXPLORATION OF THE IMPACT OF HEARING LOSS ON SOCIAL PARTICIPATION

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People can experience significant changes in their ability and desire for social participation because of hearing loss. Social participation is a broad concept which can have different meanings depending on perspective and field of research. The information we get about social participation is determined by the assumptions and constraints of the methodology used. In the field of hearing science, manuscripts investigating social participation use a wide variety of measures, covering very different participation related variables and seldom utilise a clear definition of social participation.
As a result, we previously proposed a new working definition of the concept 'social participation' in the context of hearing research, considering the domains elucidated by the interrogative pronouns who, what, with whom, how, when, where and why. These domains form the basis for this research study, which seeks to capture an in-depth picture of the social participation of individuals, and the influence of hearing loss. Adults with normal hearing (n=22) and adults with hearing loss (n=28) were provided with an app-based ecological momentary assessment (EMA) schedule, with surveys collected three times daily over seven days. Participants attended the department for a follow-up visit to reflect on the EMA task and undertook a social network analysis (SNA) interview. SNA provided valuable additional information about individuals' relationships and connections within their social network. This presentation will focus on results to date; examining how the differing domains of our definition give us a greater depth of understanding, reflecting on the ways we can comprehensively measure the social participation of individuals, look at interpersonal differences and understand the extent to which hearing loss has an effect on social participation.

Keywords: social participation, ecological momentary assessment and social network analysis

Conflict of interest: one or more authors have declared an industry affiliation

163 - WHEN THE INPUT IS NOT DEGRADED: DEFICITS IN READING IN AGE-RELATED HEARING LOSS

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Introduction: Research on age-related hearing loss (HL) has mainly focused on the processing of auditory input. However, recent findings indicate that HL can also impair non-auditory modalities such as reading ability [1, 2]. This raises questions for theories of language and cognition in HL, including the *Information Degradation Hypothesis* (IDH) [3] which postulates that degraded auditory input strains cognitive resources, like working memory (WM), and therefore may also affect higher-level language processing. If HL also affects reading ability, this suggests a broader impact on language processing beyond temporary cognitive strain. Additionally, little is known about how hearing aid use affects language processing in general, including reading ability (but see [4] suggesting beneficial effects on visual lexical processing). We therefore ask: *To what extent does HL affect higher-level written language processing (word and sentence processing) in older adults, and how do cognitive capacity and hearing aid use modulate these effects?*

Methods: Participants were older German-speaking adults: 39 with age-normal hearing (NH; Mean Age = 61.2) and 48 with HL, namely 34 using hearing aids (HA; Mean Age = 69.7), and 14 without hearing aids (no-HA; Mean Age = 68.9). Following commonly-used HL levels based on pure tone averages (PTA), the latter two groups had mild-to-moderate HL (HA Mean PTA: 36.7; no-HA Mean PTA: 33.6). Participants were tested on two reading tasks: (1) *word processing* via a lexical decision task involving high/low frequency words and pseudowords [5], (2) *sentence processing* via a word-for-word reading task involving more and less complex sentences [6], namely object and subject questions, combined with picture selection to test reading comprehension. Additional measures included a verbal and numerical WM task, PTA, and duration of hearing aid use in HA.

Results: All participants showed typical word frequency effects in word processing: higher accuracy and faster response times for high-frequency words. HA were slower than NH when processing low-frequency words. For HA, higher WM supported accuracy, especially for low-frequency words. For the no-HA group, associations between response times and Age as well as PTA were found, but no other effects. In the sentence processing task, more complex sentences lead to lower accuracy and longer response times for all participants. HA users read more slowly and performed less accurately than NH, and HA exhibited lower accuracy than no-HA too. For HA, WM again supported performance, especially under high load (increased sentence complexity). Performance was negatively correlated with age in HA and no-HA groups and, for some sentence types, with PTA. No positive effects of HA use were observed contrary to recent findings [4].

Conclusions: Results indicate that HL impairs not only auditory but also written language processing. HA users were most affected, potentially to due to their older age as a group, PTA differences or longer duration of hearing loss. WM supported performance for HA users, particularly for the processing of low-frequency or complex language. Overall, results show that HL has broader impact on the language system than previously thought, which has implications for models of language and cognition in HL, including the IDH.

Keywords: hearing loss, aging, hearing aid use, reading, language processing

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172 - IMPACT OF HEARING LOSS AND QUALITY OF HEARING CARE ON EMPLOYMENT OUTCOMES

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Hearing loss and systemic discrimination continue to significantly affect individuals on a daily basis, particularly in employment contexts. Data consistently demonstrate that people with hearing loss are more likely to be under-employed, unemployed, or take early retirement.
Hearing care professionals, such as ENTs, audiologists, and related specialists, are typically the first point of contact for individuals experiencing hearing loss. The relationship established between the client and professional is critical for effective adaptation to their new circumstances.
The European Federation of Hard of Hearing People (EFHOH) has long championed the adoption of Person-Centred Care within Audiology, recognising it as essential for supporting individuals as they adapt to using hearing aids or cochlear implants (CIs), and for helping them understand the limitations of these technologies. Frequently, this support includes assisting clients in seeking reasonable accommodations in various settings.
From October 2025 to February 2026, EFHOH, in collaboration with the European Hearing Care Professional Association (AEA) and Thomas Moore University, conducted research across Europe. The study collected vital data regarding the experiences of hearing aid and cochlear implant users, focusing on the impact of hearing loss and the quality of hearing care received, especially concerning empowerment in the workplace.
As the umbrella organisation representing European associations for hard of hearing individuals, EFHOH will present the completed research findings and recommendations for further action. Speakers Lidia Best and Claire Landesmann will share these insights, drawing upon both empirical data and lived experience.
Preliminary results highlight important issues and prompt critical discussion about the role of hearing care professionals in empowering users to manage daily challenges. The final survey data and corresponding recommendations will be shared in detail.
Discussion: What can be learned from these findings, and how can we utilise this knowledge? Does current audiology practice offer appropriate support? What improvements are needed? How can a Person-Centred Approach further empower individuals?

186 - COMPUTERIZED DYNAMIC POSTUROGRAPHY AND QUALITY OF LIFE IN CHILDREN WITH HEARING LOSS: A PRELIMINARY STUDY

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Background/Rationale: Hearing loss in childhood may affect not only auditory abilities but also balance and overall quality of life. Computerized Dynamic Posturography (CDP) provides objective information about sensory integration for postural control, while quality of life measures reflect the functional impact of hearing loss. This preliminary study aimed to compare balance performance and quality of life between children with hearing loss and typically developing peers, and to explore differences between children using cochlear implants and hearing aids.
Materials and Methods: This preliminary study included a total of 15 children aged 8–12 years: 5 typically developing children (mean age: 8.8 years) and 10 children with hearing loss (mean age: 8.6 years). Children with hearing loss included both cochlear implant users and hearing aid users. Balance performance was assessed using **Computerized Dynamic Posturography (CDP)** with the Sensory Organization Test (SOT). The following SOT parameters were analyzed: **somatosensory (SOM), visual (VIS), vestibular (VEST), visual preference (PREF), and composite equilibrium score (COMP).**
Quality of life was evaluated using the **Pediatric Quality of Life Inventory (PedsQL 4.0 Generic Core Scales), Parent Proxy Report for ages 8–12,** which assesses **physical, emotional, social, and school functioning.** Group comparisons were performed between typically developing children and children with hearing loss, and additionally within the hearing loss group (cochlear implant vs. hearing aid users).
Results: Comparison between typically developing children and children with hearing loss revealed a significant difference in the **visual preference (PREF)** parameter of the Sensory Organization Test (U=2.0, p=.003), indicating altered sensory processing in children with hearing loss. In addition, children with hearing loss demonstrated significantly lower quality of life scores in the **emotional functioning (p=.019)** and **school functioning (p=.019)** domains. No significant differences were observed in other balance parameters. Comparisons between cochlear implant and hearing aid users revealed no significant differences in postural control or quality of life.
Conclusions: Preliminary findings suggest that children with hearing loss may demonstrate differences in sensory reliance for postural control, particularly in visual preference, compared to their typically developing peers. In addition, children with hearing loss showed lower quality of life, especially in the emotional and school functioning domains. However, balance performance and quality of life outcomes appeared similar between cochlear implant and hearing aid users. Due to the small sample size, further studies with larger cohorts are needed to confirm these findings.
Keywords: Hearing loss, Sensory Organization Test, Balance, Quality of Life, Children,

QUALITY OF LIFE AND HEARING LOSS III

273 - EMOTION RECOGNITION IN SCHOOL-AGED CHILDREN USING HEARING TECHNOLOGY AND PEERS WITH TYPICAL HEARING ACROSS ANIMATED AND REAL-LIFE PHOTOGRAPHIC STIMULI

Andrea Warner-Czyz [1] - Linda Thibodeau [1] - Aaliyah Khan [1]
[1] *The University of Texas at Dallas, Dept of Speech, Language, and Hearing, Richardson, United States of America*

Introduction. Understanding how children interpret emotional expressions is essential for supporting their social, academic, and interpersonal development, yet limited research exists about how auditory experiences may shape these skills. Children often learn about emotions through simplified representations, such as animated or drawn faces, which emphasize specific facial features, making it easier for children to pick up on emotional cues. In contrast, real-life photographs present emotional expressions with greater nuance and less exaggeration, making them more challenging for children to interpret accurately. Young children generally perform better when identifying emotions from stylized images than from real-life photographs, but few researchers explore how school-age children recognize and interpret emotions based on stimuli type.
This study examined whether children who are deaf or hard of hearing (DHH) using hearing technology such as a hearing aid or cochlear implant differ from peers with typical hearing (TH) in their ability to recognize emotions across two types of visual tasks: an animated picture identification task and a photograph-based discrimination task designed to reflect more naturalistic facial expressions. We hypothesized that children who are DHH would perform similarly to peers with TH on the animated picture task, as the exaggerated emotional cues are likely to compensate for differences in auditory experience. In contrast, we expected the DHH group to show lower accuracy in the photograph-based task, which presents subtler, more realistic emotional expressions. Across all participants, performance is anticipated to be higher on the animated stimuli compared with the photographs, reflecting the relative ease of interpreting simplified and exaggerated emotional cues.
Method. Participants included 21 school-aged children (7-12 years) either diagnosed as DHH or with TH. The DHH group included 7 children (5 with bilateral cochlear implants, 2 with bilateral hearing aids) with a mean chronologic age of 9.1 years. The TH group had 14 children (M=9.9 years). All participants completed two subtests from the Test for the Evaluation of Emotions and Socialisation (TEEMS). The emotion perception subtest asked the child to select one of eight animated face images on a screen that matched the emotion word (e.g., happy) at the bottom of the screen. The emotion recognition subtest assessed required children to select one of four photographs in which the facial expression did not match the others (e.g., three show happy, one shows angry). A two-way multivariate analysis of variance was conducted to examine the effect of auditory status (DHH vs. TH) and stimuli type (e.g., animated vs. photograph) on emotion perception.
Results. Overall, children across groups achieved significantly better scores with animated versus real-life photographic stimuli, indicating that exaggerated expressions are easier to interpret than subtle, realistic ones. Children in the DHH group performed similarly to TH peers when identifying emotions from animated images. However, the DHH group achieved significantly less accurate scores than their TH peers on the photograph-based task.
Discussion. These results indicate the connection between stimulus complexity and auditory experience and emphasize the need for assessment tools that include both simplified and ecologically valid materials such as photographs versus animated drawings. Understanding these differences can help create strategies for educators and clinicians to facilitate interpretation of nuanced emotional expressions in everyday social settings in efforts to promote effective social communication and encourage peer relationships.

231 - THE IMPACT OF HEARING LOSS, HEARING CARE AND EMPOWERMENT IN THE WORKPLACE PART 01

Mark Laureyns[1,2,4] Lidia Best[3],
[1]*Thomas More University College, Audiology Department, Antwerp* - [2]*Amplifon Centre for Research and Studies CRS, Milano, Italy* - [3]*EFHOH – European Federation of Hard of Hearing People* - [4]*AEA – European Association of Hearing Aid Professionals*

Background and Aim:
The relation between hearing loss and employment is well document and in the WHO World Report on Hearing you can read “An association between hearing loss and employment in adults is evident and adults with hearing loss have increased odds of unemployment or underemployment”.
The impact of hearing care and empowerment on employment is needs to get more attention. Informing and guiding hard of hearing people and their employers on how to be successful at work is a challenge for audiologists, and many other health and social workers.
Method:
We developed a survey on this topic, joint with EFHOH (the European Federation of Hard of Hearing People), AEA (European Association of Hearing Aid Professional) and the audiology department of the Thomas University College of Applied Sciences in Antwerp, where we used the International Outcomes Inventory for Hearing Aids (IOI-HA), which we also adapted for Cochlear Implant users (IOI-CI), and questions for hard of hearing people using hearing aids, cochlear implants or other assistive devices on their experiences, needs, solutions, information and support at work. This survey was first evaluated by English native speakers, adjusted and then translated in 10 languages. After proofreading by native speakers of this language, the survey was distributed to all EFHOH and AEA member associations and networks. So far, we received responses from 1014 participants, from more than in total 30 countries. The survey is still running, so by the time of the HEAL2026 conference, we will have even more results to present. Have Your Say: Survey on the Impact of Hearing Loss and Empowerment in the Workplace – EFHOH
Results:
72% of the subjects use or used hearing aids and 31% cochlear implants.
55% are or were full-time employed, 21% part-time, 14% is currently retired, others are unemployed, student or other.
97% of the participants state that their hearing aids or cochlear implants were at least moderately worth the trouble and 85% indicated that they improved at least moderately the situations at work, where they wanted to hear better.
95% need to communicate regularly or more at work, and the acoustics at work are in 40% of the cases poor or very poor and in 36% average.
75% experience difficulties to communicate at work, 59% indicate their hearing loss affects their performance at work.
The culture at work is in 43% of the cases at least somewhat inclusive or supportive, but in 35% of cases at least somewhat exclusive, uninformed or not supportive at all. 29% of the participants have taken steps to report they were excluded or discriminated at work.
On the question “Who informed you about the possible support you could receive as a hard of hearing person at the workplace?”, 29% responded they had to research it themselves, 24% was not informed at all, and only 9% was informed by their audiologist.
Conclusions:
Although hard of hearing people experience that their hearing aids or cochlear implants, improve the situation at work and are worth the trouble, they still face challenges to be successful at work.
More than half of the participants were no informed about the possible support they could receive at work, or had to find it out for themselves.
We need urgently to inform users, employers and audiologists much better, on what it takes or what can help to be more successful at work.
In part 01, I will focus on the available research, what we can learn from this survey as audiologist to find better solutions, guide the users and their employers to be empowered and better informed to break barriers for success at work.

218 - ABSTRACT FOR HEAL 2026 SURVEY ON THE IMPACT OF HEARING LOSS AND EMPOWERMENT IN THE WORKPLACE 02

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The impact of hearing care and empowerment on employment is needs to get more attention. Informing and guiding hard of hearing people and their employers on how to be successful at work is a challenge for audiologists, and many other health and social workers.

Method:
We developed a survey on this topic, joint with EFHOH (the European Federation of Hard of Hearing People), AEA (European Association of Hearing Aid Professional) and the audiology department of the Thomas University College of Applied Sciences in Antwerp, where we used the International Outcomes Inventory for Hearing Aids (IOI-HA), which we also adapted for Cochlear Implant users (IOI-CI), and questions for hard of hearing people using hearing aids, cochlear implants or other assistive devices on their experiences, needs, solutions, information and support at work. This survey was first evaluated by English native speakers, adjusted and then translated in 10 languages. After proofreading by native speakers of this language, the survey was distributed to all EFHOH and AEA member associations and networks. So far, we received responses from 1014 participants, from more than in total 30 countries. The survey is still running, so by the time of the HEAL2026 conference, we will have even more results to present. Have Your Say: Survey on the Impact of Hearing Loss and Empowerment in the Workplace – EFHOH

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75% experience difficulties to communicate at work, 59% indicate their hearing loss affects their performance at work.
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More than half of the participants were no informed about the possible support they could receive at work, or had to find it out for themselves.
We need urgently to inform users, employers and audiologists much better, on what it takes or what can help to be more successful at work.

In part 02, Lidia Best will focus on the user point of view, exclusion, discrimination, empowerment and how to inform hard of hearing people and employers to break barriers.

247 - EVALUATION OF POSTURAL STABILITY AND BALANCE PERFORMANCE IN ADULT HEARING AID USERS WITH ACQUIRED HEARING LOSS

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Objective: The aim of this study is to examine and maintain postural stability in adult individuals using hearing aids due to acquired hearing loss, focusing on normal work with healthy eyes.
Method: The study included 15 adult individuals using hearing aids (study group) and 15 healthy individuals with normal hearing (control group). No significant differences were observed in terms of age and gender ($p>0.05$). Computerized Dynamic Posturography (CDPT) was used for postural stability and balance performance at all speeds, and balance scores were analyzed. Composite balance scores, visual, vestibular, and somatosensory sub-stages were continuously compared between groups.
Results: As a result of the evaluations, it was observed that the composite balance scores of the hearing aid-using group were significantly lower than those of the control groups ($p<0.05$). In the analysis of the scores in the sub-parameters; There was a significant weakness, particularly in visual and vestibular system scores, where speech was lost. However, no significant difference was observed between the groups in somatosensory scores.
Conclusion: This study shows that acquired hearing loss in adults is not limited to the auditory system but also negatively affects postural control and balance mechanisms. Including balance assessments in the process is of great importance in order to equalize hearing aid users, reduce the risk of falls, and increase mobility.
Keywords: balance, hearing loss, postural stability, hearing aid, dynamic posturography

251 - SENSORY PROCESSING IN ADULT HEARING AID USERS WITH POSTLINGUAL HEARING LOSS: IMPLICATIONS FOR MULTIDIMENSIONAL REHABILITATION

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Purpose:
This study aimed to investigate the sensory processing profiles of adults who use hearing aids due to postlingual hearing loss and to compare these profiles with those of normal-hearing individuals.
Methods:
Twenty adults with postlingual hearing loss who use hearing aids (study group) and 20 age- and sex-matched normal-hearing individuals (control group) participated in the study. Sensory processing profiles were evaluated using the Adolescent/Adult Sensory Profile. Group differences and relationships between variables were examined using appropriate statistical analyses.
Results:
Adults with postlingual hearing loss who use hearing aids showed significantly lower scores in the Sensory Seeking, Taste/Smell Processing, and Activity Level subdomains compared to normal-hearing individuals ($p < 0.05$).
Conclusions:
These findings indicate that postlingual hearing loss affects not only auditory function and perception but also sensory processing abilities that are essential for daily life. The results emphasize the need for multidimensional approaches in the assessment and rehabilitation of adult hearing aid users.
Keywords:
Sensory integrity, sensory processing, hearing loss

260 - ASSESSMENT OF QUALITY OF LIFE IN PATIENTS WITH FAR-ADVANCED OTOSCLEROSIS (FAO) AFTER COCHLEAR IMPLANTATION

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Background
Otosclerosis is a disease of unidentified origin, and as a result, there are many methods of treating it. Cochlear implantation is a highly effective treatment method, as demonstrated by the results of studies of implanted patients with far-advancedotosclerosis (FAO). It has a significant impact on the patients' quality of life.
Material and methods
Ten patients (seven women and three men) with FAO and profound hearing loss underwent cochlear implant surgery by Med-El. The Assessment of Quality of Life (AQoL-8D) questionnaire was used to assess health-related quality of life in the study participants.
Results
Patients completed the AQoL-8D questionnaire twice – before and 12 months after cochlear implantation. Significant improvements in patients' lives were observed. Patients achieved the greatest improvement in the psychosocial sphere in the category of Mental Health and Relationships.
Conclusions
Cochlear implantation in patients with far-advanced otosclerosis improves overall quality of life
Key words: • otosclerosis • quality of life • cochlear implants

IMPROVING HEARING CARE AND SERVICES I

98 - OBJECTIVE HEARING SCREENING IN OLDER ADULTS USING AUDITORY EVOKED POTENTIALS

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Background
Hearing loss in older adults has many physical and psychological consequences, including e.g. social isolation and depression and can even lead to the development of dementia. Hearing screening in older adults offers a simple way to prevent these negative effects of due to inner ear degeneration. Newborn hearing screening has been established in Germany since 2009 and is covered by statutory health insurance. We are using the same technology to pilot an adult screening program outside of clinical settings.
Method
The present study included adults aged 60 and over. Hearing screening was conducted using the easyScreen ABR device (MAICO, Germany). A suitable screening level was determined in a preliminary study with 135 adults in a clinic setting. For this purpose, screening hearing thresholds and a complete pure-tone audiogram were determined for each ear. In addition to hearing screening, the standardized HHIES (Hearing Handicap Inventory for Elderly – Screening Version) questionnaire was used to assess subjectively perceived hearing impairment. Hearing screenings are already underway in selected general practitioner practices in a primary care setting.
Results
In the clinic setting the optimal screening level for adults aged 60 and over is in the range between 60 and 65 dBHL. At this level, a sensitivity of approximately 90% and a specificity of around 76% can be achieved. In ongoing hearing tests conducted in GP practices a screening level of 60 dBHL was used. The ongoing hearing screenings have so far revealed that 54.7% of the test subjects have suspected hearing impairment.
Conclusions
The results show that an objective, ABR-based hearing screening is possible with an already available screening device. A screening level of 60 dBHL seems to be very suitable for adults aged 60 and over. It is conceivable that in the future screenings could be carried out across the board in GP practices. This allows a large proportion of elderly people with hearing impairments to be identified and treated appropriately. And thus, it improves participation in social life.

Keywords
hearing screening, auditory brainstem responses, age-related hearing loss

150 - CO-DESIGNING CHILDHOOD HEARING HEALTH RESEARCH WITH DEAF COMMUNITIES AND FAMILIES: LESSONS FROM ANCHOR

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The Australian National Child Hearing Health Outcomes Registry (ANCHOR) is a national initiative to collect and connect child hearing health information to drive service improvements and research insights that single studies cannot achieve alone. ANCHOR's **vision** is to give all deaf and hard of hearing children the best opportunities to reach their full potential and live healthy, fulfilled lives. Recognising the need for inclusive, culturally safe and accessible research, especially for Australian Sign Language (Auslan) users, ANCHOR partnered with families with lived experience and Deaf advocacy organisations in its design for implementation. This presentation discusses the methods, learnings and outcomes of this co-design process.

Methods: ANCHOR has been designed with family engagement as its core principle. The Australian Childhood Deafness – Community Advisory Group (AusChildDeafness-CAG) was established and led by two parents with lived experience, supported by funding from ANCHOR, using a rigorous national recruitment process that ensured cultural, linguistic and hearing diversity. The CAG of 15 parents provides ongoing methodological advice, feedback and prioritisation. The CAG has contributed across multiple stages of methodological development, including language refinement, accessibility considerations, and framing of outcomes that better reflect lived experience. This included participation in the 2025 Australasian Newborn Hearing Screening (ANHS) Conference to co-develop a national Core Outcome Set for child deafness with researchers. The parent-led initiative embeded lived and living experience into conference design and delivery, and included pre-conference orientation and accessibility supports, structured peer connection, and post-conference debriefing, guided by the Four Stages of Psychological Safety framework. We also conducted interviews and focus groups with 22 parents/carers of children who are deaf or hard of hearing as well as 6 young people who are deaf or hard of hearing.
ANCHOR has also been co-designed with the Deaf community, with the methodological process led by Auslan-using and Deaf researchers from Deaf advocacy organisations to ensure the research is tailored to safely and effectively engage Deaf participants. Focus groups and interactive online workshops were conducted in Auslan with Deaf participants who had autonomy to choose how they wanted to be involved. Written online surveys were accompanied by Auslan translation videos for each question, with the option of choosing to opt out of answering clinically-focused questions.

Results: Feedback from families highlighted the enabling conditions that allowed families to participate as co-leaders rather than as participants of research, as well as the emotional labour involved in bringing lived experience into research environments. Participants emphasised the importance of measuring child deafness outcomes beyond clinical and audiological domains, such as well-being, identity, belonging and social participation. ANCHOR's engagement strands illustrate how early, sustained and properly resourced involvement of families and Deaf communities strengthens outcome measurement and improves service relevance. Embedding family and lived-experience voice ensures that future data systems support monitoring of domains valued by families and those with lived experience, rather than solely clinical indicators.

Discussion/Conclusion: By centering families and the Deaf community as partners and leaders of research, not just consultees, ANCHOR provides a model for consumer co-production in childhood deafness research and service design. These learnings have broader implications for improving hearing care and services: outcome measurement becomes more meaningful; service accountability and equity become more visible; and system learning becomes feasible at scale.

Keywords: Co-design; Deaf Community; Family Engagement; Community Advisory Group; Auslan

178 - TRANSLATING EVIDENCE INTO PRACTICE: INTEGRATING COGNITIVE AND MENTAL HEALTH INTO HEARING CARE ACROSS THE LIFESPAN

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Background / Rationale
Hearing loss across the lifespan is associated with increased listening effort, social withdrawal, and adverse cognitive and mental health outcomes, including depression and anxiety. While the evidence linking hearing health with brain and mental wellbeing is well established, it is inconsistently addressed in routine hearing care. Clinicians report challenges translating emerging evidence into actionable, patient-centered strategies that support early engagement, interdisciplinary care, and improved quality of life. There is a critical need for scalable, evidence-informed frameworks that integrate cognition and mental health into standard hearing care.

Materials and Methods
The Listen To This initiative, developed by BrainWorks, provides a structured knowledge-translation framework designed to support clinicians in integrating cognitive and mental health considerations into hearing care across the lifespan. The framework was developed through interdisciplinary collaboration among hearing scientists, clinicians, and health advocates and is grounded in contemporary research on hearing, cognition, and mental wellbeing. Key components include clinician-facing educational resources, structured communication strategies, patient-facing materials, and flexible protocols designed to reduce stigma, facilitate shared decision-making, and promote early engagement with hearing care.

Results
Implementation of the framework has enhanced clinician confidence in discussing cognitive and mental health outcomes associated with hearing loss and provided practical tools for patient communication. Early indicators of impact include adoption of shared language across clinical settings, increased engagement with educational resources, and integration of mental health considerations into routine patient interactions. The framework also fosters interdisciplinary dialogue and provides practical guidance for addressing depression, anxiety, and social isolation in the context of hearing care.

Conclusions
Integrating cognitive and mental health considerations into hearing care services represents a meaningful opportunity to improve patient-centered care across the lifespan. The Listen To This framework demonstrates a scalable, evidence-informed approach to translating research into clinical practice. By supporting earlier intervention, promoting interdisciplinary collaboration, and enhancing clinician–patient communication, this framework contributes to innovative, patient-centered protocols that align hearing care with broader cognitive and mental health priorities.

Key Words: Cognition, Brain Health, Hearing

Conflict of interest: one or more authors have declared an industry affiliation

180 - FEASIBILITY AND ACCURACY OF AUDITORY STEADY-STATE RESPONSE IN ADULTS AGED 88–95 YEARS IN A HOME SETTING

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Background/Rationale
Hearing loss is highly prevalent among the oldest-old and often co-occurs with physical and cognitive impairments that may hinder participation in behavioural hearing assessments such as pure-tone audiometry (PTA). Auditory steady-state response (ASSR) has been shown to be accurate for estimating hearing thresholds in children and younger adults, but its feasibility and accuracy have not been systematically evaluated in individuals close to, or over 90 years of age, particularly outside a clinical environment. This study aimed to evaluate the feasibility of performing ASSR in a home setting among adults aged 88–95 years, to examine the agreement between thresholds obtained with ASSR and PTA, and to assess whether a valid auditory brainstem response (ABR) is required prior to ASSR in this age group.

Materials and Methods
This observational cohort study was conducted within the population-based Gothenburg H70 Birth Cohort Study and included individuals born in 1923–24 and 1930. Home visits were carried out among 91 participants aged 88–95 years, including individuals living in their own house or apartment as well as in nursing homes and residential care facilities. All 91 participants underwent pure-tone audiometry and tympanometry. Due to practical and/or participant-related constraints, 71 individuals completed the full test protocol, including PTA, ABR, and ASSR. ASSR was recorded using narrowband chirp stimuli at carrier frequencies of 0.5, 1, 2, and 4 kHz. PTA thresholds at the corresponding frequencies were used for comparison.

Results
ASSR thresholds were successfully obtained in a majority of participants and showed overall good agreement with corresponding PTA thresholds across test frequencies. In cases where both measures were available, ASSR thresholds generally corresponded closely to PTA thresholds, indicating clinically acceptable accuracy at the group level, although wider variability was observed at 1 kHz in the left ear only. Approximately one third of ASSR thresholds could not be obtained, primarily due to high rejection rates or participant-related factors such as discomfort during testing. Although ABR wave V was frequently absent or unclear, ASSR thresholds were often still obtainable. No consistent association was observed between cognitive screening scores and discrepancies between ASSR and PTA thresholds.

Conclusions
ASSR is a feasible method for estimating hearing thresholds and identifying hearing intervention needs in adults aged 88–95 years who cannot reliably participate in behavioural hearing assessments. The observed agreement between ASSR and PTA thresholds suggests that ASSR can be used to assess hearing acuity in individuals even at a very advanced age and when testing is performed in a home setting. Although thresholds across all test frequencies were not obtained in all participants, ASSR provided clinically relevant threshold information in the majority of cases. Furthermore, ASSR outcomes were not dependent on the presence of a clearly defined ABR response, indicating that ABR may not be required prior to ASSR in this age group.

Keywords: oldest-old; auditory steady-state response; objective hearing assessment; home-based testing; age-related hearing loss

202 - CAPTURING CHILDREN'S VOICES TO INFORM PATIENT-CENTRED OUTCOMES IN PAEDIATRIC HEARING CARE

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Background: Outcome measurement in paediatric hearing care is largely driven by biomedical and functional indicators and commonly relies on parent or clinician proxy reports. While these approaches capture audiological and speech outcomes, they may overlook children's own priorities, particularly in relation to participation, communication access, identity, and experiences of care. Deaf and hard of hearing (DHH) children are rarely engaged directly in research that informs how progress is defined and measured, despite Article 12 of the United Nations Convention on the Rights of the Child affirming children's right to express their views in matters affecting them and to have those views given due weight.

Aim
To explore what information DHH children believe hearing and health services should collect to measure their progress, and to identify implications for patient-centred care in paediatric hearing services.

Methods: A qualitative, participatory study was conducted using child-friendly focus groups with DHH children aged 6–12 years, recruited through the Victorian Childhood Hearing Longitudinal Databank (VicCHILD), a population-based research databank enrolling children with permanent hearing loss in Victoria, Australia. Focus groups were designed using principles and activities from the Voice of the Child Toolkit[1] and incorporated developmentally appropriate, multimodal methods including drawing, written reflections, and advice-giving prompts. These approaches enabled participation across a range of communication preferences and expressive abilities.
Two age-based focus groups were co-facilitated by researchers experienced in child health and qualitative methods, with communication supports available as required. Sessions were audio-recorded, transcribed verbatim, and analysed using inductive thematic analysis. Coding and theme development were undertaken by the lead researcher with co-coding and regular discussion to enhance rigour.

Results: Six children with mild to profound unilateral or bilateral hearing loss participated. Children described progress in ways that extended beyond hearing ability or device use and instead focused on how they experienced their everyday lives. A strong sense of progress was linked to achievement and belonging, with children emphasising pride in school, sport, creative activities, friendships, and being recognised for who they are.
Children also described an ongoing negotiation between wanting to be treated like their peers and needing specific supports to participate fully. Feelings of inclusion or difference were shaped by everyday interactions, such as whether peers repeated information, whether teachers understood hearing needs, and how adults responded when communication broke down. These interactions influenced children's confidence, comfort, and sense of belonging.
Communication supports were described as essential for participation, yet children frequently highlighted frustration when supports were used inconsistently or incorrectly. While hearing technologies and accommodations enabled access, children emphasised that effective communication depended on adult behaviour, consistency across environments, and shared responsibility. Children described taking responsibility for reminding adults about their needs, indicating both early self-advocacy and gaps in system-level support.
Healthcare experiences were evaluated through whether children felt heard, understood, and respected. Clear, child-friendly explanations, opportunities to express fear or uncertainty, and accessible communication practices were prioritised over technical aspects of care. Difficulties hearing clinicians, understanding complex language, or feeling dismissed undermined comfort and trust in healthcare encounters. Across settings, children offered practical advice to clinicians and educators emphasising relational care, communication accessibility, and empathy in hearing care.
Implications for Patient Care: DHH children define progress in ways that extend beyond traditional audiological or proxy-reported outcomes. Patient-centred hearing care requires outcome measures that capture children's lived experiences of belonging, communication access, confidence, and feeling understood across healthcare and educational settings. Participatory, child-friendly approaches demonstrate that even young children can meaningfully articulate these priorities and should be embedded within service evaluation and outcome frameworks so that what is measured aligns with what matters to children themselves.

Developing child-informed hearing care outcome frameworks strengthens the relevance and responsiveness of services, but also the intent of Article 12 of the Convention on the Rights of the Child: to seek, consider, and give due weight to the views of children in matters affecting them.

Keywords: Paediatric hearing care, Child-reported outcomes, Patient-centred care, Deaf and hard of hearing children, Communication accessibility

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207 - UNDERSTANDING THE FACTORS INFLUENCING TARGETED CONGENITAL CMV SCREENING: PERSPECTIVES FROM HEARING SCREENING STAFF

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Background/Rationale:
Congenital cytomegalovirus (cCMV) is the leading infectious cause of sensorineural hearing loss and neurodevelopmental disability in infancy. Detection within 21 days of life is required to confirm congenital infection and to consider antiviral treatment where appropriate. International guidance recommends targeted cCMV testing for infants who do not pass Universal Newborn Hearing Screening (UNHS), yet this is not routinely implemented. Understanding hearing screening staff views on barriers and enablers to integrating targeted cCMV screening within UNHS is essential to design feasible implementation strategies and targeted cCMV screening.

Materials and Methods:
As part of the Hearing Screening for congenital CMV (HearS-cCMV) study in Victoria, Australia (2019–2020), we used a mixed-methods approach. We conducted five one hour semi-structured focus groups with hearing screening staff involved in the HearS-cCMV study (n = 30; 23 screeners, 7 managers), guided by the Theoretical Domains Framework (TDF). Sessions were audio-recorded, transcribed verbatim and analysed thematically with deductive mapping to TDF domains. A short post-study survey of hearing screeners, managers and Early Support Service staff was used to triangulate findings and capture self-reported knowledge, competence and confidence in delivering cCMV screening.

Results:
Two main themes emerged: (1) the need for more education and training of hearing screening staff members to support conversations with families about cCMV, and (2) the challenge of balancing cCMV screening with timing of referral to diagnostic audiology. Eight key TDF domains were identified, with four central domains: knowledge and skills; beliefs about capabilities and professional role; beliefs about consequences; and environmental context and resources. Enablers within these domains included hearing screening staff support for families completing saliva swabs, streamlined integration with audiology pathways, and increased staff feelings of confidence through repeated experience of delivering cCMV screening. Barriers comprised limited cCMV knowledge among staff and caregivers, screeners' feelings of limited autonomy over timing and communication around delivery of cCMV screening, working with families with English as an additional language, time pressures, and family distress at the point of audiology referral. Survey responses aligned with focus group findings, with many hearing screening staff reported competence in aspects of cCMV screening but demonstrated the need for further training and clearer procedural support.

Conclusions:
Hearing screening staff identified clear, practical steps to support targeted cCMV screening within UNHS. These include improved education for staff and caregivers around CMV, the importance of cCMV screening, and how to best counsel caregivers about cCMV screening. Results also support the suggestion of embedding screening into the existing UNHS workflow with clear protocols. Other implementation strategies identified include the potential to allow staff discretion to time cCMV discussions appropriately, supported by governance and resources, in order to deliver sensitive and timely cCMV screening. Implementing these measures should increase staff confidence, reduce implementation barriers, and improve early detection of cCMV in infants who do not pass newborn hearing screening.

Keywords:
congenital cytomegalovirus; Universal Newborn Hearing Screening; targeted screening; qualitative study; Theoretical Domains Framework

QUALITY OF LIFE AND HEARING LOSS IV

32 - EVALUATING THE ASSOCIATIONS OF HEARING LOSS DIAGNOSIS AND TREATMENT ON PHYSICAL ACTIVITY AND HEALTH: A SCOPING REVIEW

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Background: Hearing loss affects nearly one in five individuals worldwide and is associated with adverse cognitive, social, and overall health outcomes. Physical activity, a modifiable lifestyle factor known to improve cardiovascular health, may influence hearing outcomes through shared vascular mechanisms affecting cochlear function. This study aims to qualitatively review the existing literature to identify recurring patterns in the relationship between physical activity levels and hearing loss and the impact of hearing loss treatment, such as cochlear implantation, on physical activity.
Methods: Relevant literature was identified through comprehensive searches conducted by a medical librarian in PubMed, CINAHL, Web of Science Core Collection, and the Cochrane Database of Systematic Reviews. The search process adhered to PRISMA-Searching (PRISMA-S) guidelines. Inclusion and exclusion criteria were determined prior to completing the literature search. Data extraction was performed using RedCap.
Results: A total of 101 studies were included, the majority of which were observational cross-sectional and cohort studies involving adult and older adult populations. Hearing loss was most assessed using pure-tone audiometry conducted without hearing aids and categorized as normal (<25 dB), mild (26–40 dB), or moderate to greater (≥40 dB), while some studies relied on self-reported hearing measures. Physical activity was evaluated using a range of objective tools (e.g., accelerometry, Short Physical Performance Battery) and self-reported measures, including activities of daily living, instrumental activities of daily living, and leisure-time physical activity questionnaires. Overall, findings were heterogeneous, with several studies reporting an association between lower physical activity levels and greater hearing impairment, whereas others found no significant association.
Conclusion: Existing evidence suggests a complex and heterogeneous relationship between physical activity and hearing loss. While many studies indicate that lower physical activity levels are associated with greater hearing impairment, findings remain inconsistent, highlighting the importance of future longitudinal studies to better understand the relationship and guide the impact of hearing loss treatment for hearing and overall health.

34 - INCIDENCE, SEVERITY, AND RISK FACTORS OF PLATINUM-INDUCED OTOTOXICITY IN PEDIATRIC ONCOLOGY PATIENTS: A MULTI-CENTER RETROSPECTIVE STUDY

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Background: Platinum-based chemotherapeutic agents, particularly cisplatin and carboplatin, are commonly used in pediatric oncology but are frequently associated with ototoxicity. This study aimed to evaluate the incidence, severity, and risk factors of platinum-induced ototoxicity in Korean pediatric cancer patients.

Methods: We conducted a retrospective cohort study across three tertiary hospitals in South Korea, reviewing the medical records of 314 pediatric oncology patients treated with cisplatin or carboplatin between 2004 and 2024. Hearing function was assessed using audiologic evaluations, including pure-tone audiometry, auditory brainstem response (ABR), and distortion product otoacoustic emission (DPOAE). Ototoxicity was defined as a Chang grade of ≥2a or equivalent threshold shifts on ABR/DPOAE.

Results: Ototoxicity was identified in 146 patients (46.5%). Hearing loss predominantly affected high frequencies (≥4 kHz), consistent with platinum-induced sensorineural hearing loss. Male sex, a diagnosis of medulloblastoma, and treatment with carboplatin were each significantly associated with increased risk. Patients diagnosed before age 11 exhibited significantly worse thresholds across all frequencies ($p < 0.05$). Patients who received radiotherapy showed significantly worse thresholds at low frequencies ($p < 0.001$), although total radiation dose and chemotherapy duration were not independently correlated with hearing loss.

Conclusions: Nearly half of pediatric patients treated with platinum chemotherapy developed ototoxicity, with younger age, male sex, carboplatin use, and head and neck radiotherapy identified as risk factors. These findings highlight the importance of routine hearing surveillance and the consideration of otoprotective strategies in high-risk pediatric patients.

Key words
Platinum, Ototoxicity, Pediatric, Carboplatin,Quality of life

AMPLIFICATION – TECHNOLOGIES AND STRATEGIES

323 - EFFECTS OF STEREO REMOTE MICROPHONE TECHNOLOGY ON SPEECH UNDERSTANDING AND LOCALIZATION

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Introduction: Remote microphone technology (RMT) has been recommended as part of an audiological treatment plan, particularly in educational settings where adverse listening conditions are common. RMT is designed to improve the signal-to-noise ratio (SNR) by transmitting a talker's voice directly to a listener's hearing assistive device. Digitally modulated (DM) systems consist of a transmitter, or remote microphone, and a wireless receiver that routes the signal to one or more hearing devices. In 2024, Phonak introduced the Roger On 3, the first Roger RM system to offer stereo audio transmission. When paired with bilateral personal technology equipped with RogerDirect receivers and with stereo mode enabled via the myRogerMic app, the Roger On 3 in Stereo Table mode transmits spatially differentiated audio signals. Specifically, speech originating from the right side of the table is delivered at a higher intensity to the right hearing device, while speech originating from the left side of the table is delivered at a higher intensity to the left hearing device. This asymmetric signal routing mimics interaural level di3erences and allows access to spatial auditory cues that were not available with earlier monaural RM systems.

Methods: The study included college-aged adults between 18 and 25 years of age with pure-tone air conduction thresholds of 25 dB HL or better at octave frequencies from 250 to 8000 Hz bilaterally. Testing was conducted in the 3D Audio Lab at the Callier Center for Communication Disorders in Richardson, Texas. Classroom noise stimuli were presented at 65 dBA using a circular 24-loudspeaker array positioned slightly above the head of the participant who was seated between two loudspeakers and wore HAs with Roger Direct receivers. Each participant typed each of the HINT-C sentences presented at 60 dBA in four listening conditions presented in randomized order: No technology, Low-gain HAs only, HAs with Roger On 3 in Mono Table mode, and HAs with Roger On 3 in Stereo Table. After the typing of the sentence, the participant was asked to indicate the origin of the sentence from the right or left speaker.

Results: Preliminary results with six participants revealed that average speech recognition in the no HA and HA only conditions was 55% and 46%, respectively. As expected, performance improved with the use of the DM remote microphone system to 92% and 95% for the DM system in mono table mode and stereo mode, respectively. The localization results showed that the stereo Table mode provided about a 30% improvement in accuracy over the monaural table mode.

Conclusion: The use of the Roger On3 remote microphone provided about 45% improvement in speech recognition in noise over use of HAs alone in young adults with typical hearing. Comparison of the stereo versus mono table mode settings when the Roger On3 was connected to the HAs revealed similar speech recognition but significant improvement in localization of the speech (right or left speaker). Improvements in localization will allow listeners to turn in the appropriate direction and potentially benefit from visual cues on the face and any associated gestures. Although yet to be confirmed, such localization improvements may lower listener fatigue and improve quality of life for people with atypical hearing.

Key Words: Remote microphone technology, Localization, Assistive hearing technology

355 - PREDICTING OVER-THE-COUNTER HEARING DEVICE BENEFIT THROUGH QUESTIONNAIRES AND AUDIOLOGICAL TESTING

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Background and Aim: Over-the-counter (OTC) hearing devices represent an increasingly accessible solution for individuals with mild-to-moderate hearing loss. However, not all users derive equal benefit, and identifying reliable predictors of aided benefit remains a clinical challenge. This study aimed to evaluate a comprehensive battery of audiological, psychoacoustic, and behavioral measures as potential predictors of OTC hearing device benefit in speech-in-noise conditions, using both univariate and multivariate regression analyses.
Methods: Thirty participants with either mild-to-moderate hearing loss measured using pure-tone testing or self-perceived hearing difficulties identified through self-reported questionnaires, underwent a multi-domain test protocol. Pure-tone audiometry (PTA) was performed bilaterally. All subsequent tests were conducted in a sound booth with loudspeakers. Speech reception thresholds (SRT50) were measured using the Italian Matrix sentence test (Oldenburg paradigm) in both unaided and aided conditions (smart glasses). The spatial configuration consisted of target speech presented from the front (0°) and continuous ICRA1 speech-shaped noise from three loudspeakers at −90°, +90°, and 180°, calibrated at a fixed level of 70 dB SPL at the listener's head, simulating an ecologically valid listening environment. The aided benefit was defined as the difference between unaided and aided SRT50, where positive values indicate improvement. The unaided SRT50 was also retained as a predictor variable.
Amplitude modulation sensitivity was assessed using the Audible Contrast Threshold (ACT) test through an adaptive staircase procedure. Loudness perception was evaluated with the ACALOS (Adaptive Categorical Loudness Scaling) test, administered separately for each ear in unaided condition. Three metrics were derived: the SPL corresponding to the midpoint of the loudness dynamic range (intersection), the lower slope (slope_L, i.e., the steepness of the loudness growth below the intersection), and the upper slope (slope_U, i.e., the steepness above the intersection). Spatial hearing was assessed with the Symphonia localization test, employing four loudspeakers at 45°, 135°, 225°, and 315°, with simulated sea noise calibrated at 70 dB SPL. Three randomized trials per loudspeaker were administered, and the percentage of correct localizations was computed. Participants also completed three self-reported questionnaires: the Hearing Handicap Inventory for Adults (HHIA), the Vanderbilt Fatigue Scale (VFS), and the Speech, Spatial and Qualities of Hearing Scale (SSQ), along with the Digit Span Sequencing (DSS) short-term memory test.
Pearson's correlation coefficients were computed between each predictor and aided benefit. Univariate regressions were performed on significantly correlated predictors, followed by a multivariate regression to assess the joint and independent contribution of each. Variance inflation factors (VIF) were computed to check for multicollinearity, and an incremental F-test compared univariate and multivariate model performance.
Results: Three predictors showed significant correlations with OTC benefit: ACT ($r = 0.684$, $p < 0.001$), ACALOS slope_L ($r = 0.622$, $p < 0.001$), and unaided SRT50 ($r = 0.54$, $p = 0.002$). No other predictor reached statistical significance (PTA, VFS, HHIA, SSQ, ACALOS intersection, Symphonia localization, DSS).
Univariate regressions revealed that ACT explained the largest proportion of variance in benefit ($R^2 = 0.47$), followed by slope_L ($R^2 = 0.39$) and unaided SRT50 ($R^2 = 0.30$). A multivariate model combining the three significant predictors showed that ACT ($\beta = 0.50$, $p = 0.005$) and slope_L ($\beta = 0.39$, $p = 0.04$) retained independent significance, whereas unaided SRT50 did not contribute independently ($\beta = 0.003$, $p = 0.98$). VIF values remained below 2.1 for all predictors, indicating acceptable multicollinearity. The incremental F-test confirmed that the combined model explained significantly more variance than any univariate model ($F = 3.54$, $p = 0.045$).
Conclusions: Amplitude modulation sensitivity (ACT) and loudness growth characteristics (ACALOS slope_L) emerged as the strongest independent predictors of OTC hearing device benefit, outperforming unaided SRT50 in the multivariate model. These findings suggest that suprathreshold auditory processing capabilities, rather than pure-tone hearing sensitivity, self-reported hearing difficulties, or baseline speech-in-noise performance, are the primary determinants of aided benefit. The ACT and ACALOS may serve as clinically efficient screening tools for identifying individuals most likely to benefit from OTC amplification.
Keywords: over-the-counter hearing devices, speech-in-noise, audible contrast threshold, loudness scaling, aided benefit, Matrix sentence test, multivariate regression, sound localization, hearing loss screening

Conflict of interest: one or more authors have declared an industry affiliation

282 - DEMYSTIFYING HEARING AID TECHNOLOGY FEATURES THROUGH A NOVEL ITERATIVE PROCESS IN LEXICON DEVELOPMENT

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Lack of standardized information about hearing aid technologies presents a barrier to individuals seeking to understand and make informed choices about the hearing aid features they may benefit from.

Objectives:
(1) To identify features in contemporary hearing aids as described in publicly available materials.
(2) To develop a lexicon of hearing aid features that informs consumers about available technologies.

Design: A synthesis of published information on the features of contemporary hearing aids from six major manufacturers was conducted by a multidisciplinary research team. The analysis and categorization of these findings was an iterative, agile process involving five distinct phases, Scoping, Extracting/Decoding, Mapping, Synthesizing and Consulting.

Sample size: 119 documents/publications were included in this review. These materials comprised 14 product guides and specification data sheets, and 105 white papers and technical articles.

Results: We identified 253 unique features (e.g. Feedback Management) across 12 hearing aid devices (including both premium and entry-level models). This resulted in the development of a lexicon describing the core capabilities of modern hearing aids.

Conclusion: Data synthesis identified key features of contemporary hearing aids across device models and manufacturers to inform the design of a lexicon for use by consumers.

Keywords: hearing aids; features; lexicon; consumer

136 - THE COGNITIVE-AFFECTIVE HEARING AID PARADOX: BOREDOM PRONENESS AND ATTENTIONAL DIFFICULTIES PREDICT WORSE AGE-RELATED SUBJECTIVE HEARING BUT LOWER RATES OF HEARING AID ADOPTION

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Objective: Prior work has shown that hearing loss in older adults can increase the risk of depression, loneliness, social isolation, cognitive impairments, and dementia. Yet, many older adults are unaware that these negative impacts can be attenuated by the adoption of a hearing aid. While objective hearing loss is a good predictor of hearing aid adoption, previous research has also highlighted the key role of the subjective impact of hearing-related issues in such decisions. Our prior work has shown that the subjective experience of hearing loss is worse for individuals with a relatively greater tendency to experience boredom and mind wandering. In the present study, we therefore explore the role of individual differences in these cognitive-affective factors as potential mediators of the predictive link between subjective hearing loss and hearing aid purchase.

Design: A sample of older adults (aged 50 and older) was recruited through a network of hearing-care clinics. Participants received an objective hearing assessment (audiometric thresholds) and completed self-report questionnaires on the subjective impact of hearing-related issues (hearing handicap), subjective strain experienced when listening (listening effort), tendency to experience boredom, tendency to experience difficulty maintaining task-focused attention (mind-wandering), and self-perceived level of cognitive functioning. Purchase data were obtained from the clinics to assess whether each participant purchased a hearing aid within five years of their initial clinic visit.

Results: Our findings replicated previous work showing that the subjective experience of hearing loss was worse for those with a trait susceptibility to experience boredom proneness and spontaneous mind wandering (in both hearing aid adopters and non-adopters). And while neither boredom nor spontaneous mind wandering significantly predicted hearing aid adoption on their own, a parallel-mediation model revealed that boredom and spontaneous mind wandering did partially mediate the relation between subjective hearing loss and hearing aid adoption. Interestingly, however, the nature of this partial mediation was opposite to what was expected based on the observation that those who were higher in the trait susceptibility to experience boredom and mind-wandering reported more aversive subjective hearing experiences. That is, while greater subjective hearing loss predicted a greater likelihood of hearing aid adoption, those who were more prone to boredom and spontaneous mind wandering were **less** likely to adopt a hearing aid. This suggests that such people are both more likely to have aversive subjective hearing experiences and be less able to do what it takes to address these negative impacts. Boredom proneness and the tendency to mind wander tend to be negatively correlated trait self-control. Thus, it follows that those with greater subjective hearing loss and high in boredom proneness and the tendency to mind wander might have a desire to adopt a hearing aid, but have more difficulty taking the necessary steps to attain that hearing aid. As expected, boredom proneness and mind wandering did not mediate the relation between objective hearing loss and hearing aid adoption.

Conclusion: Overall, we find that individual differences in boredom and attentional difficulties predict worse age-related subjective hearing but lower rates of hearing aid adoption.

Keywords: hearing aids, hearing aid purchase, hearing aid adoption, boredom, mind wandering

Conflict of interest: one or more authors have declared an industry affiliation

158 - REAL-WORLD SOUND PERCEPTION AND USER EXPERIENCE OF HIGH-FREQUENCY HEARING AID AMPLIFICATION: AN ECOLOGICAL MOMENTARY ASSESSMENT STUDY

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Personalised hearing-aid fittings aim to optimise listening comfort and speech intelligibility across the wide range of acoustic situations encountered in daily life. Perceived sound brightness, typically determined by the relative amplification of higher-frequency bands (≥ 2 kHz), is an important parameter influencing both sound clarity and listening comfort. Although brightness-related complaints are frequently reported in clinical practice and are often context-sensitive, brightness perception and preference remain insufficiently explored under changing real-world conditions.

This study investigated how everyday acoustic environments and listening intentions influence hearing-aid users' perception of different brightness settings. Twelve adults with mild to moderate sensorineural hearing loss participated in a two-week field trial using hearing aids programmed with two distinct brightness profiles: one 4 dB below and one 4 dB above the participants' current fitting. Participants were blinded to the active hearing aid setting and used each fitting for one week during their routine daily activities.

Ecological Momentary Assessment (EMA) was employed to capture real-world and real-time user experiences. Participants were prompted four times a day via smartphone notifications and could also initiate additional responses. Survey items comprised categorical and nominal questions addressing perceived sound sharpness, naturalness, acoustic context, and listening intent. In addition, two open-ended questions allowed participants to provide spoken or written responses, supporting more detailed qualitative insights beyond fixed-options rating scales.

Nominal EMA data indicated that participants were significantly more likely to report sound as sharper and more metallic when using the high brightness setting ($p < 0.001$). Higher environmental noise levels were also significantly associated with sharper and more metallic sound perception ($p < 0.05$). Listening intent did not show a statistically significant effect on sharpness perception ($p > 0.05$), however, intentions involving speech communication were associated with lower odds of reporting metallic sound perception ($p < 0.05$).

Analysis of the open, qualitative EMA data using a large language model, identified distinct thematic patterns across brightness conditions. Themes relating to clarity and speech intelligibility were more often observed under high-brightness settings, whereas comfort and naturalness were more commonly reported under low-brightness settings. However, harshness complaints occurred primarily under high-brightness settings, while descriptions of muffled or dull sounds were reported under low-brightness settings. In addition, sentiment analysis revealed a broad range of user experiences, with significantly lower sentiment scores observed in very noisy environments ($p < 0.001$).

At the end of the trial, most (6) participants chose to keep a low-brightness setting, 5 preferred their original fitting, and only 1 selected the high-brightness setting as default for everyday use, potentially reflecting a preference for long-term listening comfort.

Overall, the findings indicate that brightness settings influence real-world sound perception and hearing aid user experience. The use of EMA with open-ended feedback, supported by large language model analysis, demonstrates potential to reveal aspects of user experience not captured by conventional outcome measures. These results reinforce the value of integrating real-world user feedback to support more adaptive, user-centred hearing aid personalisation and signal-processing strategies.

Keywords:
Hearing aid amplification; high-frequency gain (brightness); ecological momentary assessment; real-world sound perception

Conflict of interest: one or more authors have declared an industry affiliation

70 - AUDIOMETRIC OUTCOMES FROM NEW OVER-THE-COUNTER HEARING AID GLASSES

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Background: Hearing loss is a widespread health issue, with most affected individuals experiencing mild to moderate sensorineural impairment. Despite technological advances, traditional hearing aids face barriers to adoption, including discomfort, stigma, and visibility. The acoustic glasses represent a novel over-the-counter solution, integrating amplification technology into standard eyeglass frames to provide air conduction hearing support without in-ear components. This study presents the first objective evaluation of the device's audiometric performance in individuals with mild to moderate hearing loss.

Methods: Thirty-two adults (mean age 74 years) with symmetric, age-related mild to moderate sensorineural hearing loss were enrolled. Participants underwent pure-tone audiometry and speech audiometry under free-field conditions, both unaided and aided with acoustic glasses. Device settings (gain slope and volume) were customized using the companion smartphone app, based on individual audiometric configurations and user preference. Statistical comparisons were performed using paired t-tests.

Results: The acoustic glasses significantly improved pure-tone hearing thresholds, particularly at higher frequencies (4000–6000 Hz), with average gains of 10–11 dB. Speech reception thresholds also improved, with mean reductions of 7 dB at 50% intelligibility and 6 dB at 100% intelligibility. Amplification profile preference (uniform vs. descending) closely matched participants' audiometric slopes, supporting the efficacy of the device's preset configurations. No significant differences in benefit were observed between mild and moderate hearing loss groups or across amplification profiles.

Conclusions: The acoustic OTC glasses offer clinically relevant improvements in hearing thresholds and speech intelligibility for adults with mild to moderate presbycusis. By combining discreet design, open-ear comfort, and self-directed fitting, the device addresses key limitations of traditional hearing aids. Although the observed acoustic gains seem modest compared to prescriptive devices, they are appropriate for early-stage hearing loss and may increase user acceptance.

111 - A NEW POWERFUL TECHNOLOGY FOR ASSISTIVE LISTENING IN THE 2.4 GHZ ISM BAND

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Many different technologies have been used for Assistive listening where an audio signal is captured near the source, transmitted wirelessly and directly to the hearing aids thereby eliminating the detrimental effects of surrounding noise and reverberation.
The most widely used assistive listening technology is the induction loop/telecoil system. It has been used and refined over many decades but also suffers from some significant shortcomings.
Over the last 10 years a new broadcast system in the 2.4 GHz ISM band has been developed and is now being made available by multiple companies. The system brings multiple benefits that hitherto were not available.
The sound quality using a new codec LC3 is superb and transmissions in stereo are available Audiostreams are labelled such that the users can choose between the different streams that can exist in parallel without any interference. Encryption can be employed for privacy and access control. Furthermore, this new system is based on a mainstream technology and is simple to install. Digital systems often have more latency than analogue systems and that is also the case for new broadcasting system. The LC3 codec was designed for low latency and a total latency from input to the transmitter to output from the hearing aids of less than 45 ms is possible.
Interoperability is critically important and strict implementation rules have therefore been developed. These requirement are also built into an upcoming IEC standard that specifies how transmitters and receivers shall be set up and how coverage can be measured.
The roll-out of the system has started; transmitters are being installed and compatible hearing aids are introduced from major hearing aid manufacturers.
A further benefit of the 2.4 GHz digital audio broadcasting system is that is also will be used for many other products such as ear-buds and headset for the general public. It will be available in PC's., TV's and other commercial products. Digital audio broadcasting is thus not a special thing for hearing impaired people. The new system and induction loop systems can co-exist and the new system can be seen as a supplement. Bodyworn receivers connecting to neck-loops or headsets are being offered by most transmitter manufacturers and enables hearing aids with tele-coils be connected to the new transmitters if no induction loop is present.
The opportunity to choose between different streams leads to the need for means to discover available streams and making a choice. The modern smart phone is ideally suited for this task but criticism has been raised because some potential users may not own or be able to operate a smart phone. Solutions to this problem are being pursued.
The presentation will give an overview of the technology, status on the roll-out and the future perspectives.
Key words: Assistive listening, hearing aids, 2.4 GHz wireless technology, standardization

Conflict of interest: the author has declared an industry affiliation

IMPROVING HEARING CARE AND SERVICES II

219 - WHAT'S HAPPENING WITH MY CHILD'S DATA?: PERSPECTIVES FROM PARENTS OF CHILDREN WHO ARE DEAF OR HARD OF HEARING

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Background: Data collection is a critical mechanism by which researchers and health professionals gain insight into the needs and experiences of children who are deaf or hard of hearing (DHH). Large-scale hearing registries and data linkage initiatives, such as the Australian National Child Hearing Health Outcomes Registry (ANCHOR), are increasingly integrating clinical, educational, and patient and family reported information, to support service planning, delivery and monitoring of outcomes. As these initiatives expand, understanding parent and caregiver perspectives surrounding data collection is essential to ensure trust, relevance and meaningful participation. This study aimed to investigate the views of parents of children who are DHH regarding how their child's data are collected, used, and governed.

Methods: We conducted a qualitative study via focus groups and semi-structured interviews. Parents of DHH children aged 0-26 years and residing in Australia were invited through a national online expression-of-interest process. Purposive sampling ensured participant diversity across child age, hearing loss type and severity, geographical location and cultural background. Focus group and interview transcripts were recorded verbatim and analysed using Inductive Content Analysis. Each transcript was first reviewed and coded by one author into broad content categories (e.g. '*Why is data collection important?*'). These categories were then refined into more specific sub-categories (e.g. '*Helping other families'*). Categories were compared across transcripts to identify recurring patterns, followed by synthesis and interpretation. To ensure rigour, 50% of transcripts were independently coded by two additional authors. Any minor discrepancies between coders were resolved via discussion.

Results: A total of 104 expressions of interest were received, with a final sample of 22 parents who contributed their perspectives through either focus groups stratified by the child's age or individual interviews. (Fifteen participants were divided between five focus groups stratified by child age, seven participants took part in individual interviews). Inductive Content Analysis identified seven content categories: 1. Feelings about the collection of information about their child and family by hearing health services; 2. Reasons for providing data; 3. Knowledge of data collection processes; 4. Relevance of the data being collected; 5. Concerns about privacy and security; 6. The role of data in guiding funding and programs; and 7. Opportunities for improvements and future directions. Parents expressed diverse perspectives on data collection practices. Many recognised the potential benefits of data for improving services and outcomes, but also highlighted gaps in communication, transparency, and opportunities for family input. Parents strongly valued being consulted about what information is most meaningful to collect and emphasised that better engagement with families could enhance data relevance and maximise the benefits for children and their communities. Meaningful partnerships with families and the deaf community are essential, not only to ensure parents understand why their child's data is being collected and how it is used, but also, in the words of one parent, for "embracing the deaf world".

Conclusion: Parents, as their child's primary advocates, provide essential insights into how data practices shape engagement, equity, and perceived value of research and registries. For data linkage initiatives such as ANCHOR, these findings emphasise the need for clear communication, robust data governance, and authentic, sustained engagement with families and the deaf community. Involving parents and community perspectives in the design of research, registries and data governance can support trust and improve participation. As a result, it helps ensure hearing healthcare systems remain representative and inclusive of the deaf community, and capable of generating the evidence required to meaningfully inform care, service delivery and outcomes.

Keywords: children, qualitative research; data collection, deaf, deaf or hard of hearing, health data linkage, hearing loss, parent perspective

38 - PRECEPTOR-IDENTIFIED TRAINING GAPS IN PEDIATRIC AUDIOLOGY: IMPLICATIONS FOR WORKFORCE PREPAREDNESS AND PATIENT CARE

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Background/Rationale
Pediatric audiology practice requires clinicians to integrate advanced diagnostic skills, family-centered counseling, and coordination across healthcare, educational, and early intervention systems. Compared to general audiology practice, pediatric care often involves greater clinical complexity, developmental variability, and emotionally charged decision-making contexts. As a result, preparation for pediatric audiology practice extends beyond technical skill acquisition and requires well-developed clinical reasoning, communication, and professional judgment.
Clinical preceptors play a central role in supporting this transition from learner into competent pediatric clinician through supervised clinical experiences that shape diagnostic decision-making, counseling practices, and professional independence. Despite the recognized importance of preceptors in audiology education, variability persists in both learner preparedness for pediatric practice and in the training and support available to preceptors. Although national initiatives have emphasized preceptor development, much of the existing work focuses broadly on precepting across audiology rather than addressing pediatric-specific training priorities. Previous initiatives have described core audiology competencies and general expectations for learners; however, limited published data specifically capture pediatric audiology preceptors' perspectives on which competencies early-career clinicians are least prepared to perform and which areas preceptors find most challenging to teach. Without systematic needs assessment data from pediatric preceptors themselves, efforts to train future pediatric audiologists risk misalignment with real-world clinical demands, resulting in gaps in workforce preparedness that may compromise the consistency, quality, and safety of pediatric hearing healthcare.
This study aimed to (1) identify pediatric audiology competencies that preceptors perceive as areas of under-preparedness among learners, (2) determine which skills and behaviors preceptors prioritize as the most critical targets for focused training, and (3) identify areas in which preceptors report lower confidence or greater need for support when supervising and teaching pediatric learners.

Methods
A cross-sectional survey is currently being administered to practicing pediatric audiologists serving as clinical preceptors. Survey items address perceived learner preparedness across pediatric diagnostic, counseling, and professional competencies, as well as preceptor confidence in teaching and assessment. Data collection will be completed prior to the conference, and full analyses will be presented

Results
Preliminary themes indicate variability in learner preparedness across pediatric competencies, with particular challenges noted in areas requiring clinical reasoning, counseling, and judgment. These gaps have the potential to affect pediatric diagnostic accuracy, communication with families, and care planning. Final results, along with preceptor-informed strategies and resource priorities to address these gaps in pediatric training, will be presented at the conference.

Conclusions
Preliminary findings highlight pediatric-specific training gaps with direct implications for the quality and consistency of pediatric hearing care. These findings may be broadly applicable across both clinical settings and academic training programs, providing a framework for aligning pediatric audiology training with real-world demands. By centering preceptor-identified priorities, this work aims to inform targeted preceptor development initiatives, improve alignment between academic preparation and clinical expectations, and strengthen workforce readiness. Addressing these gaps may enhance early-career clinician competence, support preceptors in their supervisory roles, and ultimately improve pediatric patient and family outcomes.

Key Words (3-5): Pediatric Audiology; Precepting; Workforce Preparedness; Patient Care

41 - CLINICAL AND SOCIOCULTURAL INFLUENCES ON HEARING AID USE WITHIN THE FIRST YEARS OF LIFE: THE RESONATE PROJECT PHASE I

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Background/Rational
Early and consistent hearing aid (HA) use is critical for optimal development in children with permanent childhood hearing loss. At present, little is known about HA use in young children within the UK. Data from the US suggest hearing aid use is often suboptimal in the early years, with variation influenced by social determinants of health. This project aims to examine patterns of hearing aid use in children aged 0–4 years living in the UK and to identify clinical and sociocultural factors associated with variation in device use.

Materials and Methods
A retrospective review is being conducted on ~500 children aged 0–4 years with permanent childhood hearing loss, across 7 audiology centres in England. We will examine clinical and demographic data including hearing aid datalogging, degree of hearing loss, speech intelligibility index score, additional disabilities, deprivation indices, ethnicity, and home language. Hearing aid datalogging values up to four years post-fitting will be analysed to investigate daily use and explore associations with sociocultural and clinical variables.

Results
Data collection is ongoing across participating sites. Pilot data (n=96, single centre) demonstrated a median use of 4.7 hours/day in the first two years post-fitting, with significantly lower use among children from more deprived backgrounds (p=0.01). Results from the full study cohort will be presented at the conference.

Conclusion
This study will provide the largest UK dataset to date examining hearing aid use in early childhood. Identifying predictors of daily use will help inform tailored support strategies for families, with the goal of optimising early language and developmental outcomes.

Keywords: Permanent childhood hearing loss; hearing aid use; early childhood; social determinants of health; equitable care.

69 - DEVELOPMENT OF AN ADULT REGULAR INTERVAL FOLLOW UP (RIFU) SERVICE

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Who is the patient group:
Our service has moved to a Patient Initiated Follow Up (PIFU) system. However, some of our patients struggle to reach out for support and cannot maintain regular contact or clinic visits. These patients have been moved to a Regular Interval Follow Up (RIFU) pathway.
This can include:
Adults with intellectual difficulties (AWID)
Cognitive decline/Cognitive issues
House/Bed bound/Mobility impaired
Sensory/visually impaired
Care home/residential home
Classed as potentially 'vulnerable' for any other reason

The aims of the RIFU service are:
To ensure regular contact and support is provided for vulnerable hearing implant patients, directly or indirectly through care givers and family members. This includes patients with all types of hearing implant devices
To avoid medical problems associated with the implant site and wound management care/advice.
To offer ongoing remote hearing support and arranging appointments or domiciliary visits if required.

How does the RIFU service work:
Patients have regular keeping in touch calls, emails and/or letters from the RIFU team. The team will triage the patients and determine the frequency and method of contact. This can be at three, six or twelve month intervals. These intervals can be adjusted accordingly by the team after each encounter with the patient. This ongoing evaluation is guiding iterative refinements of the clinical service protocol, ensuring the service remains responsive to patient's individual needs.
At each of these encounters, the team will be enquiring about updates or changes regarding:

- General health and wellbeing
- Mobility/Dexterity
- Device use and equipment management
- Skin/wound care
- Contact information

Skin care management:
At the time of the RIFU contact, the patient or a member of their support team are asked to email us a picture of the skin overlying the implant. A magnet that is too strong on the head can cause damage to the skin in this area, which is more common in elderly patients or patients with a thin skin flap. This is checked by the nurse specialist and uploaded to the patient's records. When equipment is sent to the patient it includes a QR code for our skin care advice sheet and a link to a video showing how to check the skin around the implant and processor. If there is concern regarding the patients skin an appointment is made with our nurse specialist either in the department or as a domiciliary visit. If left untreated, skin damage can lead to a breakdown of the skin and possibly an implant extrusion.
The RIFU criteria is evolving with patients being added as necessary. For example, we have expanded the criteria for RIFU to include patients who have had radiotherapy to the head and neck as we have seen a growing number of wound issues in these patients.

Audit section:
We are now conducting an audit of our RIFU service and contacts. This involves collecting data on number of RIFU contacts per week, length of contacts, device types of patients being contacted, total numbers of each device type within the RIFU cohort, number of referrals to and from specialist nurse and referrals to safeguarding. We are also collecting qualitative patient and carer feedback on RIFU contacts. We have had multiple cases of positive feedback from carers, family members and patients who have benefitted from the regular contact. Situations where patient's health/hearing has declined have been caught earlier due to the regular contacts. The RIFU service has helped prevent multiple other wound care incidents similar to others highlighted.

Remote programming/activation for AB remote:
Remote programming of patients' devices is now possible with Advanced Bionics cochlear implant software. This means that patients can have their devices activated or reprogrammed from their home/care home by a clinician in the clinic, if travelling to the hearing implant clinic becomes difficult. This is a convenient and time-efficient approach to clinical care and facilitates device optimization. In our clinical experience this has been successful and very beneficial for this group of patients, and we will continue to implement this service in our care package.

Keywords: Hearing implants, Adult patients, Vulnerable patients, Wound management, Remote care

80 - HEARFORFUTURE – IMPROVING HEARING CARE FOR OLDER ADULTS IN GERMANY

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Hearing loss affects over six million Germans aged 60 and older. However, despite modern hearing aid technologies many hearing impaired remain underserved. In January 2025 the first nationwide interdisciplinary project (HearForFuture) funded by the German Innovation Fund (G-BA) started with the aim to analyze structural, procedural and situational barriers to the provision of hearing aids in Germany.
A mixed-method approach is being pursued, combining secondary data from health insurance companies with primary qualitative data of focus group interviews and quantitative data from more than 500 patients and healthcare providers from all over Germany.
The study contains questionnaires for ENT doctors and patients, in which they can indicate their satisfaction with the hearing aid, the fitting process and the costs. Furthermore, ENT doctors were asked to provide information on prescribing and regulatory matters. Further, hearing-aid owners have the option to participate in an ecological momentary assessment (EMA) and in audiometric measures such as speech intelligibility with and without hearing aids and real ear measurement (REM).
This presentation will provide an overview of the project, the statistical methods and the initial results.
Keywords: age related hearing loss, hearing aid uptake, benefit, barriers

87 - HEARING PROTECTION IN UNIVERSITY MUSIC MAJORS

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While pursuing a music degree, during practice sessions, ensemble rehearsals, and musical performances, undergraduate student musicians are exposed to sound levels ≥90 dBA. Thus, they are at risk for early-onset hearing loss due to this sound exposure. The risk of this hearing loss can be mediated using hearing protection. Hearing protection devices (HPDs) reduce sound exposure, but most student musicians report using HPDs "Occasionally" or "Never." For those who use hearing protection, silicon, non-custom-type HPDs are used most frequently. The concern of student musicians is that, when using HPDs, their auditory experience might be distorted. Many student musicians reported either that they did not need hearing protection, they never thought of it, or that it was too expensive.

There are barriers to HPD use among undergraduate student musicians. One purpose of the current study was to overcome some of these barriers, representing three specific aims: 1) to collect questionnaire data specific to their performance histories and use of HPDs; 2) to obtain earmold impressions for appropriate earplug customization; and 3) to determine user satisfaction based on participant questionnaire responses.

San Diego State University (SDSU) undergraduate Music majors were recruited from various ensembles and from an introductory, general education music course (Music 151: Intro to Music Studies for Music Majors). The only inclusion criterion was that students were required to be formally enrolled at SDSU as a Music major. These data were collected as part of the Schools of Speech, Language, and Hearing Sciences and Music and Dance Hearing Conservation Program (HCARE: Hearing Conservation, Awareness, Research & Education). Informed consent was obtained from each participant, and an interviewer-administered survey was completed. This survey included questions specific to musicians (e.g., years of playing, type of instrument[s], and use of HPDs during rehearsal). Participants then scheduled their earmold impressions for earplug customization. Once the custom earplugs arrived, students were sent an anonymous satisfaction survey to complete, once they had used the HPDs a few times.

There were 103 participants with a mean age of 19.8 years (SD=2.8 years); 39 (37.9%) who identified as female, 62 (60.2%) as male, one (1%) as transgender male, and one (1%) as gender non-conforming. Students reported playing instruments for an average of almost 9 years (mean=8.8 years; SD=3.9 years) and slightly over 13 hours of weekly practice (mean=13.3 hours; SD=9.8 hours). Over 60% reported being taught about the effects of noise on hearing; yet, only 19.4% (n=20) reported wearing hearing protection. Of those 20 student musicians, only 4 reported using hearing protection 100% of the time. Twenty-one music majors (20.4%) reported that they felt they had a hearing loss, and over 40% reported experiencing ringing in their ears after practicing, rehearsing, or performing.

There were 77 student musicians who completed earmold impressions. Of these 77 students, 36 students (46.8%) chose -15 dB and 36 (46.8%) chose -25 dB of attenuation, while only 5 (6.4%) chose -9 dB of attenuation.

Thirty-two student musicians completed the anonymous hearing protection survey. Of these, over 70% (n=23) reported the highest level of satisfaction ("Strongly Agree") with the custom earplugs. Almost 60% responded either "Agree" or "Strongly Agree" when asked whether the music sounded just as good with the custom earplugs as when using no earplugs. Twenty-five (78.1%) reported that they could wear these earplugs comfortably during an entire practice or performance, while 18 (56.3%) reported that they plan to use the custom earplugs regularly for practice and rehearsals. Almost all of the student musicians who completed the hearing protection survey (n=30) responded either "Agree" or "Strongly Agree" when asked whether the custom earplugs provided sufficient protection, and 21 (65.6%) responded "Strongly Agree" that they would recommend wearing custom earplugs to their musician colleagues.

In summary, the HCARE program was successfully launched at SDSU and now includes over 100 Music majors. Almost 75% have received custom musician earplugs, and 93.5% chose -15 or -25 dB of attenuation. Even with a successful implementation of HCARE, more work is needed to ensure that all student musicians are comfortable wearing HPDs during most, if not all, practice sessions, rehearsals, and performances, providing consistent hearing protection when participating in musical activities involving sound levels that could potentially result in permanent hearing damage.

Key words: hearing; music; young adults; hearing protection

246 - HEARING HEALTH, CLASSROOM LISTENING, AND LOW COST INTERVENTIONS FOR SCHOOLCHILDREN: INTEGRATED FINDINGS FROM TANZANIA AND ETHIOPIA

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Background

Childhood hearing loss is a major yet often undetected barrier to learning in low resource settings, where schools lack routine screening, ear care capacity, and acoustically supportive classrooms. Preventable or treatable hearing loss often goes unnoticed, and children with permanent impairments rarely receive appropriate support. The I Hear You projects were established to address these gaps by mapping prevalence and causes of hearing loss, evaluating classroom listening conditions, developing context appropriate assessment tools, and testing feasible interventions. The work began in Tanzania, expanded to larger multi school screening and ear care initiatives, and was later extended to Ethiopia for comparative studies.

Materials and Methods

Tanzania

The first prevalence study screened 403 children in three rural schools using pure tone audiometry and otoscopy. A game based tablet screening tool was also piloted; it showed promising usability and it needs final validation to comply with the Medical Device Regulation (MDR) requirements. The screening programme was later expanded, and a second study screened 1082 children in grades 2–3 using ≥25 dB HL as criterion. This expanded study included pre and post intervention testing after cerumen removal and infection treatment. A Swahili Digit Triplet Test (DTT) was developed for speech in noise assessment. Classroom acoustics were measured, and three learning support strategies were tested: a directional personal amplifier, a teacher worn remote microphone system, and seating near the teacher.

Ethiopia

Two studies were conducted in Jimma:

1. A cross sectional screening of 396 children using pure tone screening ≥25 dB HL, otoscopy, wax removal, infection treatment, and referral.
2. A qualitative study with 12 pupils, parents, and teachers exploring experiences with neck worn personal amplifiers with built in microphone and supra aural headphones.

Results

Tanzania – Prevalence and Ear Care Outcomes

In both the 403 child and the 1082 child studies, a substantial proportion of children were found to have hearing loss – 11.5% in the first cohort, 23.2% in the second, and 34.8% in one vulnerable school. The underlying causes were largely similar across studies, with impacted cerumen being the most common preventable factor, followed by otitis, and occasional tympanic membrane perforations.

Pre /post intervention testing showed strong improvements after basic ear care procedures:

Among children with bilateral loss, nearly three quarters improved in both ears, and more than four fifths in at least one ear. Among unilateral cases, about four fifths improved. Mean improvements were 11–13 dB across groups. These findings demonstrate that much childhood hearing loss in Tanzanian schools is preventable and reversible through basic ear care.

Tanzania – Classroom Listening and Interventions

Measurements showed long reverberation times and high noise, creating short critical distances. The directional amplifier offered limited benefit, while the remote microphone system produced the strongest improvement, and seating near the teacher also helped. The Swahili DTT effectively assessed listening challenges.

Ethiopia – Prevalence and Causes

Screening found that 31.6% of children met the ≥25 dB HL criterion, with variation between schools (13–22% in four schools and 69% in one vulnerable school). Impacted cerumen was again the most common treatable cause. Many cases were reversible, and older children and girls showed higher prevalence.

Ethiopia – Experiences with Neck Worn Personal Amplifiers

Interviews indicated that the amplifier improved audibility, participation, confidence, homework engagement, and communication at home. Teachers reported better attentiveness and academic progress. Challenges included stigma, teasing, discomfort, fear of damage, lack of repair options, and reduced use in noise.

Participants emphasised the need for smaller, discreet devices, community awareness, and sustained follow up.

Conclusions

1. Childhood hearing loss is common, and much is preventable or reversible.
2. Large scale school based screening and basic ear care are feasible and effective.
3. Classroom acoustics strongly influence outcomes; remote microphone systems and seating strategies outperform simple amplification.
4. Neck worn personal amplifiers can enhance learning but require measures addressing stigma, comfort, and sustainability.
5. Effective support requires integrating ear health services, classroom acoustic considerations, and context appropriate assistive technologies.

Keywords: Childhood hearing loss; School-based hearing screening; Ear care interventions; Classroom acoustics; Assistive listening devices

IMPROVING HEARING CARE AND SERVICES III

131 - AUDITORY COGNITIVE TRAINING THROUGH THE LENS OF HOLISTIC HEARING CARE: FROM EXPLORATION TO IMPLEMENTATION

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This presentation examines the role of holistic hearing care in promoting healthy aging, with particular emphasis on the integration of digital tools into clinical practice. Auditory cognitive training (ACT) has emerged as a promising add-on to traditional audiological interventions, addressing the cognitive demands of listening. This presentation reviews current research findings on the efficacy of a digital auditory cognitive training application that employs gamified training modules aimed at improving cognitive processes relevant to speech comprehension in noise. Current results highlight its potential to deliver meaningful benefits for older adults with hearing loss. Beyond efficacy, the presentation examines practical considerations and key challenges associated with integrating ACT into routine clinical hearing care and highlights the role of ACT as a scalable, patient-centered tool to support long-term hearing health and healthy aging.

Key terms: holistic hearing care, auditory cognitive training, healthy aging

Conflict of interest: one or more authors have declared an industry affiliation

349 - CONCEPTUALIZING A FRAMEWORK FOR ASSESSING AUDITORY FUNCTIONING IN THE THAI EARLY HEARING DETECTION AND INTERVENTION SYSTEM

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In 2022, the Thai National Health Security Office offered a complimentary hearing screening service for all newborns as part of the benefits package under the Universal Coverage Scheme. The implementation of that policy led to the nationwide expansion of newborn hearing screening in Thailand. To fully realise the benefits of early detection and intervention for hearing loss, it is essential to consider the developmental outcomes of these children. According to the Joint Committee on Infant Hearing (JCIH), systematic assessment across early childhood is necessary to ensure that children identified with hearing loss are appropriately fitted with hearing devices *and* are developing listening skills capable of supporting their language development. The Thai National Newborn Hearing Screening Guidebook provides suggestions on standard practices covering the screening stage to hearing management (device fitting) and intervention. However, it does not address how children's auditory functioning abilities (e.g., functional listening skills, speech perception abilities, and the ability to listen in noisy environments) should be systematically assessed and monitored throughout the program. The research discussed in this presentation was designed to conceptualise a pilot framework for the comprehensive assessment and ongoing and monitoring of the development of auditory functioning abilities by children in the Thai Early Hearing Detection and Intervention (EHDI) system.

Objectives: The project aims to:

1. Describe current practices in assessing children's auditory functioning in well-governed highly effective EHDI systems (in this study, the Australian and New Zealand systems) as the basis for determining the minimum requirements for an evidence-informed assessment framework for auditory functioning abilities across early childhood development.
2. Describe the current practices in auditory functioning assessment in Thai EHDI system.
3. Compare and contrast the minimum requirements derived from the Australasian (i.e., Australian nd New Zealand) context with the current approaches and local context for the Thai EHDI system to create a draft framework for assessing auditory functioning skills in children in the Thai EHDI system.
4. Evaluate the readiness of Thai EHDI programs to implement the draft framework for auditory functioning assessment in their services.

Methods: This research is a multi-method study consisting of several sequential phases.

- *Phase 1 (Australia and New Zealand)*: A survey of current practice in auditory functioning assessment in Australia and New Zealand. This phase used a mixed-methods study including nation-wide surveys and focus group interviews with a consensus-building approach to identify (a) current practices, (b) the critical skill domains assessed, (c) the critical time points for assessment of those domains, and (d) the key characteristics of assessments to be used in each of those domains and time points.
- *Phase 2 (Thailand)*: A parallel survey to Phase 1 conducted in Thailand, allowing for a subsequent comparison with the findings from Phase 1 with the aim of identifying key contextual differences as the basis for the codesign of a pilot assessment framework for auditory functioning abilities for the Thai EHDI system.
- *Phase 3 (Thailand)*: Evaluation of the readiness of programs within the Thai EHDI system to implement the pilot framework for assessment of auditory functioning abilities by surveying a national sample of EHDI professionals using the Organizational Readiness for Implementing Change scale (ORIC).

Results: The outcomes of Phase 1 (Australia and New Zealand) will be reported in this presentation. Surveys were returned by professionals working in four key components of the EHDI pathway: (a) Infant diagnostic audiology, (b) hearing management (i.e., assessment and fitting of hearing aids); (c) cochlear implantation and associated habitation, and (d) early intervention. Survey responses were received from across Australia and both Islands of New Zealand. Respondents included audiologists, speech pathologists, and teachers of the deaf. Analysis of the survey data yielded a profile of the most assessed auditory skills domains, the instruments most used to assess those domains, and the typical time points at which those instruments were used.

Subsequently, focus group interviews were used to explore the features of auditory functioning measured by those instruments and the features that interviewees considered important but could not be assessed by the instruments identified. Results will be discussed in terms of the ensuing draft framework and plans for Phase 2 of the research in Thailand.

Keywords: EHDI systems, Thailand, assessment, auditory functioning

351 - MAPPING WORKFORCE AND SERVICE DELIVERY MODELS ACROSS THAILAND'S EARLY HEARING DETECTION AND INTERVENTION (EHDI) PATHWAY: A QUALITATIVE SYSTEMS STUDY USING FRAM

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Globally, permanent childhood hearing impairment (PCHI) affects 1-2 per 1,000 newborns. Without timely detection and intervention, PCHI can hinder speech, language, cognitive, and socio emotional development. Early Hearing Detection and Intervention (EHDI) programs improve outcomes when screening, diagnosis, and intervention occur promptly and are supported by sufficient workforce capacity and coordinated systems. However, in many low- and middle-income countries (LMICs), shortages of trained personnel, centralized diagnostic services, and uneven access to services lead to delays and loss to follow up.

Thailand's EHDI system experiences many of these challenges, including gaps in referral pathways, limited interprofessional coordination, and system constraints. Although there is recognition of the need for better workforce planning and redesigned service delivery models, limited systematic evidence exists on how the Thai EHDI pathway functions in practice. Most research focuses on screening coverage or clinical outcomes rather than the workforce structures, service configurations, and contextual realities that shape "work-as-done." Understanding these dynamics is essential before undertaking redesign. Insights from mature, high-performing EHDI systems, such as those in Australia, may help identify feasible adaptations for Thailand.

The project discussed in this presentation aims to map how Australia's and Thailand's EHDI pathways function in practice across different service delivery models and healthcare contexts, guided by the Functional Resonance Analysis Method (FRAM), with a view to codesigning new workforce and service delivery strategies for Thailand. Specifically, the project aims to identify:

1. *Workforce structures and scope*: Roles, scope of practice, capacity, and distribution across screening, diagnosis, audiological management, and early intervention.
2. *Constraints and training needs:* Workforce constraints and training needs, and the context-specific adaptations shaping "work-as-done."
3. *System features:* Referral pathways, information flows, infrastructure, and policy implementation factors influencing progression toward JCIH 1–2–3 benchmarks.
4. *Design implications:* Leverage points for strengthening workforce strategies and redesigning service delivery models in subsequent research phases.

Methods: This is a multi-phase mixed methods study integrating qualitative systems mapping, comparative analysis (between Australia and Thailand) and stakeholder codesign. The Functional Resonance Analysis Method guided data collection and analysis to characterize "work as done" and performance variability across the EHDI pathway in multiple settings in three Australian States (i.e., representing different models of service delivery including centralized, decentralized, and hybrid delivery with telehealth components), and three Thai health districts reflecting urban, regional, and rural/remote contexts to ensure contextual diversity for model design and testing. The study is proceeding through multiple phases:

- *Phase 1 (Australia – work as done)*: Semi structured interviews and document review to map workforce and service delivery models in three states; FRAM used to model diagnostic and intervention processes and quality assurance feedback loops.
- *Phase 2 (Thailand – work as done)*: Semi structured interviews with national and district stakeholders to map services, processes, gaps, and constraints (policy, infrastructure, workforce).
- *Phase 2A (Thailand – workforce gap analysis):* Interviews with pediatric audiologists and relevant providers to examine roles, capabilities, and gaps; alignment of current competencies to requirements under centralized, decentralized, and hybrid models; opportunities for redistribution, task sharing, and upskilling.
- *Phase 3 (Thailand – work as imagined):* Expert advisory workshops (Thailand and Australia) to codesign feasible workforce strategies and service delivery models, evaluated via cost–consequence analysis for efficiency, scalability, and implementation readiness under minimal system change/maximum efficiency principles.

Deductive-inductive coding of transcripts is being used to identify themes related to workforce structure, service configurations, referral pathways, quality assurance, and system constraints. FRAM (inputs, outputs,

preconditions, resources, controls, time) will be used to characterize interconnections and variability across the EHDI pathway. Separate models by state/district will enable cross case comparisons where possible.

Results (Australia only): The outcomes of the Phase 1 (Australia – work as done) will be reported in this presentation. System-level insights demonstrate the presence of a trained and skilled workforce which is strengthened through communities of practice and processes such as co-signing of AABR waveforms or reports. Moreover, practice and outcomes are supported by system-based feedback loops which; through good governance, effective data management, and quality assurance processes; ensure timely identification of errors (for example, clinician or equipment errors), followed by prompt management to address and correct any such errors.

Keywords: EHDI Systems, Thailand, Workforce, Pediatric, FRAM

149 - OTOLOGICAL AND AUDIOLOGICAL CARE FOR PATIENTS WITH COMBAT-RELATED EAR INJURIES DURING THE WAR IN UKRAINE: OPPORTUNITIES AND CHALLENGES

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Introduction
The war in Ukraine has been continuing since 2014, and after wide-scale hostilities in 2022, there was a need to quickly deploy additional medical facilities to treat a larger number of wounded.
An analysis of the nature of injuries in the first months of 2022 determined the priorities of military medicine, including otolaryngology and audiology. During the first year of the war, 90-95% of all combat injuries were blast injuries caused by mines, drones, artillery and other explosive devices. This trend continues to this day. The modern battlefield is dominated by drone warfare. Every day, civilians who find themselves in the blast zone of explosive devices suffer from explosions. The ears are one of the most sensitive organs affected by explosions.
Material and Methods
Analysis of the organization of otosurgical and audiological care during military operations with a high level of use of explosive weapons affecting military personnel and civilians.
Results
Two types of ear injuries are treated in otosurgery centers: blast trauma, with damage to the middle and inner ear, and shrapnel and bullet wounds to the temporal bone.
A three-stage surgical treatment regimen has been introduced for middle ear blast injuries.
Primary care for acute blast trauma of the ears is provided at primary medical care points after the soldier has been removed from the battlefield. Further treatment of audiological disorders takes place in otolaryngology departments or in other departments for associated injuries under the supervision of an otolaryngologist.
Initial estimates indicate that surgical treatment of the ears may be necessary for between 50,000 and 80,000 of those injured. The number of patients with hearing loss, vestibular disorders, tinnitus, and central and peripheral hearing and speech disorders runs into the hundreds of thousands.
Conclusions
Military and civilian otolaryngology and audiology underwent significant reform during wartime. Algorithms were created for treating otosurgical and audiological patients with acute and chronic disorders following blast trauma. A huge number of active military personnel, veterans, and civilians are awaiting otosurgical, audiological, and otoneurological assistance. Despite a significant increase in otological and audiological care, the number of people requiring treatment and rehabilitation is estimated in the hundreds of thousands. These are patients with peripheral and central hearing disorders, intense tinnitus, and balance disorders.

Keywords: Blast ear trauma, hearing loss, otosurgery, military medicine

INDUSTRY PARTNERSHIP SYMPOSIUM

360 - NUANCE AUDIO GLASSES: CLINICAL EVIDENCE AND EMERGING INSIGHTS

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Hearing loss is a highly prevalent condition, with the majority of affected individuals presenting with mild-to-moderate impairment, yet hearing-aid adoption rates remain low. Despite growing evidence linking untreated hearing loss, even in its early stages, to reduced quality of life and increased risk of cognitive decline, significant barriers such as stigma and limited acceptance continue to delay intervention. In this context, there is a pressing need for accessible, user-friendly solutions that can facilitate earlier engagement with hearing care. Recent advances in over-the-counter (OTC) hearing technologies, including open-ear amplification systems, are reshaping the audiological landscape by offering new entry points for individuals not yet ready for conventional hearing aids.

This symposium will explore the evolving OTC ecosystem across Europe, beginning with an overview of regulatory frameworks and market access for mild-to-moderate hearing impairment (**Anke Lesinski, Germany**). A technical deep dive into Nuance Audio Glasses will outline the open-ear platform, directional processing, and user interface design (**Andrea Abbate, Italy**). Clinical evidence from recent studies conducted by National Acoustic Laboratories and Western University will be presented, highlighting improvements in speech understanding and listening effort in noise (**Nara Vaez, France**). Finally, real-world audiometric outcomes and patient-centered benefits of OTC hearing aid glasses will be discussed, offering insights into their role as an early-intervention tool within the broader hearing care pathway (**Roberto Albera, Italy**).

Rather than representing an alternative to conventional hearing rehabilitation, these solutions may serve as a complementary entry point, helping to intercept early-stage hearing difficulties and reduce listening effort in noise for individuals with perceived mild to moderate hearing loss individuals.

INDUSTRY PARTNERSHIP PRESENTATIONS

326 - A FRAMEWORK FOR INTEGRATING SOUND PREFERENCE INTO PERSONALIZED HEARING AID ADAPTATION

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Background
Hearing aid rehabilitation provides audibility but users still show wide variation hearing aid use and satisfaction. Some report that amplified sound feels effortful, unnatural, or “not right,” even when fittings meet audiological targets. These experiences suggest that successful outcomes depend on more than amplification alone. How clients perceive and emotionally respond to amplified sound, including comfort, listening effort, and personal meaning, forms what we term sound preference. Despite its relevance, sound preference is not systematically used to guide individualized decisions. When hearing care professionals and clients collaboratively explore these experiences, hearing care may become more personalized and engaging. Structured opportunities to express preferences may help identify better-matched solutions while fostering empowerment, confidence, and ownership.
Methods
This work presents the Sound Preference Framework conceptualized through a theoretical synthesis.
Literature from auditory and affective neuroscience, cognitive psychology, and social and cultural psychology informed a Sound Preference Formation component. Motivational and person-centered perspectives including Self-Determination Theory, Shared Decision-Making, hearing empowerment, and Self-Efficacy Theory informed a Sound Preference Approach component. Cognitive, behavioral, and communication-oriented theories, including cognitive load theory, framing theories, choice architecture, Sense of Coherence theory, decision-making research, autonomy-supportive communication, and metacognitive reflection, informed a Sound Preference Exploration component.
Results
The outcome of this work is the Sound Preference Framework, a three-part conceptual model describing how sound preference develops, why it is clinically relevant, and how it can be explored in practice. In this presentation, particular emphasis will be placed on the Approach and Exploration components, highlighting practical considerations for HCPs who wish to integrate sound preference into daily clinical practice and support a positive rehabilitation pathway.
Sound Preference Formation - How preferences develop
The formation layer conceptualizes sound preference as a dynamic process explained by four interacting psychophysiological mechanisms. *Sensory comfort* reflects perceptual ease or strain, *Emotional reward* captures affective responses that reinforce approach or avoidance, *Cognitive ease* relates to predictability of sound perception and listening effort, and *Social meaning* reflects alignment with identity and life context. Together, these mechanisms help explain why identical hearing aid sounds may be experienced differently across clients.
Sound Preference Approach - Why addressing preference matters
This component outlines the rationale for addressing sound preference as part of rehabilitation. When clients are invited to take part in decisions about how they hear, sound preference becomes a meaningful part of the rehabilitation process. Having the opportunity to shape their listening experience may support a sense of agency, confidence, and personal connection to hearing solutions. Depending on personal and contextual moderators, incorporating clients´ sound preferences into clinical interactions may promote a more positive rehabilitation pathway. When clients perceive adequate support and manageable decisions, this may foster their engagement in rehabilitation and strengthen their sense of hearing aid ownership.
Sound Preference Exploration - How preference is explored in practice
This component translates the approach into a structured clinical process for comparing and reflecting on sound experiences. It emphasizes framing the task, whether through an online A/B sound or real-life hearing aid comparison, as an invitation to explore rather than a test, using supportive language and reduced technical complexity to promote emotional safety and ease participation. Guided reflection focuses on comfort, listening effort, and personal resonance rather than solely technical performance. The process can support clients in noticing and articulating how different sounds relate to their daily activities and preferences. Reinforcing the client’s role in shaping the outcome may help build confidence and ownership, supporting the positive rehabilitation pathway described above. Even when a clear preference does not immediately emerge, participation itself may strengthen trust and engagement.

Conclusion

The Sound Preference Framework provides a structured way of understanding, addressing, and exploring how clients relate to amplified sound. By linking preference formation with a clinical stance that values meaningful choice and guided exploration, the framework shifts attention from fitting optimization toward listening experience. Integrating sound preference into clinical interaction is proposed as a new way to support more personalized rehabilitation and strengthen engagement with hearing solutions and hearing care professionals.

Keywords: Preference exploration, Person-centered care, Autonomy, Empowerment

169 - ASSESSING PATIENTS' PREFERENCES FOR DISTINCT HEARING AID SOUND DESIGNS TO INFORM HEARING AID RECOMMENDATION

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Background/Rationale
In clinical audiology, successful outcomes depend on patients being able to engage effectively with their acoustic environments – for example by participating in conversations, understanding speech, and recognizing everyday sounds. In practice, this requires that patients adapt smoothly to their hearing aids. This can be challenging, as no single hearing-aid brand consistently matches the needs and preferences of all patients. Clinicians know that a good hearing experience is achieved differently for different patients. What feels natural for some can sound harsh to others; one type of sound processing may seem jarring while another allows to relax into the sound. With all this in mind, it may be useful to research the sound preferences of audiology patients, in order to develop tools that encourage and facilitate the assessment of sound preferences by patients and by clinicians, so that individual sound preferences can be taken into consideration when recommending a hearing aid brand.

Materials and Methods
An online study of sound preferences was conducted using the SenseLabOnline listening test platform (FORCE Technology). Participants with self-declared hearing difficulties were recruited on the Prolific platform. Their hearing was assessed with the ShoeBox Online hearing screening test and participants found likely to have normal hearing were excluded; the remaining participants were invited to complete the sound preference study. To mitigate the risk of participants not engaging continuously throughout the online task, four attention checks were embedded in the study flow. Participants who failed these checks were excluded from the study, resulting in 248 participants (63 ± 7 years, 125 women) who successfully completed the study. During the study, participants listened (unaided, over headphones) to ten different sound scenes recorded on an acoustic mannequin fitted with hearing aids with two distinct sound designs programmed for a moderate sloping hearing loss. For each scene, participants switched freely between the two recordings and used rating scales to rate their preference for one of the two hearing aids (forced-choice design). After judging all the scenes, participants were asked to reflect and rate their overall preference, and to explain the reasons for it. Participants also completed questionnaires about their hearing needs and hearing-related lifestyle.

Results
Participants' overall preferences were split almost evenly (53/47) between the two hearing aid sound designs. Around 30% of the participants rated their overall preference as strong, evenly split between the two brands (15/16). Overall preferences were moderately consistent with by-scene preferences: on average, participants selected their overall preference in 6.4 out of the 10 scenes; however, the degree of deviation varied across scenes. Preferences could not be predicted by demographic variables, hearing needs, or hearing-related lifestyle.

Conclusions
The fact that sizeable proportions of participants expressed strong preferences for one of the two sound designs is encouraging and confirms the relevance of this line of work. The findings also directly informed the development of a sound preference tool aimed at assessing audiology patients' sound preferences, to guide the selection of a preferred hearing aid brand. In particular, the preference results emphasized the need for careful selection of audio scenes, and comments from participants highlighted the importance of presenting clear, audible differences between hearing aids, delivered in a clear interface, easy to understand and use. Building on these insights, we developed a bespoke online preference tool for sound preference assessment, freely available on https://soundpreference.net/, ready to be deployed in clinical settings.

Keywords: sound preferences, hearing aids, hearing care, sound design

327 - SAME WORDS, DIFFERENT MEANINGS: HOW LISTENER LANGUAGE USE REFLECTS SOUND PREFERENCE

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Background:
Sound preference plays a role in how individuals experience hearing technology in everyday life. Beyond audibility and speech understanding, listeners evaluate sound in terms of comfort, realism, and how well it supports their participation in different listening situations. In both clinical and research contexts, people commonly use everyday language; terms such as “clear”, “natural”, or “background noise”, to explain why they prefer one sound over another.
These terms are often treated as if they have shared meanings, yet they may reflect different listening priorities and expectations. Examining how listeners spontaneously use this language can therefore provide insight into the perceptual values underlying sound preference.
The aim was to qualitatively explore how listeners describe sound in their own words and to examine how common descriptors, particularly clarity, naturalness, and background noise, relate to patterns of sound preference.

Methods
Data were drawn from three independent online comparative listening studies involving adult participants (total N 300). In each study, listeners performed A/B comparisons between two different hearing aid sound processing conditions across ecologically relevant listening scenes, including speech, environmental soundscapes, music, and natural sounds. The participants were listening to four different sound processing types, three frequency-based and one time-based. After each comparison, participants selected their preferred condition and provided open-ended written comments (829 in total) explaining their choice, without being prompted to address specific sound attributes.
Responses were analyzed using a combination of qualitative and quantitative thematic analysis. Descriptive terms and phrases were identified and coded into semantic themes reflecting different perceptual interpretations. Coding focused on how listeners spontaneously described their experiences and which aspects of sound they emphasized when justifying their preferences. The frequency of thematic references was quantified to identify dominant patterns, and language use was examined in relation to stated preferences to explore how different meanings of the same descriptor aligned with different preferred sound conditions across studies.
Results:
Listeners consistently used similar descriptive terms to refer to different perceptual qualities, and these differences were associated with different sound preferences like:
Clarity was described both as increased distinction in speech and fine detail, and as reduced competition or distraction, where sounds were easier to follow with less effort. These interpretations aligned with preferences for sound that either maximized the acoustic information or supported easier listening.
Naturalness was used to describe either a realistic acoustic environment with depth and environmental presence, or a balanced and comfortable sound that felt smooth and non-fatiguing. Listeners who focus on the distinction and detail tended to prefer sound conditions that revealed more acoustic information, whereas those who focused on reduced distraction tended to prefer conditions that felt easier to manage.
Background noise was described either as informative environmental context contributing to realism and awareness, or as interference that increased listening effort. These contrasting interpretations aligned with preferences for sound that either exposed or reduced surrounding sounds.
Conclusions:
Everyday sound descriptions reflect different perceptual priorities that are closely linked to sound preference. Words such as *clear*, *natural*, and *background noise* do not map to single acoustic properties but reflect different ways listeners evaluate and prioritize their auditory experience. Understanding how clients spontaneously describe sound can help hearing care professionals identify what aspects of listening matter most to them, supporting more effective sound preference exploration and more personalized, participation-focused hearing care.
Keywords : Sound preference, Sound quality, Perceptual attributes, Personal descriptors

AUDITORY TRAINING

148 - AUDITORY PLASTICITY: A SYSTEM FOR TRAINING PEOPLE TO IMPROVE SOUND LOCALIZATION

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Research spanning over a decade from the Virginia Tech Auditory Systems Lab emphasizes that auditory situational awareness (ASA) -- specifically the ability to localize sounds in azimuth -- is a critical yet often compromised skill in military and civilian environments. While humans possess high natural accuracy in open-ear (unoccluded) localization, this capability is degraded by hearing protection devices (HPDs), Tactical Communication and Protective Systems (TCAPS), and even civilian earphones. However, empirical evidence demonstrates that targeted auditory training can mitigate these deficits and in some cases, restore performance to near open-ear levels.

While normal-hearing individuals typically exhibit high azimuthal accuracy with the open-ear, research shows that even these baseline levels can be improved through optimized training protocols. The challenge arises when users wear TCAPS, intended to provide both hearing protection and ambient sound pass-through, and even occluding earphones. These devices impose an "artificial acoustical imprint" by altering or removing the natural anatomical structures (the pinnae) that the brain uses to process spectral and temporal cues. This results in increased angular error and a higher frequency of front-back reversals, where a listener perceives signals from the front as coming from behind or vice-versa.

To address these challenges with ear-occluding devices, researchers developed two specialized hardware/software interfaces:

- DRILCOM (Detection-Recognition/Identification-Localization-Communication): A laboratory-grade test battery designed to establish objective metrics for ASA, utilizing high-fidelity speaker arrays to present signals and record responses. Although the system was initially developed as a test system for TCAPS, auditory localization training is also possible.
- PALAT (Portable Auditory Localization Acclimation and Training System): A field-deployable, portable system featuring an expandable circular frame with 24 azimuthal loudspeakers. This system allows for training in barracks or office spaces, and has been empirically proven to be as effective as the laboratory-grade DRILCOM system and validated against outdoor trials.

The testing/training protocol utilizes a one-second "dissonant" broadband tonal complex, consisting of eight non-harmonic tonal components spanning 104 to 7880 Hz. This signal provides robust cues across a wide frequency spectrum, forcing the brain to adapt to the specific distortions introduced by a device. Training is most effective when conducted in an adaptive learning sequence where the trainee receives immediate feedback and concentrated repeat practice on azimuthal directions showing poor performance. The optimized training protocol reduced overall training time from 12 hours to 1.25 hours to reach auditory localization performance asymptote. Using the PALAT system, subjects were trained under three hearing conditions: Open-Ear (OE) condition wherein subjects did not wear any devices; In-The-Ear (ITE) condition, wherein subjects wore a 3M TEP-100, a triple-flanged, electronic pass-through earplug that inserts into the ear canal; Over-The-Ear (OTE) condition, wherein subjects wore a 3M ComTac III electronic pass-through earmuff which covers the pinnae. Briefly, the results were as follows:

- OE: Subjects started at a high performance level, ~82% absolute accuracy, pre-training and improved to ~93% (e.g., improvement of 11%) via training.
- ITE Device: Subjects performed at 30% pre-training, and improved to 49% after the training (e.g. improvement of 19%).
- OTE Device: Subjects performed at 47% pre-training, and improved to 66% after the training (e.g. improvement of 19%).

Notably, trained subjects also exhibited fewer front-back reversals, suggesting that the training successfully instills a more robust mental map of the acoustic environment that carries over to novel, high-stress sounds.

A subsequent field validation experiment exhibited that PALAT training successfully transfers to real-world environments. After subjects were PALAT-trained in the lab, they transferred to a field experiment to measure outdoor auditory localization. The field validation experiment used live blank gunshots at distance of about

150-feet from the subjects that produced a similar sound pressure level as the dissonant tonal training signal. The trained group performed better than an untrained control group under both OE and ITE hearing conditions. In summary, while electronic pass-through hearing protection devices inherently degrade the natural cues for sound localization, the human auditory system possesses sufficient plasticity to overcome these distortions through structured training, at least for some devices and the open-ear as well. Therefore, PALAT training offers a means by which soldiers and other trainees can improve their auditory localization performance, with or without an electronic hearing protector, prior to deployment into operational environments that pose danger.

Key-words: auditory training, auditory situation awareness, sound localization, hearing protection.

325 - USE OF EYE-TRACKING TO EVALUATE MELODY RECOGNITION FOLLOWING EARLY MUSIC TRAINING FOR INFANTS

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Introduction: There is considerable research documenting the benefits of music instruction in adults as well as in children. One line of research has focused on the relationship of language and music, both of which require rhythm, in order to convey meaning. They both stem from smaller units – syllables and musical beats and include precise movements, repetitive practice and focused attention. There is a need to evaluate this link in young children particularly those with hearing loss. However, until the work of Dr. Shinichi Suzuki, there has been limited attention to music instruction during the critical period. Dr. Suzuki made an important observation that all children learn to speak their native language effortlessly by listening to the adults in their environment. This was the basis for his development of the "mother-tongue" method of music instruction in 1983 that relies heavily on auditory input. This method includes sequential melody introduction, significant parental involvement, instruction at a very young age with emphasis on ear training rather reading musical notation, and engagement with a musical community. It can be hypothesized that an intensive musical experience for young children may result in enhanced perceptual abilities that apply not only to music but also to speech reception of fine acoustic cues which may in turn facilitate speech and language development. The purpose of the Baby TEMPO (Training Early Music with Parental Observation) project was to evaluate the use of eye-tracking to measure effects of the early music training based on the Suzuki approach for infants/toddlers with typical hearing prior to investigating the approach with those with atypical hearing.

Method: Six participants, ages 1:4 to 3:5 years, with typical hearing and developmental history and their parents participated in three, six-week sessions of Baby TEMPO classes. The training consisted of small group sessions with a consistent repertoire of music. During each class, the parents facilitated their child's participation by modeling the actions and reinforcing their child's attempts to participate. In addition, parents were asked to play the music daily as much as possible at home. Parents also documented their child's daily listening to the songs and provided weekly anecdotal evidence of melody recognition by their child such as making the motions to the songs. At the conclusion of the third, six-week session, sophisticated eye-tracking measures were collected using a state-of-the art Tobii Pro Eye Tracking System. The eye tracking measures included total duration, time to first fixation, number of fixations, duration of first fixation, and pupil diameter. Measures were taken while the child was presented six of the familiar class songs coinciding with photos of the corresponding instruments shown on a monitor.

Results: All parents reported some evidence of melody recognition over the course of the three, six-week sessions. Melody recognition on the eye-tracking measures was considered evident if the child demonstrated a differential eye metric to the "correct" instrument that matched the song that was played. For example, a "hit" was recorded when the child demonstrated a shorter time to first fixation for the correct photo or a longer total fixation duration while looking at the correct photo that matched the song that was played compared to the incorrect photo. All infants showed recognition through one or more of the eye tracking measures across the six songs. For example, for one song four of the six children showed a greater number of fixations on the correct photo compared to the incorrect. The two who didn't show this effect showed evidence of recognition by a substantially faster time to first fixation to the correct photo than to the incorrect one.

Conclusion: Of the six eye-tracking metrics, the time to first fixation yielded the most consistent evidence of melody recognition. The lack of consistency across the measures may be affected by the variation in overall attention to the task. Future post-training assessments may be planned over multiple days. Results may also be compromised by the short training duration of only 18 weeks. The results suggest that the use of objective eye-tracking measures may allow for observation of the benefits of early music training for infants who experience language delays such as those with hearing loss.

Key Words: Auditory training, Speech and language development, Music

235 - A NOVEL NATURALISTIC DUAL-TASK EAR TRAINING PARADIGM WITH REAL-TIME MULTIMODAL GAMIFIED NEUROFEEDBACK FOR COCHLEAR IMPLANT USERS

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Cochlear implants (CIs) are the oldest and most widely used neural prosthetic, but CI users experience listening fatigue more readily than normal-hearing individuals. This can discourage consistent CI usage and lead to a reduced quality of life. Previous work has shown that ear-training tasks can improve real-world listening outcomes, but have relied on tedious, contrived stimuli such as strings of numbers or words. Our aim is to develop a fun, engaging listening task that simulates the demands of a real-world listening environment using episodes of a TV show, and to provide game-like rewards for good listening performance derived from real-time electroencephalography (EEG). In the task we have developed, subjects must follow a target audiovisual stimulus (an episode from a TV show) while ignoring a distractor as it alternates between their left and right sides at cued intervals. A multivariate temporal response function (mTRF) is used to generate a reconstruction of the perceived stimulus from the EEG signal, which can then be compared with the actual stimulus that was presented. If the two are highly correlated, the participant is rewarded with a star animation, encouraging their further progress. A pilot study of six participants suggests that our novel task is better suited for ear-training using realistic audiovisual stimuli than a traditional version of the task. We obtain higher mean neural tracking of the target stimulus (mean Pearson correlation coefficient of 0.13 vs. 0.09, $p<0.01$) and better suppression of the ignored stimulus. Learning to manage the cognitive demand associated with CI use is essential to maximize its benefit. The task we have developed would enable CI users to practice listening in a fun, engaging way, which may translate to better real-world listening abilities and an improved quality of life.

Keywords: brain-computer interfaces, gamification, dual-tasking, auditory attention, cochlear implants, cocktail party effect, electroencephalography

PANEL DISCUSSION

From school to care homes: inclusive hearing care for vulnerable populations

Organized by Alev Pektas Sjöstrand

Alev Pektas Sjöstrand [1] - Beatrice Gardelin Novkovic [2] - Hassnaa Griouach [3]
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This special session focuses on hearing care for people with intellectual and cognitive disabilities, both children and older adults. The aim is to share practical experiences and influence the delegates on how audiological support can be implemented in everyday life.
The session starts with a pilot project which we have started for people with dementia who live in care home. It looks at the challenges of identifying hearing problems, following up hearing care, and adapting interventions for people with dementia. Focus is placed on person-centered care.
The second speech is about school settings for children with intellectual disabilities. It discusses hearing aids and other hearing technology, and how these can be adapted to work better in daily school life. Practical strategies are shared to improve access and use and acceptance of hearing technology. The importance of cooperation between schools, parents, and health care services is highlighted.
The session ends with a presentation on aided cortical testing as an objective way to verify the benefit of hearing aids in children with intellectual disabilities. The method is also discussed as a possible future tool for adults with dementia where traditional verifying methods can be difficult to use.
In summary, the session includes three presentations of a life-course perspective on inclusive and evidence-based hearing care.

INDUSTRY PARTNERSHIP PRESENTATIONS

159 - MACHINE-LEARNING–DRIVEN AI FOR RAPID BRAIN-RESPONSE BASED HEARING ASSESSMENT

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Background:
Unaddressed hearing loss affects over 1.6 billion people worldwide, disproportionately impacting populations unable to reliably complete subjective hearing tests—such as infants, elderly adults, and individuals with cognitive or physical impairments. These diagnostic gaps contribute to delayed intervention and long-term cognitive and social consequences.
Objective:
To introduce RAPID CAEP®, a novel, non-invasive hearing assessment technology implemented within the SOFI® system and designated by the U.S. Food and Drug Administration as a Breakthrough Device, which leverages cortical auditory evoked potentials (CAEPs) and artificial intelligence (AI) to provide rapid, objective hearing measurements without requiring patient response or sedation.
Methods:
Sofi® uses a semi rigid 8-channel EEG headset to capture brain responses while the patient listens passively to brief sound stimuli (chirps) and watches a silent video. The system's proprietary Rapid-CAEP® stimulation protocol and advanced signal processing allow accurate detection of late latency auditory brain responses on awake subjects. AI-driven analysis interprets auditory evoked responses in real time, compensating for movement and environmental noise. The result is an automated multi frequency air- or bone-conduction measurement generated within minutes on awake patients.
Results:
Preliminary trials conducted at the University of Oldenburg in 2023 demonstrated that Sofi® achieves hearing threshold estimations within 7 dB of standard pure-tone audiometry in under 10 minutes. The system received the 2024 WCA Innovation Award for its clinical potential. Regulatory certification is in progress. Sofi has been granted Breakthrough Device Designation by the FDA in December 2025.
Conclusion:
Sofi® represents a significant step forward in accessible hearing care, enabling reliable, objective measurements in populations historically underserved by conventional methods. Its speed and ease of use make it a promising tool across clinical and community settings.

96 - FMPI: A GENERALIZED DETECTOR FOR EVOKED POTENTIALS IN THE TIME AND FREQUENCY DOMAINS

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Reliable detection of evoked potentials (EPs)—including peripheral, midbrain, and cortical responses—remains challenging due to substantial physiological background activity. Conventional approaches typically require averaging hundreds to thousands of stimulus-evoked responses to achieve an adequate signal-to-noise ratio for statistical inference, and many established detection methods depend on assumptions that are frequently violated in practice. To address these limitations, we developed the Fmpi, a statistical detection framework that estimates the parameters of the underlying parametric F distribution at the individual level and in real time, leveraging both the temporal dynamics and spectral colour of the background noise.
In this study, we demonstrate that the Fmpi provides a unified approach for EP detection in both the time and frequency domains. Using simulations and human auditory recordings—including auditory-brainstem, cortical, and steady-state responses, with data collected from both adults and infants, including individuals with and without hearing loss, in a variety of clinical and research contexts—we show that the Fmpi maintains appropriate sensitivity while substantially reducing total testing time due to faster detections.
Beyond improved detection efficiency when a response is present, we further show that a newly introduced futility-detection method enables early termination of recordings that are unlikely to yield a detectable EP, thereby achieving additional time savings. Comparative evaluations against state-of-the-art approaches, including computationally intensive bootstrap-based detectors, reveal that the Fmpi offers comparable or superior performance across both time and frequency domains.
Collectively, these findings establish the Fmpi as an efficient and generalizable framework for EP detection across diverse electrophysiological signal types, suitable for clinical and research environments.

Keywords: evoked potentials | signal detection | ABR | ASSR | Cortical

153 - PSYCHOSOCIAL IMPACTS OF REMOTE MICROPHONE TECHNOLOGY ON WORKING ADULTS WITH HEARING LOSS

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Introduction

Approximately 20% of people worldwide have hearing loss, with 8% identified to be in the working population. Hearing well in the workplace is critical, and cited within the top 5 listening needs of people with hearing loss.

emote microphone technology is designed to help hearing better over noise, distance, and complex environments such as in reverberation. It is equipped with advanced signal processing proven to enhance listening performance in these areas. For example, MultiBeam technology designed for large meetings improves speech intelligibility at a distance and in noise compared to hearing aids alone. Additionally, Roger microphones can connect to multimedia sources for streaming, and serve as headsets for online meetings.

This study aims to build on the existing research on the benefits of remote microphone technology by exploring how it can benefit adults in the workplace. A better understanding of the socio-emotional aspect of remote microphone technology usage at work can lead to greater awareness and interest in this tool as a complementary solution to hearing aids.

Methods

Data was collected from 23 adults (11 male) with bilateral hearing loss were recruited from an independent audiological clinic in Canada. All participants were in paid employment, experienced hearing aid wearers and were novel to Roger remote microphone technology.

The average age was 52 (33 – 74 years old), with a bilateral pure-tone average (4PTA) of 55dB HL (moderate). Participants' existing Sonova hearing devices were used and paired with a provided Phonak Roger On remote microphone for a 4 week field trial.

The Psychosocial Impact of Assistive Devices Scale (PIADS) was administered after the home trial as a subjective means to measure the amount of change from hearing amplification alone.

Results

Overall, 83% of participants reported an overall benefit with Roger technology.

One-sided one sample t-tests showed significant improvements in all three sub-scales of self-esteem, competence, and adaptability. The overall PIADS score increase with Roger On indicates psychosocial benefits from remote microphone technology in the workplace.

Individual responses on the sub-scales suggested a general trend for benefit across all questions asked. The extent of the observed benefit varied across individuals, which is expected due to their diverse needs and uses of the Roger device.

Conclusion

The findings of this study suggest that Roger technology can have psychosocial benefits for adults in the working population, across a range of tested hearing aid technologies and reported occupations. Psychosocial benefits of hearing aids have been well documented in previous studies and surveys, and, to our knowledge, this is the first study to demonstrate similar results when using remote microphone technology.

Considering remote microphone systems for the workplace when assessing patients' listening needs can increase the success of the hearing aid experience. Funding options for accessibility are often available through state or country-wide funding streams.

350 - RECORDING OTOACOUSTIC EMISSIONS (OAE) WITH ADAPTIVE NOISE CANCELLATION (ANC)

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Otoacoustic emissions (OAEs) are low-level sounds of cochlear origin, which can be recorded by a sensitive microphone fitted into the ear canal. Preferably, OAE measurements are conducted in a clinical environment under controlled noise conditions like acoustically treated sound cabins. However, measurements are difficult in environments with higher ambient noise levels, as even a well-fitting probe cannot prevent external noise from entering the ear canal and masking the low-level OAE response.
To compensate for this, we have developed an ear probe that has an additional microphone to pick up noise outside the ear canal. An adaptive noise cancellation (ANC) algorithm filters out external noise and subtracts it from the internal signal, resulting in an improved signal-to-noise ratio (SNR) and a shorter test time without affecting the OAE response. The ANC algorithm has been implemented on our QSCREEN hearing screener for measuring Transient Evoked Otoacoustic Emissions (TEOAE) and Distortion Product Otoacoustic emissions (DPOAE).
The aim of the study was to record OAEs in subjects with normal hearing under noisy environmental conditions in order to evaluate the performance of the ANC algorithm.
The results show that the use of ANC makes testing in noisy environments up to 20 times faster than testing with a conventional single-microphone ear probe. In noisy conditions of around 70 dBA, over 70% of initial overall “refer” changed to “pass” results after applying the ANC.
The benefits of ANC include: (1.) reduced number of false positives, i.e., an improvement of specificity; (2.) shorter test time, and (3.) a possibility of performing the screening of cochlea function based on OAE tests in adverse environmental conditions, e.g., in the neonatal ward, at bedside, in pediatric practices, or in schools.

Keywords: DPOAE, TEOAE, OAE, Adaptive Noise Cancellation

INTERVENTION AND REHABILITATION: STRATEGIES AND METHODS I

35 - PERSONALISED COMMUNICATION STRATEGIES COUNSELLING – IS IT EFFECTIVE?

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Communication strategies are used to enhance speech understanding through behavioural, environmental, and/or technical modifications. They are widely recommended, and yet there has been little research exploring which strategies are commonly used, found effective, and/or are considered acceptable by people with hearing loss (PwHL) and their communication partners (CPs). The objective of our research was to address these gaps in knowledge, and then to develop and assess a personalised approach to communication strategies counselling.
Our series of online surveys indicated that: (i) there are 63 unique communication strategies used by PwHL and their CPs, and/or are recommended by audiologists. (ii) The 63 strategies fit into a robust co-developed framework[1,2]. The framework has four main themes: Signal (strategies that improved access to, or enhanced, the signal), Repair (strategies used to repair misunderstandings in content), Relations (strategies that engaged the CP and/or changed the dynamics between conversational partners), Preparation & Recuperation (strategies used in anticipation of, or following, a difficult communication event). Some strategies straddled multiple themes: Signal and Repair; Signal, Repair, and Relations; Relations and Preparation & Recuperation. (iii) There is considerable variability in whether a particular strategy is considered acceptable to PwHL. We used this information to develop a communication strategies booklet and counselling protocol. In this presentation we will describe the findings of a study examining their effectiveness.
The Communication strategies booklet includes 22 selected strategies that a survey showed PwHL were willing to use, found useful, and were not overly obvious. The Personalised counselling entailed the participant selecting up to three strategies to try - based on the specific situations in which they encountered listening difficulties and audiologist advice. Personal photographs provided by the participant were used to facilitate this process.
We are currently completing data collection for a study in which 90 participants aged 60+ yr. who reported difficulty hearing conversations were randomised to one of three groups. Group 1 received the Communication strategies booklet+personalised counselling, Group 2 received the Communication strategies booklet only, and Group 3 received no intervention.
Participants completed one primary (the Revised Hearing Handicap Inventory; RHHI[3]), and three secondary (the Hearing-Related Lifestyle Questionnaire[4], the Image-Based Questionnaire for Hearing[5], and the Empowerment Audiology Questionnaire-5[6]) outcome questionnaires. They were randomised to an intervention group with stratification by R-HHI score, and then received their assigned intervention at an in-person research visit. Four weeks later they attended a second research visit at which they completed the four outcome questionnaires for a second time. Participants in Group 3 also received the communication strategies booklet at this visit. A subset of participants in Groups 1 and 2 were interviewed regarding their opinions about the intervention they had received and its impact on use of communication strategies.
All participants have been enrolled in the study; data collection for 76 is complete. Informal observation indicates that participants in Group 1 (strategies booklet+personalised counselling) were more likely to try new communication strategies than participants in Group 2 (booklet alone). However, the booklet alone increase strategy use relative to no intervention (Group 3). Final outcomes from the questionnaires and interview data will be presented.

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Key words: Counselling, auditory rehabilitation, person-centred care

16 - DO INDIVIDUALIZED EDUCATION PROGRAM GOALS REFLECT THE NEEDS OF CHILDREN WITH HEARING LOSS? A NATIONAL EVALUATION OF IEP ALIGNMENT AND SERVICE PROVISION

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Children with hearing loss (CHL) frequently receive special education services through Individualized Education Programs (IEPs); however, the extent to which IEP goals accurately reflect each child's identified speech, language, and academic needs remains largely unexamined. Understanding this alignment is critical for ensuring that educational interventions effectively support communication and academic success.

The present study evaluates the relationship between IEP goals and standardized assessment outcomes among second-grade students with hearing loss across the United States of America. Drawing on data from an ongoing longitudinal outcomes study, this analysis includes IEPs and assessment data from children representing diverse geographic and educational contexts. Each IEP was comprehensively reviewed and coded for both **annual and short-term goals** using an expanded **11-category coding framework**: (1) vocabulary, (2) grammar, (3) pragmatics—communicative function, (4) pragmatics—discourse, (5) pragmatics—narrative, (6) cognition, (7) speech intelligibility (including articulation, phonology, apraxia, dysarthria, and fluency), (8) literacy (phonological awareness, decoding, word fluency, writing/spelling), (9) mathematics, (10) self-advocacy, and (11) other.

Each coded goal category was linked to corresponding standardized assessments obtained from the longitudinal study. These assessments measure key domains of language, listening, academic achievement, and cognitive functioning, allowing for direct comparison between the **skills targeted in IEP goals** and the **areas of measurable need**. This alignment analysis will help determine whether students' IEPs accurately capture their educational and communicative profiles or whether discrepancies exist that may hinder individualized intervention.

In addition to goal alignment, the study examines **service delivery variables** derived from each IEP. These include the **frequency and duration of services** (minutes per week) provided by special education professionals and the **setting in which goals are implemented** (general education classroom versus special education setting). To provide further context, **disability codes** are recorded where available, with the exception of data from Iowa, where such coding is not utilized.

The guiding questions for this investigation include:

1. To what extent do IEP goals correspond with standardized assessment results for second-grade CHL?
2. Are specific skill areas (e.g., grammar, listening comprehension, literacy) underrepresented in IEPs relative to demonstrated need?
3. How do service intensity and placement influence the alignment between goals and needs?
4. Are there national patterns or notable regional variations in IEP content and service delivery?

Preliminary analyses indicate substantial variability in both the types of goals included and the degree to which they reflect individual areas of weakness. Early patterns suggest that while IEPs often target broad academic or literacy outcomes, foundational linguistic domains such as **grammar** and **pragmatic language** may be less frequently addressed, despite standardized data showing persistent challenges in these areas for CHL. These findings highlight the need for improved integration between audiological, speech-language, and educational data when developing individualized goals.

By identifying mismatches between assessed needs and IEP content, this project aims to inform more targeted educational planning and advocate for evidence-based service delivery models. Results will contribute to a broader understanding of how children with hearing loss are supported within the U.S. educational system and may have implications for improving **interdisciplinary collaboration**, **functional assessment practices**, and **outcome-driven intervention planning**.

Ultimately, this work underscores the importance of aligning special education documentation with real-world communication and academic performance to promote equitable learning opportunities for children who are deaf or hard of hearing.

Key words:
Individualized Education Program (IEP), Hearing Loss, Language Development, Educational Outcomes, Service Delivery

157 - EVALUATION OF GROUP VERSUS INDIVIDUAL COMMUNICATION TRAINING IN HEARING AID USERS

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Background
Hearing loss is a growing global health concern, with advancing age identified as the primary contributing factor. It is associated with difficulties in speech understanding and increased listening effort, negatively affecting daily life. Although hearing aids are the primary hearing intervention for adults with mild to moderate hearing loss, communication difficulties often persist, particularly in challenging listening situations. In addition to hearing aids, communication training may enhance hearing rehabilitation outcomes, yet the optimal mode of delivery remains unclear. This study aims to evaluate in-person communication training, delivered individually or in groups, for middle-aged and older hearing aid users with mild to moderate hearing loss, in support of holistic hearing care.
Materials and Methods
Middle-aged and older adults (45-80 years) with mild to moderate hearing loss using bilateral hearing aids were randomly assigned to one of three groups: individual or group-based communication training, or a control group receiving no training. The training was based on Active Communication Education principles and consisted of two in-person sessions (± 1.5 hours each), separated by a 3-4 week interval. The first session combined theoretical components on auditory-cognitive processes underlying speech understanding and listening effort, and their impact on hearing-related quality of life, followed by the identification of personally challenging listening situations and the introduction of communication strategies, which participants were assigned to practice through a home assignment. The second session began with a discussion of the home assignment, reflecting on thoughts and emotions related to communication challenges. It also included a final integration exercise in which participants applied the learned strategies within a problem-solving, person-centered framework. Baseline assessments were conducted prior to training, and post-intervention assessments approximately two weeks after the final training session. A mixed-method design was used to collect both quantitative and qualitative data. Audiological testing was performed only at baseline, whereas self-report hearing-related questionnaires were administered both before and after the intervention period. In addition, post-intervention semi-structured interviews were conducted using a predefined interview guide. For participants in the training groups, interviews focused on expectations and experiences, as well as the program's strengths and weaknesses, including its potential for implementation in hearing care. Interviews in the control group explored expectations regarding communication training. As recruitment and testing are ongoing, planned quantitative statistical analyses include pre-post comparisons within and between groups using mixed-effects models or repeated-measures analyses, depending on data distribution. Qualitative interview data will be thematically analyzed to identify perceived benefits, barriers, and perceived facilitators of change.
Results At the time of abstract submission, 13 participants have been enrolled in the control group, 12 in the individual training group, and two group-based training cohorts of five participants each, with data collection in progress. Sample sizes are intended to approximately double prior to the conference, and findings will be presented at the HeAL Congress 2026.
Conclusions
Communication training is anticipated to be well received by participants and to support improvements in hearing-related quality of life, communication strategies, and personal adjustment to hearing loss compared with the control group. While group-based training may initially pose a barrier for some individuals, its interactive nature and opportunities for peer support can foster shared learning and reflection, potentially enhancing perceived benefits compared to individual training. Together, this ongoing study is expected to strengthen evidence-based, person-centered care for individuals with hearing loss and pave the way for more holistic hearing care.
Keywords
Communication training; hearing aids; hearing-related quality of life; hearing aid benefit; patient care

Conflict of interest: one or more authors have declared an industry affiliation

224 - BUILDING SUSTAINABLE EARLY INTERVENTION SYSTEMS FOR DEAF CHILDREN IN INDIA

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Background/ rationale Deaf children in Koppal district (Karnataka, India) face multiple challenges from birth, beginning with late identification of deafness and delays in accessing early intervention. In April 2024, Karnataka launched a Newborn Hearing Screening Programme (NHSP). Previously, screening was limited to high-risk births. While the introduction of universal NHSP is a positive and necessary step, full implementation takes time and gaps in early identification and follow-up support remain. Deaf Child Worldwide (DCW), part of the National Deaf Children's Society (a non-governmental organisation based in the UK) specialise in supporting low- and middle-income countries to establish sustainable newborn hearing screening and early intervention systems. DCW partnered with Prarambha, an organisation focused on supporting marginalised groups. Together, we found that frontline health workers lacked the skills and confidence to identify early signs of deafness, with most children identified around the age of two. Parents often had limited understanding of deafness, how to support their child's early communication, or what government entitlements and services were available.This initiative aimed to understand how international partnerships that train and support parents as peer leaders can boost newborn hearing screening, strengthen family support systems, and establish a sustainable, locally led early identification clinic.
Materials and Methods Family-Centred Early Intervention (FCEI) is an international, evidence-based framework of ten guidelines that emphasise collaborative partnerships between parents and professionals, early and accessible communication, and approaches that maximise children's development by building on family strengths. Drawing on these principles, DCW worked closely with trained staff at Prarambha to develop a sustainable support model in which parents of deaf children became peer leaders (known locally as Resource Parents), who delivered deaf-awareness sessions across their communities and to preschool teachers, and helped empower other parents of deaf children to get the support they need through identification and family-centred intervention.
Results This peer support initiative led to a 78% increase in newborn hearing screening referral rates within the first six months of birth. Resource Parents also provided tailored support to more than 50 newly identified families, offering peer counselling, guidance on government schemes, and practical help with early communication, language development, and hearing-device management. 32 families started receiving government entitlements as a result of awareness of eligibility being shared by Resource Parents. In addition, 26 hearing siblings were trained to spot safeguarding indicators and in Indian Sign Language, further strengthening family support systems. Two early intervention centres were set up in Koppal and Deodurga to make support for deaf children and their families local and accessible. Parents of deaf children have also been able to set up learning centres for their children, to support language acquisition as they grow older. Average waiting times between assessment and referral back to intervention centres reduced by 83%, from 90 days to only 15 days by the end of our intervention. One year on, Resource Parents have used their position of influence to advocate to village leaders for provisions to maintain these spaces and resources needed, and they continue to operate today. As a result of these centres, local communities have also catered for children with other needs beyond deafness, another sign of breaking down the barriers and stigma surrounding deafness and disability. This programme has shown sustainability post DCW funding as a number of interested parties have expressed an interest to maintain this work to support parents of deaf children, and the Government of Karnataka are building on plans to make universal newborn hearing screening a reality for children there.
Conclusion This work demonstrates how international collaboration to develop parent-led advocacy was instrumental in establishing a local early identification clinic, reducing the need for families to travel to hospital settings. It shows how a sustainable model can grow with time, and that collective action from parents and families of deaf children can go on to influence lasting change through local government involvement.

Keywords
Hearing screening, community-led, early intervention

225 - DEVELOPING PARENT LEADERS: THE ROLE OF COMMUNITY CONNECTORS IN SUPPORTING FAMILIES OF DEAF CHILDREN

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Background/ Rationale

Supporting a deaf child can involve significant informational, emotional, and practical challenges for families. In other areas, community-based connector roles have been explored as a way of offering lived-experience support, suggesting there may be relevance for families of deaf children. Our work at the National Deaf Children's Society (NDCS) seeks to address this gap by examining how parent-led, community-rooted support may influence families' experiences of early intervention. This presentation explores the potential impact of developing and training parent leaders—known as Community Connectors—to deliver family-centred early intervention support. This initiative positions parents as agents of change within their own communities, strengthening early intervention pathways and enabling support to more closely reflect families lived realities. The work aims to investigate how parent-led models influence family-centred practice, as well as the challenges that arise within these approaches and the strategies used to navigate them.

Materials/ method

Community Connectors were recruited exclusively from local parents of deaf children to ensure support was relatable, trusted, and rooted in shared experience. They emphasise partnership, empowerment, and responsiveness to each family's unique context. As part of their induction, Community Connectors completed a structured training programme based on Family-Centred Early Intervention (FCEI) principles – a well-established framework used internationally to guide early support for deaf and hard-of-hearing children. The programme incorporated external expertise, collaborative learning, and skills development to equip parents to provide ongoing, community-embedded support. Community Connectors were employed as specialists in their local areas, with expertise of the gaps and challenges facing deaf children and their families in their county.

Results

The Community Connector model has been piloted across eight localities in the South-East and South-West of England. Case studies illustrate how Community Connectors are influencing local systems through peer-to-peer support, partnership-building with health professionals, local authorities and charities, and co-producing solutions tailored to the needs of deaf children and their families. Early findings indicate that this parent-led approach increases reach, enhances trust, and enables more holistic, personalised support. In the last ten months, Community Connectors have supported 271 families, 109 of which were new to NDCS services. This ensures that we are meeting families of deaf children where they are and when they need peer to peer support. There have been collaborations made with 26 local groups, some of which were newly created as a result of our intervention identifying lack of group support accessible in areas close to families. Beyond working directly with families, this programme also seeks to bridge the gap with professional provision and regularly engages with teachers of the deaf (ToDs) and health visitors to link up families to family centred early intervention. We also critically reflect on the challenges encountered, such as role boundaries, sustainability, and navigating professional relationships, and the lessons learned from shifting from top-down service delivery to community-driven models.

Conclusion

The Community Connector initiative demonstrates the potential of parent leadership to strengthen family-centred early intervention. By embedding lived experience within local systems, the model fosters more responsive, relational, and community-led support for families of deaf children. Ongoing learning highlights both the promise and the complexity of parent-led approaches, offering valuable insights for future service design and delivery across the UK.

Keywords
Deafness, community, peer support, intervention, parent led

INDUSTRY PARTNERSHIP PRESENTATIONS

Speaking the same language in CI outcome: the ICF

Organized by Ilona Anderson and Artur Lorens

24 - HEARING LOSS QUALITY OF LIFE QUESTIONNAIRE (HL-QOL): LOOKING AT CI OUTCOMES HOLISTICALLY

Angelika Illg [1] - Lisa Reuter [1] - Dovile Jankunaite [2] - Maxima Wiegmann [1] - Mareike Billinger-Finke [2]
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Introduction
The monocentric study aims to prospectively investigate the holistic effects of cochlear implant (CI) use by assessing quality of life, self-esteem, feelings of loneliness, and difficulties in the workplace. Changes and developments are to be documented pre-surgery and at 3 and 12 months of device use. The relatively newly developed and validated Hearing Loss Quality of Life Questionnaire (HL-QOL) is being applied longitudinally in a large cohort of CI users. Herein we present the results up to the 3-month timepoint.
Methods
Initial datasets obtained from subjects receiving their first CI, aged 18–80 years, were evaluated. Quality of life (HL-QOL), loneliness (UCLA Loneliness Scale), self-esteem (RST), and work-related difficulties (WLQ) were assessed. Only complete datasets available by September 2025 were considered.
Results
Data from 85 people were analyzed. Quality of life improved significantly ($p < .001$) from pre-surgery ($M = 79$) to 3-month ($M = 92$). Self-esteem and loneliness remained nearly unchanged on average and did not change significantly. Among the 31 employed participants (36.5%), work-related difficulties were relatively rare both pre- and post-operatively. Age and sex showed no statistically significant effects.
Conclusion
Quality of life in individuals with hearing loss can be substantially improved within the first three months of CI use. It remains to be seen if self-esteem, loneliness, and work-related difficulties will show significant changes after 12 months of CI use.

Key Words: Cochlear Implant, Quality of Life, ICF, Patient-report outcomes, PROM

65 - SPEAKING THE SAME LANGUAGE IN CI OUTCOME: THE ICF

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The International Classification of Functioning, Disability and Health (ICF) has emerged as an important concept in hearing health and in healthcare in general. The ICF is an initiative of the World Health Organization. It was brought into force two decades ago, after years of gradual development and refinement. It is part of a broader set of frameworks that are used for classifying disease, disability, and health interventions. The purpose of the ICF is to provide a standard language and framework for describing the disabilities and functions that can be associated with health conditions.

The problem that the ICF tries to solve is that terminology can be used and understood quite differently by different people. For example, consider the word “severe” in the context of a health condition. What does “severe” refer to? Does the severity of a condition relate to the degree of impairment caused by that condition, or does it relate to the urgency with which the condition must be treated (like in a severe infection)? When people’s health is at risk, it is important to have well-defined, unambiguous, and clearly understood terminology. That is the purpose of the ICF.

The basic concept and goal of the ICF is to serve as a set of standardized terminology, where each term refers to an objective, measurable feature of a disability associated with a disease or medical condition. In this way, patients, health practitioners, researchers, and other interested parties can have clearer communication among and between each other.

The goal of this HEARRING project has been to develop a standardized suite of validated tests for assessing hearing outcomes in adult cochlear implant users. This suite contains both objective tests (to measure the users’ hearing capacity) and subjective tests (to measure the users’ hearing performance in everyday life, as well as their quality of life, satisfaction, and perceived benefit with their hearing device). Together, this suite of tests will provide a unified and comprehensive framework for evaluating outcomes in adults cochlear implant users in a manner compliant with the ICF framework. The test suite has been validated in a multi-centric clinical trial across 5 countries.

This panel will discuss the ICF for adult cochlear users, including its value, tests required, outcomes, how to work with it in clinical practice and future developments.

255 - INTEGRATING WORQ AND LOCALIZATION TOOLS WITHIN THE ICF FRAMEWORK FOR COCHLEAR IMPLANT USERS

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This study presents the integration and verification of two assessment tools within the International Classification of Functioning, Disability and Health (ICF) framework for cochlear implant (CI) users: the HEARRING_LOC_ICF localization scale and the revised Work Rehabilitation Questionnaire (WORQ-CI). The objective was to establish standardized methods for evaluating sound localization performance and work-related functioning consistent with ICF qualifiers in CI recipients. The HEARRING_LOC_ICF system classifies localization ability using a graded ICF scale ranging from 0 (no impairment) to 4 (complete impairment), improving comparability of localization data across test setups, institutions, and listener groups. Parallelly, the WORQ-CI, derived from the ICF core set for work related functioning assessment and condensed into 17 questions mapped to 14 ICF categories, was applied in a multicenter cross-sectional cohort of 177 adult CI users with at least one year of device experience. Responses, collected in clinics and online, demonstrated that most participants reported no difficulties across functional domains (53.7%–91%), displayed educational levels comparable to the general population, and showed high rates of employment or successful reintegration into professional life. Combining the WORQ-CI and HEARRING_LOC_ICF tools under a unified ICF-based framework enables a multidimensional assessment of real-world functioning in CI users. This approach supports enhanced data comparability, meta-analytic integration, and evidence-based advancement of rehabilitation and outcome monitoring in cochlear implantation research.

Keywords: ICF, WHO, Ccohlear Implants

286 - OUTCOME ASSESSMENT AFTER COCHLEAR IMPLANTATION BASED ON THE INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH

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Objective

To use International Classification of Functioning, Disability and Health, known more commonly as ICF, as a clinical tool for evaluating audiological rehabilitation after cochlear implantation.

Methodology

The opinions of experts were gathered on their clinical experience about the most relevant ICF categories and codes to describe outcomes after cochlear implantation. For the relevant ICF categories, the most commonly used assessment tools and methods were identified. The ICF-based CI outcome measures 72 adults were assess preoperatively and postoperatively using the ICF-based CI outcome measures

Results

For “Body Functions and Structures”, most participants (54%) reported a complete impairment preoperatively for speech discrimination in noise followed by self-reported localization (47%). Postoperatively, both categories still frequently pose a complete impairment for the participants, but the frequency decreased to 37% and 18%, respectively. Most of the participants perceived no impairment preoperatively for falling (92%), emotional functions (73%), and dizziness (70%). Postoperatively, falling remained the category for which most participants perceived no impairment (84%), followed by dizziness (69%), and tinnitus (69%)

Conclusion

Using the ICF can help target the holistic (re)habilitation of CI recipients. By providing a common language, it can enable clearer communication across disciplines, and closer comparison between different studies, which is essential for meta analyses.

Keywords

Cochlear Implants, CI, International Classification of Functioning, Disability and Health, ICF, Adults, Outcomes

12 - SPEAKING THE SAME LANGUAGE: THE ICF - CLINICAL PRACTICE

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The International Classification of Functioning, Disability and Health (ICF) provides a comprehensive framework for understanding health and disability beyond traditional medical diagnoses. This presentation explores how the ICF can reshape the practice of speech-language therapy for deaf and hard-of-hearing individuals by shifting the focus from impairment correction toward participation, empowerment, and holistic well-being.

Historically, speech and hearing interventions for deaf and hard-of-hearing children have often been driven by the assumption that integration into the hearing world should be the primary goal. Such a deficit-oriented approach tends to prioritize speech intelligibility, auditory performance, and "normalization," frequently leading to experiences of inadequacy and reduced self-confidence among clients. It also reinforces hierarchical relationships between professionals and patients, in which the therapist acts as an expert who "fixes" the client rather than a partner who supports the client's goals.

The ICF framework offers a valuable alternative by addressing functioning on multiple levels—body functions and structures, activities, participation, environmental factors, and personal factors. Applying this model to speech-language therapy enables clinicians to see beyond hearing thresholds and pronunciation accuracy, considering the individual's communicative environment, social participation, and personal aspirations.

In practice, this shift begins with a narrative-based anamnesis, where understanding the patient's story and goals takes precedence over standardized checklists. Therapists gather information about the etiology and progression of hearing loss, technological support systems, communication contexts, and personal resources. This holistic assessment forms the foundation for therapy planning that aligns with the patient's values and everyday life.

Therapeutic goals are then structured according to the SMART framework—Specific, Measurable, Achievable, Relevant, and Timed—while remaining grounded in ICF categories. Short-term objectives may address auditory discrimination or comprehension, while long-term goals emphasize participation outcomes such as effective communication at work or in social situations. Environmental adaptations and awareness among family and peers further support these outcomes.

By integrating the ICF, speech-language pathologists move from a purely restorative model to a participation-oriented approach that strengthens autonomy and self-efficacy. Therapy becomes a collaborative process emphasizing empowerment and meaningful change rather than correction of deficits. The ICF thus acts as a shared professional language that connects disciplines, ensures consistency in care, and encourages reflective practice.

IMPROVING HEARING CARE AND SERVICES IV

227 - THE AUSTRALASIAN CONGENITAL CMV REGISTER (ACMVR): MEASURING HEARING OUTCOMES AND ANTIVIRAL THERAPY USE TO DRIVE CLINICAL CHANGE

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Background/Rationale: Congenital cytomegalovirus (cCMV) is the leading infectious cause of childhood hearing loss and disabilities. Recent evidence suggests antiviral therapy in the first month of life improves outcomes in children with symptomatic cCMV (i.e. jaundice, intrauterine growth restriction, microcephaly). Antiviral therapy may be used in cCMV-affected children with isolated hearing loss; however, the outcomes of these children following treatment are not well defined. The Australian congenital CMV register (ACMVR) was set up to strengthen the evidence on cCMV outcomes and better understand the outcomes of antiviral therapy in children with isolated hearing loss.

Aims: Describe the clinical characteristics, hearing outcomes and use of antiviral therapy in Australian children with cCMV enrolled in the ACMVR.

Materials and Methods: The ACMVR is a multi-site, multi-state register including Australian children born with cCMV. Children <18 years with confirmed (lab confirmed infection <21 days) or probable (lab confirmed infection >21 days and clinical or neuroimaging features suggestive of cCMV) cCMV infection are eligible for inclusion if they are residing in a participating State/Territory at the time of recruitment. Once identified, children are recruited into the registry and clinical data is extracted via medical records and parent questionnaires. The register records demographic data, maternal data, perinatal and neonatal data, including hearing screening results collected in early life. Details about antiviral therapy use in the first six months of life are recorded, Neurodevelopmental outcomes, hearing outcomes and neuroimaging data at 12 months, 24 months, 36 months and 60 months are recorded. Here, descriptive statistics are used to report on deidentified data collected between 2020 and 2024 including neonatal characteristics, newborn hearing screening results, antiviral therapy use, hearing outcomes at 12 months and developmental screening data at 12 months for children with cCMV. All children with available data are included in descriptive analyses.

Results: A total of 236 children with cCMV were included in these analyses. The denominator indicates the sample size for each measure. Approximately half (50%, 117of 232 with available data) of participants are male, 93% (200/216) are singletons and 75% (162/215) were born at term. Almost all children (87%, 175 of 200 with available data) had clinical signs of infection in the neonatal period with jaundice, intrauterine growth restriction and microcephaly being the most common. Around half the children (48%, 88of 182 with available data) did not pass newborn hearing screening shortly after birth with 91% (39 of 43 with available data) having a confirmed hearing loss by 12 months. Of these, 60% (50 of 84 with available data) had received antiviral therapies. Amongst the remaining 52% (94 of 182 with available data) of children who passed newborn hearing screening, 29% (8 of 27 with available data) had a confirmed hearing loss by 12 months. Approximately a third (35%, 30 of 86 with available data) of the babies who passed newborn hearing screening received antiviral therapies. By 12 months, 67% (47 of 70 with available data) of babies with cCMV had hearing loss. Of the 40 children with developmental data available at 12 months, parents reported concerns about their child's gross motor (35%, 14/40), fine motor (20%, 8/40) and communication (17%, 7/40) development.

Conclusion:
The ACMVR is an important data platform to track cCMV outcomes and inform clinical practice. It is an active registry with data collection ongoing. This will result in data completeness increasing over time as children age. To date, the registry has been a useful tool for building a prospective evidence base to inform management of asymptomatic cCMV. The available data confirms the progressive nature of hearing loss in children with cCMV, and the importance of audiological follow-up for all children with cCMV. Our study also highlights the challenges of targeted cCMV screening programs in missing a large proportion of children with cCMV.

Keywords: Congenital cytomegalovirus, cCMV, hearing, antiviral therapy

228 - THE AUSTRALIAN NATIONAL CHILD HEARING HEALTH OUTCOMES REGISTRY (ANCHOR): TOWARDS A NATIONAL LEARNING HEALTH SYSTEM

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The Australian National Child Hearing Health Outcomes Registry (ANCHOR) is a national program to establish an outcomes registry for deaf and hard of hearing (DHH) children and young people. The goal of ANCHOR is to enable a Learning Health System that measures outcomes, tracks progress along the hearing health pathway, and identifies gaps and opportunities for service improvement. The program focuses on three interconnected aims: (1) National scoping of existing child hearing health services, datasets and associated costs; (2) Prototyping a national outcomes registry through secure data linkage across two Australian states (Victoria and Queensland); and (3) Co-developing a Core Outcome Set (COS) that reflects the outcomes that matter most to DHH children, young people, families, and service providers.

Inclusive, culturally safe, and community-led engagement is central to ANCHOR's design and implementation. The program has been co-designed with more than 100 stakeholders, including Deaf community representatives, clinicians, researchers, educators, policy makers and families with lived experience through the AusChildDeafness-Community Advisory Group (CAG). ANCHOR also incorporates methodologies that support culturally safe engagement with Aboriginal and Torres Strait Islander communities and Deaf Auslan users, including Deaf-led focus groups, yarning sessions, and communication in accessible modalities.

Aim 1: We conducted a national environmental scan of child hearing health services and databases in Australia and identified system-level barriers and enablers to the development of a coordinated Learning Health System. Data were collected via online surveys through snowball sampling, 100 respondents across 95 organisations reported on 296 services. Findings revealed a diverse and fragmented landscape of child hearing health services and databases that span national, state and non-government jurisdictions. Substantial variability was observed in service models, data elements collected, reporting arrangements, and governance structures. Data collection was largely siloed, with limited linkage across the diagnostic, rehabilitative, educational, and developmental domains of the hearing health pathway. These fragmented data systems limit the capacity to monitor service performance, equity of access, and long-term outcomes. Despite these challenges, examples of strong system-level coordination and data stewardship were identified in specific jurisdictions, demonstrating that national coordination is feasible with appropriate investment and governance.

Aim 2: We developed the prototype for a national registry through secure linkage of priority datasets. Priority data custodians and datasets were identified through stakeholder consultation, and ethics approval was obtained for a waiver of consent to support population-level linkage. Legal agreements, data governance arrangements, and technical specifications for secure linkage were completed. Cross-jurisdictional data linkage is currently underway to test feasibility, harmonise data structures, and evaluate the potential to scale to a national platform.

Aim 3: We have co-developed a COS for childhood deafness with 175 lived- experience participants and 202 professional stakeholders. We conducted a rapid evidence review, qualitative interviews, focus groups and workshops. We captured perspectives directly from young children using "Voice of the Child" methods.

Over 200 candidate outcomes were identified and organised into five core outcome domains (medical/audiological, service provision, child development, early intervention/education, and well-being/daily functioning), with 16 sub-domains. Two rounds of eDelphi Surveys have been completed in which participants ranked the importance of each outcome on a nine-point Likert scale (1 = least important and 9 = critically important). The COS will be finalised in an online endorsement meeting.
ANCHOR aims to produce actionable evidence that optimises service delivery, strengthens equity of access and improves outcomes for DHH children and their families. By integrating data linkage, community driven outcome measurement, and inclusive stakeholder engagement into a Learning Health System framework, ANCHOR represents a national opportunity to transform how child hearing health services are evaluated, governed, and improved. This presentation will describe the methods, key findings, and lessons learned from establishing a national child hearing health outcomes registry in Australia.

Keywords: childhood hearing loss, outcomes registry, learning health system, core outcome set, stakeholder engagement

229 - THE AUSTRALIAN NATIONAL CHILD HEARING HEALTH OUTCOMES REGISTRY: CHILD HEARING CATEGORISATION SYSTEMS AND SERVICES ACROSS AUSTRALIA

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Background: Early detection and intervention for hearing loss can transform a child's life, but Australia lacks a consistent nationwide system to track and improve outcomes of deaf and hard of hearing (DHH) children, with persistent inequities in health and developmental outcomes. To address these gaps, the Australian National Childhood Hearing Health Outcomes Registry (ANCHOR) was initiated. Key components include mapping Australia's current child hearing services and datasets, understanding how information is collected, and assessing the feasibility and costs of a national registry, form key components of this work.

Aims: 1) Conduct a national environmental scan of child hearing health services and databases in Australia to identify system-level barriers and enablers to developing a coordinated learning health system for DHH children. 2) Investigate how childhood hearing loss is categorised across Australian hearing health services to assess the feasibility of harmonising categorisation systems into a single national framework to support consistent, equitable data collection and reporting.

Method: A cross-sectional national online survey collected responses from organisations providing hearing health services for DHH children aged 0-18 years in Australia. The survey captured organisation characteristics, services, data collection and quality, interoperability, stewardship and governance. Hearing loss categorisation data were collected across four service types: Universal Newborn Hearing Screening (UNHS), diagnostic audiology, hearing rehabilitation, and hearing implantation. Reported categories and associated hearing-level thresholds were compared across jurisdictions, category systems and service types. Data were analysed descriptively.

Results: Ninety nine organisations delivering 290 hearing health services to DHH children in Australia completed the survey. For aim one, we identified a diverse and fragmented landscape of child hearing health services and databases operating across the country and in state-specific jurisdictions. Personally identifying information was commonly collected and stored in structured fields (65–82%), whereas sociodemographic characteristics, research information, and hearing-loss risk factors were inconsistently captured and often recorded in free text, with substantial missingness. Data quality was rated acceptable or good by 49% of organisations, with 8% reporting excellent quality. Interoperability was limited: 57% produced routine client reports, 24% reported to external bodies, and 34% had multiple databases. Most lacked a data dictionary (64% primary, 56% secondary), and few could provide one (11% primary, 5% secondary). A minimum dataset was maintained by 59% of organisations, most commonly covering 6–10 years (14%). Governance practices varied: data security was managed by database administrators (33%) or IT departments (30%), 47% obtained written parental/guardian consent, 50% included a privacy statement, 39% had an ethics committee, and 57% reported interest in data linkage, with 55% participating in research.

For aim two, 43 organisations reported hearing-loss severity categories and 40 provided threshold ranges. 45% of organisations used a 6-category system. Normal (≤20 dB HL), Mild (21–40 dB HL), Severe (71-90dB HL) and Profound (≥91 dB HL) thresholds were consistent, whereas Moderate (upper limits 31-45dB HL, lower limits 40-70dB HL), Moderately Severe (upper limits 40-61dB HL, lower limits 60-90dB HL), and Severe-to-Profound (upper limits 60-95dB HL, lower limits 90-110dB HL) thresholds varied considerably, with overlapping ranges across services. The Slight category was rarely used.

Conclusions: Despite Australia's strong investment in UNHS and hearing health services, fragmented data systems limit system-level learnings. Many organisations use threshold ranges broadly aligned with recognised standards, indicating a strong basis for harmonisation. However, variation in mid-range categories highlights the need for a unified national framework to ensure consistent interpretation, service planning and reporting. Establishing coordinated nationwide systems will improve care, outcomes, and equity for DHH children, and provides a framework applicable to other countries seeking to optimise childhood hearing health pathways.

Keywords: Child hearing health; National registry; Learning health system; Data harmonisation, Environmental scan

212 - SHAPING CHILDREN'S HEARING SERVICES ACROSS THE UK THROUGH FAMILIES' LIVED EXPERIENCES

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Background/ Rationale: In 2025, an independent review of children's hearing services in England (the Kingdon Review) examined concerns about the quality and consistency of paediatric audiology assessments and set out recommendations to ensure children's hearing services are safe, responsive and centred on improving patient experience. Families' lived experiences of services and care offer critical insight into how processes and policies are experienced in practice. Integrating these insights into service design and delivery allows services to focus on what matters to families. Within this context, we supported three distinct areas of work focused on families' lived experiences of children's hearing services across different UK nations (England, Northern Ireland and Wales). In England, we explored families' experiences of the National Health Service (NHS) 'review and recall' process, introduced to address quality assurance concerns where families are asked to return with their child for repeat audiology testing. In Wales, we worked closely with Newborn Hearing Screening Wales to understand parents' perspectives on a proposed change to newborn hearing screening policy and what support families need should changes be implemented. In Northern Ireland, we explored families' experiences of children's hearing services to identify strengths, gaps and priorities for improvement. Taken together, this work aimed to centre family voices, identify cross cutting themes across different national contexts, and generate insights and recommendations to inform more responsive, coordinated and family centred children's hearing services across the UK.
Materials and Methods: Across all three strands of work, parents and carers of deaf children with different types and levels of hearing loss (including unilateral and bilateral) were invited to share their experiences of hearing services through 3 semi-structured interviews and 6 focus groups, conducted online with communication support where required. Recruitment approaches varied by project and context, including social media outreach and invitation letters distributed via NHS Trusts. All participants provided written informed consent, and sessions were audio-recorded and transcribed using Microsoft Teams transcription. Transcripts were checked for accuracy and anonymised prior to analysis. Qualitative data were analysed using reflexive thematic analysis (Braun and Clarke, 2016), with analysis undertaken iteratively and reflexively by the research team. Following individual project analyses, the team met to compare findings across the three datasets, identify cross-cutting themes and insights spanning the different national contexts.
Results: Across the strands of work, families described identification of hearing loss as a significant and often vulnerable moment, in which they valued good emotional support. Families highlighted the importance of clear, consistent and deaf-aware communication, with information delivered in plain language and tailored to their child's needs. To empower families, support and guidance need to be consistent and ongoing. Support should begin before identification by providing clear, accessible information about what to expect. It should continue during the appointment through empathetic communication, straightforward explanations, and space for questions. Support should then carry on afterwards with consistent follow-up, easy-to-understand guidance, and a named professional whom families can turn to for navigating services and making informed decisions with confidence. This includes delivering information in plain language, tailored to each family's needs and level of understanding.
Conclusion: Together, these findings demonstrate the value of centring families' lived experiences in shaping children's hearing services. These insights identify opportunities to improve services through empathetic communication, clearer and integrated care pathways, timely support while waiting for services, and meaningful engagement with families. The insights have informed the development of practical guidance to support services in Wales and England to improve how they communicate with families.

Keywords: audiology, hearing loss, children, qualitative, lived experience

233 - EMPOWERING CONNECTION: PROFESSIONALIZING SERVICE FOR PEOPLE WHO ARE DEAFBLIND AND LIVING WITH DUAL SENSORY LOSS

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DeafBlind Ontario Services is dedicated to supporting people who are deafblind, as well as those with developmental disabilities who are Deaf, hard of hearing, or who use alternative forms of communication. Across our supported living homes and community-based programs in Ontario, Canada, we empower individuals to communicate, live independently, and build meaningful connections rooted in person-directed values.

For people who are deafblind, this support is facilitated through Intervenor Services. Intervenors provide accessible, accurate information that enables individuals to make informed choices, communicate effectively, develop concepts, navigate their environment, and achieve maximum independence. As defined by the Ontario Ministry of Children, Community and Social Services (MCCSS), *"an intervenor facilitates the interaction of the person who is deafblind with other people and the environment."* [1]Intervenors act as narrators, informers, guides, and communicators—ultimately serving as a *"bridge, not a barrier*[2].

This presentation highlights the importance of professionalization within the deafblind sector and introduces the Certified Deafblind Intervenor Specialist (CDBIS) credential, offered through the Academy for Certification of Vision Rehabilitation & Education Professionals (ACVREP). Developed through a partnership between CNIB Deafblind Community Services and DeafBlind Ontario Services, the CDBIS credential formalizes the specialized work of intervenors by validating education, experience, and competency through a rigorous certification process.

Participants will gain insight on:

- The purpose and impact of the CDBIS credential.
- How certification recognizes advanced training, specialized sensory loss skills, and professional expertise within the field of deafblindness.
- The role of certification in promoting ongoing professional learning and strengthening sector-wide standards in dual sensory loss
- The findings and field impact following beta testing and the official launch of the CDBIS credential.
- Our progress to date and future goals for increasing awareness and participation internationally and nationally.

This session will demonstrate how formalized standards, competency validation, and professional certification contribute to improved quality, consistency, and confidence in Intervenor Services across the deafblind sector.

Key words: deafblind, intervenor, certification, specialized services

[1] 2014-2015 Ministry of Children, Community and Social Services (MCCSS) Policy Framework
[2] ACVREP CDBIS Certification Handbook

INTERVENTION AND REHABILITATION: STRATEGIES AND METHODS II

337 - REDEFINING HEARING CARE: CLINICAL TRANSLATION OF A CELL BASED THERAPY FOR NEURAL HEARING LOSS

Cherith Campbell-Bell [1] - Rachel Haines [1] - Efstratia Papoutselou [1,2,3] - Eleni Genitsaridi [1] - Marcelo Rivolta [1,4] - Douglas Hartley [1,2,3,5]

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Neural hearing loss is an important and often under-recognised contributor to poor outcomes with current hearing interventions. It affects people of all ages and is associated with conditions such as auditory neuropathy spectrum disorder (ANSD) and age-related hearing loss (presbycusis). Degeneration and loss of auditory neurons can lead to increased difficulties in complex listening environments, even when pure-tone thresholds appear normal.

Although hearing aids and cochlear implants remain central to current hearing care, their effectiveness depends on the integrity of the auditory nerve. When neural loss or dysfunction is present, everyday listening and satisfaction can be limited, highlighting a critical unmet need within existing devices.

Rinri Therapeutics has developed Rincell-1, a cell-based therapy designed to restore auditory nerve function through replacement and regeneration of lost or damaged spiral ganglion neurons. By directly targeting the neural substrate underlying hearing impairment, Rincell-1 has the potential to transform treatment for neural hearing loss, either as a standalone intervention or in combination with established technologies, depending on disease stage and patient characteristics.

This presentation will outline Rinri's extensive clinical development programme, supporting the translation of auditory nerve regeneration into the clinic. We will present data from the development and application of a comprehensive neural health test battery designed to enable robust patient characterisation, selection, and outcome assessment. We will also present results from a study evaluating test-retest reliability and feasibility of use as clinical trial outcome measures. Together, these data provide an evidence base to support endpoint selection, patient stratification, and trial design for regenerative therapies targeting neural hearing loss.

Finally, we will introduce Rinri's first-in-human (FIH) clinical trial of Rincell-1, which received Clinical Trial Authorisation (CTA) approval in the UK in 2025. By addressing neural integrity as a modifiable therapeutic target for the first time, this work illustrates a translational pathway toward more biologically informed hearing care, with the potential to improve speech perception, quality of life, and long-term outcomes across diverse patient populations.

Conflict of interest: one or more authors have declared an industry affiliation

261 - AUDITORY DEVELOPMENT OF YOUNG CHILDREN WITH PROFOUND HEARING LOSS, COCHLEAR IMPLANTS AND CONGENITAL CMV INFECTION

Piotr Henryk Skarżyński [(1)] - Anita Obrycka [(2)] - Aleksandra Chodkiewicz [(1)] - Natalia Czajka [(1)] - Artur Lorens [(2)] - Rita Zdanowicz [(1)] - Henryk Skarżyński [(3)]

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Background

Congenital CMV infection is one of the most common intrauterine infections. Approximately 5–7 of 1000 newborns are infected with CMV, which they catch from their mother during pregnancy. Hearing loss caused by congenital CMV infection is sensorineural, can be unilateral or bilateral, and the degree of hearing loss can range from mild to complete deafness. The aim of this study was to assess auditory development in young children with profound hearing loss, cochlear implants (CIs), and congenital cytomegalovirus (cCMV) infection and to determine the effect of comorbidities on their development.

Material and methods

The study group (cCMV group) consisted of 47 CI children—18 girls and 29 boys—who had been diagnosed as having prelingual hearing loss due to cCMV infection (with or without comorbidities); the mean age at CI activation was 15.2 months (range: 9.7–23.8; SD = 3.5). The reference group (no cCMV) consisted of 117 similar children (57 girls and 60 boys) who had profound sensorineural hearing loss not caused by cCMV infection; they had no comorbidities. The mean age at CI activation in the second group was 14.3 months (range: 7.9–23.5; SD = 4.0). Auditory development in all children was assessed with the LittlEARS Auditory Questionnaire (LEAQ) at CI activation and at about 1, 5, 9, 14, and 24 months of CI use.

Results

The mean LEAQ total score increased over a similar time frame from 9.8 pts to 28.9 pts in the cCMV group without comorbidities, from 4.5 pts to 18.5 pts in the cCMV group with comorbidities, and from 9.2 to 31.6 pts in the reference group with no cCMV infection.

Conclusions

Early cochlear implantation in children with sensorineural hearing loss due to congenital CMV infection and no comorbidities promotes their early auditory development in a similar way to children without cCMV infection.

Key words: • CMV • cochlear implants • hearing loss

205 - CROSS-CULTURAL ADAPTATION AND PSYCHOMETRIC TESTING OF THE PEDIATRIC ABBREVIATED PROFILE OF HEARING AID BENEFIT IN TURKISH

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Background: Early diagnosis and appropriate auditory intervention are critically important for the quality of life in children with hearing loss. To achieve the targeted auditory improvement in daily life, the chosen auditory amplification system must be adapted to the individual's hearing loss characteristics, and device satisfaction must be evaluated. Considering daily life conditions, speech tests conducted in silence or noise in a clinical setting may be limited in evaluating the effectiveness of an individual's hearing aid or cochlear implant. At this point, self-report scales based on subjective auditory perception and experience play a supportive and complementary role to clinical evaluation methods by providing multifaceted information regarding auditory performance. The Abbreviated Profile of Hearing Aid Benefit (APHAB) is a widely used self-report scale developed to evaluate the benefit and satisfaction obtained from hearing aids in adults. Pediatric APHAB (P-APHAB), on the other hand, is the pediatric version of APHAB and is a structured and validated measurement tool designed to evaluate the perceived auditory performance of children aged 9-17 with hearing loss in different listening environments. The scale consists of two separate forms: a parent version (24 items) and a child version (24 items). This study aims to adapt the P-APHAB into Turkish and evaluate its validity and reliability.

Materials and Methods: A total of 359 children aged 9-17 and their parents were included in the study. The study group consisted of 139 children with hearing loss and their parents. Of these, 65 were bilateral hearing aid users and 74 were cochlear implant users. The control group consisted of 220 children with normal hearing and their parents. The child and parent versions of the P-APHAB scale were administered separately to the participants. Participants were only asked to answer the section of the scale related to "aided" use, thus aiming to assess the communication/listening problems experienced by children with their devices. Data were analyzed using SPSS v25 and AMOS v22 software.

Results: According to the results of exploratory and confirmatory factor analyses, it was determined that both the child and parent versions of the Turkish scale have a four-factor structure and provide generally acceptable structural validity at a borderline level for the target group. Cronbach's alpha coefficients were above 0.70 in all subgroups, thus confirming adequate internal consistency. A moderate positive correlation was found between child and parent responses ($r = 0,590$, $p < .001$). The total scores obtained by individuals with hearing loss on the scale were found to be significantly higher than those of their normally hearing peers $p < .001$).

Conclusions: The Turkish P-APHAB scale is a measurement tool that provides acceptable validity and sufficient reliability in evaluating communication difficulties experienced by children using hearing aids or cochlear implants in different listening environments, from both the child's and parent's perspectives.

Keywords: *hearing loss, hearing aid, cochlear implant, subjective assessment, scale*

INDUSTRY PARTNERSHIP PRESENTATIONS

Hearing reimagined: an auditory brainstem implant journey

Organized by Hannah McPierzie

334 - ACCESSIBILITY AND COMMUNICATION IN ADULT HEARING REHABILITATION: A LIVED-EXPERIENCE PERSPECTIVE

Hannah McPierzie [1]
[1] *SensesWA, Deafblind Services, Perth, Australia*

Adult hearing rehabilitation is often designed around predictable pathways and single-sensory assumptions, yet many adults experience hearing loss in far more complex ways. Sudden hearing loss, rapid decline, and dual sensory loss create rehabilitation journeys that do not fit standard models of care. This presentation offers a lived-experience perspective on navigating auditory rehabilitation as a deafblind adult, highlighting the mismatch between rehabilitation theory and the realities faced by people with combined sensory loss.

The session examines how accessibility barriers are embedded in the everyday structures of audiology services. Booking systems that rely on phone calls, clinic layouts that depend on visual cues, patient-call systems that are inaccessible to those with low vision or no hearing, and inconsistent use of speech-to-text technologies all shape whether rehabilitation is possible, safe, and equitable. These barriers are amplified when clinicians lack familiarity with the communication methods used by the communities they support. Despite working closely with D/deaf and hard of hearing adults, few audiologists have proficiency in Auslan, tactile sign, or basic visual communication strategies such as gestures, facial expression, or large-print resources. This gap limits the therapeutic relationship and restricts the patient's ability to participate fully in their own rehabilitation.

Drawing on feedback from the deafblind community, the presentation explores how rehabilitation processes can be redesigned to reflect the lived reality of dual sensory loss—particularly in an ageing population where both hearing and vision commonly decline. It argues for a model of rehabilitation that integrates multiple communication modalities, anticipates access needs from the outset, and positions the patient as an expert in their own communication. Practical strategies for improving clinic accessibility, strengthening clinician communication skills, and embedding inclusive practice into routine care will be shared.

By centring lived experience, this presentation highlights opportunities for clinicians, services, and communities to work together to create accessible, responsive, and person-centred rehabilitation pathways. It invites a re-imagining of adult hearing rehabilitation that recognises the diversity of sensory experience and ensures no one is excluded from the process of reconnecting with sound.

Keywords: accessibility; deafblindness; rehabilitation; communication

155 - HEARING AGAIN THROUGH ABIS: A LIVED-EXPERIENCE JOURNEY IN PARTNERSHIP WITH MEDEL

Hannah McPierzie [1]
[1] *Hannah McPierzie Consulting, Director, Perth, Australia*

Neurofibromatosis type 2 (NF2) is a rare condition that frequently results in profound hearing loss due to bilateral vestibular schwannomas and the neurosurgical interventions required for their management. For many individuals, including myself, this trajectory involves multiple brain surgeries and the irreversible loss of natural hearing. The psychological impact of such loss is significant, encompassing grief, identity reconstruction, and the challenge of communication barriers.

This presentation documents the lived experience of transitioning from silence to sound through two auditory brainstem implants (ABIs), both manufactured by MEDEL. While one ABI provides meaningful auditory input, the other has never produced auditory response, underscoring both the potential and limitations of this technology. With 12 electrodes delivering access to sound, rehabilitation required technical adaptation, sustained perseverance, and emotional resilience. Learning to interpret novel auditory signals illustrates the complexity of ABI rehabilitation, which extends beyond perception to encompass connection, participation, and psychosocial adjustment.

A distinctive element of this journey has been the evolving partnership with MEDEL. As the first ABI mentor in MEDEL's HearPeers program, I contribute lived-experience guidance to individuals navigating ABI use or considering implantation. Engagement with MEDEL has also included visiting their headquarters in Innsbruck to deliver professional learning sessions for engineers, researchers, and clinical staff, highlighting the everyday realities, needs, and challenges of implant users. These interactions demonstrate the value of user–industry collaboration in shaping device development, support pathways, and organisational understanding of diverse hearing outcomes.

Beyond personal recovery, this experience has informed a sustained program of advocacy and education. I contribute to audiology and medical curricula nationally and internationally, integrating lived experience into professional training to enhance clinician preparedness and empathy. Advocacy also extends to systemic change, promoting accessible rehabilitation pathways, improved awareness of hearing loss, and recognition of the varied trajectories associated with implantable technologies.

By situating personal experience within broader clinical, educational, and industry contexts, this presentation illustrates how lived experience can drive collective progress in hearing health. It highlights the transformative potential of auditory brainstem implants, the intersection of rehabilitation and grief, and the importance of meaningful partnerships between users, clinicians, and industry in advancing hearing care across the lifespan.

Posters

P01 – HEARING ASSESSMENT & DIAGNOSTICS

P01.01

71 - SELF-ADMINISTERED HEARING AID FITTING AND BENEFIT ASSESSMENT IN THE FIELD USING A RESEARCH HEARING AID

Kim Marleen Rullmann [1] - Theresa Jansen [2] - Volker Hohmann [1] - Hendrik Kayser [1]
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Most hearing tests are performed in laboratory conditions leading to reliable and reproducible results. However, they often lack representation of real-life problems, making field testing a relevant research topic. Therefore, tools for use outside the laboratory are required such as the *Virtual Hearing Clinic* (VHC) [1], a framework that provides self-administered hearing diagnostics and is accessible from mobile devices. It features unsupervised methods for pure-tone audiometry, categorical loudness scaling, and measurement of speech intelligibility.
The goal of the current study was to evaluate whether the VHC is able to capture a potential hearing aid benefit as well as perceived differences between distinct hearing aid settings in the field. To that end, the VHC was extended with a method for (self-)adjustment of amplification settings and a subjective in-situ evaluation procedure of hearing support. To enable aided measurements in real-world environments, this extended VHC framework was implemented on the *Portable Hearing Lab* (PHL) a wearable research hearing device running the *open Master Hearing Aid* (openMHA) software [2].
In a subject study, 20 hearing-impaired participants performed the VHC measurements with different gain settings. A loudness-based, an audiogram-based, a self-adjusted setting, and a non-amplified setting were investigated. Audiometry, speech, and loudness tests were conducted in an office room, in-situ evaluation was performed at a bus stop, a shoe store, and a café.
The hearing loss of all participants could be captured and hearing aid benefits as well as differences between hearing aid settings were observed for both the audiological tests and the in-situ ratings. These results show the potential of these tools to bridge the gap between laboratory tests and real-world hearing aid benefit assessment.

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[2] Kayser, H., Herzke, T., Maanen, P., Zimmermann, M., Grimm, G., Hohmann, V. (2022). Open community platform for hearing aid algorithm research: open Master Hearing Aid (openMHA). *Software X*, 17.

Keywords**:** hearing aid benefit, field study, subjective assessments, self-adjustment

P01.02

133 - EVALUATING A SPEECH INTELLIGIBILITY BASED ALGORITHM FOR PREDICTION OF SPEECH-IN-NOISE PERCEPTION IN OLDER ADULTS

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Speech-in-noise perception declines with age due to interacting peripheral and central auditory, as well as cognitive, changes. In early old age, peripheral hearing loss is the primary factor, whereas age-related changes in central auditory processing and cognition become increasingly important with advancing age. Comparing measured speech-in-noise performance with predicted outcomes can provide clinically relevant information on whether listening difficulties are age-appropriate or indicative of additional underlying mechanisms
The aim of this study was to evaluate a Speech Intelligibility Index (SII)–based algorithm for predicting speech-in-noise recognition in older listeners using Swedish sentence material (Phonemically balanced S/N +4) and based on individually measured pure-tone thresholds, as well as the stimulus presentation level. The algorithm, developed by Magnusson (1996), extends the traditional SII approach by incorporating a desensitization factor for cochlear hearing impairment and an age-related correction for the oldest adults.
From a population-based investigation (Gothenburg H70 Birth Cohort Study), we selected participants with valid speech in noise test results, excluding those with severe or conductive hearing loss, or with a native language other than Swedish. The final sample comprised 316 older adults (215 aged 70 years and 101 aged 85 years). Standardized pure-tone audiometry and speech-in-noise testing were conducted in a controlled laboratory setting, and participants additionally completed a comprehensive cognitive test battery. Predicted speech recognition scores for each ear were calculated using the SII-based algorithm and were compared with measured speech-in-noise performance.
Preliminary results showed good agreement between predicted and measured performance for the majority of women aged 70 and 85 years as well as for men aged 70 years. In contrast, prediction accuracy was lower for men aged 85, who often performed below expected levels despite age correction. Data regarding the participants' cognitive function did not explain the results in a consistent fashion, suggesting contributions from central auditory processing.
In conclusion, the SII-based algorithm provides clinically relevant predictions of speech-in-noise perception for many older adults. Discrepancies between predicted and measured performance may help identify individuals who require further audiological assessment and thereby support individualized diagnostic management and rehabilitative strategies.
Key words: Age-related hearing loss, Speech in noise, Cognition, Speech Intelligibility Index

P01.03

144 - HOW DO SELF-REPORT HEARING SCALES REFLECT SPEECH PERCEPTION IN COCKTAIL PARTY NOISE IN EXPERIENCED HEARING-AID USERS?

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Background and rationale
There are inconsistencies, across several studies, as to the importance of relationships between self-report hearing related measures, and speech in noise impairments, and such relationship, in users of conventional hearing-aids, has not been largely investigated.
The present study aimed to analyse, in experienced hearing-aid (HA) users, the interrelations between (1) Speech perception in cocktail party noise (SPIN), measured with and without HAs (2) a self-assessment of the listening effort perceived during the SPIN task (TLE) and (3) self-report auditory scales (the 15 items short-form of the Speech Spatial and Qualities of hearing scale (15iSSQ) and the Extended listening Effort Assessment Scale (EEAS).

Material and methods
Thirty two patients, aged of 77.5 years (SD=12), with a mean HA experience of 5.6 years, completed the 15iSSQ and EEAS. Their SPIN thresholds were assessed with (HA_SPIN) and without their HAs (UA_SPIN), using a four alternative forced choice test in free field, with several fixed SNR ratios, in babble noise. They were asked to self-assess their listening effort at each of those SNR ratios, allowing to define a “task related listening effort threshold” with (HA_TLE) and without HAs (UA_TLE), i.e., the SNR for which they self-evaluated their listening effort as 5 out of 10. Conditional process analysis was used.

Results
SSQ decreased as both HA_SPIN ($r=-0.47$, $p<0.01$) and HA_TLE increased ($r=-0.36$, $p<0.05$). Relationship between SSQSpeech and UA_SPIN (and UA_TLE) showed a strong moderating influence by HA experience and HA daily use (HADU), explaining up to 31% of variance. 15iSSQQuality depended on HA SPIN and HA_TLE ($r=-0.50$, $p<0.01$), and the relationship between SSQQuality and UA_TLE was moderated by HADU. EEAS scores depended on both HA experience and UA_SPIN, with a strong moderating influence by HADU.

Conclusion
Relationships between auditory questionnaires and speech in babble noise tests are strongly moderated by both HA experience and HADU, even in experienced HA users, showing the need to take into account those variables when analyzing relationships between scales and hearing in noise tests in HA users.

Keywords
Speech in Noise Perception; Hearing-Aids; Patient-Related Outcome Measures; Listening Effort

P01.04

145 - THE NEURAL BASES FOR AUDIOVISUAL SPEECH COMPREHENSION IN NATURALISTIC CONTEXTS

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Understanding speech is an innately multisensory process. It combines our ability to process pitch, tone, acoustics, and visual input simultaneously, with little effort. Speech perception thus offers a unique opportunity to investigate how our senses collaborate in noisy environments.
In many traditional experimental designs, auditory, visual, and language components of stimuli are deliberately isolated, introducing what has been termed a “laboratory-style” bias. Although these controlled settings help identify consistent behavioral or neural responses, they do not reflect how speech is processed in real life, where communication is fast, contextual, and shaped by environmental variability. These limitations hinder our understanding of the complex interplay between auditory and visual signals, such as the effects of background noise and facial cues. This limitation is evident even in functional neuroimaging studies, which often show that the left posterior superior temporal sulcus (pSTS) is active when audiovisual information is processed. However, due to a lack of comprehensive stimuli, it remains unclear how these neural mechanisms might function in everyday speech.
To address these gaps, researchers have increasingly turned to naturalistic stimuli. These are continuous, dynamic, context-rich, and multisensory. Specifically, movie-watching paradigms offer an ecologically valid way to study cognition. They combine visual, auditory, and narrative elements that naturally engage broad neural networks. Movie-based studies spark new and exciting avenues of research and discovery as such paradigms elicit reliable, simultaneous sensory responses across individuals, especially in visual, auditory, and higher-order cortical areas.
The current study aims to assess multisensory speech perception using two full-length films: 500 Days of Summer (1 hour, 35 minutes) and Citizen Four (1 hour, 53 minutes). We used functional magnetic resonance imaging (fMRI) data from the Naturalistic Neuroimaging Database (NNDb) (Aliko et al., 2020). We manually annotated onset times for over 22,000 speech events between both movies. Words were also coded for whether the talker’s mouth was visual (audiovisual speech) or not (auditory-only speech). These were then convolved with a hemodynamic response function (HRF) to create regressors for a general linear model (GLM) analysis. We hypothesized increased activation in the superior temporal gyrus (STG) for audio-only words. We also expected visual cortex responses for audiovisual speech and robust pSTS activation during naturalistic viewing.
Using a whole-brain corrected threshold, we consistently identified speech-related activation in bilateral STG across all 38 individual participants. Further, we identified several regions of overlap between the two movies. This was true for both auditory-only and audiovisual speech. Contrary to expectations, we did not observe visual cortex activation for audiovisual speech. However, we found enhanced activation in the left pSTS in all participants.
These findings underscore the potential of movie-watching paradigms for ecologically valid speech processing. By expanding on traditional experimental approaches, this method provides valuable new insights into how the brain supports real-world communication. Moreover, the implications extend beyond research alone, as naturalistic speech-processing research can drive advances in hearing-aid algorithms and help integrate audiovisual features into assistive devices. This, in turn, underscores the importance of ecological validity for practical benefits. Finally, continued naturalistic neuroimaging work will further inform the development of adaptive hearing technologies.

Keywords: Speech perception, Listening effort, Auditory Neuroscience, Functional MRI, Audiovisual

P01.05

146 - FROM REMEMBERING TO HEARING : COGNITIVE INFLUENCES ON MATRIX SENTENCE TESTS THRESHOLDS IN HEARING-IMPAIRED PATIENTS.

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Background and Rationale

Sentence matrix tests, used mainly for speech in noise assessments, are composed of short syntactically correct but semantically improbable sentences, made from a fixed set of 50 words. In all languages, a decrease of the 50% threshold of about 1.2 dB has been shown across the first 2 tests, with further decrease of less than 1 dB for further tests, in groups of young normally hearing individuals. This well-known training effect has yielded the recommendation of performing two training lists of 20 sentences each of overcome this procedural learning effect. However, the decline of verbal learning abilities and working memory that comes with age, could affect the duration and extend of the training effect in older population with hearing-impairments.

The aim of this study was to assess the potential influence of verbal learning, verbal fluency and working memory abilities on the evolution of matrix sentence test thresholds with practice, in older patients with hearing-aids.

Material and methods:

Thirty patients, aged 73.2 years (SD=9.7) with hearing impairment (Best ear pure tone hearing threshold (PTA) of 41.7 dB HL (SD=1.7)), and hearing-aids were included.

The French Matrix test (Framatrix) was performed 5 times (T1 to T5), using 5 different lists of 20 sentences each, in randomized order, in the open set mode, using a collocated signal and a fixed level noise emitted from a loudspeaker placed at a distance of 1 meter in front of the patient. The noise was held constant at 65 dB SPL with the signal level varying adaptatively, to obtain the 50% threshold.

Patients' working memory was assessed using forward and backwards digit span presented visually. Other cognitive tests involved phonological verbal fluency and a lexical test. Verbal learning and memory for frmatrix specific words was assessed using a Framatrix recall task, and a purposely built Matrix word recognition test. Before and after the Matrix session, patients were tested for memory of the matrix test items. Twenty patients, out of the 30, were retested 3 to 4 weeks later, allowing the assessment of the reproducibility of the test.

Results

A mixed-effects model with random intercepts, using test number, PTA and memory scores as fixed effects, revealed a strong effect of test number, with the threshold decreasing progressively from T1 (mean=2.4 dB, SD=3.22) to T5 (mean=-0.7, SD=1.9) (all $p < .001$). Threshold increased significantly with PTA for all tests ($p<0.0001$), but this PTA effect was significantly attenuated in later tests, as shown by robust PTA x test number interactions (all $p<0.005$).

As memory tests scores increased, matrix test threshold decreased significantly ($p=0.008$), especially for T1, and this effect was significantly reduced in T4 and T5 (test number x memory interactions, $p<0.03$). The intra-subject difference in thresholds, calculated across the last four tests, ranged from 0.5 dB to 4.2 dB, and increased significantly as verbal fluency decreased ($r=-0.39$, $p<0.04$).

For the 20 patients group involved in the reproducibility study, a linear mixed effect model showed significantly lower thresholds in the second session and a decreasing influence of test number. The PTA effect on threshold was significantly lower in session 2, and there was a significant influence of verbal learning, where better learning was associated with lower thresholds. Between the two sessions, Bland-Altman test showed that a change in thresholds of more than 3.5 dB (for the third test), and 2.7 dB (later tests) reflected changes not linked to measurement variability.

Conclusion

In an older population with hearing-impairment, the training effect with sentence matrix test is significantly greater than in normal hearing population. It depends, to a small degree, on verbal learning abilities and affects the sensitivity of the test across sessions and test number. This should be taken into account when comparing repeated thresholds in different conditions for the same patient, where a change of less than 3 dB in thresholds might be linked to measurement variability.

P01.06

164 - TOWARDS MORE INDIVIDUALIZED HEARING AID FITTING METHODS: LINKING LABORATORY MEASURES TO REAL-WORLD OUTCOMES

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People with hearing impairment sharing similar audiograms can vary substantially in their speech perception with hearing aids, both in laboratory measurements and to an even larger degree in subjective assessments in the real world. To better adapt hearing aid settings to individual needs and ensure the best possible fitting for the user, reliable predictions of real-world hearing-aid benefit are needed - either through new measurement procedures or refined models that take individual hearing abilities into account.

The joint research project “Individualized, Model-Based Hearing Aid Fitting” (IMFIT) explores the relationship between aided speech perception (i.e., speech recognition and listening effort) in the laboratory, in real-world assessments and in predictive modeling.

In a screening study, speech recognition measurements were performed with 100 participants with hearing impairment to characterize individual hearing ability. Measurements were conducted over headphones using virtual acoustics to simulate a measurement room and included stationary and fluctuating speech-like noise from different directions. Individualized amplification was applied to ensure audibility. Results showed substantial variability in speech recognition thresholds (SRTs) for listeners with similar hearing thresholds, particularly in conditions with fluctuating noise.

Based on these results, 20 hearing-impaired participants who exhibited very high or very low SRTs were selected for further testing. All participants were individually fitted with hearing aids and completed an extended test battery including measures of speech intelligibility, subjective listening effort and loudness perception. Results showed that SRTs from the screening study with amplified signal presentation via headphones closely corresponded to those obtained with real hearing aids, individual fitting and loudspeaker presentation.

To assess the real-life relevance of the laboratory results, Ecological Momentary Assessment (EMA) was conducted during a guided tour and within the participants’ individual daily environments. EMA outcomes were related to laboratory results, and the predictive power of the lab-based measurements for real-world aided speech perception was evaluated.

This work was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation), Project ID 352015383, SFB 1330 Project C4, as well as the Lower Saxony Department of Science and Culture and the European Regional Funding (EFRE, ZW 7- 87012865)

P01.07

175 - THE COGNITIVE UNDERPINNINGS OF SPEECH IN NOISE INTELLIGIBILITY: A LATENT VARIABLE ANALYSIS

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Background/Rationale: Listeners' scores on cognitive tests often predict the intelligibility of speech in noise (SIN) above and beyond audiometric thresholds. In particular, based largely on studies using the Reading Span Task, working memory has been proposed to play a key role in SIN intelligibility. However, all cognitive abilities are positively intercorrelated, with people who perform better on one cognitive test also performing better on others. Thus, an association between working memory and SIN intelligibility may be artefactual: another cognitive ability, correlated with working memory, may instead underlie performance in SIN tests. Indeed, recent studies have revealed that scores on tests of abilities such as fluid reasoning and processing speed also predict SIN intelligibility. This raises the question: Which cognitive abilities truly enable success while listening to speech in noise?

Materials and Methods: A two-session study was conducted online. Three hundred younger and middle-aged adults, who all passed a hearing screening questionnaire and a headphone check, completed Session 1. Participants completed three tests sensitive to each of three abilities: the perception of semantically meaningful sentences in noise (e.g., normal IEEE sentences, such as "The boy was there when the sun rose"), the perception of semantically nonsensical sentences in noise (e.g., scrambled IEEE sentences, such as "The soft wire stunned the shiny eggs"), and crystallized knowledge (e.g., the Mill Hill Vocabulary Scale). For each type of speech, each test was comprised of unique sets of 30 sentences, recorded using unique talkers and masked with unique multi-talker "babble" (6-, 9-, or 12-talker). Participants typed back what they heard for each sentence and were scored based on keywords. For each speech test, two signal-to-noise ratios were used that, based on piloting, targeted mean scores of 70%. In Session 2, participants again completed three tests sensitive to each of several abilities: working memory, fluid reasoning, processing speed, and attention control.

Results: Data from Session 1 indicate that mean speech test scores were near expected levels (~70%), and that mean cognitive scores far exceeded chance levels. Scores for all six speech tests (three meaningful, three nonsensical) were strongly intercorrelated (rs > .85). Indeed, exploratory factor analysis revealed that these six speech scores were so closely related that they were best explained by a single statistical factor, rather than two. The three crystallized knowledge tests were, as expected, moderately intercorrelated and loaded moderately to strongly onto a second factor. Crystallized knowledge, at the factor level, exhibited little to no association with the speech factor. Early data from Session 2 indicate that, as expected, each triad of tests sensitive to a single cognitive ability were intercorrelated and loaded onto their own factors. However, unlike crystallized knowledge, these other abilities—such as working memory and fluid reasoning—significantly correlated with speech test scores.

Conclusions: Reporting words masked by multi-talker babble, either from semantically meaningful or nonsensical sentences, appears to be a single ability. Thus, both types of speech in noise perception appear to tap into the same cognitive processes. Listeners with better crystallized knowledge do not necessarily perform better in SIN tests, although those with better working memory and fluid reasoning may benefit from these capacities. Data collection for Session 2 is ongoing. Once completed, latent variable-based structural equation modelling will investigate whether any of these cognitive abilities, such as working memory, support SIN intelligibility when statistically accounting for the others. This finding would facilitate the implementation of brief and targeted cognitive tests in audiology, which could in turn improve the sensitivity of hearing tests to impairment or hearing aid fittings.

Keywords: Cognition, Working Memory, Crystallized Knowledge, Speech Perception, Speech in Noise

P01.08

192 - MELODIC AND RHYTHMIC CUES IN SUNG SPEECH: IMMEDIATE RECALL AND DELAYED RECOGNITION

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Objective: Sung speech integrates linguistic content with melodic and rhythmic structure and is often assumed to facilitate verbal memory (i.e., the *Song Memory Advantage*). However, prior findings on whether sung speech facilitates verbal memory are mixed, possibly because pitch and rhythm are rarely manipulated independently. This study dissociated pitch contour and rhythmic regularity to test their separate contributions to immediate and delayed sentence recall, and whether these effects vary with perceptual musical skills.
Methods: A cohort of fifty normal-hearing young adults (mean age = 20.18 years; 22 males) with no musical training participated. Participants listened to 96 ten-syllable Mandarin sentences presented as either a spoken baseline or sung speech in a 2 × 2 design manipulating pitch (fixed versus varied) and rhythm (fixed versus varied). In the short-term recall task, participants typed each sentence immediately after hearing it (self-paced). Delayed recall was assessed one week later using an old/new recognition test. To ensure attention to melodic information, a melody recognition probe (same/different) was interleaved within the sung blocks. Additionally, perceptual musical skills related to speech perception were assessed using the Profile of Music Perception Skills (PROMS).
Results: Across conditions, short-term recall accuracy was higher for spoken than sung speech, with the spoken baseline showing a ceiling effect. Within sung speech conditions, sung speech with fixed-rhythm contours produced higher recall accuracy than varied-rhythm contours, regardless of pitch variations. Recall accuracy did not differ significantly between fixed-pitch and varied-pitch contours, regardless of rhythm. Additionally, melody recognition accuracy exceeded 75%, indicating that participants attended to melodic contours during encoding. For delayed recall, speech recognition (d') was higher for spoken than sung sentences, providing no evidence for a long-term advantage of sung presentation. Within fixed rhythm conditions, speech sung on varied-pitch contours yielded a higher d' than fixed pitch, suggesting that pitch variation facilitates delayed recognition when rhythmic structure is stable. Perceptual musical skills, particularly accent and melody subtests, were positively correlated with short-term recall but not with delayed recognition.
Conclusion: Overall, these findings demonstrate no song memory advantage in short-term recall and delayed recognition of speech sentences. Instead, rhythmic regularity emerges as the primary contributor to short-term recall, supporting the temporal scaffolding hypothesis that stable temporal structure scaffolds attention and encoding. Pitch variations may provide secondary support for speech recognition when rhythmic structure is stable. Moreover, perceptual musical skills were associated with immediate recall but not delayed recognition, highlighting the potential role of musical skills in immediate speech recall.
Keywords: song memory advantage, sung speech, short-term recall, rhythm, pitch

P01.09

204 - CLINICAL PERFORMANCE OF APPLE AIRPODS PRO 2 FOR SELF-ADMINISTERED AUDIOMETRY AND SELF-FITTED HEARING REHABILITATION IN PATIENTS WITH MILD TO MODERATE HEARING LOSS

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Background: Over-the-counter (OTC) hearing aids have recently emerged as accessible alternatives to conventional hearing aids, driven by advances in consumer audio technology and regulatory changes. This study aimed to evaluate the accuracy of self-administered pure-tone audiometry (PTA) and the clinical efficacy of self-fitting an OTC device (Apple AirPods Pro 2) compared with clinician-led audiologic assessment and fitting in adults with mild-to-moderate hearing loss.

Methods: This prospective comparative study enrolled 30 adults with mild-to-moderate hearing loss. Participants underwent clinician-administered PTA, word recognition score (WRS), and speech-in-noise (SpIN) testing, followed by self-administered PTA and self-fitting using an OTC device. Audiologic outcomes, including aided PTA thresholds, functional gain, WRS, and SpIN performance, were compared between clinician-fitted and self-fitted conditions using Wilcoxon signed-rank tests.

Results: The study included 30 participants (14 men and 16 women) with a median age of 62 years (interquartile range [IQR], 64–67). The median pure-tone average was 39.21 dB HL (IQR, 35–42.5) in the right ear and 40.25 dB HL (IQR, 36.25–44.38) in the left ear. Self-administered PTA thresholds differed significantly from clinician-administered PTA (39.73 ± 6.22 dB vs 38.15 ± 7.17 dB ; p = 0.005). Functional gain also showed a significant difference between clinician-fitted and self-fitted conditions (7.39 ± 3.64 dB vs 6.11 ± 4.38 dB ; p = 0.007). No significant difference was observed in word recognition scores between the two fitting methods (p = 0.28). In contrast, speech-in-noise list scores differed significantly between conditions (p < 0.001), although word- and sentence-level scores were comparable.

Conclusion: Self-fitting of an OTC hearing device using AirPods Pro 2 demonstrated partial clinical feasibility; however, significant discrepancies in PTA accuracy and functional gain were observed compared with clinician-led procedures. Performance variability was particularly evident in speech perception under noisy conditions, underscoring the need for cautious clinical adoption and further validation of OTC self-fitting approaches.

Keywords: Over-the-Counter Hearing Aids, Self-Administered Audiometry, Hearing Aid Fitting

P01.10

213 - EMOTIONALLY-VALENCED MUSICAL INTERVALS FACILITATE VERBAL MEMORY

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Objective Musical mnemonics enhance memory encoding and retrieval by engaging emotional and arousal-related mechanisms. According to the arousal and mood hypothesis, music influences memory through changes in arousal or mood and activation in emotional brain regions. However, prior findings on the effects of emotional valence in sung mnemonics are mixed, with some studies reporting benefits of positively-valenced music and others found no effect. This study examined how emotional valence (positive, negative, or neutral) of sung mnemonics affects immediate and delayed word recall. We hypothesized that positively-valenced sung mnemonics would enhance recall relative to negative and neutral conditions.
Methods Emotional valence was manipulated using consonant and dissonant musical intervals, known to evoke pleasant and unpleasant feelings. Consonant intervals included major third, minor third, and perfect fifth, while dissonant intervals comprised minor second and tritone. Neutral intervals used unison pitch. Participants recalled lists of 5-9 Mandarin bisyllabic words presented either in spoken format or sung with positive, neutral, or negative musical intervals. Recall was tested both immediately (after 30 seconds) and after a 24-hour delay. Emotional valence ratings of the musical intervals were collected using a 7-point Likert scale. Supplementary measures related to musical emotion processing, including the Barcelona Music Reward Questionnaire (BMRQ) and Beck Depression Inventory (BDI-II), were also collected to assess individual differences in music reward sensitivity and depressive tendency.
Results Words sung onto emotionally-valenced intervals (both consonant and dissonant) had higher recall accuracy compared to neutral intervals. Consonant intervals were rated as more pleasant than dissonant or uni-pitch intervals, validating the consonance-dissonance dichotomy in affect processing. Although spoken words still showed superior overall recall, emotionally-valenced sung words outperformed neutral unison intervals. Memory performance was significantly modulated by individual differences: higher music reward sensitivity (specifically social reward and mood regulation) predicted better recall for consonant intervals, while higher depressive tendency (BDI-II) was associated with poorer encoding only for dissonant stimuli. Notably, music reward sensitivity showed a stronger relationship with recall for dissonant intervals, suggesting that individuals with higher sensitivity demonstrate enhanced memory encoding even for emotionally unpleasant musical stimuli.
Conclusion Collectively, these findings support the memory benefits of musical mnemonics on word recall. Words sung onto emotionally-valenced musical intervals, either pleasant (consonant) or unpleasant (dissonant) facilitate short-term verbal memory. The effects are significantly modulated by individual differences in music reward sensitivity and depressive tendency. These findings have important implications for utilizing music-based intervention to improve memory processing in clinical or educational settings.

P01.11

248 - DEVELOPMENT AND VALIDATION OF A MANDARIN STAGGERED SPONDAIC WORD TEST (TW-SSW) FOR CENTRAL AUDITORY PROCESSING ASSESSMENT

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Background
Central auditory processing (CAP) refers to neural mechanisms responsible for the interpretation and organization of auditory information, including speech perception and sound localization. Central auditory processing disorders may present as difficulty understanding speech in noise or following verbal instructions despite normal peripheral hearing sensitivity. The Staggered Spondaic Word (SSW) test is a dichotic listening paradigm widely used to evaluate central auditory nervous system function through temporally overlapping disyllabic stimuli presented to both ears, generating competing and non-competing listening conditions. Owing to its binaural competition demands, the SSW test enables simultaneous assessment of multiple auditory processing abilities. This study aimed to develop and validate clinically applicable Mandarin SSW materials for use in Taiwan (TW-SSW).
Materials and Methods
Development was conducted in two stages: stimulus construction and homogeneity validation. TW-SSW materials were designed according to Katz's principles (1963): (1) each item consists of two familiar spondees, (2) competing syllables are duration-matched, and (3) non-competing syllables form meaningful disyllabic words. Candidate stimuli were extracted from the Taiwan Mandarin Conversational Spoken Corpus, representing spontaneous conversational speech across diverse communicative contexts. Eligible disyllabic words occurred more than ten times in the corpus and shared identical tonal patterns. Words involving tone sandhi or beginning with /yī/ or /bù/ were excluded, yielding 177 disyllabic words.
All stimuli were recorded by a male Taiwan Mandarin–speaking speech-language pathologist in a sound-treated booth using controlled speech rate and clear articulation. Each token was recorded three times in WAV format. Recording quality and intelligibility were rated by three normal-hearing listeners, and the highest-rated tokens were selected and edited using GoldWave software. One hundred TW-SSW test items were generated. Item homogeneity was evaluated by analyzing syllable duration across three positions (first, middle, and third syllables). Twenty-two normal-hearing adults (15 females, 7 males) participated. Cognitive screening included registration, calculation, and working memory components of the Mini-Mental State Examination. Inclusion criteria were pure-tone thresholds ≤25 dB HL (250–8000 Hz), good speech discrimination, and symmetrical auditory brainstem response wave I–V interpeak latencies. Four competing and four non-competing conditions were administered under right-ear-first (REF) and left-ear-first (LEF) listening conditions. Test–retest reliability was examined.
Results
Mean syllable durations at the first, middle, and third positions were 0.84, 0.87, and 0.84 s, respectively. Levene's test confirmed homogeneity of variance across syllable positions. A one-way analysis of variance (ANOVA) demonstrated a significant effect of syllable position on duration, and Scheffé post hoc comparisons indicated that the middle syllable was significantly longer than the first and third syllables. Error rates across eight REF and LEF listening conditions were analyzed; items demonstrating zero errors across both listening modes were operationally defined as homogeneous. Following test–retest evaluation, 38 items satisfied homogeneity criteria and were retained as the final TW-SSW stimulus set.
Conclusions
The TW-SSW represents a standardized Mandarin dichotic listening test developed using corpus-based stimulus selection and empirical homogeneity validation. The binaural competition demands of the TW-SSW support multidimensional assessment of central auditory processing and provide a clinically applicable evaluation tool for Mandarin-speaking populations.

Keywords: central auditory processing; dichotic listening; staggered spondaic word test

P01.12

264 - SUMMARY OF 10 YEARS OF THE STIMULATION OF POLYMODAL SENSORY PERCEPTION BY SKARŻYŃSKI (SPPS-S®) BASED ON THE RESULTS OF OVER 4 THOUSAND PATIENTS

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Background
In 2014, the Skarżyński Method of Polymodal Sensory Perception Stimulation (SPPS-S®) was introduced to the market. It is a form of auditory stimulation applied in various groups of disorders that coexist with central auditory processing disorders. The solutions used in SPPS-S® offer a multifaceted therapy by simultaneously engaging different senses (hearing, vision, and touch), their integration, and coordination combined with psychological training. Patients can undergo SPPS-S® therapy either at a rehabilitation center (in person) or at home (remotely). The device used for therapy is the only one on the Polish market that has a medical device conformity certificate, and this solution has been awarded and recognized with numerous accolades both in Poland and abroad.The aim of this work is to present the method of Polymodal Sensory Perception Stimulation by Skarżyński (SPPS-S®) and the results of patients who, over the course of 10 years since the method's introduction to the Polish market, have utilized this rehabilitation method.
Material and methods
The analysis is based on the results of 4,372 patients who underwent SPPS-S® therapy between 2014 and 2024
Results
The patients' results confirm a statistically significant effect of the therapy in all analyzed tests assessing central auditory processing.
Conclusions
Based on the analysis of the patients' results, it has been demonstrated that SPPS-S® therapy is an effective form of treatment for patients with central auditory processing disorders. The method's principles, which utilize cutting-edge telemedicine solutions and medical device conformity certification, ensure high safety in its application.
Key words: • SPPS-S therapy • CAPD • central auditory processing disorders

P01.13

265 - THE IMPORTANCE OF HEARING SCREENING AND CENTRAL AUDITORY PROCESSING IN SCHOOL-AGED CHILDREN

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Background

The aim of the study was to evaluate the prevalence of undiagnosed hearing impairment or central auditory processing disorders in children from I and VIII grades of primary schools in Warsaw.

Material and methods

The participants in the study were 15,659 pupils from classes I and VIII attending primary schools in Warsaw. As part of the study, the hearing threshold for air conduction at frequencies of 0.5–8 kHz was determined, and a test assessing central auditory processing was performed: FPT (Frequency Pattern Test), DDT (Dichotic Digit Test), the Auditory Behaviour Scale (SAB), and an interview questionnaire developed for the program.

Results

Abnormal test results were found in 1946 children, of which abnormal hearing screening test results were found in 678 children tested, while reduced central auditory processing results were found in 1268 children.

Conclusions

The program implemented draws attention to the fact that tests of central auditory processing are included in the testing protocol. As has been shown, peripheral hearing testing alone is not sufficient to exclude abnormalities concerning the sense of hearing.

Key words: • hearing screening • central auditory processing disorders • pure tone audiometry

P01.14

276 - USE OF EXTENDED HIGH FREQUENCY AUDIOMETRY TO PREDICT CHANGES IN FINNISH MATRIX SENTENCE TEST

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Conventional pure-tone audiogram assesses the audibility of sounds only up to 8khz and does not measure how listeners perceive speech in noisy everyday situations. Hearing thresholds in the extended high frequency (EHF, 8khz-20khz) range have been shown to better predict difficulties in speech perception in noise (SPIN). Since all published studies on EHF hearing have been conducted in Germanic languages, the aim of our study was to assess the impact of language on the role of EHF hearing in predicting SPIN measured with the Finnish matrix sentence test (FMST) in Finnish-speaking participants.

Material & Methods

We recruited 100 healthy native Finnish speaker aged 22-74 years, with age-normative hearing and no previous exposure to ototoxic medication. Study measures included audiometry (0.125khz-16khz) and SPIN assessments with the Finnish matrix sentence test (S0N0 and S0N±90). The test-retest time was 7 months.

Results

Participants' mean age was 52.14 years (SD 14.57), and the mean pure-tone average (PTA) from conventional frequencies (0,5khz, 1khz, 2khz and 4khz) was 10.44 dB (SD 9.77 dB) and from EHF (9khz, 10khz, 12,5khz, 14khz, 16khz) PTA was 49.45 dB (SD 25.08 dB). The mean speech-reception threshold (SRT) was -8.37 dB SNR (SD 1.13 dB SNR). Fifty-nine participants were under the age of 60, and their mean age was 42.45 (SD 10.88). Their mean PTA from conventional frequencies was 6.12 dB (SD 6.13 dB) and from EHF PTA was 34.76 dB (SD 21.69) and mean SRT -8.87dB SNR (SD 0.77).

In the full cohort, both age and EHF PTA were significantly associated with FMST results in unadjusted linear regression analyses (age: $R^2 = 0.27$, $p < 0.0001$; PTA: $R^2 = 0.27$, $p < 0.0001$). However, given the strong correlation between age and PTA, multivariable models demonstrated that in our cohort of listeners without significant hearing loss, PTA was not independently associated with FMST results after adjustment for age ($p = 0.13$), whereas age remained significantly associated ($p = 0.027$). Inclusion of quadratic and interaction terms did not improve model fit. Among participants younger than 60 years (N = 59), neither age nor high-frequency PTA was significantly associated with FMST results in unadjusted or adjusted models.

Conclusion

Our preliminary results suggest that in our Finnish-speaking study population without significant hearing loss, the role of extended high frequency thresholds in explaining SRTs was not significant.

P01.15

302 - AGE EFFECTS ON DIOTIC AND ANTIPHASIC SPEECH-IN-NOISE PERFORMANCE IN BRAZILIAN SCHOOL-AGE CHILDREN

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Age Effects on Diotic and Antiphasic Speech-in-Noise Performance in Brazilian School-Age Children
Background/Rationale: The Brazilian Portuguese Digits-in-Noise Test (BP-DIN) has been validated and is an accurate tool for identifying hearing loss in individuals aged 18 years and older. Validation in the pediatric population is ongoing, and understanding factors that influence performance in both presentation modes (diotic and antiphasic) is essential, particularly considering their potential complementary use in hearing screening programs. This study aimed to characterize age-related changes in speech-in-noise performance in school-aged children in both diotic and antiphasic presentation modes. Materials and Methods: This cross-sectional study included school age children. The antiphasic BP-DIN was conducted in a school setting, in acoustically quiet environments checked by NIOSH application, using the hearDigits application (hearX) accessed via web interface on smartphone with insert earphones. Participants listened to 23 digit triplets presented in filtered white noise and entered responses on the device keypad. An adaptive procedure adjusted stimulus levels according to performance. Signal-to-noise ratio (SNR) for speech recognition was the outcome measure. All participants underwent pure-tone hearing screening (AD229B audiometer; pass–fail criterion of 20 dB HL at 1, 2, and 4 kHz) and completed a questionnaire addressing auditory perception and listening habits. The order of test presentation (diotic and antiphasic) was randomized across participants. Descriptive statistics were calculated for SNR values in both conditions. The Shapiro-Wilk test was applied to verify data normality. The association between age and SNR was examined using Spearman`s correlation for each mode, adopting a 5% significance level. Results: The sample comprised 131 children (6–16 years; mean age = 10.8 ± 2.27 years), of whom 47.3% were male and 52.7% were female. Eight participants did not complete the test under the diotic condition, and four did not complete the antiphasic condition. In the diotic condition (n = 117), six participants were excluded due to non-compliance during testing; median SNR was -8.20 dB (Q1 = -10; Q3 = -5.8). In the diotic condition, age was moderately and negatively correlated with SNR (Spearman's ρ = –0.346, $p < .001$), indicating better speech-in-noise performance with increasing age. In the antiphasic condition (n = 123), four participants were excluded due to non-compliance during testing; median SNR was -9.6 dB (Q1 = -13.3; Q3 = -6.6). In the antiphasic condition, age was moderately and negatively correlated with SNR (Spearman's ρ = -0.372, $p < .001$), indicating improved speech-in-noise performance with increasing age. Conclusion: Age was negatively correlated with SNR in both presentation modes. In the diotic condition, the correlation was moderate, and a slightly stronger association was observed in the antiphasic condition, indicating progressive improvement in speech-in-noise performance with increasing age.

Key words: speech-in-noise; pediatric audiology; hearing tests; screening; child

P01.16

304 - TACTILE CUES SHAPE NEURAL PROCESSING OF SPEECH IN NOISE

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Speech processing and understanding are generally efficient in quiet environments but become challenging under adverse listening conditions, such as in the presence of noise. In such contexts, listeners rely not only on auditory input but also on multisensory integration mechanisms to extract the target speech signal. Linguistic information used for successful extraction of the salient signal is not only conveyed through the auditory channel: the beneficial role of visual cues is well established, whereas little is known about the contribution of other sensory modalities, such as the haptic modality (Guilleminot et al., 2022; Răutu et al., 2023, Răutu et al., 2025).
In this work, we investigated the neural tracking of continuous speech in different types of background noise in the presence or absence of a tactile stimulation aligned with linguistic information, to test whether temporally structured haptic cues can scaffold speech processing under adverse listening conditions.
Electroencephalography (EEG) was recorded from 30 right-handed, normal-hearing participants (mean age = 25.7 years, SD = 3.7; 40% male, 60% female) while they listened to short narratives presented in two formats: audio-only (A) and audio-tactile (AT). In the A conditions, naturalistic continuous speech was embedded either in traffic noise or in multi-talker background noise (both at an SNR of −1 dB). In the AT conditions, speech was embedded in multi-talker noise (SNR – 1dB) while participants simultaneously received vibrotactile stimulation temporally aligned either with phoneme or word onsets of the target speech. Within the EEG session, speech comprehension and intelligibility scores were collected.
Neural synchronization with the speech envelope and tactile stimulation was assessed at the individual level using univariate and multivariate Temporal Response Functions (TRFs), allowing us to quantify the temporal alignment between neural activity and speech dynamics.
Although behavioral measures of speech intelligibility and comprehension did not differ significantly across conditions, results revealed an anticipated neural tracking of the speech sound envelope in the traffic compared to the multi-talker noise condition ($p<0.05$, cluster corrected). Furthermore, multivariate analyses comparing the multi-talker A condition with the two AT conditions (separately for phoneme or word onsets) showed that neural tracking was significantly modulated by vibrotactile stimulation ($p<0.05$, cluster corrected). However, no clear evidence of enhanced speech envelope tracking emerged. Overall, these findings confirm a stronger impact of multi-talker background noise compared to traffic noise, consistent with previous literature (Straetmans et al., 2024.). Moreover, results suggest that haptic stimulation temporally aligned with high-level linguistic features modulates neural processing involved in speech processing under noisy listening conditions, supporting the view that haptic modality can be used to shape cortical dynamics associated with speech processing.

Keywords: Neural tracking; Speech-in-noise; Auditory-tactile speech processing; Phoneme Onsets; Word Onsets;

P01.17

310 - DIGITS-IN-NOISE HEARING SCREENING AND GLOBAL COGNITIVE STATUS IN COMMUNITY-DWELLING VERY OLD ADULTS

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Introduction: Hearing loss and cognitive decline are both strongly associated with advancing age. In Jardim do Seridó, a municipality in Northeast Brazil, a substantial proportion of residents are aged 80 years or older, highlighting the need for community-based screening strategies. Objective: This study aimed to describe digits-in-noise (DIN) screening results and examine their relationship with global cognitive status in community-dwelling very old adults. Methods: Cross-sectional study. The validated antiphasic Brazilian Portuguese Digits-in-Noise test (BP-DIN) was administered at participants' homes in quiet environments using the hearDigits widget (hearX) on an examiner-provided smartphone and in-ear headphone. Participants listened to 23 digit triplets presented in filtered white noise and repeated them aloud, while the examiner entered responses directly into the device. An adaptive procedure automatically adjusted presentation levels according to performance to estimate the speech reception threshold (SRT). Pure-tone audiometry was not available; therefore, BP-DIN was used as a functional hearing screening measure. Global cognitive status was assessed using the Leganés Cognitive Test, a screening instrument designed for populations with low educational levels. Scores range from 0 to 32, with values ≤26 indicating cognitive impairment and ≤22 indicating severe cognitive impairment. Based on these cutoffs, participants were classified into three groups: no cognitive impairment (G1), cognitive impairment (G2), and severe cognitive impairment (G3). Statistical analyses included Spearman's correlation and the Kruskal-Wallis test with Dwass-Steel-Critchlow-Fligner post-hoc comparisons. Results: Fifty-three individuals from 80 to 94 yrs old (mean age = 84.5 ± 3.25 years) participated in the study. BP-DIN SRTs ranged from -8.60 to 17.7 dB SNR. Based on the BP-DIN cutoff, 11.3% passed and 88.7% failed the hearing screening. Median BP-DIN values were 1.2 dB in G1, -2.4 dB in G2, and -1.8 dB in G3. No significant differences were observed between groups according to cognitive status (Kruskal-Wallis $\chi^2(2) = 0.016$, $p = 0.992$, $\varepsilon^2 = 0.0003$). No significant correlation was found between BP-DIN SRTs and Leganés scores (Spearman's $\rho = -0.111$, $p = 0.430$), indicating that DIN screening performance did not vary according to global cognitive status in this very old and relatively homogeneous sample. Conclusion: In this community-based sample of adults aged 80 years and older, DIN screening revealed a high prevalence of hearing difficulties but was not associated with global cognitive screening scores. The absence of association should be interpreted with caution given the homogeneity of the sample and the lack of audiometric data. Community-based mobile DIN screening using simple equipment appears feasible and clinically relevant in underserved very old populations.

Key words: Hearing Tests; Mass screening; Association; Cognitive Dysfunction

P01.18

311 - DEVELOPMENT AND CULTURAL ADAPTATION OF A NORWEGIAN VERSION OF THE TEST OF LISTENING DIFFICULTIES–UNIVERSAL FOR ADULTS

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Adults who report persistent difficulty understanding speech in noise despite normal pure-tone thresholds represent a growing clinical concern. Such listening difficulties are frequently associated with auditory processing disorder (APD), defined as impaired neural processing of auditory information within the central auditory nervous system. In Norway, there is currently no standardized, ecologically valid speech-in-noise measure specifically designed to simulate complex real-world listening environments for adults. The present project aims to develop and culturally adapt a Norwegian version of the Test of Listening Difficulties–Universal (ToLD-U) for adult clinical and research applications.

The ToLD-U was originally developed in Australia by Harvey Dillon and Sharon Cameron as a realistic, multi-talker speech-in-noise test sensitive to several underlying causes of degraded speech understanding. Administered under headphones, it simulates a reverberant classroom environment with a frontal target talker delivering high-context sentences in a conversational speaking style, combined with six competing talkers presented from different apparent spatial locations. A defining methodological feature of the ToLD-U is morpheme-level scoring combined with acoustic equalization of morpheme intelligibility. During original development, relative intelligibility of each morpheme was empirically measured, and stimulus levels were adjusted to minimize systematic differences across items, thereby improving measurement precision while maintaining ecological validity.

The Norwegian adaptation follows established international guidelines for cross-cultural test development, including forward translation, back-translation, expert panel review, and pilot testing. However, because the ToLD-U relies on high-context sentence materials and morpheme-level intelligibility control, adaptation requires systematic stimulus reconstruction rather than direct linguistic translation.

Sentence materials were newly developed in Norwegian using lemma frequency lists derived from large-scale Norwegian language corpora to control lexical frequency distribution. High-frequency lemmas representative of contemporary adult spoken Norwegian was prioritized to enhance ecological validity and reduce unintended lexical bias. Sentences were constructed to maintain syntactic naturalness and high semantic predictability while avoiding phonological overlap and excessive coarticulatory cues. Contextual constraint was quantified using a written cloze procedure in which adult participants predicted one omitted lexical item. Only sentences demonstrating high cloze probability were retained for acoustic recording.

Following recording with native Norwegian-speaking talkers, morpheme-level intelligibility will be evaluated under multi-talker babble conditions to estimate relative contribution of each morpheme to overall sentence recognition. Acoustic calibration procedures will then be applied to equalize morpheme intelligibility across items, replicating the core methodological principle of the original ToLD-U. Competing speech signals are reconstructed to simulate realistic Norwegian reverberant listening environments while preserving the spatial configuration and signal-to-noise characteristics of the original paradigm.

Subsequent psychometric evaluation in an adult Norwegian sample will establish normative speech reception thresholds in noise (SRT), examine internal consistency and test–retest reliability, and explore construct validity in relation to self-reported listening effort and functional communication difficulties.

The Norwegian ToLD-U is intended to provide an ecologically valid and psychometrically robust tool for identifying adults with suspected auditory processing difficulties. By combining controlled lexical frequency, quantified contextual predictability, and morpheme-level acoustic equalization within a realistic spatial listening paradigm, the instrument aims to bridge the gap between laboratory-based speech perception measures and everyday communicative challenges.

Keywords: auditory processing disorder, speech-in-noise assessment, morpheme intelligibility, adult audiology

P01.19

338 - DIFFICULTIES IN FOREIGN LANGUAGE LEARNING AMONG CHILDREN AGED 9–11 AT RISK OF AUDITORY PROCESSING DISORDER: PERSPECTIVES OF PARENTS AND TEACHERS

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Background / Rationale

Auditory Processing Disorder (APD) constitutes a significant challenge in the school setting, particularly in the context of foreign language acquisition. Difficulties in the analysis and interpretation of auditory stimuli may affect reading, writing, speech comprehension in noise, and the ability to sustain attention to verbal messages. It is estimated that approximately 2–5% of children aged 7–10 years may exhibit symptoms of APD, which often remain undiagnosed, leading to progressively increasing educational difficulties. Foreign language learning, due to differences in phonological systems and heightened perceptual demands, may further exacerbate underlying auditory processing difficulties.

Aim

The aim of the study was to assess the prevalence of risk for Auditory Processing Disorder and foreign language learning difficulties among children aged 9–11 years, as well as to compare observations made by parents, homeroom teachers, and English language teachers.

Materials and Methods

The study employed *The Scale of Auditory Behaviours (SAB)* questionnaire and a supplementary survey. The SAB consists of 12 items referring to various symptoms of APD and enables the assessment of the frequency of specific behaviors, including those related to school functioning and foreign language learning.

The analysis included 47 complete sets (triplets) of questionnaires independently completed by a parent, a homeroom teacher, and an English language teacher for the same fourth-grade primary school students. The children's ages ranged from 9 to 11 years (M = 10.15; SD = 0.42).

Results

Parents assessed the risk of APD significantly lower (M = 48.74; SD = 7.18) compared to English language teachers (M = 44.89; SD = 9.12) and Polish language teachers (M = 45.34; SD = 9.74). Pairwise comparisons revealed statistically significant differences between parents' ratings and those of English language teachers ($p = 0.0054$).

The findings indicate that foreign language teachers more frequently observe difficulties related to auditory perception and processing than parents. This may be attributed to the fact that the foreign language classroom environment places greater demands on phoneme discrimination, speech comprehension under challenging listening conditions, and rapid auditory information processing.

Conclusions

The results confirm that auditory difficulties in children at risk of APD may be more apparent in the context of foreign language learning than in the home environment. Differences in the perception of difficulties between parents and teachers underscore the need for multidimensional assessment and close cooperation between the school and family environments.

Early identification of APD risk and consideration of the specific demands of foreign language learning in the diagnostic process may contribute to more effective student support and the reduction of secondary educational difficulties.

Keywords: auditory processing disorders, foreign language learning, parent's and teacher's assesment, hearing screening, SAB

P01.20

345 - AUTOMATED AUDIOMETRY IN SCHOOLCHILDREN: A SCOPING REVIEW

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Rationale: Hearing loss in children and adolescents represents a significant public health concern, with direct impact on language development, academic performance, and social participation. Although pure-tone audiometry is considered the gold standard for assessing hearing thresholds, its implementation depends on specific equipment and, ideally, a sound-treated booth, which limits access in school settings and low-resource regions. In this context, mobile device–based automated audiometry has emerged as a promising alternative to expand access to hearing screening and assessment. However, heterogeneity is observed in the instruments, protocols, and application contexts described in the literature, particularly in school-aged populations. Therefore, systematically mapping the available evidence on the use of automated audiometry in children and adolescents is warranted. **Materials and Methods:**This scoping review was conducted in accordance with the Joanna Briggs Institute recommendations and reported following the PRISMA Extension for Scoping Reviews (PRISMA-ScR). The protocol was prospectively registered on the Open Science Framework (DOI: 10.17605/OSF.IO/Z86TC). The research question was structured using the PCC framework (Population: children and adolescents up to 18 years; Concept: automated audiometry; Context: healthcare). Searches were performed on December 11, 2024, in PubMed/MEDLINE, Embase, Scopus, Web of Science, and Google Scholar, without language or year restrictions. Original observational studies applying automated audiometry for hearing screening and/or threshold estimation in school-aged populations were included. Reviews, case reports, editorials, conference abstracts, and studies with insufficient outcome description were excluded. Study selection was conducted by two independent reviewers, with disagreements resolved by a third reviewer. Data extraction included study design, country, sample characteristics, testing setting, technology used, comparator, and primary outcomes. **Results:** A total of 1,023 records were identified, of which 57 duplicates were removed, resulting in 966 studies screened by title and abstract. After full-text review, 13 studies met the eligibility criteria. Publications ranged from 2014 to 2024 and included diverse study designs: seven cross-sectional, three prospective, two cohort, and one longitudinal study. Sample sizes ranged from 28 to 6,231 participants, totaling 16,095 children and adolescents aged 3 to 18 years. Automated audiometry was predominantly implemented in school and preschool settings, as well as in hospitals and rural communities. Technologies mainly involved tablets, smartphones, and computers using dedicated software and calibrated headphones; in some cases, noise-attenuating headsets and environmental sound level monitoring were employed. Most studies compared automated audiometry with conventional pure-tone audiometry conducted in a sound-treated booth or with manual portable screening. Overall, findings indicated performance comparable to conventional methods for hearing screening purposes and, in some studies, for threshold estimation. Good sensitivity and agreement were reported across different contexts, including administration by trained non-specialist personnel, such as community health workers and supervised technicians. However, substantial heterogeneity was identified across protocols (tested frequencies, pass/fail criteria, threshold-seeking algorithms, number of repetitions), devices, and testing environments, limiting direct comparisons and quantitative synthesis. Environmental noise was identified as a critical factor, particularly at low frequencies (e.g., 500 Hz), potentially increasing false-positive rates. Additionally, younger children demonstrated greater difficulty in understanding instructions and maintaining engagement, negatively affecting performance in some studies. **Conclusion:** Mobile device–based automated audiometry appears to be a viable and promising alternative to expand access to hearing screening and, in certain contexts, hearing threshold estimation in children and adolescents. Its implementation in school and community settings may reduce logistical barriers, support public health initiatives, and optimize human resources while maintaining overall performance comparable to conventional methods. Nonetheless, important gaps remain regarding protocol standardization, validation across different age groups, and environmental noise control. Investments in calibration procedures, acoustic monitoring, and age-appropriate technological adaptations are essential to consolidate automated audiometry as an effective, safe, and scalable tool for pediatric hearing healthcare.

Keywords: audiometry; hearing screening; teleaudiology; mobile applications; child; adolescent.

P02 – EPIDEMIOLOGY, GENETICS & RISK FACTORS

P02.01

31 - TRICHOSTATIN A PRESERVES HEARING IN A COL4A3-DEFICIENT ALPORT SYNDROME MODEL BY SUPPRESSING OXIDATIVE STRESS AND INFLAMMATION VIA HO-1 SIGNALING

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Background/Rationale Alport syndrome (AS) is a type IV collagen disorder that frequently leads to late-onset progressive sensorineural hearing loss, yet no pharmacologic therapy is available to prevent auditory decline. Histone deacetylase inhibitors (HDACis) exert pleiotropic anti-inflammatory and anti-oxidative effects. We investigated whether trichostatin A (TSA), a class I/II HDACi, mitigates hearing deterioration in a Col4a3 knockout (KO) mouse model of AS and explored underlying mechanisms.
Materials and Methods Wild-type (WT) and Col4a3 KO mice received intraperitoneal TSA (10 mg/kg, once daily) or vehicle from 3 to 7 weeks of age. Auditory function was assessed weekly using auditory brainstem response (ABR) to click and tone-burst stimuli (4 to 7 weeks). Cochlear pathology was evaluated by transmission electron microscopy (TEM) focusing on stria vascularis (SV) vascular basement membrane thickness. Oxidative stress was assessed using 4-hydroxynonenal (4-HNE) and 3-nitrotyrosine (3-NT) in cochlear tissue and cell models. Inflammatory status was quantified by cytokine expression (interleukin-6, interleukin-1 beta, tumor necrosis factor alpha, and transforming growth factor beta 1). Mechanistic pathways were interrogated via KEAP1-NRF2-HO-1 signaling in vivo and in vitro using HEK293T cells with siRNA-mediated COL4A3 knockdown and HEI-OC1 cells with TSA exposure.
Results Col4a3 KO mice developed progressive ABR threshold elevation beginning at 4 weeks, reaching approximately 60 dB SPL by 6 weeks. TSA significantly preserved hearing in KO mice; at 7 weeks, click ABR thresholds were improved (approximately 43 +/- 2 dB SPL with TSA vs 56 +/- 5 dB SPL in controls), without detectable adverse effects in WT mice. TEM demonstrated marked SV vascular basement membrane thickening in KO mice, which was attenuated by TSA. TSA reduced cochlear oxidative stress signals (4-HNE and 3-NT) and suppressed proinflammatory cytokines, both in cochlear tissue and in COL4A3-deficient cellular models. Mechanistically, Col4a3 deficiency downregulated HO-1, while TSA suppressed KEAP1 and restored HO-1 expression in vivo. In vitro, TSA induced HO-1 even when NRF2 induction was blunted by COL4A3 knockdown, suggesting a key role for HO-1 signaling in mediating anti-oxidative and anti-inflammatory effects.
Conclusions Systemic TSA treatment preserves auditory function and ameliorates SV pathology in a Col4a3-deficient AS model by reducing oxidative stress and inflammation, prominently via HO-1 signaling. HDAC inhibition represents a promising therapeutic strategy for slowing progressive genetic hearing loss in AS and warrants further studies toward cochlea-targeted delivery and translational safety evaluation.
Keywords: Alport syndrome; trichostatin A; histone deacetylase inhibitor; oxidative stress; heme oxygenase-1

P02.02

259 - THE SCREEN CCMV STUDY: PREVALENCE AND HEARING OUTCOMES OF CONGENITAL CMV IN AUSTRALIAN CHILDREN

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Background/Rationale

Congenital cytomegalovirus infection (cCMV) is a leading infectious cause of hearing loss and neurodevelopmental disability. The Screen cCMV study aims to inform the evidence base for cCMV by determining the 1) prevalence of cCMV in an Australian population and 2) hearing outcomes of cCMV infants.

Materials and Methods

Screen cCMV was run in partnership with the GenV study (https://www.genv.org.au/), a whole-of-state birth cohort with over 124,000 participants (49,394 newborns born between 04 October 2021 and 03 October 2023 and their 74,600+ adult parents) recruited from across Victoria, Australia. This large and diverse cohort provides researchers with a uniquely representative sample of Victorian families. Screen cCMV included saliva samples that were collected on ORACollect DNA OCR-100 swabs from GenV newborns within the first 3 weeks of life. Saliva samples were processed and stored in the GenV Biobank at -80ºC until use. Saliva samples underwent viral nucleic acid extraction using TANBead Maelstrom 9610 System or Qiagen QIAcube HT Systems, followed by real-time polymerase chain reaction (PCR) testing for CMV in two steps: 1) eight-sample pooled CMV PCR testing, followed by 2) individual CMV PCR retesting of all samples from positive pools. A subset of 192 saliva samples underwent beta actin testing to confirm saliva samples contained genomic DNA. cCMV results will be linked with GenV-collected demographic data and state-wide hearing screening data in April 2026. We will use descriptive statistics to describe cCMV prevalence determined by the proportion of CMV positive saliva in the entire cohort, and prevalence of hearing loss. Adjusted cCMV prevalence will account for the proportion of samples with no genomic DNA via beta actin testing.

Results

GenV collected a total of 39,117 saliva samples from newborns, with 33,339 (85.2%) of these collected in the first three weeks of life. A total of 5472 PCR tests were performed (4165 pooled, 1307 individual) on 33,339 newborn saliva samples. The empirical efficiency of pooling samples was 6 (average number of infants per PCR test). This led to 83.6% tests saved using the sample pooling methodology. Of 4165 pooled PCR tests, CMV DNA were detected in 161 (3.9%). Of 1307 individual PCR tests completed, CMV DNA were detected in 94 (7.2%). Individual CMV PCR testing confirmed CMV in 94 of 33,339 GenV newborns, a prevalence of 0.28% (95% CI: 0.23%, 0.34%). Beta actin was detected in 191/192 (99.5%) of saliva samples tested. The adjusted prevalence, accounting for the proportion of saliva samples with genomic DNA, was 0.28% (95% CI: 0.23%, 0.35%). Hearing outcomes of GenV babies born with cCMV will be available in April 2026.

Conclusions

This is the first large scale study to determine birth prevalence of cCMV in an Australian population. Approximately 3 out of every 1000 babies in the GenV cohort had cCMV. This figure is representative of a cohort of newborns born during and shortly after the COVID-19 pandemic. Given international data has shown that birth prevelence declined during lockdown periods, and with Melbourne experiencing significant lockdown

periods, this figure likely represents a minimum estimate of cCMV in an Australian population. Mapping the short- and long-term hearing outcomes of babies born with cCMV as GenV data is linked will provide crucial information about the natural history of hearing and developmental outcomes in asymptomatic and symptomatic cCMV-affected children.

Keywords:
Congenital cytomegalovirus, cCMV, screening, population study

P02.03

52 - GENETIC ANALYSIS OF 474 INDEPENDENT OTOSCLEROSIS SAMPLES

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Introduction: Otosclerosis is a disease of the middle and inner ear manifesting in a slowly developing, intermittent hearing loss. As the transmission of sound via the eardrum and ossicular chain increasingly impairs, hearing loss aggravates and can ultimately lead to deafness. Genetic, viral and hormonal influences are discussed as the underlying factors of the inflammation-like remodeling processes of the bone with fixation of the stapes footplate to the oval window. Regarding the manifestation and expression of the hearing loss, three different degrees of Otosclerosis can be distinguished: 1. The classic middle ear type with pure conductive hearing loss. 2.The pure inner ear type, capsular Otosclerosis, with sensorineural hearing loss. 3.The affection of both the middle and inner ear resulting in a combination of conductive and sensorineural hearing loss. Accordingly, the predilection sites of Otosclerosis lesions and their frequencies are: Oval window: ~ 90%, Round window: ~ 40% Cochlea: ~ 30% - Internal auditory canal: ~ 30% - Semicircular canals: ~ 15%. So far, eight different gene locations for Otosclerosis have been identified using polymorphic microsatellite markers in individual extended families. In addition to that another four genes, SMARC4, SERPINF1, FOXL1 and MEPE have so far only been described in individual patients. However, a clearly responsible gene has not been identified yet. The aim of the research project is to identify genes responsible for Otosclerosis in a larger cohort of clinically well-characterized patients. An additional candidate gene for Otosclerosis is the gene SPP1, as this gene is functionally related to the gene MEPE.
Methods: The aim of the research project is to identify genes responsible for Otosclerosis in a larger cohort of approximately 474 independent clinically well-characterized patients. DNA sequencing techniques and, if required, quantitative PCR (qPCR) methods, will be used to analyze whether the genes FOXL1 (MIM 603252, Gene ID: 2300), MEPE (MIM 605912, Gene ID: 56955) and SPP1 (MIM:166490, Gene ID: 6696) are involved in Otosclerosis.
Results: First results have shown different alterations in the gene SPP1, seven genetic single nucleotide polymorphisms and ten mutations. Six mutations were identified that are not currently listed in the NCBI databases and are therefore considered potentially novel (c.232T>C, p.Ser78Pro; c.245A>T, p.His82Leu; c.671G>A, p.Ser224Asn; c.721A>G, p.Lys241Glu; c.796C>T, p.Leu266Phe; c.880G>A, p.Glu294Lys). Whereas four mutations have previously been reported in the NCBI databases (c.94-1G>A, rs139555315; c.238G>A, p.Glu80Lys, rs376158660; c.455C>G, p.Thr152Arg, rs775719155; c.812G>A, p.Arg271His, rs140081980). Several of these mutations result in amino acid substitutions relative to the wild-type protein and are associated with significant alterations in protein structure and functional properties suggesting pathogenic relevance. The protein encoded by this gene SPP1 is involved in the attachment of osteoclasts to the mineralized bone matrix. It is secreted and binds hydroxyapatite with high affinity. The osteoclast vitronectin receptor is found in the cell membrane and may be involved in the binding to this protein. In addition, this protein is also a cytokine that upregulates the expression of interferon-gamma and interleukin-12. Several transcript variants encoding different isoforms have been identified for this gene.
Conclusions: In contrast to previous reports, involvement of the FOXL1 gene in Otosclerosis was excluded, while the impact of the gene cannot be conclusively assessed yet. In contrast to that, different alterations in the MEPE gene were detected. The SPP1 gene, which is functionally related to the MEPE gene, was therefore analyzed. For the first time, our results demonstrate various mutations in the SPP1 gene in patients with Otosclerosis, indicating a potential involvement of this gene in Otosclerosis.
Keywords: Otosclerosis; Genetics; SPP1; Bone Remodeling; Hearing Loss

P02.04

56 - SCREENING FOR THE AUTOIMMUNE-LINKED VARIANT RS4947296 IN BRAZILIAN MENIÈRE'S DISEASE PATIENTS

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Ménière's Disease (MD) is a rare inner ear complex disorder characterized by episodic vertigo, sensorineural hearing loss, tinnitus, and aural fullness. The etiology of the disease is yet to be outlined, but studies have suggested an interplay of environmental and genetic factors. The prevalence of MD is 34-190/100.000 in European population, however epidemiologic data regarding Brazilian population is yet limited. The diagnostic criteria are based in clinical symptoms, although they do not consider the great diversity observed amongst the patients, who respond differently to treatments and to the mechanisms of the disease. Moreover, Autoimmune Diseases have had great epidemiological evidence supporting its association with MD. An intergenic regulatory variant (rs4947296) has been found in European patients, suggesting an NF-κB-mediated inflammatory response. Therefore, in this study, we investigated the intergenic SNP rs4947296 in 26 non-related patients diagnosed with MD through Sanger Sequencing technique and analyzed their clinical records. This SNP is in Hardy-Weinberg equilibrium, as expected. It was observed that the allele frequency of allele C was 32% in the total sample, a value significantly higher than that observed in the non-Finnish European population (7.9%). In addition, it was observed that in cases with bilateral symptoms, the allele frequency reached 28%, and in patients with autoimmune comorbidities, it reached 33%. There is a significant association ($p<0.43$) between the genotype T/T and the use of vertiginous drug. There was no association between the SNP and vertigo, tinnitus, aural fullness, hearing loss nor laterality of the disease at diagnosis. Seven of our patients (23,3%) have coexisting autoimmune diseases, but it was not associated with this variant. Thirteen patients (43,3%) reported migraine as a correlated factor, corroborating the higher prevalence of this condition found in MD patients. Two of our patients presented Bilateral symptoms at the diagnosis of MD, but the onset of symptoms was not early in both cases as described in the literature. The combination of these findings with the association of rs4947296 with bilateralism and its role as a regulator of TWEAK/Fn14/NF-κB pathways positions this variant as a promising target for molecular diagnosis and personalized therapies. However, functional studies and validation in larger cohorts are needed, particularly in the Brazilian population, which is still underrepresented in these analyses.

Keywords: Ménière's Disease, Autoimmune Ménière's Disease, rs4947296, Precision Medicine

P02.05

116 - OBJECTIVE HEARING IMPAIRMENT AND SUBJECTIVE HEARING DIFFICULTIES IN THE FINNISH POPULATION AGED 55 AND OLDER

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Background:
Age-related hearing loss is the leading cause of hearing impairment in high-income countries and represents a growing public health challenge in aging populations. Hearing loss is associated with increased risks of depression, social isolation, and cognitive decline. Large-scale epidemiological studies typically rely on pure-tone audiometry, which may underestimate functionally relevant hearing deficits. Speech-in-noise perception is considered a more sensitive and ecologically valid indicator of auditory function; however, population-based data using standardized speech-in-noise tests remain limited.
The Terve Suomi (Healthy Finland Study), conducted by the Finnish Institute for Health and Welfare (THL), produces nationally representative data on the health, well-being, and service use of adults residing in Finland. In the 2022–2023 cycle, 9862 adults aged ≥20 years were invited to participate in the health examination, and of the 5749 (58%) adults who participated, 3027 (52.7%) were over the age of 55, and therefore eligible for the hearing test.
Objectives of the study were:

(1) To estimate the population prevalence of speech-in-noise perception difficulties among adults aged ≥55 years using the Finnish Digit Triplet Test (DTT);
(2) To examine associations between objective speech-in-noise performance and self-reported hearing difficulties across age and sex;
(3) To assess hearing aid use in relation to both objective and subjective indicators of hearing difficulties.

Materials and Methods:
All participants aged ≥55 years attending the health examination were invited to complete the Finnish DTT independently during the visit. Subjective hearing difficulties were assessed with self-report items addressing everyday listening performance, including both self-evaluations and reports from a significant other. Hearing aid use was also queried. Analyses applied THL's population weighting factors to account for stratified sampling and differential participation, ensuring national representativeness. Associations among speech reception thresholds (SRTs), age, sex, subjective hearing difficulties, and hearing aid use were examined using survey-weighted statistical models.

Results:
Of 3027 participants aged ≥55 years, 2825 (93.3%) successfully completed the DTT. Population-weighted analyses showed a clear age-related decline in speech-in-noise performance, accompanied by increasing prevalence of self-reported hearing difficulties across age groups. In all age groups, participants reported more self-perceived hearing difficulties than those attributed by their significant others. Across the population, the proportion of adults reporting at least some hearing-related difficulties exceeded the proportion of participants using hearing aids. Detailed prevalence estimates and interaction effects will be presented in the final poster.

Conclusions:
These findings demonstrate a substantial population burden of speech-in-noise perception difficulties among older adults in Finland. Despite universal access to hearing aids, hearing aid uptake remained limited relative to both objective and subjective indicators of hearing difficulty. The divergence between objective speech-in-noise performance and self-reported difficulties highlights the limitations of relying solely on subjective measures in epidemiological surveillance, particularly at older ages. Incorporating objective functional hearing assessments into routine population health examinations may improve the identification of hearing-related disability and support more effective public health strategies for hearing care in aging populations.

Key words: Speech perception in noise, Age-related hearing loss, Digit Triplet Test, Hearing difficulties, Hearing aid use, Population-based study

P02.06

132 - HEARING AID UPTAKE AND WORK-RELATED OUTCOMES OVER TIME: EVIDENCE FROM A TARGET TRIAL EMULATION

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Background: Hearing loss reduces participation in work and can lead to decreased work productivity, higher need for recovery (NFR) after work and increased sick leave. Rehabilitation with hearing aids (HA) improves speech understanding and increases social participation. It is however unknown if HAs also have a positive effect on work outcomes. This research gap was addressed in this longitudinal study. Our research questions were: 1) is HA uptake associated with participation in paid work?; 2a) is there an association between HA uptake and sick leave, presenteeism (a measure of work productivity), job insecurity and NFR after work?; 2b) is this association different across subgroups, namely <40/ ≥40 years old, male/female, yes/no tinnitus, yes/no hyperacusis and hearing loss before/ after the age of 18 years?; 2c) is this association mediated by self-perceived hearing disability?; 3) is average hours of HA wearing time associated with the 2a outcomes?; 4) are number of years of HA use associated with the 2a outcomes?.

Methods: We used data collected in the Netherlands Longitudinal Study on Hearing from November 2006 until January 2025. This cohort study includes adults across the full range of hearing ability. Participants fill out a questionnaire and perform a hearing test every 5 years. The current study emulated a randomized controlled trial: participants eligible for a HA but not using one were included and thereafter assessed for HA uptake, hours of daily HA use, years of HA (non-) use and the work outcomes. This was done per 5-year follow-up period: 0-5, 5-10 and 10-15 years. All analyses were corrected for possible confounders, based on Directed Acyclic Graphs. Generalized estimating equations were used to account for the dependency in data as up to three 5-year periods could be included per participant.

Results: Per research question, 205, 126, 126 and 152 participants were included respectively. HA uptake was not associated with any of the work outcomes. The direction of the association for all outcomes indicated that HA uptake is beneficial, except for participation in paid work (odds ratio (OR): 0.93, 95% confidence interval (CI) [0.38 – 2.24]) and NFR (ß: 9.88 on a scale of 1-100, 95% CI [-0.71 - 20.48]). HA uptake also had an OR of 0.55 (95% CI [0.19 – 1.58]) for sick leave, indicating that HA uptake (non-significantly) decreased sick leave. We found no effect of subgroup on the association between HA uptake and work-related outcomes. There was a negligible amount of mediation by self-perceived hearing disability for these associations. Neither daily wearing time nor years of HA use were significantly associated with the outcomes.

Conclusion: Although most associations between HA uptake and the work outcomes were in a favorable direction, none reached statistical significance. The results of this study suggest that more fine-grained and sensitive outcomes are required to measure the association between HAs and work outcomes. Behavioral factors that could influence both HA uptake and work outcomes such as attitude towards challenges and coping should also be studied to get a better understanding of how HA uptake affects work outcomes. We recommend that workers with hearing loss do consider using HAs, as improvements in non-work outcomes are well-established.

Keywords: hearing aid, work participation, work productivity, need for recovery, sick leave.

P02.07

152 - HEARING LOSS INCREASES THE RISK OF DEPRESSION IN THE OLDER POPULATION, A LONGITUDINAL SWEDISH REGISTRY STUDY

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Background
Hearing loss occurs in approximately one third of individuals aged 65+, and it is estimated that 95% of the world's population will require hearing aid by the age of 80. Hearing loss leads to communication difficulties due to increased difficulty in hearing what others say as well as distinguishing between different speakers. The impact of hearing loss on communication often leads to withdrawal from social contexts and a feeling of exclusion as well as an increase in risk of unemployment and reduced participation in social activities, all of which are associated with an increased risk of depression. Although associations between hearing loss and depression have been observed previously, these relationships have not been studied on a large scale and over time. The present study aims to decrease this gap in knowledge through the use of longitudinal registry data of the Swedish population.

Methods
Registry data from Statistics Sweden (Statistiska centralbyrån) (SCB) and Sweden's National board of health and welfare (Socialstyrelsen) was utilised between 2001-2021, including all individuals aged 70 years at any time point between 2001-2011 and then followed for 10 years past their 70th birthday. ICD-10 diagnosis codes were used to identify individuals with diagnosed hearing loss (sensorineural hearing loss) and depression. Between groups design where individuals with (before the age of 70) and without hearing loss (before the age of 81) was compared on incident of depression between ages 70-80. Covariates included time between first hearing impairment diagnosis and age 70, gender, education, hypertension, rheumatic heart disease, and living alone or not. Descriptives and OR for hearing loss was estimated. Cox proportional hazards models were performed to investigate whether the prevalence of one variable (hearing impairment) effects time to event (depression).

Results
The following results are based on a preliminary analysis. The results indicated a significantly increased risk of developing depression across a window of 10 years' time for individuals with sensorineural hearing impairment at age 70 (OR=1.63 CI=1.30-2.02). Cox proportional hazards models (adjusted analyses controlling for covariates) revealed hazard rations for hearing impairment with the outcome depression at HR=1.31, CI=1.10-1.57. All covariates were significant with hazard rations of HR=1.30, CI=1.20-1.41 for hypertension, HR=1.23, CI=1.14-1.33 for living alone, and HR=1.10, CI= 1.01-1.17 for being female.

Discussion
These preliminary results indicate that hearing impairment increase the risk of depression. This effect remained even when controlling for effects of hypertension, living alone and gender. The strength of the study lies in its large sample and lack of attrition due to no dropouts (apart from due to death or migration).

Keywords: Hearing loss, depression, registry study, longitudinal, epidemiology

P02.08

193 - STROKE AS A CAUSE OF BILATERAL SUDDEN SENSORINEURAL HEARING LOSS: A SYSTEMATIC REVIEW

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Background:
Bilateral sudden sensorineural hearing loss (SSNHL) is an uncommon clinical presentation and, unlike unilateral SSNHL, is more frequently associated with serious systemic or central nervous system pathology. Among these etiologies, cerebrovascular events are particularly concerning because of their potential morbidity and the narrow therapeutic window for intervention. Although stroke is a well-established cause of acute neurological deficits, its presentation as isolated or predominant bilateral SSNHL is rare and remains poorly described in the literature. This lack of characterization may contribute to delayed diagnosis, especially when patients present without overt focal neurological signs or with initially unremarkable neuroimaging.

Methods:
A systematic review of the literature was conducted using PubMed, Embase, Scopus, and CINAHL databases to identify studies reporting bilateral SSNHL attributable to ischemic or hemorrhagic stroke. Eligible publications included observational studies, case series, and individual case reports. Data extraction focused on patient demographics, vascular territory and stroke location, initial and follow-up imaging findings, presence and type of associated neurological symptoms, timing of symptom resolution, and documented cardiovascular risk factors. Descriptive analysis was performed to summarize patterns of presentation and diagnostic findings.

Results:
A total of 54 patients with bilateral SSNHL secondary to stroke were identified across the included studies. Infarctions involving the vertebrobasilar circulation and temporal lobes were the most commonly reported stroke locations, reflecting the vascular supply to central auditory pathways. Initial non-contrast computed tomography (CT) scans were frequently normal or non-diagnostic, whereas advanced imaging modalities—particularly CT angiography, magnetic resonance imaging (MRI), and magnetic resonance angiography (MRA)—were more sensitive in detecting ischemic lesions or vascular abnormalities. Notably, only 28 patients (51.9%) exhibited focal neurological deficits at presentation, and many of these deficits were transient, subtle, or had resolved by the time of clinical evaluation. Cardiovascular risk factors, including hypertension, diabetes mellitus, hyperlipidemia, smoking history, and atrial fibrillation, were identified in 45 patients (83.3%), underscoring a strong association between bilateral SSNHL and underlying vascular disease.

Conclusions:
Stroke represents an underrecognized but clinically critical cause of bilateral SSNHL. The frequent absence of persistent focal neurological deficits and the limited sensitivity of initial plain CT imaging pose significant diagnostic challenges and may lead to delays in appropriate management. These findings emphasize the inadequacy of relying solely on neurological examination and non-contrast CT in this patient population. Early consideration of cerebrovascular etiologies and prompt use of advanced vascular imaging are warranted in patients presenting with bilateral SSNHL, particularly in the presence of cardiovascular risk factors, to facilitate timely diagnosis and intervention.

Keywords: Sudden sensorineural hearing loss; Stroke; Neuroimaging; Ischemia; Vertebrobasilar circulation

P02.09

194 - INDEPENDENT & CUMULATIVE ASSOCIATIONS OF HEARING, OLFACTORY, AND VISUAL IMPAIRMENTS WITH COGNITIVE IMPAIRMENT IN OLDER ADULTS IN SINGAPORE

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Background: Sensory impairments are prevalent in older adults and are increasingly recognized as risk factors for cognitive impairment (CoI). While individual associations of hearing, olfactory and visual impairments with CoI have been reported, few population-based studies have simultaneously examined the independent and combined contributions of each of these sensory impairments.

Objective: To evaluate the independent and combined associations of hearing, olfaction and vision with CoI in community-dwelling older adults from a multiethnic Asian population.

Methods: We analysed the baseline visit of the Population Health and Eye Disease Profile in Elderly Singaporeans (PIONEER), a population-based cohort study of adults aged ≥60 years in Singapore. CoI was defined as an education-adjusted Montreal Cognitive Assessment–Basic (MoCA-Basic) score below education specific cut-offs (<19, <22 and <24 for primary, secondary and tertiary education) or a Six-Item Cognitive Impairment Test (6-CIT) score ≥8. Sensory function was assessed across three domains: hearing (pure-tone audiometry at 0.5–4 kHz in the better ear, per 10-dB increase; impairment defined as pure-tone average >25 dB), olfaction (Sniffin' Sticks Identification Test, per unit decrease; impairment defined as score <12), and vision (binocular presenting near visual acuity, per 0.1 logMAR increase; impairment defined as logMAR >0.30 [worse than N6 at 40 cm]). Multivariable logistic regression models examined the independent associations between each sensory function measure and CoI, with hearing, olfaction and vision included simultaneously and adjusted for demographic, clinical, and lifestyle covariates. A separate model examined the association between the number of sensory impairments (none, single, dual or triple) and CoI, adjusting for the same covariates. All analyses were repeated using presenting better-eye distance visual acuity as a sensitivity analysis.

Results: Of the 2,098 PIONEER participants (mean age±SD 72.2±8.0 years; 52.2% women; 51.0% Chinese 24.8% Malay, 24.2% Indian), the weighted prevalence of CoI was 6.5% (n=198, 95% CI: 5.5–7.7). The weighted prevalence of hearing, olfactory, and visual impairment are, 68.2% (n=1541, 95% CI: 65.6–70.6), 28.1% (n=673, 95% CI: 25.7–30.5), and 14.5% (n=344, 95% CI: 12.7–16.5) respectively. Poorer hearing (odds ratio [OR], 1.47; 95% confidence interval [CI], 1.20–1.81; $p < 0.001$), poorer olfaction (OR: 1.22; 95% CI: 1.12–1.33; $p < 0.001$), and poorer vision (OR: 1.30; 95% CI: 1.11–1.52; $p < 0.001$) were each independently associated with increased odds of CoI. Compared with participants with no sensory impairment, any single sensory impairment was not associated with CI (OR 0.78; 95% CI: 0.31–2.23; p=0.62), any dual sensory impairment showed a trend toward higher odds of CoI (OR 2.37; 95% CI: 0.98–6.64; p=0.07), while triple sensory impairment was strongly associated with increased odds of CoI (OR 6.76; 95% CI: 2.15–23.16; p=0.001). In sensitivity analyses using distance visual acuity instead of near visual acuity, the associations between hearing and olfactory impairment and CoI remained unchanged, whereas distance visual acuity was not associated with CoI.

Conclusion: In this multiethnic Asian cohort, poorer hearing, olfaction and near vision were independently associated with CoI. Triple sensory impairment was also associated with CoI, compared to no sensory impairment. These findings highlight the importance of multimodal sensory screening in ageing populations, to identify individuals at increased risk of CoI and inform interventions targeting modifiable sensory deficits, such as cataract surgery, corrective lenses, and hearing aids.

Keywords: sensory impairment, hearing loss, cognition

P02.10

341 - ASSESSING THE OCCUPATIONAL RISK OF NOISE-INDUCED HEARING LOSS IN MUSICAL THEATRE EDUCATION

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Background: A growing body of evidence indicates that both professional musicians and student musicians are at elevated risk for noise-induced hearing loss (NIHL) (Backus et al., 2007; Barlow, 2010; Gopal et al., 2013; McIlwaine et al., 2012; Miller et al., 2007a; Olson et al., 2016; Phillips & Mace, 2008; Smith et al., 2019; Tufts & Skoe, 2018; Washnik et al., 2016). These populations are routinely exposed to hazardous sound levels during individual and ensemble rehearsals, concerts, and other music-related activities (Chesky, 2010; McIlwaine et al., 2012; Miller et al., 2007b; Smith et al., 2019; Washnik et al., 2016). Repeated exposure to high-intensity sounds may contribute to a range of auditory and non-auditory consequences. Similar exposure patterns have been reported among collegiate music theatre majors (Busenbarrick & Davenport, 2020). Although music theatre students may participate in fewer live music events than traditional music majors, the performance-intensive structure of their curricula and frequent involvement in live productions may increase their susceptibility to NIHL. Despite the widespread presence of university theatre programs, empirical data characterizing sound exposure in this population remains limited. Accordingly, systematic evaluation of daily noise exposure among music theatre students is warranted. Objectives: This study aimed to compare daily noise exposure dose and 8-hour time-weighted average exposure ($L_{TWA(8)}$) during a typical college day, and to estimate annual noise exposure, between music theatre majors and non-music majors. Methods: Eighty-four college students were recruited, including music theatre majors (n = 42) and non-music majors (n = 42). All participants completed an annual noise exposure questionnaire. A subset of participants (17 per group) underwent personal noise dosimetry across two consecutive weekdays, with monitoring durations ranging from 8 to 14 hours per day. Noise exposure was quantified using an ER-200D personal noise dosimeter configured in accordance with National Institute for Occupational Safety and Health (NIOSH) criteria. Results: Noise dosimetry revealed that 58% (10/17) of music theatre majors exceeded NIOSH recommended exposure limits on at least one monitoring day, while 41% exceeded these limits on both monitoring days. Estimated annual noise exposure was significantly greater in music theatre majors compared with non-music majors. Repeated-measures analysis of variance demonstrated a significant main effect of group for both noise dose and $L_{TWA(8)}$. Furthermore, objective dosimetry metrics exhibited moderate positive correlations with annual noise exposure estimates. Conclusion: The findings suggest that music theatre majors may be at increased risk for NIHL and related music-induced auditory conditions, including tinnitus, hyperacusis, and speech-in-noise difficulties. These results underscore the need to include music theatre majors in university-based hearing conservation programs.

Keywords: music theatre majors; noise dose; noise exposure; noise dosimetry; noise induced hearing loss.

P03 – EARLY IDENTIFICATION & PAEDIATRIC HEARING

P.03.01

8 - ANALYSIS OF NATIONAL JCIH RISK FACTOR DATA REPORTING IN THE UNITED STATES OF AMERICA: A 10 YEAR OBSERVATION.

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Objectives:
Evaluate JCIH hearing loss risk factor reporting in newborns in the United States of America over the ten-year period between 2011-2021, and identify gaps in risk factor reporting nationwide.

Study Design:
This was an IRB-exempt, 10-year retrospective meta-analysis study using anonymized data collected by each state's EHDI program. Reports of JCIH risk factors and prevalence of later confirmed hearing loss were aggregated for analysis.

Methods:
We contacted EHDI representatives from all 50 states as well as Puerto Rico and the District of Columbia to request anonymized risk factor data and rates of hearing loss on a state-by-state basis. Data was collected for the years 2011, 2016, and 2021, when available. States that were unable to provide such data were noted and excluded from analysis. Results were binned by geographic region and compared via Pearson's chi-square test.

Results:
Risk factor analysis on a nationwide level is currently impossible, despite the existence of nationwide EHDI programs for over 20 years. Of the U.S. states and territories contacted, six have responded and are willing to provide anonymized hearing loss and risk factor data, and responses from the remaining 44 states and 2 territories are pending.

Conclusions:
There are currently significant gaps in the collection and reporting of hearing loss risk factor data in newborns. Though participation in newborn hearing screening and EHDI programs continues to increase, this gap in data reporting represents a major opportunity for improvement.

P.03.02

55 - WHY DO SOME ADOLESCENTS WITH COCHLEAR IMPLANTS STRUGGLE WITH READING? A COGNITIVE PERSPECTIVE

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Background: Deaf adolescents have often been described as weaker readers compared to their typically-hearing peers. However, with earlier intervention and significant advances in hearing technology, a positive trend in reading comprehension has been observed among adolescents with cochlear implants, despite substantial inter-individual variability in performance (Mayer & Trezek, 2018). Furthermore, cognitive factors such as reasoning abilities and short-term memory have been demonstrated to impact reading comprehension outcomes (Tighe et al., 2015). The aim of our study was to examine the reading comprehension skills of adolescents with cochlear implants, aged 10 to 15, and to determine the extent to which these skills can be predicted by verbal and nonverbal reasoning abilities as well as by short-term memory capacity.
Materials and Methods: We recruited 56 French-speaking adolescents between 10 and 15 years of age: 28 with typical hearing (TH group) and 28 with severe or profound congenital deafness who were fitted with one or two cochlear implants (CI group). Each participant completed two reading comprehension tasks (one involving sentences and one involving short texts), a short-term memory task (word span), a verbal reasoning task (word definition), and a nonverbal reasoning task (matrix).
Results: There were no significant differences between the two groups in terms of word span, nonverbal reasoning, and total score in sentence comprehension. However, adolescents with cochlear implants performed more poorly than their typically-hearing peers in verbal reasoning and text comprehension, showing specific weaknesses in identifying the main idea, recalling details, and processing predictive information. They were also slower than their peers in the sentence comprehension task, and experienced specific difficulties in processing personal pronouns. When the predictor variables were included in the statistical models, the group differences were rendered non-significant for all comprehension measures. Regarding sentence comprehension, accuracy was significantly predicted by word span, verbal reasoning skills, and nonverbal reasoning skills, whereas response time was significantly predicted only by verbal reasoning. Accuracy in text comprehension was predicted by both verbal and nonverbal reasoning. Across all analyses, verbal reasoning emerged as the strongest predictor.
Conclusions: Adolescents with cochlear implants aged 10 to 15 achieved comparable reading comprehension performance to their typically-hearing peers in the sentence-level task, albeit more slowly, but lower in the text-level task. They also demonstrated specific difficulties with personal pronouns and with identifying certain types of information within a text. However, when the selected predictor variables were included in the statistical models, group differences were entirely neutralized, with verbal reasoning emerging as a particularly influential factor. Overall, these findings improve our understanding of the difficulties deaf adolescents sometimes encounter, as well as the range of factors that clinicians must consider when planning personalized reading interventions. Training reasoning skills appears to be especially important for improving reading comprehension outcomes. Further investigation of morphosyntactic and pragmatic abilities is a promising direction for future research.

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Keywords: reading, cochlear implant, adolescence, reasoning, memory

P.03.03

78 - PERCEPTION AS PREVENTION: INTEGRATED SENSORY ASSESSMENT FOR EARLY DETECTION OF METABOLIC AND VASCULAR PATHOLOGY

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Background and Purpose
Hearing care is exquisite at measuring loss. CARE (Cognition-Auditory-Retinal Evaluation) suggests we also recognize transformation. 537 million adults live with type 2 diabetes, 1.28 billion have hypertension and over 76 million with glaucoma. Conditions that share a common thread: They reshape the tiny rhythms of blood , nerve and perception. Research shows that Diabetes doubles Glaucoma risk and makes hearing loss two to three times more likely.; Hypertension raises the chance of hearing loss and cognitive decline. Hearing loss does more than just affect what you hear: Large-scale studies show that people with hearing loss have a fall risk that's 17-51% higher compared to those without. When hearing loss is not treated the chance of a fall injury rises three times. Evidence indicates that every 10 dB increase in hearing loss, the risk of falling increases by approximately 140%. Yet clinical silos treat these as separate pathologies rather than chapters in one systemic story.
This abstract introduces CARE, a practice model that treats sensory assessment as an early detection tool. CARE proposes that perception itself can reveal systemic change before conventional pathology emerges.
Theoretical Framework
CARE expands A.M. Skeffington's four circles of behavioral optometry (Anti-Gravity, Centering, Identification, Speech-Auditory), which describe how visual function supports spatial organization and how we create meaning. CARE integrates this with modern neuroscience, by connecting Skeffington's circles to the dorsal stream (spatial processing, safety, orientation) and ventral stream (object recognition, identification and meaning).
CARE uses ideas from sensory physiology: Gustav Fechner's psychophysics shows that time matters. Hermann von Helmholtz's theories of perception and Charles Scott Sherrington's work on sensory-motor integration are the physiological foundation. CARE adds the auditory dimension to Skeffington's model. Before the brain creates meaning, the brain must locate the source of the sound. Low-frequency auditory input provides grounding, the feel of presence and safety. Higher frequencies enable directionality and spatial clarity. While identification of sound meaning engages the ventral stream.
Insights from dementia research illuminate why emotion and time sit at the model's centre. With dementia the sensory coherence weakens. The client loses regulation and the connection, becoming increasingly dependent on their emotional anchors. Drawing on Jerome Bruner's narrative psychology and Max Weber's "Verstehen" , CARE interprets clinical data not as static loss, but as a search for meaning. Therefore chronic metabolic and vascular conditions are recognized as early signals of disrupted coherence, emerging long before conventional pathology becomes clinically visible. These changes reflect not isolated disease processes, but a system struggling to maintain orientation, timing, and emotional regulation in the face of declining sensory input.
Methodology
CARE reveals connections that have always existed across disciplinary fields. The model integrates hearing, vision, and neuroscience within Skeffington's four circles (Anti-Gravity, Localisation, Identification, and Speech) showing how dorsal and ventral brain pathways organise experience over time, with emotion at the centre.
CARE employs familiar clinical tools: Pure-tone audiometry, speech testing, brief cognitive screening, fundus photography, and Optical Coherence Tomography (OCT). But treats them as elements of dialogue rather than isolated measurements. Fundus and OCT images serve as the "mirror of our health," revealing vascular and neural patterns that provide the "why" behind observed changes in auditory and cognitive function.
Preliminary Findings
Current findings remain hypothetical yet promising, emerging from sensory science and clinical observation. Early patterns suggest hearing loss happens twice as often in people with diabetes. The subtle decline in speech-in-noise performance may precede measurable cognitive change. The pilot shows that disciplinary co-observation deepens insight, revealing potential of multiple illnesses before pathology signs become evident.
Clinical Implications
CARE shifts hearing care from measuring loss to recognizing transformation. The professional is able to become an interpreter of sensory dialogue, which enables detection of metabolic and vascular pathology before cognitive decline or fall injury occurs. CARE is a preventive sensory guidance protecting the client's ability to connect, understand meaning, maintain balance "and" remain engaged with their world.

Conclusion
By recognizing perception as “The body’s first language”. CARE offers a pathway to integrated preventive health. Where we listen to what emerges, rather than only measuring what is lost. We honor the body’s wisdom and intervene before silence falls. “CARE was always there, hidden beneath our noses in academic research, now evolved through integration."

Keywords: preventive hearing care, sensory-cognitive integration, combined practice, multimorbidity screening, narrative medicine

Conflict of interest: one or more authors have declared an industry affiliation

P.03.04

99 - SERBIAN VALIDATION OF THE LITTLEARS® EARLY SPEECH PRODUCTION QUESTIONNAIRE: POSSIBILITY OF STRENGTHENING EARLY IDENTIFICATION OF HEARING IMPAIRMENT IN CHILDREN

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Background:
The greatest importance of early detection of hearing impairment is reflected in better speech-language and educational outcomes in children. Before the introduction of newborn hearing screening (NHS), significant hearing impairments often remained undetected until the second or third year of life. Today, the opportunities for early identification and intervention in congenital hearing impairment are great, which allows for optimal speech-language development of these children, better learning abilities and consequently better school success. However, not all permanent hearing loss in children will be identified by the NHS, especially if it is not universal or does not have a structured follow-up system. In addition, approximately 25% of children who undergo the NHS identified as having sensorineural hearing loss during the first year of life. Parent-reported tools that record preverbal speech production in everyday settings could offer a practical and scalable solution for early identification of these children. The LittlEARS® Early Speech Production Questionnaire (LEESPQ) is a short, age-specific instrument designed to document milestones in early speech production from birth to 18 months, and there has previously been no standardized tool for this developmental period in Serbian. The establishment of a validated Serbian version is necessary to strengthen early detection, especially in contexts where systematic follow-up of hearing loss in infants is limited.
Aim:
To present the psychometric characteristics of the validation and adaptation process of the LEESPQ for Serbian-speaking caregivers, and to evaluate its potential for implementation as a clinical and public-health screening tool in settings with limited early-hearing-detection infrastructure.
Methods:
The English LEESPQ was translated using a forward–backward procedure by bilingual experts. A total of 203 typically developing infants (0–18.9 months; 96 male, 107 female; 20 preterm) were assessed between using paper and electronic formats. Psychometric analyses included Guttman split-half reliability, Cronbach's alpha, Pearson correlation between chronological age and total score, and a second-order polynomial regression model to generate age-specific normative values and 95% confidence intervals. Normative curves were compared with published German and Canadian-English datasets to assess cross-linguistic applicability.
Results:
The Serbian LEESPQ demonstrated high internal consistency (Cronbach's $\alpha = 0.882$) and acceptable predictive accuracy (Guttman $r = 0.622$). Total score correlated strongly with age ($r = 0.822$; $p < 0.001$), confirming the age-dependent structure of the instrument. The quadratic regression model explained 68% of variance and enabled the calculation of age-specific lower confidence limits, which serve as clinically meaningful cutoffs for identifying children at risk of delayed speech production. No significant sex differences were observed. Comparisons with German and Canadian-English normative curves revealed no statistically significant differences, supporting the cross-population robustness of the instrument. The LEESPQ also proved applicable for preterm infants when corrected age was used. Transition to an electronic format substantially increased response rates, demonstrating feasibility for large-scale implementation.
Conclusion:
The Serbian adaptation of the LEESPQ is a reliable, valid, and culturally appropriate instrument for assessing early speech production. Its age sensitivity and ease of administration make it suitable for routine use in pediatric, audiological, and early-intervention settings.
Public-health significance:
Implementing LEESPQ in clinical practice provides a low-cost, scalable method for identifying deviations from typical speech-language development at the earliest stages. This is particularly valuable in countries without UNHS or structured follow-up systems, where infants with hearing loss or neurodevelopmental vulnerabilities are at high risk of late identification. By integrating LEESPQ into routine pediatric visits, community health centers, and post-screening monitoring, clinicians can detect early warning signs, initiate timely referrals, and support families in recognizing developmental concerns. Widespread use of the questionnaire may strengthen interdisciplinary collaboration, improve continuity of care after neonatal screening, and contribute to the development of national early-intervention registries. As an electronic tool, LEESPQ also offers opportunities for remote monitoring and population-level surveillance, supporting equitable access to early identification services.
Keywords: early identification, LEESPQ, speech and language development, screening

P.03.05

139 - NEURAL SPEECH TRACKING IN YOUNG COCHLEAR IMPLANTED ADULTS

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Language acquisition relies on critical periods in early development during which the brain is particularly sensitive to linguistic input. For typically hearing individuals, early auditory exposure is crucial for the maturation of neural systems supporting speech perception, lexical access, and semantic integration. In cases of congenital deafness, auditory input may be partially restored through cochlear implantation (CI). While early implantation has been associated with improved language outcomes, it remains unclear to what extent neural processing of continuous naturalistic speech, at different levels of the linguistic hierarchy, resembles that of typically hearing peers in adulthood.
The present study investigates whether young adults with congenital deafness who received early cochlear implants process naturalistic speech similarly to typically hearing individuals at both lower-level acoustic and higher-level linguistic stages of neural processing. EEG data were recorded from two demographically matched groups of young adults: 12 early-implanted CI users (mean age at implantation: 1 year and 10 months) and 12 typically hearing controls. All young adults CI users had received structured speech therapy before and after implantation. During the experimental session, participants listened to short narrative stimuli presented in two conditions: audio-only (A) and audiovisual (AV) and subsequently completed a comprehension task.
Neural synchronization with speech was assessed at the individual level using Temporal Response Functions (TRFs). We first examined tracking of lower-level acoustic features, focusing on the speech envelope. In a second step, we focused on higher-level linguistic features reflecting lexical and semantic processing. Higher-level linguistic predictors were derived from the narrative stimuli to capture word-by-word variation in lexical and semantic information during continuous speech. Word frequency and lexical surprisal were computed using probabilistic language models trained on large text corpora, providing indices of lexical frequency and contextual predictability. Semantic dissimilarity was estimated by quantifying the distance between the semantic representation of each word and the preceding contextual embedding, thereby capturing dynamic semantic updating across the narrative. These predictors were time-aligned to the speech signal and incorporated into the TRF framework to assess neural sensitivity to hierarchical linguistic information beyond acoustic structure.
At the acoustic level, both CI users and typically hearing participants exhibited robust TRFs to the speech envelope in both A and AV conditions. For both groups, neural tracking was significantly enhanced in the AV condition relative to the A condition ($p < 0.05$, cluster-corrected), indicating a facilitative effect of visual speech cues. However, CI users showed significantly higher TRF amplitudes overall, potentially reflecting increased neural effort or compensatory mechanisms during speech tracking. In line with this interpretation, CI users performed significantly worse on the comprehension task compared to their hearing peers ($p < 0.05$).
At the linguistic level, analyses are ongoing and will assess the extent to which neural responses are modulated by lexical and semantic predictors. Specifically, we are investigating whether CI users show typical neural sensitivity to lexical frequency and surprisal, as well as to semantic dissimilarity between words and their preceding context. These analyses aim to clarify how well CI young adults perform higher-order language processing, beyond low-level acoustic tracking.
Overall, our findings suggest that early cochlear implantation supports the development of neural mechanisms underlying speech tracking that largely resemble those observed in typically hearing individuals. Nevertheless, differences in neural effort, comprehension performance, and potentially in higher-level linguistic processing point to lingering effects of early auditory deprivation. These results underscore the importance of early auditory input during critical periods of language development and highlight the need for continued support to optimize long-term language outcomes in CI users.

Keywords: cochlear implants, neural tracking, language development, linguistic features

P.03.06

295 - ATHOS - AT THE ORIGIN OF SOUNDS: NEURAL ENTRAINMENT TO CONTINUOUS SPEECH BEFORE AND AFTER PEDIATRIC COCHLEAR IMPLANTATION

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Language acquisition depends on both biological factors, including the integrity of the central nervous system and peripheral sensory pathways, and experience-driven interactions with the environment through the senses, particularly audition and vision. In congenitally deaf individuals, early auditory deprivation profoundly affects language development. Technological advances have provided effective compensation, with cochlear implants (CIs) being the most advanced and widely used intervention (Winn et al., 2021). Research in pediatric and adult CI users shows substantial benefits for speech perception and language outcomes (Pavani & Bottari, 2022; Federici et al., 2025), and earlier implantation is associated with better development of the auditory cortex and linguistic outcomes (Sharma et al., 2002; Niparko et al., 2010).

A key question remains unanswered: how does the infant brain develop to encode and synchronize with auditory and audiovisual features of natural speech after cochlear implantation? Studying this process in very young children is challenging due to the difficulty of reliably acquiring behavioral data. Thus, objective and noninvasive neural measures are required.

With support from Cochlear Ltd., we are conducting a multicenter longitudinal study investigating neural speech processing in cochlear-implanted infants using electroencephalography (EEG). Seven pediatric hospitals and research centers across Italy participate, and the study aims to map the developmental trajectory of neural responses to continuous, naturalistic speech during the first year of CI use.

The aim of the project is to describe the developmental trajectory of how young children's brains adapt following cochlear implantation by objectively measuring EEG responses to continuous natural speech. The experimental session comprises two conditions: listening to short stories presented as audiobooks (auditory-only condition) and hearing stories while watching the face of a speaker narrating them (audiovisual condition). Each recording session lasts approximately 15 minutes and includes seven stories of approximately one minute for each condition. Each child undergoes EEG testing at four time points: a few weeks before surgery (T0), shortly after CI activation (T1), three months after activation (T3), and one year after activation (T5).

While data collection is ongoing, we have begun analyzing a subsample of data from seven participants who completed both T0 and T1, three of whom have also completed T3. The first analysis conducted consists of a qualitative description of this unique longitudinal dataset focusing on these seven subjects. The sample includes four males and three females, with an age range of 9 to 22 months. All participants were diagnosed with congenital bilateral profound deafness and had previous experience with hearing aids prior to cochlear implantation. All seven subjects were implanted with at least one cochlear implant from Cochlear Ltd. and were recruited from three of the seven collaborating centers.

The interval between the first two testing sessions (T0 and T1) varied across participants, as it depended on organizational aspects. For these six subjects, the time between T0 and T1 ranged from approximately 7 days to 2 months. For the three participants who completed T3, the interval between T1 and T3 ranged from 2 months to approximately 2 months and 20 days.

EEG data were explored at the individual level, and neural synchronization with the speech sound envelope was assessed using Temporal Response Functions (TRFs). As expected, TRF responses were weak before implantation (T0) and shortly after CI activation (T1). An increase in neural tracking was observed at T3, three months after activation, suggesting emerging cortical synchronization with continuous speech.

These preliminary findings support EEG-based neural entrainment as a promising objective biomarker of early auditory development in infants with cochlear implants, with important implications for optimizing intervention timing, rehabilitation strategies, and individualized clinical follow-up.

Keywords: EEG, longitudinal, infants, natural speech.

P.03.07

232 - VALIDATION OF THE LITTLEARS AUDITORY QUESTIONNAIRE (LEAQ) AND THE LITTLEARS EARLY SPEECH PRODUCTION QUESTIONNAIRE (LEESPQ) IN NORWEGIAN 0–18-MONTH-OLD CHILDREN

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Objectives: Hearing loss in infants is detected and treated earlier than ever, increasing the need for validated instruments to assess auditory and spoken language development. In Norway, validated instruments for the youngest infants are lacking. In the presents study, we aimed to evaluate the validity and reliability of the Norwegian versions of the LittlEARS Auditory Questionnaire (LEAQ) and the LittlEARS Early Speech Production Questionnaire (LEESPQ) in Norwegian children with typical hearing aged 0–18 months. An additional aim was to assess the correlation between the two questionnaires.

Methods: In this cross-sectional study, parents of 872 infants completed a digital questionnaire containing the LEAQ, the LEESPQ and background information. Psychometric analyses were conducted to evaluate the reliability and validity of the instruments, and normative values were established. The correlation between total scores on the LEAQ and total scores on the LEESPQ, in addition to the influence of sex, parental education level and multilingualism on total scores was examined.

Results: The Norwegian versions of the LEAQ and the LEESPQ are age-dependent, reliable and demonstrate high internal consistency. Although a few items had limited impact on the measurements of the constructs they were considered important to the questionnaires as a whole. Sex, parental education level and multilingualism did not significantly influence the scores. There was a strong correlation between total scores on the LEAQ and the LEESPQ.

Conclusion: The findings support the clinical utility of both LEAQ and LEESPQ as screening and follow-up tools for early monitoring of auditory behavior and spoken expressive language development.

Keywords: Validation study, LittlEARS, auditory development, spoken language development, Norwegian

P.03.08

270 - SENTENCE REPETITION AND WORKING MEMORY IN EARLY IMPLANTED SCHOOL-AGED CHILDREN

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Children with cochlear implants (CI) often achieve age-appropriate performance on simple language measures such as vocabulary yet continue to experience difficulties with more complex language processing (e.g. Geers et al., 2009). This discrepancy suggests that traditional outcome measures may underestimate the language difficulties in this population. Sentence repetition (SR) is a widely used index of complex language processing that draws simultaneously on phonological processing, morphosyntax, and semantics (Polišenská et al. 2015). Previous studies have shown that CI users often perform below typically developing (TD) peers on SR (e.g. Kronenberger and Pisoni, 2019). According to the executive function (EF) language compensatory model, when fast and automatic processing is compromised—as is often the case in children with CI—language processing becomes slower and more effortful, increasing reliance on EF, including working memory (WM; Kronenberger et al., 2013; Kronenberger & Pisoni, 2019). At the same time, children with CI show robust deficits in phonological working memory (PWM) and more variable outcomes in general working memory (GWM; Akçakaya et al., 2019; Asker-Árnason et al., 2015).

To address how vulnerabilities in SR and WM jointly shape complex language processing in children with CI, the present study compared SR, PWM, and GWM performance in early implanted children and TD peers, and examined how SR in the CI group relates to PWM and GWM.

Twelve children with CI (aged 8–12 years), implanted at a mean age of 9 months, participated in the study. Ten of them received early speech, language, and listening intervention (data missing for one participant). The comparison group consisted of 22 TD peers. All participants completed tasks assessing SR, PWM, and GWM. Children with CI performed comparably to their TD peers on GWM, suggesting that central executive aspect of WM is relatively spared. In contrast, they showed lower performance on both the RS task and the PWM measure. Thus, even in a sample of early implanted children included in early intervention, PWM remained vulnerable, and complex language skills indexed by SR were compromised relative to TD peers. These findings are consistent with earlier reports of persistent PWM weaknesses and difficulties with RS in pediatric CI users.

Within the CI group, SR was positively associated with both PWM and GWM, aligning with the EF language compensatory model: when rapid, automatic phonological encoding is degraded, children appear to rely more heavily on WM and executive control to “fill in” missing phonological and lexical information. In this context, poorer SR likely reflects imprecise bottom-up encoding of sentence input that taxes limited WM resources; children with stronger WM can better support this effortful processing and thus achieve relatively higher SR scores, whereas children with weaker WM show larger SR deficits. Given that early degraded auditory input in many children with CI may lead to fragile phonological and lexical representations (Romano et al., 2021), everyday spoken language processing is more WM-demanding (Kronenberger et al., 2011), rendering complex tasks such as SR especially susceptible to these limitations.

Taken together, these findings suggest that even early implantation and intervention do not fully resolve phonological weaknesses, leaving children with CI more vulnerable to cognitive overload during everyday communication, which—like SR—simultaneously engages multiple language components. Moreover, the association between WM measures and SR in the CI group underscores the potential role of both PWM and GWM in supporting complex language processing under conditions of degraded auditory input.

Keywords: sentence repetition, working memory, cochlear implants, deaf children

P.03.09

234 - LITTLE LISTENERS PARTICIPATORY DESIGN: INVOLVING FAMILIES AND CLINICIANS IN THE STUDY OF NEURAL PROCESSING OF LANGUAGE IN TODDLERS WITH BILATERAL COCHLEAR IMPLANTS.

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Early adoption of bilateral Cochlear Implants (CIs), prior to age 12 months, has been positively associated with better long-term receptive and spoken language abilities. Although many benefit greatly from paediatric cochlear implantation, the outcomes can vary across children, reflecting the uniqueness of each child, and external factors such as medical comorbidities, access to hearing rehabilitation, and the quantity/quality of communication in the home.

Addressing these individual differences is exacerbated by the lack of objective tools available to clinicians to optimise device programming, predict functional outcomes, or guide interventions during critical periods of auditory and language development. Current CI programming relies on behavioural responses to simple detection tasks or electrophysiological measures of auditory brainstem function that provide limited information about higher-level auditory processing, essential for speech understanding in real-world listening environments. The resulting inability to provide evidence-based, personalised interventions represents a significant clinical gap that impacts both individual patient outcomes and healthcare resource allocation efficiency.

To address this, our study's aim is to develop a clinical tool using High-Density Diffuse Optical Tomography (HD-DOT) to objectively assess cortical markers of language development in paediatric CI recipients whilst listening to and viewing speech in noise. Standard audiological assessment relies on behavioural responses requiring verbal communication, sustained attention, and cognitive maturity that are not yet developed in infants and young children. Using HD-DOT represents a significant advancement over traditional functional Near Infrared Spectroscopy (fNIRS) through dense channel arrays that enable tomographic image reconstruction with improved spatial resolution and depth sensitivity.

Patient and Public Involvement and Engagement (PPIE) has emerged as a cornerstone in health and social care research, ensuring that the voices of patients, service users, carers, and the wider public are integrated at every stage of the research process. This approach not only enhances the relevance and quality of research but also fosters transparency, trust, and mutual learning between researchers and the communities they serve. PPIE encompasses activities from consultation and collaboration to co-production, with each level offering opportunities for meaningful participation. The benefits of PPIE are well documented, including improved study design, greater participant recruitment and retention, and the generation of outcomes that better reflect the priorities of end users.

We have implemented a three-stage action research study design. This involves in-person consultations with i) parent groups of 5-8 parents of CI children of any age, ii) clinician groups with 2-6 people with a representative mix of professions (e.g. Paediatric Audiologist, Speech and Language Therapist) and iii) individual families of CI recipients aged up to 2 years. All focus groups and meetings are conducted onsite in our research rooms to demonstrate equipment and experimental tests in action.

This work began with a clinician group. We reviewed the experimental paradigm, and the clinicians gave feedback and suggested appropriate adjustments that have been implemented. Next, we will conduct a focus group with parents/carers of children with CIs. The objectives are to understand their experiences relating to their child's hearing experiences and developmental changes since receiving their CI, to understand their thoughts of the experimental paradigm and parental questionnaires, and to understand what information parents want to receive about taking part in an experiment. The final group will be individual families with children in the age range of intended participants to try on the HD-DOT cap with their CIs and try a sample of the experimental conditions to provide feedback on the practicalities of running the experiment.

Results of Clinician Focus Group

The first clinician focus group took place in January 2026 with three paediatric audiologists, and two members of the research team. Discussion of the protocol resulted in the following feedback:

- Need to include an auditory only condition.
- Coordinate sessions to align with clinical appointments.
- Provide greater detail on study inclusion criteria.

- Conduct HD-DOT imaging at two timepoints 6 months apart to understand changes over time.

Parent groups and individual family meetings are scheduled within the next month. Feedback will be used to modify our protocol and improve approaches for recruitment and retention of the families in the study. By identifying the needs and responding to the feedback of various stakeholders we aim to develop a diagnostic approach for monitoring speech acquisition in infants with CIs.

Cochlear Implants; Infants; Speech and Language; Infrared; PPIE.

P.03.10

241 - FACILITATING FOLLOW-UP TO NEWBORN HEARING SCREENING THROUGH VIRTUAL, JUST-IN-TIME, CAREGIVER COACHING

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Universal newborn hearing screening has been highly successful in identifying infants at risk of hearing loss. However, across the United States of America—and particularly in large urban areas—many families struggle to obtain recommended follow-up after an initial referral. Nationally, 27% to 30% of infants who do not pass newborn hearing screening are lost to follow-up. In Washington, DC, reported loss-to-follow-up rates have been substantially higher, reflecting system-level barriers faced by families after hospital discharge rather than shortcomings in hospital screening programs.

When follow-up is delayed, infants miss the Joint Committee on Infant Hearing (JCIH) benchmarks for early hearing detection and intervention (screening by 1 month, diagnostic evaluation by 3 months, and intervention by 6 months). Missing these benchmarks can have significant consequences for language, communication, academic, and psychosocial development.

Findlen et al. (2025) explored providers' perceptions of barriers to adherence to the 1-3-6 JCIH recommendations. Commonly cited barriers included limited family awareness of the importance of follow-up testing, competing family responsibilities, transportation challenges, difficulty navigating a complex healthcare system, and lack of nearby services. These are the precise barriers that the caregiver coaching project described below is designed to address.

This pilot study explores the use of virtual, just-in-time caregiver coaching to reduce loss to follow-up after newborn hearing screening. Delivered online at times convenient for caregivers, coaching builds knowledge, skills, and confidence to support early communication and language development, emphasizes timely follow-up and connection to audiological, medical, and early intervention services, and promotes responsive parent–child interactions. Coaching also supports informed decision-making by providing clear, unbiased information about hearing loss, communication opportunities, and hearing technologies, while facilitating navigation of healthcare and early intervention systems through assistance with scheduling, communication with diagnostic centers, and logistical supports such as transportation or childcare. Finally, the intervention fosters emotional and community support by linking families to resources, peer networks, and coping strategies.

The team includes an early interventionist, a speech-language pathologist, and two parents of deaf children with lived experience navigating the Early Hearing Detection and Intervention (EHDI) system in Washington, DC. The team developed a process map to identify points in the post-screening pathway where barriers are most likely to occur and where caregiver coaching could be most beneficial. From this mapping process, the team identified a set of preliminary coaching themes aligned with the project goals and known barriers to follow-up.

The identified coaching themes reflect the supports families may need during this period. Coaching begins with understanding each family's unique circumstances before sharing information. Caregiver-determined themes include explanations about the importance of follow-up testing, what a potential diagnosis of hearing loss may mean, and how early communication and language development—supported by neuroplasticity and critical developmental periods—can begin immediately. Coaching also guides caregivers in interpreting audiological information, including audiograms, and understanding intervention options such as hearing aids or cochlear implants. Care navigation is a core component and includes identifying barriers, coordinating diagnostic follow-up, connecting families to early intervention services (e.g., Parent-Infant or other early intervention programs), and addressing logistical needs such as transportation. Finally, caregivers are linked with experienced parents, professionals, and organizations to ensure they feel supported and informed as they begin their journey. Additional themes emerging from coaching sessions are added to this inventory, contributing to a clearer understanding of caregiver needs.

The coaching intervention is intentionally brief and just-in-time, consisting of two to three sessions lasting approximately 50 minutes each. After each session, the themes addressed are documented, and caregivers complete a brief questionnaire assessing which information was more or less helpful and what questions remain. At the conclusion of coaching, caregivers participate in a focused interview to assess perceived benefits related to the project goals.

This work aims to provide immediate benefits, including improved adherence to follow-up recommendations and shorter time to diagnosis or intervention. The project also targets patient-centered outcomes such as

reduced caregiver stress and increased confidence in navigating the system. At a system level, findings will inform more efficient use of audiology services by reducing missed appointments, clarifying which coaching themes are most relevant to families, and contributing to understanding the role of just-in-time caregiver coaching in improving early hearing detection and intervention outcomes.

Early Hearing Detection and Intervention, coaching

P.03.11

268 - SUMMARY OF THE EARLY DETECTION PROGRAM FOR HEARING DISORDERS, INLCUDING CENTRAL AUDITORY PROCESSING DISORDERS IN OVER 30.000 SCHOOL-AGED CHILDREN (2023-2025)

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Background

Hearing screening plays a crucial role in the prevention of hearing disorders by enabling early identification and prompt initiation of appropriate diagnostic and therapeutic actions. Early detection of hearing problems in children, especially during early school age, is essential for proper speech development and effective functioning in the school environment. Despite the widespread implementation of newborn hearing screening programs, there is still a lack of systematic continuation of hearing screening in school-aged children in Poland, which constitutes a significant gap in health prevention. The Institute of Physiology and Pathology of Hearing has been conducting screening programs in various regions of the country for years. These programs not only allow early detection of hearing impairments but also increase awareness among parents and teachers regarding hearing disorder prevention and intervention options.

Material and methods

The study involved 33,134 students from grades 1 and 8 attending primary schools in Warsaw. The screening procedure included determination of air conduction hearing thresholds for frequencies ranging from 0.5 to 8 kHz. Students with normal hearing thresholds were further qualified for selected tests assessing central auditory processing. These tests included the frequency pattern test, duration pattern test, and dichotic digit test.

Results

An abnormal result in the screening audiometry was found in 10.6% of the children tested. The majority of hearing losses (68.4%) were unilateral. Analysis showed that among children with normal screening audiometry results, 7.9% exhibited central auditory processing disorder.

Conclusions

Hearing screening in children starting school education should be a permanent element of health prevention. Early detection of hearing disorders and prompt implementation of appropriate diagnostic, therapeutic, and rehabilitative measures are essential for the child's proper development. Effective implementation of screening programs requires cooperation among various medical and educational environments. Long-term preventive actions, supported by health education and promotion, contribute to reducing undiagnosed hearing disorders in the population, improving overall health, and decreasing healthcare costs. A key element of screening effectiveness is ensuring adequate acoustic conditions and adherence to medical procedures, while combining a screening audiometer with a centralized management system constitutes the most optimal model for mass hearing screening.

Key words: hearing screening • school-aged children • hearing loss • central auditory processing • early detection • prevention

P.03.12

269 - DIAGNOSTIC MANAGEMENT OF THE SENSE OF HEARING IN PATIENTS WITH AUTISM SPECTRUM DISORDERS (ASD)

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Background
Hearing disorders are characterized by changes in the auditory system and are one of the main disorders that cause limitations in communication and social interaction in children. Autism spectrum disorder, on the other hand, is a pervasive developmental disorder that includes deficits in socialization, communication, and adaptive functioning. Like hearing loss, autism spectrum dis-orders (ASD) also exhibit language changes that often lead to indeterminate or inaccurate diagnoses. Many symptoms of hearing impairment and pervasive developmental disorders overlap, requiring differential diagnosis by a multidisciplinary team. This publication presents an up-to-date procedure for diagnosing hearing disorders in patients with pervasive developmental disorders.
Key words: • pervasive developmental disorders • hearing disorders • central auditory processing disorders

P.03.13

312 - INTONATION PRODUCTION IN CHILDREN WITH COCHLEAR IMPLANTS: ACOUSTIC AND PERCEPTUAL EVIDENCE

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Cochlear implants (CIs) have substantially improved spoken language outcomes for children born with severe-to-profound hearing loss. Despite the unprecedented access that CIs offer, there are limits to the information they provide. One significant limitation of current CI technology is the lack of fundamental frequency (f0) and other fine-structure information in the coded signal that ultimately reaches the cochlea. Fundamental frequency is an important acoustic feature on which the perception of intonation is based, and while secondary pitch cues are available to CI users (such as temporal fluctuations in the speech envelope delivered to individual channels), they are not as robust as f0.

The present study examined how limitations in f0 information influence children's production of intonation patterns used to mark yes–no questions and statements. We hypothesized that children with cochlear implants (CWCI) would show differences in intonation production relative to children with typical hearing (CWTH), reflecting reduced access to fine temporal and spectral cues. To test this hypothesis, intonation productions by CWCI were compared with those of age-matched CWTH.

Participants included 20 CWCI (43–100 months of age) and 20 CWTH (40–101 months of age). Statements and yes–no questions were elicited and recorded using an interactive role-play procedure designed to elicit naturalistic productions. Each child produced multiple utterances intended as either statements (e.g., *I like cheese*) or yes–no questions (e.g., *Do you want some cake?*).

Elicited productions were segmented into individual audio files and randomly presented to a group of 10 adult listeners with normal hearing. Listeners rated perceived intonation patterns using a visual analog scale ranging from 0 (falling) to 1000 (rising). Listener reliability was assessed through repeated judgments, and only listeners demonstrating correlations of .80 or higher were included in subsequent analyses. Mean perceptual ratings were calculated for each utterance.

Acoustic analyses were conducted using PRAAT (Boersma & Weenink, 2025). For each utterance, the final two syllables were identified, and the vocalic portions of each syllable were segmented and labeled. Acoustic measures included mean, minimum, and maximum f0 and intensity for each vocalic portion. Differences in mean f0 and intensity between the penultimate and final syllables served as acoustic indices of intonation patterning and were compared with perceptual ratings.

Preliminary analyses from a subset of participants (14 CWCI and 14 CWTH) revealed both similarities and differences in intonation production across groups. Both CWCI and CWTH distinguished between intended questions and statements using systematic changes in f0 and, to a lesser extent, intensity. Strong relationships were observed between listener judgments and final-syllable f0, as well as between perceptual ratings and f0 and intensity changes across the final two syllables. The primary group difference was a tendency for CWCI to produce higher overall f0 values compared to their hearing peers.

Ongoing analyses will extend these findings to the full sample and examine child- and family-level factors that may help explain variability in intonation production among CWCI. Planned analyses include the roles of age at implantation, duration of CI use, maternal education, and associations with vocabulary and broader language skills. Findings will be interpreted in relation to prior work on prosodic production in children with cochlear implants, including previous studies of contrastive stress (Mahshie & Larsen, 2023), to further elucidate the auditory and non-auditory factors supporting intonation development.

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P.03.14

215 - IMPACT OF VESTIBULAR FUNCTION ON THE NEUROPSYCHOMOTOR PERFORMANCE OF INFANTS WITH CYTOMEGALOVIRUS: PRELIMINARY RESULTS

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Introduction: The vestibular system is one of the first sensory systems to begin its functional maturation process, playing an important role in the organization of muscle tone, postural control, and the acquisition of initial motor skills. Vestibular changes can compromise sensorimotor integration and negatively impact neuropsychomotor developmental milestones. In infants with cytomegalovirus (CMV), inner ear impairment can occur early and without obvious clinical signs, making the recognition of these changes a challenge. Although the auditory impact of CMV has been widely described, the investigation of vestibular function is still under-explored in early clinical practice.
Objective: To evaluate sacular otolithic function and its relationship with neuropsychomotor performance in infants with congenital and perinatal cytomegalovirus.
Methodology: This is a preliminary, analytical-descriptive study approved by the Research Ethics Committee (No. 7.190.153). Twenty-seven infants were included in the study and tested for CMV using polymerase chain reaction (PCR) on urine samples. Infants were classified as having congenital CMV (cCMV) when PCR was performed up to the 21st day of life (n=6), perinatal CMV (pCMV) when performed after this period (n=9), or control group (CG) with negative PCR (n=12). All infants were up to six months of age at the time of audiological and otoneurological evaluation. The audiological evaluation included tympanometry with a 1000 Hz probe, evoked otoacoustic emissions, Brainstem Auditory Evoked Potential (BAEP) with click stimulus and BAEP by specific frequency at 500, 2000, and 4000 Hz, with the aim of characterizing the integrity of the middle ear and the peripheral and central auditory pathway. Saccular otolith function was assessed using cervical vestibular evoked myogenic potential (c-VEMP), considering presence, absence of response, interaural asymmetry, and/or latency changes. Neuropsychomotor development was assessed using the Bayley Scales of Infant and Toddler Development – Third Edition (Bayley-III). Data analysis was descriptive and exploratory.
Results: All infants had audiological results within normal ranges at the time of evaluation, including tympanometry with a 1000 Hz probe, otoacoustic emissions, and click and frequency-specific BAEP, suggesting integrity of the middle ear and peripheral and central auditory pathways in the study sample. Regarding vestibular evaluation, 14.8% of subjects with CMV had bilateral absence of responses in c-VEMP, two from the CMVc group and two from the CMVp group. In addition, 22.2% of the sample presented some type of alteration in c-VEMP, with a higher occurrence in the CMVp group (50%), followed by CMVc (33.3%) and GC (16.7%). The main alterations observed were increased latency and interaural asymmetries, suggesting saccular dysfunction. Normal vestibular responses were observed in 63% of infants, mainly among controls (91.7%). In the integrated analysis with Bayley-III, it was observed that 100% of infants with bilateral absence of c-VEMP responses had lower mean scores in the gross motor domain when compared to subjects with preserved vestibular function. In the cognitive domain, two infants in the CMVc group had borderline scores. Infants with normal vestibular responses performed better overall in the domains evaluated, with no scores indicative of motor delay in the period analyzed.
Conclusion: In this study, worse motor performance was observed in infants with CMV, especially in the domain of gross motor skills. The findings suggest that impaired otolithic function, as assessed by c-VEMP, may be associated with worse motor outcomes in this population. The presence of normal auditory responses reinforces that the changes observed seem to primarily involve vestibular function, highlighting the importance of early otoneurological evaluation even in the absence of hearing impairment. Early identification of vestibular hypofunction stands out, therefore, as a potential biomarker of risk for neuropsychomotor developmental delays. However, as these are preliminary results, it is important to continue the study with larger samples and longitudinal designs in order to confirm these associations and deepen our understanding of the impact of vestibular dysfunction on child motor development.
Keywords: Cytomegalovirus; Vestibular System; Vestibular Myogenic Evoked Potentials; Child Development; Early Diagnosis

P04 - AUDITORY NEUROSCIENCE, LISTENING EFFORT & COGNITIVE DECLINE

P.04.01

47 - BEHAVIOURAL RESPONSES TO LISTENING DIFFICULTY IN CONVERSATION: REVIEW AND THEMATIC MAPPING OF PRIMARY EVIDENCE

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Background and aims: The ways in which people with hearing loss respond to listening difficulty in in-person conversation are complex and heterogenous. This study seeks to assemble and map the currently fragmented evidence, distinguishing between behavioural ('what people do') and affective ('what people feel') responses. Here we report only on behavioural responses.
Methods: We conducted a scoping review following PRISMA-ScR guidelines. Articles were identified through systematic searches in five indexing databases, and through reference checking. Thematic synthesis was used to collate and condense data into distinct themes and categories. The literature search identified 8503 studies (both qualitative and quantitative), 81 of which were selected for inclusion. Responses from people with hearing loss, people with normal hearing, and communication partners were identified.
Results: Behavioural responses were assembled into five partially overlapping themes, each consisting of multiple categories. We labelled the themes as follows:
'Signal' - Optimizing ability to receive/understand the signal (auditory or visual)
'Repair' - Repairing mishearings and misunderstandings of the content of the conversation
'Relations' - Manipulation/negotiation of the relations between interlocutors
'Preparation & recuperation' - Strategies used before or after a conversation
'Flow' - Related to timing and negotiation of the conversational floor.
Further organising principles were 'what I do' vs. 'what other people do' and 'when I have difficulty' vs. 'when others have difficulty'.
Conclusion: People with hearing loss and their communication partners respond to listening difficulty in conversation in a wide range of ways, covering diverse aspects of communication. Strikingly, people with normal hearing report most of the same response types as people with hearing loss. Nevertheless, there is a paucity of evidence regarding responses of people with normal hearing, and a need for more studies making direct comparisons between people with and without hearing loss. Our grouping of responses into themes and sub-categories may facilitate future theory-building and the design of more targeted studies.

Keywords: Behaviour, conversation, communication partner, effort, review

P.04.02

48 - IMPACT OF PLATINUM-BASED CHEMOTHERAPY ON COGNITION, HEARING AND OLFACTORY FUNCTION: A SYSTEMATIC REVIEW

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Background/Rationale: Platinum-based chemotherapy is widely used in cancer treatment, but it is also associated with significant adverse effects, including cognitive impairment, hearing impairment, and olfactory dysfunction. These complications can profoundly impact quality of life and long-term survivorship outcomes. However, their prevalence and interrelationships – particularly the sensory-cognitive interplay – remain uncertain. This systematic review aimed to consolidate existing literature on cognitive impairment, hearing impairment, and olfactory dysfunction in adults treated with platinum-based chemotherapy and to identify methodological approaches while clarifying implications for sensory and cognitive outcomes.

Materials and Methods: A comprehensive search was conducted in MEDLINE, EMBASE, Cochrane, and Web of Science for studies published between 2010 and 2025. Inclusion criteria targeted adult cancer patients receiving platinum-based chemotherapy, excluding radiotherapy and pediatric populations. Forty-seven studies met eligibility: 21 cross-sectional, 25 cohort, and one qualitative study. Critical appraisal was conducted using the Joanna Briggs Institute (JBI) tools to assess methodological quality and risk of bias. Data were synthesized narratively due to heterogeneity in outcome measures and reporting.

Results: Hearing loss was the most frequently reported adverse effect, with objective prevalence ranging from 20–94% (age-adjusted: 22–30%) and self-reported prevalence from 23–59%. Cognitive decline was observed in 11–63.6% of participants in the few studies that assessed it, and olfactory dysfunction appeared largely transient and lacked prevalence data. Only three studies examined the link between hearing loss and cognition, all reporting significant associations consistent with sensory-cognitive interactions that may influence patient functioning and quality of life. Methodological variability such as inconsistent hearing-loss classification criteria, lack of baseline measures, variable assessment tools, and skewed representation of male testicular cancer survivors, limited comparability across studies.

Conclusions: Platinum-based chemotherapy exerts substantial cognitive and sensory effects, with strong evidence for progressive, dose-dependent hearing loss and suggestive links to cognitive decline. Olfactory changes are less studied but clinically relevant. Standardized protocols, routine audiological monitoring, and inclusion of underrepresented populations are critical for improving care and addressing quality-of-life implications. Further research should explore sensory-cognitive interplay, employ more standardized tests with clearer reporting of treatment details, prioritize longitudinal designs with baseline measurements, and evaluate interventions that may eliminate long-term impacts.

Keywords: platinum-based chemotherapy; cognitive impairment; hearing loss; quality of life; sensory-cognitive interplay

P.04.03

50 - THE DEVELOPMENT OF AN AUDIO DEEP LEARNING MODEL CLASSIFYING MISOPHONIA TRIGGERING SOUNDS VERSUS NON-TRIGGERING SOUNDS

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Misophonia is a disorder characterized by decreased tolerance to specific sounds, referred to as “triggers”, leading to emotional and behavioral distress, estimated to affect around 20% of individuals worldwide. However, limited research is available on the identification of the disorder and potential treatment options. This study developed a classification model to distinguish between misophonia triggering sounds (MIS) and non-triggering sounds (NMIS) and develop a model output that would play “white noise” in the individuals' environments accordingly. The study was conducted in two parts: training an Audio classification model with a dataset containing audio samples for MIS and NMIS and testing a set of unclassified audio samples as MIS or NMIS. At first, eight common MIS sounds for many individuals with misophonia were determined based upon the literature. Using GitHub, two repositories, namely MIS and NMIS, were created, where 98 and 733 recordings were present, respectively. The recordings of the chosen eight sounds were coded as MIS, while all non-triggering sounds were coded as NMIS. Recordings in both sets were collected from online libraries such as Pixabay and Freesound. The MIS and NMIS repositories were then downloaded from GitHub and loaded to a Google Colab notebook, serving as the raw dataset. The initial model was developed through adaptation via the Audio Deep Learning Model, an example and architecture for Audio Deep learning. After the model was trained through a loop utilizing the audio samples in the two repositories, the model was transferred to a Raspberry Pi device using a cloudpickle file. Additional commands were then added to the model to connect it to the microphone and speaker added onto the Raspberry Pi. 98 MIS and 733 NMIS audio samples, corresponding to a total of 831, were analyzed and labelled as MIS and NMIS sounds. Results were obtained by testing the model with a validation dataset containing 166 audio samples. The model’s accuracy was initially measured as 94%, and ultimately 90% after the final round of training. Validation testing on the model was then performed by finding new, unlabeled sounds from the original online sound libraries and inputting them into the model to see what they were classified as. At this stage, the model accurately and reliably predicted NMIS and MIS sounds.Once the model was downloaded onto a Raspberry Pi and the device was connected to both a microphone and a speaker, all of the incoming sounds, whether MIS or NMIS, were classified as MIS, and white noise was played, suggesting an issue of sensitivity. Future work will attempt to improve the sound sensitivity of the model using the Raspberry Pi to serve as a prototype for a supportive treatment option for misophonia along with the conventional method of Cognitive Behavioral Therapy. These preliminary results demonstrate that there is promising potential in developing an effective prototype for misophonia using an Audio classification model.

Key words: misophonia, raspberry pi, machine learning, training model

P.04.04

75 - SHH AGONIST ENHANCES MATURATION OF INNER EAR HAIR CELLS IN INNER EAR ORGANOIDS DERIVED FROM OTIC PROGENITOR CELLS

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Background: The regeneration of functional hair cells (HCs) remains a critical challenge in addressing sensorineural hearing loss. This study aimed to investigate the molecular and functional mechanisms driving stereocilia maturation within inner ear organoids (IEO) derived from homogenic Lgr5-positive progenitor cells (LPCs) and to compare outcomes with traditional heterotypic cultures.
Methods: Mouse cochlear LPCs were isolated via magnetic-activated cell sorting (MACS) to establish homotypic cultures, ensuring purity and eliminating the heterotypic influences present in traditional manual isolation (MI) methods. Differentiation into HCs was induced through Wnt and Notch signaling modulation. Transcriptomic profiling using bulk and single-cell RNA sequencing (scRNA-seq) identified gene expression changes linked to stereocilia development. A Sonic Hedgehog (Shh) agonist was applied to enhance structural maturation of HCs. Functional assessment included electron microscopy, FM1-43 uptake assays, and microelectrode array recordings in assembloids of IEO with primary spiral ganglion neurons (SGN) co-cultures.
Results: While homotypic LPC-derived IEOs successfully differentiated into HC-like cells, initial morphological assessment revealed immature stereocilia structures. Bulk RNA-seq analysis highlighted a downregulation of morphogenesis-related genes in these organoids. The application of a Shh agonist, acting as a key morphogen, promoted stereocilia development, as evidenced by enhanced ultrastructural features and increased expression of cuticular plate-associated genes (*Pls1, Lmo7* and*Lrba)*. Single-cell RNA sequencing (scRNA-seq) further identified distinct cell clusters, which exhibited robust expression of stereocilia-related genes (*Espn, Lhfpl5, Loxhd1* and *Tmc1)*, indicative of advanced HC maturation. Electrophysiological assessments of IEO-SGN assembloids using microelectrode arrays confirmed functional mechanoelectrical transduction between cells.
Conclusion: This integrated approach elucidates critical pathways and cellular dynamics underpinning stereocilia maturation and functional HC development in EIOs. These findings provide new insights into the molecular regulation of HC maturation and support the utility of Shh-modulated IEOs as a promising platform for inner ear regeneration and therapeutic development for inner ear regenerative therapies.
Keywords: inner ear organoid, Lgr5, sonic hedgehog, RNA sequencing, microelectrode array

P.04.05

92 - BEYOND LISTENING EFFORT: A MULTIDIMENSIONAL DEFINITION OF EDUCATIONAL FATIGUE UNDERPINNING THE "FATIGUE IN EDUCATIONAL CONTEXTS" INCLUSIVE ASSESSMENT TOOL FOR DEAF AND HARD OF HEARING STUDENTS

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Background

Fatigue is a pervasive yet poorly defined issue affecting D/deaf and Hard of Hearing (DHH) students in K-12 educational settings. Despite growing recognition of fatigue as a contributor to academic and psychosocial outcomes, the absence of a universally accepted definition has resulted in inconsistent conceptualization, measurement and intervention across studies. As a result, fatigue is often misunderstood by DHH students, parents, and educational teams. Students may fail to recognize and/or dismiss symptoms of fatigue, while educators frequently misinterpret fatigue-related behaviors as a lack of motivation, laziness, or non-compliance. Fatigue has been linked to lower academic outcomes, and recent research highlights overlapping symptomatology between fatigue and ADHD (Mattingly et al., 2023) increasing risk of misattribution and inappropriate intervention for DHH students.

Rationale/Methods

The purpose of this poster presentation is to propose a comprehensive, inclusive definition of fatigue that reflects its multidimensional nature and the diverse experiences of DHH learners in educational settings. To inform this definition we conducted a systematic review of existing literature to examine how fatigue has been defined and conceptualized in research involving DHH populations. The systematic review included 64 peer-reviewed articles. Review parameters and selection criteria are presented in the poster. Definitions were examined for conceptual focus, domains of fatigue addressed, and relevance to educational contexts.

Results

The review confirmed a lack of consensus regarding the definition of fatigue, particularly for DHH individuals. Although fatigue is increasingly described as multidimensional, definitions varied substantially across studies. When examining article definitions several key patterns emerged:

1. Fatigue research has historically centered on clinical and health-related contexts, with an emphasis on physical fatigue and performance-based outcomes.
2. DHH students consistently report higher levels of fatigue than their hearing peers.
3. Most definitions and measures of fatigue related to DHH students prioritize listening-related fatigue, often overlooking other important contributors, such as visual and attentional demands, cognitive and physical effort, and students' social–emotional strain.
4. When fatigue is narrowly defined as listening fatigue, other critical dimensions particularly, physical, cognitive, and social-emotional fatigue are underrepresented limiting the ecological validity of existing assessment approaches.

Drawing on insights from the systematic review and insights from our research participants we propose the following definition: *Educational Fatigue refers to a state of persistent cognitive, social-emotional, and physical exhaustion resulting from prolonged engagement in cognitively or physically demanding, socially complex, and emotionally taxing learning environments. It arises from sustained effort across academic tasks, interpersonal interactions, and performance expectations—often without sufficient recovery time (Rohatyn-Martin et al., 2025).*

This definition conceptualizes fatigue as both subjective, experienced as overwhelm, disengagement or reduced motivation, and objective, observable through decreased performance, reduced participation, or behavioral change. It explicitly attributes fatigue to sustained high levels of effort across cognitive, social-emotional, and physical domains, acknowledging multiple pathways through which fatigue develops. Importantly, the definition is inclusive of the heterogeneity of DHH learners, and applies across auditory and visual modalities.

The definition also distinguishes fatigue from tiredness. Unlike tiredness, fatigue is not easily alleviated by sleep or short breaks and may persist despite adequate rest. Educational fatigue commonly manifests as reduced attention, concentration, emotional resilience, and academic efficiency, with implications for learning, social relationships, and overall well-being.

Implications

This redefined conceptualization of fatigue provides a foundation for more consistent terminology in research and practice and supports the development of assessment tools that more accurately reflect DHH students' lived experiences. This definition of educational fatigue served as the conceptual foundation for the development of the Fatigue in Educational Contexts (FEC) survey measuring fatigue across cognitive, social-emotional, and physical domains. By broadening the focus beyond listening effort alone, this work promotes greater awareness among educators, families, clinicians, and researchers and supports more appropriate identification, intervention, and support.

Conclusion

A comprehensive, multidimensional definition of educational fatigue is essential for advancing research, improving assessment practices, and reducing misinterpretation of DHH students' behaviours in educational settings. By reframing fatigue as a complex, effort-based phenomenon, this work aims to enhance equity, empower DHH learners, and support improved academic and well-being outcomes.

P.04.06

94 - DOES THE SELECTIVITY IN PUPIL RESPONSES BETWEEN RELEVANT AND IRRELEVANT BACKGROUND SOUNDS REVEAL CHALLENGES IN ATTENTIONAL CONTROL?

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Auditory attentional control, including sustaining and switching attention to relevant sounds while ignoring irrelevant ones, is crucial for navigating busy auditory scenes. This ability can be compromised by hearing loss, which affects audibility and increases cognitive load under a limited cognitive capacity. We investigated how manipulating the sound level of both relevant and irrelevant background sounds affects selectivity, both in behavior and pupil responses. This selectivity is defined as the difference between responses to relevant versus irrelevant background sounds.
We recorded pupil size from 44 middle aged to older participants (ages 44-83 years; PTA: 7.5 – 64 dB HL) while they performed a dual task. The primary task involved sustained attention to an audiobook, and the secondary task required memorizing spoken numbers (preceded by a cueing sound) from a relevant location, with numbers from an irrelevant location also presented. The levels of the spoken numbers and the cueing sound were manipulated relative to the primary target (-27, -19, -11, -3 dB). Louder background sounds led to both higher hit rates of relevant - and relatively more stream confusion of irrelevant background sounds (compared to random errors), highlighting that louder background sounds attract more attention. Preliminary analysis revealed level-dependent pupil selectivity, peaking at the intermediate background-sound level of -11 dB, suggesting a sweet spot at the group level. Participants who achieved a higher hit rate also showed higher selectivity in the pupil response. Further analysis will explore the relationship among selectivity, age, auditory profiles, and cognitive tests, respectively.
The results can help to understand how both auditory and cognitive tests predict behaviorally beneficial levels of background sounds and thus may help to improve individualization of noise reduction and directionality in hearing devices.

Conflict of interest: one or more authors have declared an industry affiliation

P.04.07

102 - THE AUDITORY SYSTEM IN ALZHEIMER'S DISEASE – PRELIMINARY FINDINGS FROM THE AUDITORY BIOMARKERS OF HEALTHY AGEING AND ALZHEIMER'S DISEASE STUDY

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Emerging evidence suggests a connection between hearing loss and dementia, yet the distinct contributions of peripheral and central auditory dysfunction remain unclear. Behavioural measures of hearing are often confounded by cognitive demands, making it challenging to disentangle auditory and cognitive contributions. The aim of this study is to explore how auditory function (from the inner ear to the auditory cortex), and integration of auditory and cognitive components, differs between individuals with mild cognitive impairment (MCI) due to Alzheimer's disease and cognitively healthy controls.
We aim to recruit 100 participants with MCI and 100 controls to undergo comprehensive baseline and two-year follow-up assessments. These include sensitive behavioural and electrophysiological auditory tests, cognitive evaluations, and analysis of Alzheimer's disease-related plasma biomarkers [neurofilament light chain (NFL), amyloid-beta (Aβ40/42 ratio), and phosphorylated tau (p-Tau181/217)]. Data collection is ongoing, and we will present preliminary cross-sectional results (from n=150) highlighting the relationship between auditory measures and cognitive function in healthy ageing and MCI.
Our findings may help to clarify the interplay between auditory processing and cognitive decline, providing insight into potential mechanisms linking auditory dysfunction to Alzheimer's disease.

Keywords: Cognitive impairment, hearing, auditory processing, biomarkers

P.04.08

182 - PERIPHERAL AUDITORY FUNCTION AND COGNITIVE PERFORMANCE ACROSS THE ADULT LIFESPAN

Viktoria Machajdik [1] - Josef Seebacher [2] - Simone Graf [2] - Philipp Zelger [2] - Matthias Dallio [2] - Franz Muigg [2] - Lukas Mayer-Suess [3] - Michael Knoflach [3] - Stefan Kiechl [3] - Sonja Rossi [4]

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Age-related changes can affect both hearing and cognitive performance. Hearing loss has been associated with an increased risk of dementia. However, the mechanisms underlying auditory and cognitive decline are not yet fully understood. Several theories propose sensory deprivation (Sensory Deprivation Theory), increased cognitive load due to hearing loss (Cognitive Load Theory), and shared neurodegenerative processes (Common Cause Theory) as links between hearing loss and cognitive decline. The present study aims to investigate age-related changes in peripheral auditory function and their association with cognitive performance across adulthood.

The sample includes approximately 100 participants in each of four age groups (18–34, 35–49, 50–64 and 65–79 years). Peripheral cochlear function was assessed using distortion product otoacoustic emissions (DPOAE) to estimate hearing thresholds from 1 kHz upwards. Cognitive performance was evaluated using the Montreal Cognitive Assessment (MoCA), a screening tool for mild cognitive impairment and early detection of dementia. Preliminary results indicate that reduced peripheral cochlear function and lower MoCA scores were more prevalent in older age groups. Furthermore, individuals with reduced peripheral cochlear function performed worse on the MoCA compared to those with higher peripheral cochlear function. These results suggest a potential association between peripheral auditory deficits and reduced cognitive performance across adulthood.

Further analyses will examine whether subjective hearing difficulties as well as additional demographic factors contribute to a more detailed understanding of the association between auditory and cognitive function. Overall, these findings highlight the relevance of early audiological assessment for supporting cognitive health in aging populations.

Keywords: hearing loss, cognitive decline, aging, peripheral auditory function

P.04.09

252 - THE INFLUENCE OF MASKER TYPE AND INTELLIGIBILITY LEVEL ON LISTENING EFFORT IN ADOLESCENTS

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Understanding speech in background noise is a complex task, and adolescents persistently perform worse than adults in such situations. When the competing noise is composed of interfering talkers (informational masking), this ability does not reach mature levels until late adolescence (around 16 years old). The underlying mechanisms explaining this protracted development of performance against informational maskers are still not completely understood although they could be related to cognitive resources or the recruitment of those. Understanding speech in background noise can be effortful. In adults, informational maskers elicit more listening effort (as measured by pupil dilation during task) than energetic maskers. To our knowledge, there is currently no study that compared listening effort between different types of maskers in adolescents using pupillometry. The aim of this study is to investigate the potential differences in listening effort and effort allocation between adolescents and adults, in different types of maskers and different intelligibility levels. Considering that listening effort does not reflect intelligibility scores, investigating listening effort might provide more insights to the differences observed between adolescents and adults in intelligibility measures. In this study, pupil dilation was measured in children (12-13 years old) and young adults during a speech intelligibility task against two types of maskers (speech-shaped noise and 2-talker speech) and at two signal-to-noise ratios (SNRs) corresponding to each participant's individual performance of 50 and 84% correct response. Working memory was evaluated using the reverse digit span from the WISC-V battery. Data collection is still ongoing. A repeated measures ANOVA will assess the effects of masker type, intelligibility level and age group on pupil dilation. In adults, preliminary results show larger peak pupil dilation in the 2-talker condition compared to the SSN condition and larger peak pupil dilation in the 50% compared to the 84% intelligibility level. For speech-in-noise performance, we expect a group difference only in the 2-talker condition. We therefore expect to observe an interaction between group and condition on pupil dilation. Depending on the exact values of pupil dilation and SRTs, such an interaction could indicate that adolescents deploy more, less or the same amount of effort as adults for poorer SRT against 2-talkers. Those results could help understand whereas their performance is limited by their cognitive resources or their ability to allocate those.

Keywords: listening effort, speech-in-noise, adolescents

P.04.10

277 - AN EVALUATION OF THE EFFECTS OF HEARING LOSS ON MEMORY AND LEARNING SKILLS

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In recent years, the impact of hearing loss on cognitive functions such as memory processes has become an increasingly important topic of research. The literature suggests that impairments in the auditory system can negatively affect not only auditory perception but also cognitive skills. This study aims to investigate the relationship between hearing loss with memory and learning performance across different age groups. Participants were divided into four groups based on age and hearing status: Group I – individuals with normal hearing (18–50 years), Group II – individuals with hearing loss (18–50 years), Group III – elderly individuals with normal hearing (65–85 years), and Group IV – elderly individuals with hearing loss (65–85 years).
In order compare the impact of different age and hearing status groups, various cognitive tests were utilized. These tests are Auditory Verbal Learning Test, Visual Aural Digit Span Test – Form B, and Corsi Block Test. According to the findings, a significant difference was found between the two groups of participants aged 18–50 (Groups I and II) for the subcomponents of the Auditory Verbal Learning Test ($p<0.05$). In the Visual-Aural Digit Span Test, a significant difference was found in the evaluated scores ($p<0.05$), except for the visual-oral and visual-written score ($p>0.05$). For the Corsi Block Test, no significant difference was found between these two groups ($p>0.05$). On the other hand, for the comparisons between the elderly groups (Groups III and IV), significant differences were observed for the scores of the Auditory Verbal Learning Test and the Visual-Aural Digit Span Test ($p<0.05$). However, no significant difference was observed for the Corsi Block Test results ($p>0.05$).
Overall the results reveal that hearing loss negatively affects memory and learning skills no matter what is the age group, furthermore this effect is more pronounced in the elderly group.

Keywords: cognitive functions, hearing loss, learning, memory

P.04.11

278 - THE EFFECT OF BINAURAL BEATS STIMULATION ON LISTENING EFFORT

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Listening effort is defined as the attention and cognitive resources allocated to a specific auditory task in situations where task demands are high, such as demanding listening conditions. Binaural beats, which have been increasingly proven to be effective in various cognitive, memory, and attention areas, are the perception of a third sound by presenting two sounds with different frequencies to each ear separately. In this study, it was aimed to evaluate the effects of Beta and Theta binaural beats stimulation on the listening effort of individuals and also on their ability to understand speech in noise. A total of 36 people with normal hearing were included in the study. Participants were randomly assigned to Beta binaural beats, Theta binaural beats, and control groups. Initially, pure tone audiometry, speech audiometry, and MoCA (Montreal Cognitive Assessment) tests were applied to the participants. HINT (Hearing in Noise Test) and dual task paradigm tests were applied to the participants who met the criteria. Then, Beta or Theta binaural beats stimulation was performed according to the group to which the participants were divided. The participants listened to these sounds for 15 minutes every day for 1 week. Then, HINT and dual task paradigm tests were applied again for the final evaluation. Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) 22.0. As a result of the statistical analyses, it was found that Beta binaural beats stimulation had a significant effect on listening effort ($p<0.05$). Theta binaural beats stimulation had no significant effect at all on the listening effort ($p>0.05$). It was also seen that Beta binaural beats stimulation had a significant effect on the ability to understand speech in noise ($p<0.05$). Theta binaural beats stimulation had no significant effect on the ability to understand speech in noise. In conclusion, this study revealed that Beta binaural beats have the potential to reduce listening effort and increase the ability to understand speech in noise.

Keywords: Beta wave, binaural beats, listening effort, Theta wave, understanding speech in noise

P.04.12

283 - EFFECTS OF SPEECH STIMULI AND PRESENTATION MODE ON THE FREQUENCY FOLLOWING RESPONSE IN NORMAL-HEARING ADULTS

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Introduction: The Frequency-Following Response (FFR) is a subcortical auditory evoked potential that captures phase-locked neural activity to the spectral and temporal features of acoustic stimuli, allowing for objective assessment of speech sound encoding within the central auditory system. Although most studies employ the syllable /da/, consonant–vowel–consonant stimuli such as /dao/ have been introduced due to their potential to elicit more robust responses, enabling assessment of fine temporal structure and envelope encoding. Objective: To investigate the effects of different speech stimuli and presentation modes on the FFR in normal-hearing adults. Method: This cross-sectional, prospective study was approved by the Research Ethics Committee (no. 5,685,328). Twenty-eight normal-hearing adults (nine males, 19 females; mean age 25.1 ± 4.2 years), native speakers of Brazilian Portuguese with no hearing complaints or history of tinnitus, participated. All participants presented Transient Evoked Otoacoustic Emissions (TEOAEs) in at least three frequency bands between 1 and 4 kHz, with a signal-to-noise ratio (SNR) ≥ 6 dB. The speech stimulus /dao/ (217 ms; fundamental frequency [F0] = 113 Hz) was presented monaurally (right and left ears) and binaurally, while the /da/ stimulus (170 ms; F0 = 100 Hz) was presented to the right ear. Stimuli were delivered at 80 dB nHL via ER-3A insert earphones, using alternating polarity, a stimulation rate of 3.7/s, and band-pass filtering from 30 to 1500 Hz. Fewer than 10% of sweeps were rejected due to artifacts out of 1,000 accepted sweeps per condition. The /d/ and /a/ segments of /da/ and the /d/, /a/, /o/, and /ao/ segments of /dao/ were analyzed. Time- and frequency-domain measures included prestimulus root mean square (RMS), neural lag, cross-correlation, pitch strength, pitch error, spectral amplitudes of the F0, mid harmonics (H2–H4), high harmonics (H5–H6), and SNR. Statistical analysis was performed using the Shapiro–Wilk, Wilcoxon, and Friedman tests, with a significance level set at $p < 0.05$. Results: For the /da/ stimulus, a mean neural lag of 9.34 ms was observed, accompanied by robust pitch strength and higher spectral amplitudes at the F0 and H2–H4 compared to high harmonics, despite lower cross-correlation values. For the /dao/ stimulus, binaural presentation resulted in more robust FFR responses compared to monaural conditions, with greater spectral amplitudes at F0 and both mid (H2–H4) and high harmonics (H5–H6), as well as a trend toward reduced neural lag. Conclusion: In normal-hearing adults, the FFR was influenced by both speech stimulus characteristics and mode of presentation. The /dao/ stimulus, particularly under binaural presentation, elicited responses with shorter neural lag and enhanced harmonic representation, whereas the /da/ stimulus demonstrated superior F0 SNR. These findings indicate stimulus- and presentation-specific sensitivity of the FFR, suggesting that /da/ is more suitable for assessing periodicity encoding, while binaural /dao/ provides greater sensitivity to spectral resolution and binaural integration mechanisms, supporting its complementary use in routine clinical and research assessments.

Keywords: Frequency Following Response; auditory evoked potentials; speech perception; binaural processing; neural encoding.

P.04.13

308 - NEURAL SIGNATURES OF AUTOMATIC PHONETIC DISCRIMINATION REVEALED BY EEG FREQUENCY TAGGING

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The human brain shows marked plasticity during development, and early exposure to speech shapes phonetic sensitivity and language processing. From the earliest stages of life, infants can discriminate a wide range of phonemic contrasts (e.g., /pa/-/ba/) and become progressively attuned to the phonemic repertoire of their language, showing an enhanced sensitivity to native phonetic contrasts. Moreover, even among native contrasts, phoneme discrimination is further modulated by the language-specific acoustic and articulatory features that define each phonemic category. Critically, phonemes that differ across multiple articulatory and phonological features (e.g., manner, place, voicing) are easier to discriminate when compared to phonemes showing higher acoustic similarity. Accordingly, consonant discrimination difficulty is often assumed to be hierarchically organized as a function of articulatory and phonological distance between contrasts. A standardized electrophysiological measure that extracts fast and objective signatures of phonetic categorization could offer a valuable tool to test this discrimination hierarchy at the neural level and to support language assessments in early ontogeny. To this end, we validated in adults an electroencephalography (EEG) frequency tagging paradigm to automatically detect consonant contrasts and quantify discrimination strength across contrasts. In Experiment 1, we first tested the suitability of the phonetic properties of native (Italian) synthetic syllables through a two-alternative forced choice task in which participants were asked to discriminate syllables pairs that differed in consonant type. To assess automatic neural discrimination of the phonetic contrasts tested in Experiment 1, in Experiment 2, we implemented an EEG frequency tagging paradigm, employing triplets of syllables presented at a base rate of 3.333 Hz, with oddball stimuli varying in consonant identity, presented at 1.111 Hz (one every two standard stimuli) to measure automatic neural discrimination responses. To assess the robustness and generalization of phonetic contrast discrimination under increasing contextual variability, we implemented three discrimination conditions: (i) a low-variability condition with one speaker and fixed vowels, (ii) an intermediate-variability condition with randomized speakers and fixed vowels, and (iii) a high-variability condition with one speaker and randomized vowels. These contexts allowed us to test whether graded discrimination and a putative hierarchy across contrasts emerged and whether they were preserved as talker-related and coarticulatory variability increased. Behavioural data from Experiment 1 confirmed that Italian participants accurately discriminated native syllable contrasts. Results from Experiment 2 showed robust neural responses at the base frequency, reflecting auditory tracking. Moreover, we found significant neural responses at the oddball frequency and its harmonics extracted from the EEG frequency-domain representation, revealing the sensitivity of this technique for detecting automatic phonetic discriminations. Specifically, oddball-response amplitude varied across phonetic contrasts in line with their articulatory and phonological properties, and this hierarchy was preserved across all three generalization conditions. Overall, our findings suggest that this paradigm may be integrated into future assessments of linguistic abilities, offering a novel tool for tracking phonetic aspects of language in both typical and atypical auditory development, especially when behavioral responses are difficult to obtain, such as in early ontogeny.

Keywords: EEG frequency tagging; Fast Periodic Auditory Stimulation (FPAS); automatic consonant discrimination

P.04.14

330 - VISUALIZING EFFORTFUL LISTENING: UNOBTRUSIVE CAMERA-BASED MONITORING IN HEARING AID USERS

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Effortful listening (EL) occurs when additional neurocognitive resources must be recruited to maintain speech understanding under adverse acoustic or cognitive conditions. Noise reduction (NR) algorithms in hearing aids (HA) attempt to alleviate EL and improve speech perception by selectively attenuating background noise while enhancing salient speech cues, thus enhancing the signal-to-noise ratio (SNR). However, assessing listening effort (LE) is complex: it reflects a multidimensional construct spanning acoustic demands, neurocognitive load, and affective state, where different modalities often yield divergent findings. In real-world clinical settings, conventional contact-based sensors (cardiac, electrodermal, ocular, neural) are time-consuming, intrusive or impractical for routine HA fittings.
To address this, we introduce a contactless video-based modality using a standard RGB camera to extract physiological and behavioural LE markers. Facial videos of 28 experienced HA users were recorded during a repeated-measures speech-in-noise (SiN) task in a commercial audiology clinic. The NR feature was toggled ON/OFF in counterbalanced 30s segments during continuous podcast speech (58 dBA) amid multi-speaker babble (60 dBA, SNR -2 dB) simulating speech-in-quiet (SiQ) conditions (NR-ON) versus speech-in-noise (SiN, NR-OFF). We extracted the remote Autonomic Arousal Index (rAAI) via remote photoplethysmography (rPPG) from facial blood volume changes and tracked eyebrow movements/eye blinks using stabilized facial landmarks.
Subjective ratings confirmed strong LE reductions with NR active. Both rAAI and eyebrow movements clearly differentiated NR-ON from OFF: rAAI reduced consistently during ON (rapidly rising upon deactivation), while eyebrow movement frequency and amplitude were attenuated (“frozen”) under OFF (high effort, SiN) conditions but showed marked relief, becoming more frequent and dynamic when NR was active (lower effort). These effects persisted after ruling out head movement confounds, with no significant differences in 3-DoF head orientation (yaw/pitch/roll) or total stability index between conditions. Linear mixed-effects (LME) and latent variable modeling (LVM) provided robust validation of these markers' sensitivity, specificity, and complementary roles. LME analyses confirmed rAAI's strong association with functional hearing loss (OLSA scores) while controlling for condition effects, with greater relative relief in poorer-hearing participants during NR-ON. Eyebrow kinematics inversely tracked subjective LE ratings, revealing a "frozen" behavioral state under high-effort SiN (NR-OFF) conditions that became markedly more dynamic under NR-ON conditions. LVM further highlighted the multidimensionality of effort: it identified rAAI as a robust indicator of a core autonomic latent effort construct, while showing that volitional behavioral markers, such as eyebrow kinematics, provide distinct and complementary insights into the listener's experience.
These findings establish contactless computer vision as an invaluable tool for the assessment of effortful listening. By deriving multiple complementary features, including both physiological (rAAI) and behavioral (eyebrow kinematics) markers, from a single non-invasive modality, this approach bypasses the intrusiveness of traditional sensors. Crucially, this multimodal capability revealed critical individual differences: while participants with greater hearing loss exhibited disproportionately larger physiological relief when noise reduction was active, their behavioral release from the "frozen" state remained suppressed. These nuances highlight the need for multidimensional assessment strategies to fully understand the diverse ways individuals experience the cognitive load associated with effortful listening. To fully transition these methods to naturalistic monitoring, future protocols must address current limitations by extending analysis windows to capture autonomic peaks. Furthermore, incorporating multi-spectral and 3D cameras offers significant potential to enhance physiological signal reliability and maintain robust tracking during unconstrained movement at minimal cost. Ultimately, by bridging the gap between laboratory precision and clinical practicality, contactless video analysis provides a highly scalable complement to traditional audiological research.

Keywords: effortful listening, contactless, hearing aids, remote photoplethysmography, facial kinematics

Conflict of interest: one or more authors have declared an industry affiliation

P.04.15

340 - BRIDGING THE GAP: INTERDISCIPLINARY COGNITIVE SCREENING TRAINING

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Background/Rationale: Early identification, comprehensive assessment, and interdisciplinary management of mild cognitive impairment (MCI) and early-stage dementia are critical for slowing cognitive decline and enhancing participation in daily life. Concurrently, age-related hearing loss (HL) represents a significant and growing global health concern. Epidemiological evidence indicates that nearly two-thirds of adults aged 70 years and older experience some degree of hearing impairment (Lin et al., 2013). Furthermore, the World Report on Hearing estimates that over 1.5 billion individuals worldwide currently live with hearing loss, with projections increasing to approximately 2.5 billion by 2050 (World Health Organization, 2021). Given that HL has been identified as a modifiable risk factor and potential precursor to MCI, rising prevalence of either condition contributes substantially to individual, societal, economic, and public health burden (Grenier et al., 2024; Powell et al., 2021; Washnik & Anjum, 2022). Existing literature has largely examined knowledge of cognitive screening among practicing healthcare providers and community-dwelling older adults; however, limited evidence addresses training of pre-service clinicians in Speech-Language Pathology (SLP) and Audiology (AuD), particularly regarding interdisciplinary collaboration in cognitive screening. Structured interdisciplinary educational experiences involving SLP and AuD students represent a promising pedagogical strategy for preparing pre-service clinicians to address the clinical complexities associated with cognitive decline in older adults (Davis et al., 2019; Kaf et al., 2011). Accordingly, there is a critical need for targeted training that emphasizes cognitive screening, interprofessional collaboration, and patient-centered health education for individuals with cognitive impairment (Mamo et al., 2023; Mayer et al., 2023; Oh & Morris, 2021; Saccasan & Scerri, 2020). The primary objective of the present study was to evaluate the effectiveness of an interdisciplinary training workshop in enhancing knowledge, attitudes, and self-efficacy among graduate students in SLP and AuD with respect to integrating cognitive screening for older adults into future clinical practice. Materials and Methods: Fifty-five graduate students (SLP = 38; AuD = 17) enrolled at a large public university in the United States of America participated in a 2-hour interdisciplinary workshop grounded in active-learning principles and facilitated by SLP and AuD faculty. The workshop combined didactic instruction with interactive, hands-on practice of cognitive screening procedures using the Montreal Cognitive Assessment (MoCA) and the Saint Louis University Mental Status (SLUMS) examination. Participants were organized into small interdisciplinary groups comprising both SLP and AuD students to promote peer learning and collaborative clinical reasoning through case-based scenarios. Within each group, one student administered a screening while peers observed, provided structured feedback, and engaged in reflective discussion of clinical decision-making processes. This format facilitated active participation, strengthened confidence in screening administration, and encouraged integration of multiple professional perspectives within a supportive, practice-oriented learning environment. Pre- and post-intervention outcomes were measured using structured questionnaires incorporating Likert-scale items and open-ended responses. Results: Quantitative and qualitative analyses demonstrated statistically significant improvements in foundational knowledge, more favorable attitudes toward incorporating cognitive screening tools into clinical practice, and increased self-perceived efficacy in administering screening assessments. Collectively, these findings highlight the potential of targeted educational interventions to enhance preparedness of future SLP and Audiology professionals in serving older adults with MCI. Conclusions: Integration of collaborative, reflective, and experiential learning approaches may effectively bridge the gap between theoretical instruction and clinical implementation, thereby strengthening clinical competencies and potentially improving patient outcomes. Sustained investment in the development, implementation, and evaluation of interdisciplinary training models is essential to promote a culture shift in dementia care and ensure that emerging clinicians are equipped to address the complex needs of an aging population. Advancing cognitive screening education requires both rigorous empirical inquiry and disciplinary commitment from SLP and AuD professions to define and operationalize their roles in dementia care. Embedding these practices within routine training and clinical service delivery may better prepare future providers to meet the escalating demand for dementia-capable care.

Cognitive Impairment, Cognitive Screening, Interdisciplinary Training

P.04.16

348 - STRUCTURAL AND FUNCTIONAL NEUROIMAGING CORRELATES OF SPEECH IN NOISE PROCESSING: THE MEDIATING ROLE OF COGNITION

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Background/Rationale
Difficulty understanding speech in noisy or otherwise challenging listening environments is a common issue across the adult lifespan and is increasingly recognized as a potential early marker of cognitive decline. While peripheral auditory impairment provides an intuitive explanation for such difficulties, neural networks and associated cognitive functions have recently been suggested as contributing factors. Peripheral hearing loss has further been shown to exert direct effects on brain structure, functional connectivity, and cognition. Specifically, it is theorized that hearing loss may lead to an altered functional organization of the brain as it adapts to degraded auditory input. Consequently, accounting for peripheral hearing is essential when attempting to isolate the specific neural and cognitive associates of Central Auditory Processing (CAP), of which degraded speech processing is a proxy. To date, however, this has not been adequately addressed in large-scale population-based studies covering a wide age range.

Materials and Methods
The study used data from the first round of the Rhineland Study, an ongoing, community-based, prospective cohort study based in Bonn, Germany. Participants are invited to partake in the study if they are at least 30 years old and living in one of two geographically defined locations in Bonn. Peripheral hearing was assessed using pure-tone audiometry across nine frequencies (0.5–16 kHz). CAP was assessed using the Göttinger Satztest, a validated sentence-in-noise processing test. Magnetic Resonance Imaging (MRI) and functional Magnetic Resonance Imaging (fMRI) were performed using 3T Siemens MAGNETOM Prisma scanners. We investigated the relation between regional brain volumes seed-based resting state functional connectivity (RSFC) features and CAP using multivariable linear regression analyses. Analyses were adjusted for age, sex, and peripheral hearing thresholds, and false discovery rate (FDR)-corrected for multiple testing. We investigated whether any observed neuroimaging associations with CAP varied with age by running additional models including and age*imaging feature interaction term. Finally, we ran mediation analyses to investigate whether and to what extent cognitive function, as measured by performance on a battery of neuropsychological tasks, played a role in the observed relations between structural and functional imaging features and CAP.

Results
Our analysis included 4,412 participants for the analyses on structural MRI measures and 4,114 participants for resting-state fMRI measures, with an average age of 55.5 years. Larger gray matter volumes of the right pars opercularis, left inferior temporal gyrus and left lateral orbitofrontal sulcus were associated with better performance on the speech-in-noise processing task. Furthermore, stronger RSFC, particularly within the cingulo-opercular network, was significantly related to better CAP. None of the structural or RSFC associations with CAP exhibited interactions with age that survived FDR adjustment. Results from the mediation analysis showed that performance on tasks included in our domain scores for executive function and working memory mediated the association between cingulo-opercular connectivity and CAP, explaining between 7 and 12% of the variance.

Conclusions
These findings confirm and extend theoretical models of degraded speech perception, such as the ease of language understanding model, highlighting that successful listening in adverse conditions is supported by cognitive resources and the integrity of associated neurobiological networks. The absence of age interactions further underscores that this support system is a stable characteristic of central auditory function across the lifespan.

Keywords: Central Auditory Processing, Speech-in-Noise Assessment, Neuroimaging, Auditory Neuroscience, Functional Connectivity

P05 – TINNITUS

P.05.01

51 - EAGLE SYNDROME WITH SECONDARY INTERNAL CAROTID PSEUDOANEURYSM: AN UNUSUAL CAUSE OF PULSATILE TINNITUS

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A 51-year-old male with no significant past medical history presented to an outside neurotologist with three months of left ear pulsatile tinnitus of variable intensity without hearing loss or vertigo. Examination was unremarkable, with normal otoscopy and no audible bruit of the head or neck. Audiogram with tympanometry was normal. CT angiogram was obtained which showed a pseudoaneurysm of the ipsilateral internal carotid artery. There was marked elongation of the styloid processes bilaterally, with the left showing a discontinuity, or “pseudoarthrosis,” immediately adjacent to the pseudoaneurysm. The patient was started on aspirin therapy with improvement in pulsatile tinnitus. He was referred to our institution for management. Given concern that movement of the calcified styloid at the site of pseudoarthrosis may have played a role in formation of the pseudoaneurysm, he underwent transcervical resection of his styloid process. After an uncomplicated post-operative course, six weeks later he underwent carotid arteriography with coil embolization of the pseudoaneurysm. He remains free of pulsatile tinnitus, with no cranial nerve deficits.

Eagle syndrome, first described by Dr. Watt W. Eagle at Duke University in 1937, represents a constellation of symptoms attributable to an elongated styloid process or more appropriately, calcification of the stylohyoid muscle and tendon. Eagle Syndrome has been broken down into neurologic and vascular variants, depending on the structures impacted and thus the symptoms reported. In the former, symptoms arise from compression of lower cranial nerves, most commonly the glossopharyngeal, by the styloid, with resulting oropharyngeal, cervical or facial pain, otalgia, or dysphagia. With vascular variants, symptoms arise from compression of the internal jugular vein or carotid artery, with reported symptoms including pulsatile tinnitus, dizziness, or headache. More severe complications reported include carotid artery dissection or ischemic infarcts due to carotid occlusion. Treatment is largely symptom dependent and consists of transcervical or transoral resection of the elongated styloid to relieve compression of involved neurovascular structures. In the present case, pulsatile tinnitus served to alert treating physicians to the presence of an internal carotid artery pseudoaneurysm likely caused by the elongated styloid. Practitioners should be aware of Eagle syndrome as a diagnostic entity, as well as the potential for severe sequelae of this usually rather benign entity such that significant morbidity can be averted.

Keywords: Tinnitus; Eagle Syndrome; Carotid pseudoaneurysm

P.05.02

230 - INTERAURAL AUDITORY BALANCE AND DEVICE USE IN TINNITUS OUTCOMES AFTER COCHLEAR IMPLANTATION FOR SINGLE-SIDED DEAFNESS AND ASYMMETRIC HEARING LOSS

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Background/Rationale

Cochlear implant (CI) has emerged as an effective treatment option for patients with single-sided deafness (SSD) and asymmetric hearing loss (AHL), not only for auditory rehabilitation but also for tinnitus suppression. However, the mechanisms underlying tinnitus improvement remain incompletely understood, and the relative contributions of hearing gain, interaural auditory balance, and device usage patterns have not been fully clarified. This study aimed to evaluate clinical and audiometric factors associated with tinnitus improvement after CI in adults with SSD or AHL.

Materials and Methods

This retrospective cohort study included adult patients aged 18 years or older with SSD or AHL who underwent unilateral CI at Samsung Medical Center between September 2019 and October 2024. Patients were included if paired preoperative and approximately 1-year postoperative Tinnitus Handicap Inventory (THI) assessments were available. Interaural auditory balance was quantified using the Functional Auditory Imbalance (FAI) index, defined as the postoperative minus preoperative value. Clinical variables included age, sex, duration of deafness, preoperative hearing thresholds, hearing gain in the implanted ear, daily CI usage time, and follow-up duration. Univariate linear regression analyses were performed to evaluate associations between tinnitus improvement and clinical factors. A multivariate linear regression model including age, sex, postoperative FAI, hearing gain, and daily device usage time was constructed to identify independent predictors. Statistical significance was set at $p < 0.05$.

Results

A total of 71 adult patients were included. The mean age at surgery was 51.1 ± 13.3 years, and 31 percent were male. The mean duration of deafness was 6.6 ± 8.8 years. The mean preoperative THI score was 42.4 ± 27.7, decreasing to 26.6 ± 24.0 at postoperative follow-up, indicating overall tinnitus improvement. The mean daily CIt usage time was 11.0 ± 3.8 hours. In univariate analyses, worse preoperative hearing in the contralateral ear was associated with reduced tinnitus improvement (β = −0.41, 95 percent confidence interval −0.75 to −0.07). Hearing gain in the implanted ear was not associated with tinnitus improvement. Greater residual interaural imbalance after implantation, reflected by higher postoperative FAI values, was inversely associated with tinnitus improvement (β = −0.38, 95 percent confidence interval −0.72 to −0.04). Daily CI usage time showed a positive association with tinnitus improvement (β = 2.33 per hour per day, 95 percent confidence interval 0.63 to 4.04).

In multivariate analysis, daily device usage time remained independently associated with greater tinnitus improvement (β = 2.27, 95 percent confidence interval 0.51 to 4.02). Postoperative FAI demonstrated a directionally consistent inverse association with tinnitus improvement (β = −0.39, 95 percent confidence interval −0.79 to 0.01). Age, sex, and hearing gain showed negligible associations.

Conclusions

In adults with SSD or AHL, CI was associated with significant tinnitus improvement. Greater daily device usage and improved interaural auditory balance were more closely related to tinnitus reduction than absolute hearing gain in the implanted ear. These findings suggest that sustained device use and restoration of auditory symmetry may play key roles in tinnitus suppression after CI.

***Keywords**: cochlear implant; tinnitus; single-sided deafness; asymmetric hearing loss; auditory imbalance*

P.05.03

303 - PARAMETER-BASED ACOUSTIC CHARACTERIZATION: A PILOT DESCRIPTIVE ANALYSIS OF YOUTUBE TINNITUS SOUND THERAPY CONTENT

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Background
Tinnitus is the perception of sound without an external stimulus and affects an estimated 278 million people worldwide (1). It occurs in 10-15% of the population and presents substantial heterogeneity in clinical features and treatment response (2). Sound-based interventions, including masking and music-based therapies, are widely used alongside counseling approaches. However, their acoustic parameters and delivery protocols remain unstandardized and are rarely tailored to individual psychoacoustic characteristics such as tinnitus frequency, intensity, or residual inhibition(3).
Residual inhibition (RI)-the temporary reduction or suppression of tinnitus after acoustic stimulation-is a key physiological phenomenon in treatment research. RI is thought to depend on the stimulus's frequency content, energy distribution, and intensity, suggesting that different acoustic profiles may yield variable effects across patient subgroups.
As more than half of patients seek health information online, YouTube has become a common source of tinnitus sound therapy content(4,5). Yet, these materials have not been systematically evaluated using physical and psychoacoustic metrics. Most videos also lack information on individual tinnitus frequency, residual inhibition status, or application criteria.
This study aims to characterize the spectral and psychoacoustic features of selected YouTube tinnitus therapy videos and to propose a preliminary acoustic classification framework to inform future patient-based investigations of residual inhibition.

Materials and Methods
YouTube was searched for videos on "Tinnitus sound therapy" for longer than 60 minutes. Recordings were included if they contained the term "tinnitus" in the title or description, presented continuous sound, and did not include speech. Guided meditations, personal narratives, and technically inadequate recordings were excluded.
All files were resampled to 44.1 kHz and converted to mono for standardization. From each video, three non-overlapping 60-second segments were selected. Introductory and closing sections were excluded.
Acoustic features were computed using the MATLAB-based Timbre Toolbox. Parameters were predefined to capture spectral and temporal properties. Spectral measures included spectral centroid, spectral flatness, and spectral roll-off. Temporal measures included attack time, attack slope, temporal centroid, and energy modulation frequency.
Mean power spectra were derived using the short-time Fourier transform (STFT). ERB-based mean energy profiles were calculated to model cochlear band resolution. Total energy was also estimated.
Segment-level values were averaged to obtain one representative measure per video. Videos were descriptively classified as nature-based or noise-based according to content characteristics. Owing to the exploratory design, analyses were limited to descriptive statistics.

Results
Twelve videos were analyzed (nature, n=6; noise, n=6). Spectral and temporal parameters were evaluated descriptively for each group.
Spectral parameters: The STFT-based spectral centroid averaged 3110.29 Hz (SD=926.61) in the nature group and 2182.93 Hz (SD=3551.34) in the noise group. Spectral roll-off was 6826.84 Hz (SD=2153.90) for nature and 4685.47 Hz (SD=6202.48) for noise. Spectral flatness was markedly higher in the noise group (mean=1.2796, SD=1.3904) than in the nature group (mean=0.0015, SD=0.0015).
In ERB-based analyses, spectral centroid averaged 3367.82 Hz (SD=616.73) in the nature group and 2138.48 Hz (SD=2868.57) in the noise group. ERB spectral roll-off was 10234.95 Hz (SD=966.95) for nature and 5357.43 Hz (SD=6539.43) for noise.
Temporal parameters: Mean attack time was comparable between groups (nature: 27.88 ms, SD=16.55; noise: 28.11 ms, SD=15.33). Attack slope averaged 28034.11 (SD=30021.46) in the nature group and 20062.58 (SD=48264.98) in the noise group. Energy modulation frequency was lower in the nature group (mean=4.38 Hz, SD=3.49) than in the noise group (mean=7.23 Hz, SD=6.24).

Conclusion

This study demonstrates that YouTube videos labeled as tinnitus sound therapy do not exhibit a uniform acoustic profile. Nature- and noise-based content showed distinct tendencies in energy distribution, spectral structure, and modulation characteristics. Notable variability was observed in spectral flatness, spectral roll-off, and energy modulation frequency. Wide within-group ranges further indicate substantial heterogeneity across videos.

These findings suggest that online tinnitus therapy content lacks acoustic standardization. Given the well-established psychoacoustic variability of tinnitus across individuals, objective evaluation of digitally delivered sound stimuli appears warranted.

The results show that spectral and temporal metrics can be systematically quantified in this context. This parameter-based framework may support future patient-based studies aimed at identifying acoustic determinants of therapeutic response. Linking acoustic features to physiological phenomena such as residual inhibition may further inform the classification and development of sound-based tinnitus interventions.

Keywords: Tinnitus,Sound therapy,Acoustic analysis, Spectral features,Frequency-Amplitude modulation

P.05.04

324 - PREVALENCE AND AUDIOLOGICAL PROFILE OF TINNITUS IN PUERTO RICAN ADULTS

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A retrospective record review study was conducted to establish the prevalence of tinnitus in Puerto Rican adults. Three thousand records were considered and studied from which a sample size was selected to establish the prevalence of Tinnitus in patients whose hearing and balance were tested to establish clinical status in these areas. Socio-demographic variables, Hearing thresholds, Speech Audiometry, Loudness Discomfort levels (LDLs), and Tinnitus Matching measures were obtained and analyzed. A subgroup who completed the Tinnitus Handicap Inventory was also studied to establish the effect on quality of life in the different dimensions included in the instrument. A descriptive statistical analysis of the sample, correlations between the variables as well as inferential analysis were performed to study tendencies and plausible associations.

Puerto Rican adults from 21 to 64 years old with and without hearing loss reporting tinnitus as a clinical complain from different socio-economic status were included in this research. They underwent audiologic assessment at the Medical Sciences Campus (MSC) clinic of the University of Puerto Rico (UPR) between January 2022 to March 2024. Participants consent to the study was obtained after the MSC-UPR-Office of Protection of Research Participants (IRB) approval.

Results indicated a significant prevalence of tinnitus in the PR cohort studied when compared with other ethnic groups reported in the literature. Since Puerto Rican's genetics are influenced by Spanish, African and Caribbean Indian genetics, a comparison between prevalence of tinnitus on those ethnic groups and PR was performed. Although gender balance was obtained in the study cohort, a tendency of having a more severe impact on females was registered. A percentage of the participants indicated that their tinnitus initiated after having COVID-19. Effects of Tinnitus in Quality of Life, as reported by the participants in the Tinnitus Handicap Inventory, varied among the subjects ranging between mild to severe.

The Puerto Rican cohort studied reflected that tinnitus is a sound perception disorder prevalent among the participants. An association with the occupational background as well as hearing and other clinical pathologies was observed. Although the effects on the quality of life of the subjects were varied, patients with louder and continuous tinnitus reported more disturbance and interference on their quality of life.

This study is the first addressing tinnitus in PR. Results of this seminal study support further research in the prevalence of Tinnitus in other geographic areas in the island and its effects in quality of life. Also points to the importance of doing research on external variables that cause tinnitus such as occupational background and co-mobilities that may have a role in the manifestation or initiation of tinnitus. Since Tinnitus management in the earlier stages is paramount to achieve quality of life our team’s projected next step is to develop an identification and intervention protocol for patients that suffer this condition in Puerto Rico.

P.05.05

49 - CLINICAL CHARACTERISTICS OF PULSATILE TINNITUS RELATED TO CEREBROVASCULAR DISEASES

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Introduction
Tinnitus is the subjective perception of sound in the absence of an external acoustic stimulus. It is a common condition experienced by approximately 10–15% of the population, characterized by a diverse range of pathophysiologies and etiologies. Tinnitus is generally categorized into subjective and objective types, or further classified into non-pulsatile and pulsatile tinnitus. Pulsatile tinnitus (PT), in particular, is defined by rhythmic sounds synchronized with the patient's heartbeat. This condition holds significant clinical importance as it is often closely associated with alterations in intracranial hemodynamics or cerebrovascular diseases, rather than being a mere abnormality of the auditory system. Although PT accounts for only 4–10% of all tinnitus cases, early diagnosis and precise evaluation are imperative, as some underlying causes are attributed to potentially life-threatening vascular disorders.
The purpose of this study is to propose clinical recommendations for the early differentiation of cerebrovascular diseases during the diagnostic and therapeutic processes for pulsatile tinnitus. To this end, we analyze the clinical characteristics and frequency of vascular etiologies in a cohort of patients presenting with tinnitus, while reviewing the utility of radiologic assessments and the impact of early diagnosis on patient prognosis.
Materials and Methods
A retrospective analysis was conducted on patients who visited Seoul National University Boramae Medical Center between January 2015 and October 2025 with a chief complaint of PT and underwent radiologic evaluations. Based on the initial examinations, patients with non-pulsatile or non-vascular tinnitus were excluded, as were those with venous diseases that could serve as structural causes of PT.
Out of a total of 229 subjects initially screened, 27 patients (11.79%) suspected of having a correlation between radiologic findings and ipsilateral PT were included in the final study population. We collected and analyzed their demographic characteristics, the laterality of the tinnitus, differential diagnoses based on imaging studies, clinical management, and any history of treatment-related complications.
Results
The male-to-female ratio was 8:19, with a mean age of 64.3 years (range: 34–81). Regarding the location of PT, 9 cases were right-sided, 11 were left-sided, 6 were bilateral, and 1 was localized to the head. Radiologic evaluation identified dural arteriovenous fistula (dAVF) in 12 cases, internal carotid artery (ICA) stenosis in 7 cases (including 1 case of Moyamoya disease), aneurysms in 7 cases, and arteriovenous malformation (AVM) in 1 case. The average time from the onset of PT to diagnosis varied by disease: 41 days for AVM, 324 days for dAVF, 399 days for aneurysms, and 601 days for ICA stenosis, indicating that ICA stenosis was diagnosed latest after onset. Among the 12 patients with dAVF, 9 underwent embolization; 8 reported complete resolution of tinnitus, while 1 reported improvement. Of the 3 patients who chose observation, 2 reported persistent tinnitus of the same intensity, and 1 reported improvement.
For the 7 patients with ICA stenosis, no surgical intervention was performed; 3 received medical therapy, and 4 underwent observation. All patients receiving medical therapy showed improvement in PT symptoms, and 2 patients in the observation group also reported improvement.
In the aneurysm group (7 patients), coil embolization was performed in 2 cases. Neither of these patients experienced improvement in PT; conversely, 3 of the 5 patients who underwent observation showed symptomatic improvement.
The single case of AVM was located in the right pterygoid plexus and showed successful resolution of tinnitus following Gamma Knife surgery. Accompanying symptoms, including hypalgesia and V3 trigeminal neuralgia, also resolved post-treatment.
Conclusion
These results suggest that PT can manifest from various vascular lesions, each characterized by distinct clinical features and treatment outcomes. In cases of dAVF, a favorable prognosis can be expected with appropriate invasive treatment, though the risk of treatment-related complications must be carefully considered. For ICA stenosis, conservative management alone can lead to significant symptomatic improvement, necessitating a cautious approach toward invasive interventions. For cerebral aneurysms, a direct causal relationship with PT is often unclear, requiring a multidisciplinary approach when making treatment decisions.

P.05.06

332 - MULTIDISCIPLINARY MANAGEMENT OF PERSISTENT TINNITUS: INTEGRATION BETWEEN AUDIOVESTIBULAR ASSESSMENT AND PSYCHOLOGICAL INTERVENTION WITH EMDR

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Introduction: Tinnitus is a multifactorial symptom that may be associated with vascular changes, usually related to ischemic events and alterations in cerebral blood flow, which can affect the auditory and vestibular pathways, both in their peripheral and central components. In these cases, the persistence and intensity of the symptom are not only due to the location of the lesion, but also to central mechanisms of sensory modulation and emotional factors, especially when tinnitus is associated with high-impact events. Thus, clinical management requires a multidisciplinary approach that integrates audiovestibular assessment, medical procedures, and specific psychological interventions.
Objective: To describe the multidisciplinary approach in the management of a patient with tinnitus associated with vascular changes, highlighting the integration between audiovestibular assessment and the use of Eye Movement Desensitization and Reprocessing (EMDR) as a complementary strategy in the treatment of tinnitus.
Methodology: This is a descriptive clinical report approved by the Research Ethics Committee under opinion 7,890,476. The patient underwent audiological and vestibular evaluation, including tonal audiometry, Brainstem Auditory Evoked Potential (BAEP), and Cervical Vestibular Myogenic Evoked Potential (cVEMP). The patient was followed up in an interdisciplinary manner by speech therapists, psychologists, and otolaryngologists. The psychological intervention included the application of EMDR with a focus on desensitizing the memory associated with the onset of tinnitus.
Result: Female patient, 55 years old, complaining of persistent tinnitus that began abruptly after a sensation of an “explosion in the head.” She had a history of stroke and stenosis of the right internal carotid artery. Associated with the tinnitus, she reported dizziness triggered by linear accelerations, such as going up and down stairs and using an elevator, with concomitant worsening of the perception of tinnitus. The condition was accompanied by emotional and functional symptoms, including anxiety, stress, sleep disturbances, and difficulty in performing activities of daily living, demonstrating a significant impact on quality of life. Audiological evaluation revealed profound sensorineural hearing loss in the right ear and mild hearing loss in the left ear. In click PESS, no responses were observed on the right side. cVEMP characterized right saccular hypofunction, with responses present but reduced amplitude and increased latency, indicating partial impairment of the inferior otolithic pathway. Based on the findings, an integrated approach involving speech therapy, psychology, and otolaryngology was instituted. The audiological approach included counseling, hearing monitoring, and tinnitus management strategies, combined with vestibular rehabilitation exercises aimed at otolithic compensation and improving functionality and quality of life. In psychology, EMDR was used to focus on desensitizing memories associated with the impact of tinnitus and reducing the negative emotional response related to persistent sound perception.
Conclusion: The findings reinforce that tinnitus requires an integrated multidisciplinary approach that addresses both auditory-vestibular and emotional aspects. The use of EMDR stands out as a complementary strategy in the management of tinnitus, especially in contexts where the symptom has a high emotional impact. These findings highlight the importance of interprofessional collaboration for a more comprehensive, individualized, and patient-centered approach.

Keywords: Tinnitus; Multidisciplinary Care Team; Eye Movement Desensitization and Reprocessing; Vestibular Function Tests; Audiology

P06 - AMPLIFICATION & IMPLANTABLE DEVICES

P.06.01

13 - OUTCOME OF PATIENTS WITH COCHLEAR IMPLANTATION AT DESSAU MEDICAL CENTER

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Introduction
Worldwide, approximately one-third of people over the age of 65 suffer from advanced, profound sensorineural hearing loss or deafness. Providing these patients with a cochlear implant (CI) is a complex and demanding task for an ENT clinic. For many years, we have been developing and expanding cochlear implant (CI) care close to home for our patients in Dessau and surroundings. Regarding rehabilitation, we work closely with the Potsdam Hearing Therapy Center (outpatient rehabilitation) and the Cecilienstift Cochlear Implant Rehabilitation Center in Halberstadt (inpatient rehabilitation).

Materials and methods
We analyzed patients with deafness who had received a cochlear implant over the past 5 years. Intra- and postoperative complications were recorded and the audiological outcomes were evaluated.

Results
In recent 5 years, 78 patients have been treated with a CI at the Dessau Medical Center. These included 43 female and 35 male patients aged 44 to 95 years. Ten patients underwent bilateral implantation. Three revision surgeries were performed (2.3%). One implant was explanted due to recurrent wound healing complications (n=1), one implant was replaced due to a technical defect (n=1), and one revision surgery was performed due to an exposed cable in the radical cavity (n=1).
Significant complications included temporary facial paralysis in two patients (1.5%), persistent vertigo in six patients (4.7%), and pain in two patients (1.5%). Good speech comprehension was achieved in the majority of patients, and 100% numerical comprehension was achieved in most patients, depending on their daily condition and mental state.

Conclusion
CI fitting is the optimal option for patients with deafness to enable speech perception, improve directional hearing, and optimize speech discrimination, especially in background noise. Additionally, it can reduce tinnitus, and significantly improve quality of life and cognitive performance. Postoperative complications include vestibular disorders, reported in up to 30% of implanted patients. In the Dessau cohort, only 4.7% of our patients were affected, although the cause of the dizziness was highly varied and could only be attributed to the CI in one patient. We achieved free-field speech intelligibility of over 50% in 56 patients (72%). A subjective improvement in everyday hearing is reported by significantly more patients and depends on many other factors, such as compliance with the device, social environment, and general health. Despite all efforts, including in rehabilitation, success in terms of a significant hearing improvement cannot be predicted or guaranteed.

Key words: Deafness – Cochlear Implantation – Complications

P.06.02

58 - LONGITUDINAL USAGE DATA IN SINGLE-SIDED CI IMPLANTED CHILDREN

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Background: Research and clinical experience indicate that children with single-sided deafness (SSD) implanted with a cochlear implant (CI) in the deaf ear use the CI less consistently than bilaterally implanted and bimodal children. The reasons for this are partially unknown but it is hypothesized that factors including age at implantation and motivation have a significant effect. Less consistent daily use might lead to non-use.

Objectives: This study investigates the correlation between SSD CI recipient longitudinal daily device use with respect to three factors 1) age when tested, above vs. below median age 2) age at implantation, less vs. older than 3 years, and 3) experience with CI, below vs above 2.5 years. Recipients with less than 12 months of CI experience are excluded from the analysis.
Daily device use might also depend on factors including duration of deafness, etiology, objective measures such as speech in noise and localization, and subjective measures testing functional hearing. These interrelated dependencies are further studied in detail in the PhD project titled Cochlear Implant in Children with Single-Sided Deafness:
hearing, complex language development and intervention, Ida Jensen Friis, 2025-2029 conducted at the Audiology Clinic - Århus University Hospital, DK.
Longitudinal daily device usage is analyzed for N=42 SSD CI recipients with median age of 6.8 years (2.5 – 18.5 years). All 42 recipients are enrolled in the PhD project.

Methods: Longitudinal time on air (TOA) data is extracted using proprietary dataviewer software licensed under relevant research agreements. All data is analyzed using standard open-source statistical analysis software.
The data is modelled using simple mean, linear regression and polynomial fitting. The three models will be discussed at the conference in terms of validity for statistical analysis and as possible predictors for future CI non-usage.

Results: Longitudinal mean TOA is 7 hours/day across all recipients.
There are no statistically significant differences in mean TOA when comparing recipients with respect to 1) age when tested 2) age at implantation, and 3) CI experience.
Subsequently statistical analysis of linear regression slope based on longitudinal data is performed.
Recipients are divided into two groups with either positive or 0 slope vs. negative slope. A positive or 0 slope indicates longitudinal increasing or stable TOA.
The linear regression analysis shows the following:

- Recipients with positive or 0 slope:
  - is significantly younger when implanted (mean age = 2.4 years vs. 6.3 years respectively, $p<0.001$)
  - is significantly younger when tested (mean age = 5.7 years vs. 9.2 years respectively, $p=0.002$)
  - no statistical difference in CI experience between the two groups (mean experience = 2.8 years vs. 2.3 years respectively, $p=0.27$)
- Recipients implanted before 3 years of age shows significantly different slope than recipients implanted later (mean slope = 0.39 and -0.52, respectively, $p<0.001$)

The results indicate that device usage is dependent on 1) age at implantation and 2) age when tested.
Experience with CI is not considered a significant factor when analyzing TOA data using linear regression or simple mean as data modeling.
Data shows that the variance generally is larger when 1) recipient age is above median age and 2) age at implantation is later than 3 years of age, both with respect to TOA and linear regression slope.

Keywords:
Cochlear Implants, Single-Sided Deafness, Daily device use

P.06.03

209 - ENHANCING SOUND PRESSURE OUTPUT IN GRAPHENE-BASED HYBRID BONE CONDUCTION HEARING AIDS THROUGH ELECTROMAGNETIC AND ELECTROSTATIC INTEGRATION

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Bone conduction hearing aids (BCHA) actively serve patients with conductive hearing loss or external auditory canal problems, including auditory canal atresia, ossicular dislocation, etc. They are typically categorized into surgically implanted devices, embedded directly into the skull, and adhesive devices, which transmit sound through the skin. The latter are advantageous for being non-invasive and suitable for children under five. However, adhesive devices, due to their sound transmission method, require enhanced sound output performance compared to implanted devices. Graphene, known for its low mass density yet excellent mechanical and electrical properties, finds application in various electronic fields. Graphene, a two-dimensional (2D) nanomaterial, consists of carbon atoms exfoliated from graphite and connected by sp^2 hybrid bonds forming a honeycomb structure. Its outstanding mechanical strength, superior thermal conductivity, and exceptional electrical properties have garnered significant attention within the scientific community. These unique attributes have propelled extensive research into its potential applications across various technological and industrial domains, such as displays, energy storage devices, and biomaterials. As mentioned above, graphene is not only electrically outstanding but also lightweight and mechanically strong. Due to its excellent electrical conductivity and lightweight yet strong mechanical properties, graphene has been explored for use in electroacoustic transducers, which require superior electrical and mechanical characteristics. Currently, it serves as a diaphragm in electroacoustic transducers, enabling stable vibrations across broad frequency ranges. The electroacoustic transducers of BCHA are typically driven by electromagnetic methods, which may be effective in low-frequency ranges but not in high-frequency ranges. This study successfully introduced a hybrid approach that combines the complementary advantages of both electromagnetic and electrostatic modes by utilizing a graphene sheet as the diaphragm for a hybrid graphene BCHA. The electrostatic mode, which performs better in high- frequency ranges compared to the electromagnetic mode, was implemented in this hybrid structure. According to the measured frequency response data, the hybrid mode showed up to an 11 dB improvement compared to the electromagnetic mode and up to a 21 dB improvement compared to the electrostatic mode, exhibiting a relatively flat shape over a wide frequency range. Subsequently, the device's effectiveness as a BCHA is confirmed through experiments on rabbits, showcasing its potential in auditory aid advancement. This study has been published in Nano Research.

KEYWORDS: graphene, bone conduction hearing aid, loudspeaker, frequency response

P.06.04

222 - IMPACTS OF COCHLEAR IMPLANTATION IN ADULTS WITH SINGLE-SIDED DEAFNESS: PERSPECTIVES OF USERS AND COMMUNICATION PARTNERS

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Single-sided deafness (SSD) in adults can impose substantial functional, psychosocial, and relational challenges. Cochlear implantation (CI) is the only intervention capable of restoring auditory input to the deaf ear, and existing evidence demonstrates improvements in speech-in-noise understanding, sound localization, tinnitus reduction, and hearing-related quality of life. However, nearly all current research has relied on laboratory-based measures and standardized patient-reported outcome tools, which may not fully capture the lived experience of SSD or the everyday consequences of receiving a CI.

This study explores impacts of cochlear implantation for adults with SSD, emphasizing the perspectives of both CI users and their frequent communication partners. Group interviews were conducted to examine how CI users perceive changes in daily functioning following implantation, and parallel interviews with their communication partners assessed how SSD and CI-treatment affected their own everyday lives. Including communication partners enabled exploration of potential third-party disability and offered an external perspective on CI outcomes. The dyadic structure allowed for comparison of converging and diverging viewpoints on the benefits and limitations of CI.

Seven adult SSD CI-users and seven of their frequent communication partners participated in three sets of parallel group interviews (each comprising 2–3 dyads). All interviews were transcribed verbatim and analyzed using the Framework Method to identify thematic patterns within and across individuals and dyads.

The findings provide insight into how cochlear implantation influences everyday functioning, communication, social interactions, emotional well-being, and relational dynamics - not only for CI users but also for those who share their communicative environments. This study contributes new knowledge on the real-life impact of CI in SSD and expands understanding of both user and partner experiences before and after implantation.

Keywords:
Single-sided deafness; Cochlear implantation; Communication partners; Third-party disability

P.06.05

237 - CLINICAL STRATEGIES AND HEARING AID FEATURES FOR MUSIC LISTENING

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Background/Rationale: The programming and fitting of hearing aids (HAs) are performed by an audiologist, who must understand the user's specific demands and preferences to address their individual needs. Most HA algorithms are optimized for speech amplification while ensuring the user's auditory comfort. However, speech and music are complex signals with distinct acoustic properties; thus, algorithms designed for speech emphasis may adversely affect music perception. Given that both signals may be equally essential for HA users, particularly musicians, this study aimed to identify clinical strategies utilized by audiologists during the HA fitting process for musicians and to correlate them with device characteristics that may positively influence musical signal processing. **Materials and Methods:** The quantitative study observed all required ethical considerations. To identify clinical strategies, a custom-designed, mixed-method online questionnaire was distributed among audiologists who reported at least one year of experience in HA fitting and had treated at least one musician for HA adaptation. For the present study, responses to three closed-ended questions were analyzed: 1. “How often do you typically include specific programs for the patient's musical activities?”, 2. “Which HA adjustments have you performed and consider effective for improving the musician's experience during musical practice?”, and 3. “Do you provide any specific guidance to musician patient(s) for music-related situations?”. The sample consisted of 34 audiologists, 31 of whom were female (91.2%) and three were male (8.8%), with a mean age of 33 years. The audiologists' average professional experience was 15.7 years; only one participant (2.9%) reported having treated a single musician, while the remainder had treated two or more. These data underscore the participants' expertise and the clinical relevance of their professional insights. Data were analyzed using descriptive and inferential statistics. To identify the electroacoustic characteristics of HAs that may influence musical signal processing, a scoping review was conducted following the PRISMA Extension for Scoping Reviews protocol and registered on the Open Science Framework. The guiding research question “What HA characteristics and/or features are described in the literature as alternatives that influence the user's perception of musical sounds?” was formulated using the PCC acronym: Population - HA users, Concept - HA characteristics and/or features, and Context - perception of musical sounds. The literature search was performed across the PubMed, Embase, Scopus, and Web of Science databases by three independent reviewers. Thirteen scientific articles, published between January 2019 and November 2024, were included for analysis. These studies described HA electroacoustic characteristics whose performance was evaluated in the presence of musical signals, using methodologies based on computational simulations and/or real-life HA users, with no specific inclusion criteria for participants. **Results**: The scoping review revealed that features demonstrating a positive influence on musical sound processing included frequency gain adjustments, Convolutional Neural Network audio classifiers, and adaptive feedback cancellation methods. Conversely, the physical characteristic of deep-insertion HA models showed a negative influence. Non-linear frequency compression, digital noise reduction, and gain compression were found to be non-influential. Statistical analysis among the response options from the audiologists indicates that the majority (73.5%) add a specific memory program for music in the HA. Microphone directionality adjustments (80.6%), noise reduction (77.4%), and frequency gain (74.2%) were the most frequently cited programming strategies for improving the musician's listening experience during musical activities. Additionally, memory switching (64.7%), the use of mobile applications (47.1%), and audio streaming devices (38.2%) were the most reported complementary strategies for enhancing auditory performance during musical tasks. Therefore, among the HA electroacoustic features that can positively influence music processing, the adjustments performed by audiologists involve frequency gain and the addition of memories to music listening, which functionality depends on audio classifiers. Other adjustments mentioned by the audiologists were either found non-influential or were not identified in the scoping review.. Finally, the limitations of the scoping review are acknowledged, specifically the absence of a meta-analysis and the limited number of included studies, reflecting the scarcity of research and the significant methodological diversity in the field. **Conclusion**: It was a partial convergence between the clinical strategies and the electroacoustic features that positively influence musical signal processing. Further research is required to provide deeper insights into the topic presented.

Key words: Hearing Aids; Music; Hearing Loss; Continuity of Care; Scoping review.

P.06.06

238 - HEARING AIDS IN MUSICAL ACTIVITIES: MUSICIAN USER EXPERIENCES AND AUDIOLOGISTS' CLINICAL STRATEGIES"

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Background/Rationale: The hearing aid (HA) fitting process must be conducted by an audiologist, considering the specific demands of the user. Although the primary objective of HAs is speech perception, music perception can be equally important for musicians. While both speech and music are complex signals, they possess distinct acoustic characteristics; thus, specific HA programming may be required for music listening. This study aimed to correlate clinical HA fitting strategies employed by audiologists with the demands of musician users regarding HA use during musical activities. **Materials and Methods:** The quantitative study observed all required ethical considerations. Two custom-designed, mixed-method online questionnaires were utilized: the first targeted audiologists with at least one year of experience in HA fitting and who had treated at least one musician; the second targeted musicians with bilateral hearing loss acquired after the onset of their musical practice and who were HA users. For the present study, responses to four closed-ended questions for musicians were analyzed, regarding their auditory perception with HAs and complementary strategies used during musical practice and appreciation. Additionally, responses to two closed-ended questions for audiologists were analyzed, concerning HA programming strategies and complementary guidance provided to musicians. The sample included 12 musicians (10 males, 83.3%; 2 females, 16.7%; mean age 60.3 years) and 34 audiologists (31 females, 91.2%; 3 males, 8.8%; mean age 33 years). The expertise of the participating musicians is noteworthy, with mean durations of musical experience, hearing loss, and HA use being 45.8 years, 12.3 years, and 4.7 years, respectively. Data were analyzed using descriptive and inferential statistics. **Results:** Musicians reported difficulties using HAs during musical practice, primarily regarding "instrument timbre in general" (25%), "instruments of other musicians" (16.7%), and "voices of other singers" (16.7%). During music appreciation, difficulties were mainly related to "instrument timbre" (25%) and the "voice type" (16.7%). The fitting adjustments most frequently cited by audiologists to improve listening during musical activities were microphone directionality (80.6%), noise reduction (77.4%), and frequency gain (74.2%). Although frequency gain adjustments were cited less frequently, they may constitute clinical strategies to indirectly address the timbre perception difficulties reported by musicians, even if such difficulties are inherent to hearing loss. Notably, only a small portion of musicians reported these difficulties, suggesting successful HA adaptation for musical activities. Complementary strategies reported by musicians included "removing the HA," "changing the HA program," "singing louder," and "decreasing HA volume" during practice, and "increasing music volume" during appreciation. The most frequent complementary strategies recommended by audiologists were memory switching (64.7%), use of mobile applications (47.1%), and use of audio streaming devices (38.2%). The only complementary strategy common to both groups was changing the HA memory, also recommended in the scientific literature. There is no recorded link between the participating audiologists and musicians, which may explain the lack of a direct correlation between the groups' results. Conversely, these findings may indicate the impossibility of standardizing demands or strategies for HA use during musical activities. Limitations regarding sample size and characterization preclude the generalization of results. **Conclusion:** A partial convergence was observed between the demands of musician HA users and the clinical strategies employed by audiologists.

Key-words: Hearing Aids; Music; Hearing Loss; Continuity of Patient Care; Perception.

P.06.07

266 - OUTCOMES OF COCHLEAR IMPLANTATION IN MUMPS-INDUCED SINGLE-SIDED DEAFNESS

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Background

Mumps, a viral infection from the Paramyxovirus family, is a rare but significant cause of sensorineural hearing loss (SNHL), especially in children. While typically unilateral, mumps-induced SNHL can result in profound single-sided deafness (SSD), for which cochlear implantation (CI) may be considered when hearing aids are ineffective. This study aimed to evaluate outcomes of CI in patients with SSD caused by mumps.

Material and methods

This retrospective study included 14 patients (10 females, 4 males; mean age 39.4) with Single-Sided Deafness caused by mumps. Inclusion criteria included a hearing threshold ≥90 dB HL and no benefit from hearing aids. Audiometric evaluations and speech discrimination tests were conducted preoperatively and 12 months postoperatively. Surgical procedures followed the six-step Skarżyński method with a round window approach.

Results

Implants were successfully placed in all patients, with full electrode insertion achieved in 92.9% of cases. The mean time from hearing loss to implantation was 28.1 years. Postoperative speech discrimination improved significantly: from 0–10% preoperatively to 48.9 word-recognition score (WRS) without and 66.8 WRS with an active processor. Hearing preservation was achieved in 11 out of 12 evaluable patients, with partial preservation in 58% and minimal in 33%.

Conclusions

Cochlear implantation in patients with single-sided deafness caused by mumps, provides substantial auditory benefits, particularly in speech perception. Favorable surgical outcomes were achieved even in cases with cochlear ossification. Given the scarcity of evidence specific to this etiology, the present findings underscore the effectiveness of CI and warrant further validation through large-scale, prospective investigations.

Key words: • Mumps • cochlear implants • hearing loss

P.06.08

267 - COCHLEAR IMPLANTATION BENEFITS FOR PATIENTS WITH TRAUMA-INDUCED BILATERAL HEARING LOSS: A RETROSPECTIVE STUDY

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Background

Accidental or intentional head trauma can result in degrees of sensorineural hearing loss (SNHL), but if the cochlear nerve is intact, cochlear implantation is the main option to restore hearing. This retrospective study evaluated outcomes from cochlear implantation in 9 patients with bilateral severe SNHL after major head trauma.

Material and methods

The study included 9 patients who lost their hearing (deep hearing impairment) due to major head trauma and were qualified for cochlear implantation. Before surgery, each patient underwent tonal and speech audiometry in free field, using a fitted hearing aid. To assess the benefits of cochlear implants, tests were repeated 12 months after surgery, with speech audiometry conducted in quiet and noisy conditions using an active cochlear implant.

Results

The patients exhibited various consequences of major head trauma, such as fractures of various skull bones and brain tissue damage. All participants showed significant improvement in speech understanding with the active cochlear implant. Before surgery, the average speech audiometry score with hearing aids was 1.6%, which increased to 61.7% in a quiet environment and 32% in a noisy environment after surgery. **Conclusions** Cochlear implants give the ability to hear and understand speech to patients who have injuries from major head trauma. The complexity and multifaceted nature of head injury highlights the need for further research and the development of therapeutic methods.

Key words: • head trauma • cochlear implants • hearing loss

P07 - AUDITORY TRAINING, INTERVENTION & REHABILITATION

P.07.01

23 - EXPLORING INTERVENTIONS AND EFFECTIVENESS IN IMPROVING ARTICULATION AND SPEECH INTELLIGIBILITY IN ADOLESCENTS WITH COCHLEAR IMPLANTS: A CASE REPORT

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Background:
Adolescents with cochlear implants often exhibit unstable articulation and reduced speech intelligibility due to limitations in auditory resolution, which can affect their academic learning and social interactions. As articulation and speech intelligibility becomes increasingly influential on peer relationships and self-concept during adolescence, enhancing articulation skills and speech intelligibility is a key focus in clinical practice.

Methods:
The case is a 16-year-old adolescent with bilateral severe sensorineural hearing loss who received cochlear implants at ages 2 (right ear) and 7 (left ear). The patient completed three years of auditory training between ages 7 and 10 but had not received ongoing intervention during adolescence. Presenting concerns included reduced articulation accuracy and limited control of intonation and prosody, leading to decreased overall speech intelligibility.
The intervention incorporated auditory training, phonetic placement method, multimodal supports (audio and video recordings), and Multi-Sensory strategies . Therapy was delivered once weekly for 50 minutes over a four-month period, supplemented with structured home-based recording practice.
Pre- and post-intervention assessments included the Percentage of Correct Consonants (PCC), Speech Intelligibility (derived from orthographic transcription of recorded words by an unfamiliar listener and calculated as the percentage of phonemically correct responses), the Speech Intelligibility Rating (SIR), and a self-perceived speech difficulty measure using a Visual Analogue Scale (VAS).

Results:
After four months of intervention, the patient's Percentage of Correct Consonant (PCC) increased from 22% to 55%, and word speech intelligibility improved from 28% to 57%. The Speech Intelligibility Rating (SIR) increased from Level 2 to Level 3, indicating a one-level improvement in speech clarity. The self-rated speech difficulty on the Visual Analogue Scale (VAS) decreased from 7/10 to 5/10, reflecting reduced perceived speech-related distress.

Conclusion
Systematic intervention strategies can effectively enhance articulation and speech intelligibility in adolescents with cochlear implants. Visual feedback, in particular, was found to facilitate motivation and self-monitoring. Although the critical period for speech development has passed, improvements in articulation and speech clarity were still achievable through visual and auditory feedback combined with targeted articulation practice, suggesting that adolescents retain continued capacity for speech development and plasticity beyond puberty. Future studies with larger sample sizes and long-term follow-up are recommended to verify the durability of treatment effects.

Key words: Cochlear implants, Adolescent，Speech Intelligibility、phonetic placement method

P.07.02

42 - CO-DESIGNING AN EQUITABLE COMPLEX INTERVENTION TO OPTIMISE HEARING AID USE IN DEAF INFANTS: THE RESONATE PROJECT PHASE II

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Background/Rational
Many infants born with permanent childhood hearing loss are fitted with hearing aids within the first months of life. While early intervention is key to mitigate the risks that hearing loss can pose to a developing child, many families demonstrate low use of hearing aids in the early years. Social determinants of health are associated with hearing aid use in young children, highlighting inequity and unmet needs in the current care pathway. Utilising co-design methodology, the current study aims to develop a new equitable complex intervention to support parents and professionals to optimise hearing aid use in deaf children aged 0-4.

Materials and Methods
Interviews and focus groups with parents and professionals (audiologists, teachers of the deaf, speech and language therapists, psychologists and physicians) are currently being conducted across three phases. During phase I, the 'discovery phase', we aim to understand the barriers and facilitators to achieving/supporting optimal hearing aid use with young deaf infants. In phase II, we will build on our phase I learning and begin designing an intervention strategy alongside parents and professionals. During phase III, our draft intervention will be reviewed by a new team of participants. An iterative approach to intervention development will be guided by critical theory, the COM-B model and the Theoretical Domains Framework.

Results
Data collection and intervention development is currently ongoing. Our findings from phases I and II of the study will be prepared for the conference in May 2026.

Conclusion
This study will provide a valuable insight into hearing aid use in early childhood. To our knowledge, our theory-led co-designed intervention will be the first of its kind to support early consistent hearing aid use, providing equitable care for families who face varying challenges.

Keywords: Permanent childhood hearing loss; hearing aid use; early childhood; family interventions; equitable care.

P.07.03

117 - THE RELATIONSHIP BETWEEN CARDIORESPIRATORY FITNESS AND SPEECH-IN-NOISE UNDERSTANDING IN ADULTS

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Background: Understanding speech in noisy conditions becomes increasingly arduous with age. Importantly, many listeners have normal hearing sensitivity but still find it difficult to communicate in crowded environments. The focus of audiological care is typically on finding ways to improve auditory processing by amplifying sound or repairing systems in the ear. Yet, in order to understand noisy speech, one must be not only be able to hear what was heard but also hold it in memory, process it rapidly, and (in a conversation) decide how to respond. Previous research has suggested that understanding speech in noise (SIN) requires increased listening effort and an upregulation of cognitive processing, particularly of executive function. Similarly, there is robust literature on the association between executive function and cardiorespiratory fitness (CRF). The gold standard measure of cardiorespiratory fitness is quantified by maximal volume of oxygen uptake (VO_{2max}) and reflects the ability of the body to perform under cardiorespiratory stress. Prior work has highlighted that higher fit individuals perform better on executive function tasks compared to their lower fit peers. Given that understanding speech in noise relies on executive functions and higher cardiovascular fitness levels benefit executive function, we hypothesized that CRF will be associated with SIN performance.
Methods: We recruited 41 healthy adults ages 18-61 years who were fluent in English, without cognitive deficits, and not using hearing aids. Participants answered questionnaires about demographics, medical history, and hearing health history. They also completed a pure-tone audiometry (PTA) test to get a measure of hearing sensitivity and three executive function tasks: the flanker task, operation span, and reading span. For the flanker task we looked at the tradeoff between speed and accuracy with an inverse efficiency score (IES) in the incongruent condition, by dividing reaction time by the proportion of correct responses (reported in seconds). Our main dependent variable was intelligibility from a speech-in-noise task where they heard sentences in three different levels of speech-shaped noise (quiet, 0 dB SNR, -5 dB SNR) and had to repeat back out loud what they heard. We then calculated the percentage of words correct for each noise condition. Participants' VO_{2max} was measured using a graded treadmill test where their pace was self-selected and steady, but incline increased every two minutes until volitional exhaustion. We used these scores to divide the participants into higher fitness and lower fitness categories. We used Welch two-sample *t*-tests to examine differences in speech intelligibility across fitness groups for each noise condition. We similarly used t-tests to investigate differences in hearing sensitivity across VO_{2max} categories as well as differences in performance on the executive function tasks and VO_{2max} categories. Our focus was on the -5 dB SNR condition where we saw the most variability in speech intelligibility.
Results: In the -5 dB SNR condition, the higher fit group demonstrated significantly greater mean percentages of words (M= 59.66, SD= 12.23) compared to the lower fit group (M= 49.53, SD= 15.67), t(38.64)= 2.32, p= 0.03. The same was true in the 0 dB SNR condition, with those in the higher fit group reporting greater mean percentage of words (M= 88.09, SD= 9.30) compared to those in the lower fit category (M=80.00), t(37.50)= 2.28, p= 0.03. Additionally, higher fit participants (M= 4.39, SD= 4.93) trended towards exhibiting better hearing sensitivity (lower PTA score) compared to lower fit participants (M= 5.83, SD= 4.40) although the difference was not statistically significant, t(40.584)= -1.12, p= 0.27. Similarly, those who were in the higher fit category (M= 77.81, SD= 109.07) trended towards lower (better) incongruent IES scores compared to their lower fit counterparts (M= 173.97, SD= 453.83) however, the trend was not statistically significant, t(27.41) = -1.02, p=0.32. Lastly, there were no significant differences in span scores between VO_{2max} categories.
Conclusion: Despite decades of research investigating why some listeners struggle in noise more than others, there remains a lack of beneficial interventions. Our study provides a step in the right direction highlighting that higher levels of cardiorespiratory fitness led to better understanding of speech in noisy environments. These findings can lead to treatment implications for speech-in-noise decline that comes with age. Improving cardiorespiratory fitness may be a low-cost noninvasive way to bolster hearing health.

Key words: Speech-in-noise, executive function, cardiorespiratory fitness

P.07.04

127 - FROM SIGNALS TO MEANING: COGNITIVE TRAINING COULD IMPROVE SEMANTIC PROCESSING AFTER COCHLEAR IMPLANTATION - AN EEG-FNIRS STUDY

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Cochlear implants (CIs) provide a significant improvement in speech comprehension for people with severe hearing loss. However, comprehensive rehabilitation involving check-ups, adjustments and speech therapy is required after surgery. Notably, the brain must adapt to the new electrical signals following CI treatment, a process that requires neuroplasticity. Differences in speech comprehension outcomes between individuals could be explained by links between hearing and cognitive abilities, and a beneficial cognitive training could facilitate the rehabilitation process and improve speech comprehension outcomes.
This study investigates whether additional cognitive training using an app can positively influence CI rehabilitation and support neuroplastic adaptations. To this end, we are studying two groups of patients (> 50 years) with bilateral hearing loss who have been fitted with a CI. In addition to receiving routine clinical care, one group performs postoperative hearing exercises at home, while the other group independently trains their cognitive abilities using an app. Six months after CI activation, we record the neural processing of semantics (semantically correct and incorrect sentences presented auditorily) using electroencephalography (EEG) and functional near-infrared spectroscopy (fNIRS). Event-related potentials (ERPs) are analysed to investigate fast temporal processing mechanisms in the brain and haemodynamic responses (fNIRS) are examined to identify the underlying brain regions involved.
Preliminary results for patients in both groups show an early positive ERP response, with a stronger response for semantically correct sentences compared to semantically incorrect sentences. This could represent a P300 component and thus reflect an attentional response. Interestingly, individuals who have used the cognitive training app for six months show greater negativity for semantically incorrect sentences than for semantically correct ones in later time-windows, which could be seen as a precursor to an N400 response indicating the onset of linguistic processing. The fNIRS results indicate stronger activations in the group that trained their cognitive abilities for six months than in the auditory training group, particularly when processing semantically correct sentences.
In summary, these preliminary results demonstrate that CI-users exhibit altered neural processing patterns compared to individuals without hearing loss. This suggests that the rehabilitation process continues six months after CI activation. Our preliminary results suggest that patients who used the cognitive training app exhibit patterns that are more typical of linguistic processing which indicates that an additional cognitive training could support speech comprehension rehabilitation after cochlear implantation, which could lead to implications for optimising hearing rehabilitation after cochlear implantation.

Keywords: Cochlear implants, Language comprehension, Electrophysiology, Near Infra-Red Spectroscopy

P.07.05

177 - DO INDIVIDUALIZED EDUCATION PROGRAM GOALS REFLECT THE NEEDS OF CHILDREN WITH HEARING LOSS? A NATIONAL EVALUATION OF IEP ALIGNMENT AND SERVICE PROVISION

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Children with hearing loss (CHL) frequently receive special education services through Individualized Education Programs (IEPs); however, the extent to which IEP goals accurately reflect each child's identified speech, language, and academic needs remains largely unexamined. Understanding this alignment is critical for ensuring that educational interventions effectively support communication and academic success.

The present study evaluates the relationship between IEP goals and standardized assessment outcomes among second-grade students with hearing loss across the United States of America. Drawing on data from an ongoing longitudinal outcomes study, this analysis includes IEPs and assessment data from children representing diverse geographic and educational contexts. Each IEP was comprehensively reviewed and coded for both **annual and short-term goals** using an expanded **11-category coding framework**: (1) vocabulary, (2) grammar, (3) pragmatics—communicative function, (4) pragmatics—discourse, (5) pragmatics—narrative, (6) cognition, (7) speech intelligibility (including articulation, phonology, apraxia, dysarthria, and fluency), (8) literacy (phonological awareness, decoding, word fluency, writing/spelling), (9) mathematics, (10) self-advocacy, and (11) other.

Each coded goal category was linked to corresponding standardized assessments obtained from the longitudinal study. These assessments measure key domains of language, listening, academic achievement, and cognitive functioning, allowing for direct comparison between the **skills targeted in IEP goals** and the **areas of measurable need**. This alignment analysis will help determine whether students' IEPs accurately capture their educational and communicative profiles or whether discrepancies exist that may hinder individualized intervention.

In addition to goal alignment, the study examines **service delivery variables** derived from each IEP. These include the **frequency and duration of services** (minutes per week) provided by special education professionals and the **setting in which goals are implemented** (general education classroom versus special education setting). To provide further context, **disability codes** are recorded where available, with the exception of data from Iowa, where such coding is not utilized.

The guiding questions for this investigation include:

1. To what extent do IEP goals correspond with standardized assessment results for second-grade CHL?
2. Are specific skill areas (e.g., grammar, listening comprehension, literacy) underrepresented in IEPs relative to demonstrated need?
3. How do service intensity and placement influence the alignment between goals and needs?
4. Are there national patterns or notable regional variations in IEP content and service delivery?

Preliminary analyses indicate substantial variability in both the types of goals included and the degree to which they reflect individual areas of weakness. Early patterns suggest that while IEPs often target broad academic or literacy outcomes, foundational linguistic domains such as **grammar** and **pragmatic language** may be less frequently addressed, despite standardized data showing persistent challenges in these areas for CHL. These findings highlight the need for improved integration between audiological, speech-language, and educational data when developing individualized goals.

By identifying mismatches between assessed needs and IEP content, this project aims to inform more targeted educational planning and advocate for evidence-based service delivery models. Results will contribute to a broader understanding of how children with hearing loss are supported within the U.S. educational system and may have implications for improving **interdisciplinary collaboration**, **functional assessment practices**, and **outcome-driven intervention planning**.

Ultimately, this work underscores the importance of aligning special education documentation with real-world communication and academic performance to promote equitable learning opportunities for children who are deaf or hard of hearing.

Key words: Individualized Education Program (IEP), Hearing Loss, Language Development, Educational Outcomes, Service Delivery

P.07.06

203 - THE EFFECT OF THE USE OF HEARING AIDS IN ELDERS: COGNITIVE AND PSYCHOSOCIAL FATIGUE IMPROVE

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Older adults with hearing loss have difficulties during conversation because an elevated auditory threshold reduces speech intelligibility, especially in noisy environments. Listening and comprehension often become exhausting tasks for hearing-impaired elders and determines social isolation and depression.
The aim of this study was to investigate the benefit from hearing aid use in relation to relief from listening-related fatigue. 49 hearing-impaired elders affected by presbycusis were included in the sample. They were all hearing aids users. The Modified Fatigue Impact Scale was used to assess cognitive, physical and psychosocial fatigue and the Cognitive Failures Questionnaire was also used to investigate daily errors related to lack of memory and reduced mindedness. Hearing aids rehabilitation resulted in improved speech intelligibility in competing noise, and a significant reduction in cognitive and psychosocial fatigue and listening effort in conversation. Vitality was also improved and a significant reduction in the Cognitive Failures Questionnaire scores was observed. Findings from the study indicate that the use of hearing aids in older impaired listeners provide them not only with an increased auditory function but also with a reduction in listening-related fatigue and mindedness.This study shows that susceptibility to both cognitive fatigue and cognitive failures in elders affected by both mild and moderate hearing loss are alleviated by the use of hearing aids, in the absence of major psychiatric disorders.

P08 - QUALITY OF LIFE & PSYCHOSOCIAL IMPACT OF HEARING LOSS

P.08.01

187 - THE ASSOCIATION BETWEEN SELF-PERCEIVED AUDITORY DISABILITY AND PSYCHOSOCIAL HEALTH IN A LONGITUDINAL COHORT STUDY

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Objective
Hearing loss affects millions of people worldwide and is linked to psychosocial consequences such as loneliness, depression, and anxiety. Self-reported hearing problems may offer unique insights into emotional and social functioning beyond what audiometric tests reveal. Evidence on the association between self-perceived auditory functioning, measured with an extensive questionnaire, and psychosocial health in adults aged 18–70 remains scarce. This study seeks to explore this relationship.

Methods
We used baseline and up to 15 years of follow-up data from the Netherlands Longitudinal Study on Hearing. This is an ongoing web-based cohort with adults of all hearing abilities, currently aged 18-85 years. Every 5 years they perform an online digits-in-noise (DIN) test and fill out a survey. Self-perceived auditory disability is assessed using the Amsterdam Inventory for Auditory Disability and Handicap (AIADH), while psychosocial outcomes, including distress, depression, anxiety, somatization, and loneliness are measured with validated questionnaires. The cross-sectional associations between self-perceived auditory disability and psychosocial outcomes were analyzed using linear mixed-effect models and generalized estimating equations, accounting for repeated measurements. Potential effect modifiers and confounders included age, sex, age, hearing device use (hearing aid and/or cochlear implant), results from the DIN test and, for those with hearing loss, age of onset.

Results
Self-perceived auditory disability was significantly associated with higher levels of loneliness, distress, anxiety, depression and somatization, after stratification for effect modifiers and adjustment for confounders. In most analyses outcomes showed a dose-response increase with worsening self-reported auditory disability.
Hearing device use modified the relationship between auditory disability and depression as well as anxiety. Additional effect modifiers were found after stratification for device use. In non-device users depression symptoms were increased only in those aged 18 to 65 years. Anxiety symptoms in those not using a device increased in all age groups, but associations were somewhat less strong in those >65 years. Among device users depression symptoms were higher in those with tinnitus than in those without. Anxiety in device users was affected by age of hearing loss onset, where those with onset after the age of 18 had higher anxiety levels.

Conclusion
These findings highlight the broad psychosocial impact of self-reported hearing difficulties. They emphasize that hearing loss affects not only communication but also mental well-being, and also show that the impact may vary depending on factors such as hearing aid use, age, age of onset of hearing loss and tinnitus status. Providing psychosocial support when indicated, alongside hearing rehabilitation, may improve overall well-being.

Key words: subjective hearing problems; Amsterdam Inventory for Auditory Disability and Handicap; mental health; loneliness; well-being

P.08.02

19 - NAVIGATING THE WORKPLACE WITH HEARING LOSS: PRACTICAL INSIGHTS FROM PERSONAL AND PROFESSIONAL EXPERIENCE

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Many of us have grappled with how best to navigate, communicate, and self-advocate around hearing loss in professional settings. This topic frequently surfaces within our community and remains deeply relevant as workplace norms, expectations, and technologies continue to shift. In recent years, the rapid expansion of remote and hybrid work, the adoption of new communication platforms, and evolving organizational cultures have reshaped what "effective communication" looks like. For individuals with hearing loss, these changes bring both new opportunities and challenges. Research underscores this complexity: for example, Andin et al. (2025) found that shifting from pre-pandemic to pandemic and post-pandemic work settings significantly affected well-being, communication demands, and fatigue among employees with hearing loss, particularly as remote work increased reliance on digital audio and video tools. These findings highlight how important it is to feel equipped and supported in navigating such environments.

This presentation on hearing loss in the workplace will be led by two professionals with hearing loss who offer both clinical expertise and lived experience. As an audiologist and a speech-language pathologist, they bring years of experience supporting clients, implementing workplace accommodations, and resolving communication barriers. As individuals with hearing loss, they also understand how communication strategies function outside textbooks and in the realities of meetings, deadlines, team dynamics, and technology limitations. This combination creates a supportive and authentic learning environment that allows participants to explore not only what strategies can help but also how those strategies feel and unfold in practice.

One of the most common and sensitive questions employees face is determining when and how to disclose their hearing loss. Disclosure is influenced by concerns about stigma, perceived career consequences, workplace culture, and the desire for clear communication. Southall, Jennings, and Gagné (2011) note that workers often weigh social and professional risks against practical communication needs when deciding whether to disclose. During the presentation, the speakers will share their own disclosure experiences—what shaped their decisions, what they considered beforehand, and how conversations progressed. They will offer frameworks to help attendees determine the timing and approach that best match their comfort levels and professional environments.

For those who choose to disclose, a natural next step is seeking guidance on accommodations, technology, and communication adjustments that make the workplace more equitable. Available tools range from captioning software and remote microphone systems to amplified telephones, Bluetooth connectivity, noise management strategies, and environmental modifications. Granberg and Gustafsson (2021) emphasize that workplace well-being for individuals with hearing loss depends not only on technology but also on organizational support, communication climate, and job demands. By connecting these findings to lived experience, the presenters will help attendees identify practical solutions suited to their specific roles and environments.

Because telephone communication remains central in many workplaces—even as digital tools expand—the presentation will also incorporate recommendations from Koerber and Jennings (2020), who identified evidence-based strategies for improving phone accessibility for employees with hearing loss. Their findings highlight options such as captioned phones, acoustic coupling accessories, colleague training, and workflow adjustments that reduce reliance on audio-only communication. These insights will be discussed alongside audience experiences in both remote and in-person contexts, acknowledging that phone and video communication each pose unique challenges.

Equally important is the role of self-advocacy. Many people with hearing loss hesitate to ask for repetition, clarification, or environmental modifications, even when such requests are reasonable and essential for participation. The presenters will offer strategies for building confidence in these interactions, recognizing when self-advocacy is appropriate, and understanding when to involve supervisors, human resources staff, or accessibility offices. Participants will also receive an overview of relevant accommodations and legal protections to ensure they leave with both practical knowledge and a clear sense of their rights.

Ultimately, the presenters aim to create an experience that is informative, relatable, and empowering. They seek to blend research, professional insight, and personal experience into a cohesive discussion that supports attendees in navigating the workplace with hearing loss. The goal is for participants to leave feeling more confident, better informed about available resources, and more connected to a community of individuals who understand their experiences.

Through shared perspectives, evidence-based recommendations, and open dialogue, attendees will gain both strategies and a strengthened sense of support and agency in their professional lives.

Key words: Workplace accommodations, Self-advocacy, Quality of life, Communication strategies, Assistive technology

P.08.03

100 - PSYCHOSOCIAL FACTORS ASSOCIATED WITH HEARING AID UPTAKE, USE, AND SATISFACTION IN ADULTS WITH AGE RELATED HEARING LOSS: A CROSS SECTIONAL STUDY

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Background: Hearing aids (HAs) are the standard intervention for age-related hearing loss (ARHL) and have been shown to positively affect quality of life (QoL). However, these benefits can only be observed if individuals obtain HAs and use them appropriately. Identifying the factors that motivate individuals to adopt and use HAs as well as derive satisfaction from them is therefore crucial. Psychosocial factors may play a key role in these processes, yet they remain insufficiently explored in the context of ARHL.
Materials and Methods: The present cross-sectional study investigates associations between psychosocial factors (e.g., self-perceptions of aging, hearing-related adaptive strategies) and HA-related outcomes, namely HA uptake, HA usage patterns, and HA satisfaction, among adults with ARHL.
Results: A total of 160 participants aged 40 years and older, with varying degrees of ARHL, were included. Using multiple regression models adjusted for sociodemographic and health-related confounders (e.g., age, gender, education, physical functioning), we examined relationships between psychosocial factors and HA uptake, use, and satisfaction.
Conclusions: By identifying psychosocial factors relevant to HA-related decisions and experiences, this present study contributes to a more comprehensive understanding of factors that support the adoption and sustained use of HAs. In the long term, these findings may underpin the development of targeted interventions aimed at improving QoL in individuals with ARHL.

Keywords: psychosocial factors, hearing aids, age-related hearing loss, quality of life

P.08.04

115 - NATURE EXPERIENCES OF DEAF AND HARD-OF-HEARING ADULTS: EFFECTS OF NATURE EXPOSURE ON THEIR MOOD AND PERCEIVED RESTORATIVENESS

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Background/Rationale
Nature and its sounds have been shown to improve mood, perceived restorativeness, and wellbeing, at least in hearing populations. It is suggested that the combination of both visual and auditory nature stimuli drives these salutogenic effects. However, there is no prior knowledge on whether Deaf and Hard-of-Hearing (DHH) people receive similar benefits from nature exposure. Our work is the first to examine the nature experiences of DHH people and the first to compare mood and restorativeness between DHH and hearing adults. Our three objectives are: (1) To examine whether nature improves mood in DHH people in comparison to hearing peers; (2) To assess the perceived restorativeness of nature between DHH and hearing people; and (3): To understand how DHH adults experience nature.
Materials and Methods
We will recruit a total of 42 participants (ages 18-60), divided equally into two groups (21 DHH and 21 hearing) and balanced for age and gender. Data collection will take place at Athalassa National Forest Park between January and April. Participants will complete the Positive and Negative Affect Scale before and after a 20-minute nature walk, to assess their mood. After the walk, participants will also complete the Perceived Restorativeness Scale, to assess nature restorativeness. Moreover, participants will complete the Nature Relatedness Scale to draw comparisons between the two groups on their connection to nature. Finally, after the nature walk, we will conduct semi-structured interviews (a) to better understand the nature experiences of DHH vs. hearing participants; (b) to assess the Attention Restoration Theory and Stress Restoration Theory in both groups, and (c) to uncover themes on the relationship DHH people have with nature. Quantitative data will be analysed using hierarchical regression with two-step models; Model 1 will control for age, gender, baseline positive affect, and natural beauty scale, while Model 2 will assess the group effect (DHH and hearing) to draw comparisons on mood, restorativeness, and nature relatedness. Qualitative data from the interviews will be analysed using thematic analysis.
Results
Data collection is currently underway, and we anticipate our first results in May, before the start of the conference. Therefore, here we present the expected results based on existing literature on hearing populations. We anticipate that there will be differences in mood and restorativeness between DHH and hearing adults, given that the audiovisual integration of nature elements promotes better mood and stress recovery than visual-only nature exposure. An alternative assumption is that DHH and hearing participants will demonstrate similar improvements in mood and restorativeness, owed to the enhanced visual cognition some deaf people exhibit, which may counterbalance the disrupted auditory input. From the thematic analysis, we expect to identify themes that capture participants' sensory experience and meaning-making around nature and nature elements.
Conclusion
Our work will provide novel findings that will contribute towards better understanding how DHH people are affected by and experience nature.
*The project is implemented under the programme of social cohesion "THALIA 2021-2027" co-funded by the European Union, through Research and Innovation Foundation.
Keywords
Deaf, hard-of-hearing, nature, wellbeing, restoration.

P.08.05

294 - THE USE OF SPEECH PERCEPTION IN NOISE AND SELF-REPORTED HEARING MEASURES FOR EARLY DETECTION OF BALANCE DIFFICULTIES AND FALLS RISK IN OLDER PEOPLE.

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Background
Falls are a serious health risk for older people, especially those with hearing problems who are more than twice as likely to fall compared to those with normal hearing. Falling and its consequences have a significant impact on individuals (loss of quality of life, nursing home admissions) and society (healthcare costs). Early detection of balance deterioration and the risk of falling is thus crucial to preventive care. However, hearing status is rarely considered when evaluating gait and balance. The current research explored the utility of Words In Noise (WIN) test, which simulates everyday- hearing situations, and a self-reported hearing measure- The Amsterdam Inventory for Auditory Disability and Handicap (AIADH)- as predictors of balance problems and risk of falling.
Materials and Methods:
A sample of 148 individuals (18–90 years) completed two objective hearing tests: Standard Pure-Tone Audiometry and the WIN test, in an attempt to better preserve the ecological validity of the human hearing-balance relationship, one self-reported hearing inventory—AIADH, one balance test—Timed Up and Go (TUG), and the Activity-Specific Balance Confidence Scale (ABC) that self-reports balance. The analysis included correlation and regression analyses.
Results:
The findings suggest that AIADH and the WIN test constitute good predictors of a decline in balance and an increased risk of falling, which complements objective hearing thresholds measures in adults aged forty and over. Prediction accuracy rises with age. The findings also reveal that out of all the AIADH subscales, the detection subscale is the best predictor of balance problems and risk of falling.
Conclusions:
Thus, the current results support previous research recommending the evaluation of balance in individuals with hearing deterioration, to potentially reduce falling and prevent its consequences. Using an available self-report hearing inventory can be a useful and potentially cost-effective tool for the early detection of balance problems and hearing deterioration. Health authorities should consider incorporating this type of evaluation as a remote screening tool for large populations at risk. The relatively greater contribution of the right ear to balance, compared to the left ear, should be considered during hearing evaluation and rehabilitation.

Key Words: Hearing Loss, Fall Risk, Ballance

P.08.06

313 - HEARING-SPECIFIC QUALITY OF LIFE IN SINGLE-SIDED DEAFNESS: DEVELOPMENT AND APPLICATION OF A NOVEL QUESTIONNAIRE

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Single-sided deafness (SSD) causes a lack of binaural hearing and reduces speech comprehension in noise. This condition significantly impairs quality of life, but it remains an underestimated problem. There are instruments for measuring the most important handicaps for people with SSD, directional hearing and the decrease of speech understanding in noise. The assessment of patients' subjective, hearing-specific quality of life is of growing importance in guiding personalised rehabilitation decisions. There is currently no validated and widely used questionnaire in Hungary for assessing the hearing-specific quality of life of patients affected by SSD and evaluating the success of rehabilitation.
The aim of our study was the development and validity testing of such a questionnaire and present our results and experiences from our first years of research (2022-2024). The questionnaire was developed based on internationally used and validated questionnaires (The Speech Spatial and Qualities of Hearing Scale Abbreviated Profile of Hearing Aid Benefit Nijmegen Cochlear Implant Questionnaire), but it was supplemented based on the patients subjective feedback. A group of experts (ENT specialist, audiologist, otoneurologists psychologist, and speech therapist) participated in the creation. During the professional development of the questionnaire, we tested the comprehensibility and relevance of the questions in a pilot study. Based on the results provided by the sample, we subjected our questions to factor analysis, on the basis of which we modified and finalized the questionnaire and drew conclusions. 67 patients with SSD completed our questionnaire, supplemented with the validated THI (Tinnitus Handicap Inventory), at the Department of Oto-Rhino-Laryngology, Head and Neck Surgery, Semmelweis University, Budapest. A control sample of 64 participiants with normal hearing also took the questionnaire's above. We followed up our patients, and some of them completed the questionnaire after undergoing instrumental rehabilitation (CI, OSIA/BAHA/Bone-Bridge, CROS system).
Based on the research CI has significant advantages over alternatives mainly due to the possibility of restoring directional hearing. Cochlear implantation is fully covered by national health insurance in Hungary for patients with SSD. Our results demonstrate that in the appropriate indication and timing cochlear implantation is available in Hungary and is a useful rehabilitation option for the treatment of severe unilateral hearing loss. Furthermore, a methodologically sound questionnaire based on both patient-reported experience and professional expertise can be successfully implemented in clinical practice and may facilitate the long-term evaluation of rehabilitation outcomes in SSD.
Keywords: SSD, Hearing-Specific Quality of Life, Factor Analysis, Rehabilitation

P09 - DIGITAL & COMPUTATIONAL HEARING CARE

P.09.01

140 - FASTER AND MORE ROBUST AUTOMATED DETECTION OF AUDITORY BRAINSTEM RESPONSES

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Background
Auditory Brainstem Response (ABR) is routinely used to estimate hearing thresholds and assess the integrity of auditory pathways. In clinical practice, the presence of an ABR must be identified from the coherent averaging of electroencephalography (EEG) sweeps collected after repeated acoustic stimuli. This typically relies on visual inspection by audiologists. This approach introduces risks of subjectivity and inter-observer variability, especially near the hearing threshold, where the signal-to-noise ratio (SNR) is low and visual cues become ambiguous. To mitigate such risks, methods based on the so-called Fsp and Fmp indicators were proposed in the literature. While these methods are widely implemented in commercial systems, their reliability is known to degrade with noise and physiological artifacts. This is of practical relevance, as increasing the number of sweeps prolongs testing times and may affect patient comfort, signal quality, and overall test feasibility. Alternative statistical methods available in the literature could be more suited for ABR detection.
The aim of the present work is to assess, using both simulated and real datasets, five methods (Fsp, Fmp and three possible alternatives based on either Hotelling's T^2 test or q-sample test) for automated ABR detection, and to evaluate their relative merit in terms of test duration and robustness against false/missed detections under different SNR conditions.
Materials and Methods
Both simulated and real datasets were analysed. Real data consisted of 25 ABR recordings from six subjects, acquired at stimulus intensities between 30 and 90 dB nHL, sampled at 40 kHz, with 2000 sweeps per recording.
Simulated recordings were generated by filtering zero-mean Gaussian white noise with an all-pole filter. The poles were derived from two autoregressive models fitted to the pre-stimulus segment of real, unfiltered ABR traces (one model per trace, model orders were 16 and 18). After standard pre-processing, ABR templates obtained by coherent averaging of real recordings were added to each sweep to simulate "response present" conditions. In total, four ABR templates were obtained, and the same template was added to each sweep within the same recording. Templates were rescaled to achieve SNRs ranging from -40 dB to -20 dB, allowing performance evaluation across different noise levels. To further increase realism, temporal jitter was introduced to model physiological variability in response onset. Simulated data were structured in the same manner as real recordings (2000 sweeps per recording).
The techniques evaluated against the conventional Fsp and Fmp indicators were the Hotelling's T^2 test in the time domain (HT2T) and frequency domain (HT2F), and the q-sample uniform score test (q-sample). Each method was applied offline (once per 2000-sweep recording) to assess detection ability, and online (after every 10 sweeps) to evaluate detection time. For online testing, a Bonferroni-adjusted significance threshold was used to account for multiple comparisons.
Results
On real data, the alternative methods consistently outperformed the benchmark in terms of detection (true positive rate, TPR). TPRs were 92% for HT2T, HT2F and q-sample, and 68% for both Fsp and Fmp. Additionally, the alternative methods achieved faster response detection, requiring on average fewer sweeps than Fsp and Fmp. For instance, responses acquired at 90 dB nHL required, on average, fewer than 500 sweeps for HT2T, HT2F and q-sample, while Fsp and Fmp reached detection after more than 1000 sweeps.
Using simulated data, all methods showed comparable false positive rates (FPR) (1% for all approaches, except for q-sample, which showed an FPR of 2%). As expected, detection performance decreased with degrading SNR for all methods. However, HT2T, HT2F and q-sample consistently retained higher TPRs than Fsp and Fmp. For instance, at intermediate SNR levels, while Fsp and Fmp maintained TPRs below 40%, all the other methods resulted in TPRs above 80%. Online testing results mirrored those observed in real recordings. At equal SNR, the alternative methods required substantially fewer sweeps to reach a "response present" decision compared to Fsp and Fmp (e.g., fewer than 300 sweeps versus more than 900 sweeps at high SNR).

Conclusions
This work demonstrates that HT2T, HT2F and q-sample outperform Fsp and Fmp in both response detection and test duration, without significantly increasing FPRs. These findings highlight the potential of these methods for future implementation in clinical ABR recording devices.
Keywords: Auditory Brainstem Response, automated detection, statistical methods, testing time

Conflict of interest: one or more authors have declared an industry affiliation

P.09.02

161 - DIGITAL SELF-MANAGEMENT PROGRAMS FOR ACQUIRED HEARING LOSS: A SCOPING REVIEW OF AVAILABLE SOLUTIONS, DESIGN FEATURES, AND EFFECTIVENESS

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Background/Rationale: Hearing loss (HL) is one of the most prevalent chronic conditions in later adulthood, affecting communication, social participation, and quality of life. Digital self-management programs offer promising opportunities to support adults with HL in their everyday lives. However, the landscape of existing digital self-management interventions, their design principles, and empirical evidence regarding user engagement and effectiveness remains insufficiently mapped. Understanding which programs are available, how they are designed, what features are included, which elements promote adherence, and which outcomes have been evaluated is essential for developing evidence-based, user-centered digital self-management tools. This scoping review systematically maps digital self-management programs for adults with HL, including tinnitus patients with HL and cochlear implant (CI) programs. It pursues two main objectives: (1) providing a comprehensive overview of existing digital self-management programs, their functions, and reported effectiveness, and (2) analyzing design principles from a Human-Computer Interaction (HCI) perspective, particularly regarding their relationship with user engagement and adherence.

Materials and Methods: A systematic literature search was conducted across five databases (PubMed, Scopus, IEEE Xplore, ACM Digital Library, PsycINFO), including peer-reviewed publications from 2010 onwards. The initial search yielded 2157 records. After deduplication, 1383 unique records were screened. Two reviewers independently screened the literature following PRISMA-ScR guidelines. Currently, 165 full-text articles are being assessed for final inclusion. Data extraction focuses on program characteristics (type, delivery platform, content), design principles (user-centered design, accessibility, personalization, engagement strategies), evaluation methods, and reported outcomes regarding both clinical effectiveness and usage/adherence metrics.

Results: Preliminary analysis indicates a diverse landscape of digital interventions spanning multiple categories. Programs identified include auditory training applications for CI and hearing aid users, internet-based cognitive behavioral therapy for tinnitus management, communication strategy training platforms, and comprehensive self-management programs. Delivery platforms include web-based applications, smartphone apps, and desktop software. Initial observations suggest varying degrees of integration of evidence-based design principles and engagement strategies such as gamification and progress tracking. The final synthesis will comprehensively document the distribution of program types, systematically analyze incorporated design principles and reported effectiveness, and examine relationships between design features and sustained user engagement.

Conclusions: This scoping review will provide clinicians and audiologists with a comprehensive overview of available digital self-management tools and their evidence base, identifying which programs demonstrate effectiveness and what design features promote adherence. For developers and researchers, it will identify best practices for integrating audiological expertise with HCI principles to create digital interventions that effectively support adults with HL in their everyday lives.

Keywords: Digital health interventions, hearing loss, self-management, user engagement, Human-Computer Interaction

P.09.03

244 - MUSCLES AROUND THE EAR AS INDICATORS OF DIFFERENT MODES OF ATTENTION DURING CINEMATIC IMMERSION

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The human pinna-orienting system is a vestigial motor-system that, despite having lost its original orienting function approximately 25 million years ago [1,3], remains responsive to auditory stimulation and is modulated by attention, affect, and sound direction [2,3]. Residual activity of this system can be measured via surface electromyography of the post-auricular muscle (PAM), which has been shown to exhibit both reflexive responses to sound onsets as well as more sustained or transient activity patterns [4]. Due to its sensitivity to attentional and affective factors, PAM activity may provide a physiological window into attentional processes during naturalistic cinematic experiences. This is of particular interest for gaining a deeper understanding of immersion, which can be described as a state of intense involvement in which an individual becomes deeply absorbed in an induced reality and temporarily disengages from the surrounding physical world. Strauss et al. suggested that the role of attention in immersion can be conceptualized within a two-competitor model, in which attention is a necessary but not sufficient condition to understanding immersion [5].
In the present, highly exploratory study, we investigated whether different components of PAM activity might reflect these distinct attentional processes during movie viewing. Specifically, we hypothesized that PAM responses elicited by acoustic edges in the movie audio may reflect endogenous auditory attention, whereas the PAM reacting to off-target chirps may index susceptibility to distraction and in this context exogenous attention.
PAM activity was recorded using Ag/AgCl electrodes placed directly on the tendon of the post-auricular muscle and approximately 1 cm posterior to it, at a sampling rate of 1200 Hz, on participants while they viewed a movie in an immersive environment. The movie was presented over approximately 60° of the visual field, and the soundtrack was delivered via two loudspeakers positioned in front of the participant at a sound pressure level of 60 dB(A). Additionally, brief auditory chirps were presented every 15 seconds from loudspeakers positioned behind the participant at ±150° relative to the line of sight, to elicit reflexive PAM responses. Participants were instructed to watch the movie attentively and naturally, and afterwards reported their ratings of attention for each individual scene.
Data from 4 participants (age: 25.75±2.36 years) was included in the analysis. The electromyographic signal was bandpass filtered between 30 and 300 Hz and notch filtered at 50 Hz and its harmonics. The data were segmented around acoustic edges within the movie soundtrack—identified using a gammatone-filterbank—and around the externally presented chirps. A root-mean-square-envelope with a window size of 35 ms was computed, and responses were baseline-corrected (500ms). For each scene, an equal number of single responses was averaged (300 for acoustic edges and 8 for chirps), and scene-level PAM activity was compared between scenes rated as high versus low attention.
While the results are not statistically robust, due to the very small sample size, a trend emerged: acoustic edges elicited larger PAM responses during scenes rated as highly attentive, whereas chirp-evoked PAMRs were larger during scenes rated as less attentive. If confirmed in larger samples, these findings suggest that post-auricular muscle activity during naturalistic audiovisual stimulation may differentiate endogenous attentional engagement from exogenous attentional capture and would offer a promising and minimally obtrusive possibility to quantify attention and examining its relationship to and distinction from immersion.

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Keywords: Auricular Muscles, Attention, Acoustic Edges

P.09.04

245 - PHASE-LOCKED NEURAL RESPONSES TO ACOUSTIC EDGES IN SPEECH: A PROMISING TOOL FOR EVALUATING HEARING AID NOISE REDUCTION PERFORMANCE BASED ON NEURAL SPEECH TRACKING

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Listening to speech is known to produce neural activity that is synchronized to the slow amplitude fluctuations in the speech envelope. Typical factors that impair this neural envelope encoding are background noise and hearing loss, which effectively reduce the signal-to-noise ratio (SNR) for the target speech signal. Fortunately, previous research investigating electroencephalographic (EEG) indices of speech processing in hearing aid users has demonstrated that noise reduction (NR) algorithms can partly restore the brain-to-speech synchronization under adverse listening conditions. Specifically, studies using stimulus reconstruction (SR) analyses have shown that NR improves speech envelope encoding. However, while this indicates that envelope reconstruction accuracy provides a valuable tool for objectively evaluating NR performance, the SR approach does not provide any information about the neural mechanism underlying this improved speech encoding.

Beyond raw envelope encoding, neural speech tracking has been shown to be established through phase-locked brain responses to acoustic edges in the derivative of the speech envelope, which highlights rapid amplitude fluctuations and may be referred to as the speech onset envelope. Furthermore, recent findings suggest that the spectrotemporal consistency with which these brain responses are elicited by the individual acoustic edges drives SR accuracy for the speech onset envelope, with a higher response consistency resulting in a better envelope recoverability. Considering the NR effects on speech envelope encoding and the close relationship between raw and speech onset envelope representations, it could be expected that hearing aid NR algorithms also improve the neural encoding of the onset envelope. Given the above, it is likely that such improvements would be driven by an enhanced spectrotemporal consistency of brain responses to acoustic edges, which are presumably sharpened by the NR and thus more likely to elicit phase-locked neural activity. Such insights would enable a more detailed evaluation of NR performance based on precisely defined neural mechanisms.

To investigate the proposed approach in more detail, we analyzed EEG data from 25 experienced hearing aid users (age: 50-82 years, experience: 1-20 years) who took part in a single-speaker continuous listening study using event-related potential (ERP) techniques and a SR approach. Participants were fitted with bilateral hearing aids that were capable of running a NR algorithm based on a deep neural network designed to attenuate noise from all directions. Their task was to listen to a target speaker presented from the front under speech-in-quiet conditions as well as speech-in-noise conditions with and without NR. In speech-in-noise conditions, ecologically valid noise was presented from all loudspeakers with identical sound intensities to achieve a total SNR of -2dB. Regardless of listening condition, segmenting the EEG recordings relative to acoustic edges in the speech onset envelope revealed phase-locked neural responses characterized by the P1-N1-P2 complex of the auditory late response. The inter-trial phase coherence of these responses in their characteristic time-frequency range indicated that speech-in-noise conditions were associated with lower spectrotemporal consistency than the speech-in-quiet condition. Importantly, however, NR partly restored the spectrotemporal consistency under noisy conditions, suggesting that NR enhanced the consistency of neural responses to acoustic edges in speech. These observations were highly correlated with reconstruction accuracies that were obtained from a SR analysis for the sound onset envelope. Thus, our findings suggest that ERP-based analyses provide a promising alternative to the SR approach for objectively evaluating benefits of hearing aid NR algorithms on neural speech tracking with an enhanced interpretability regarding the underlying neural mechanisms.

Whereas the acoustic edges used for our proposed approach can be identified through a straightforward envelope thresholding procedure, future research could extend this work by investigating whether NR also affects the spectrotemporal consistency of neural responses triggered by other speech landmarks that require a more precise speech annotation, such as phonetic information. Furthermore, while our results suggest that our approach provides valuable insights under controlled lab conditions, confirmatory results obtained from studies that are designed with ecologically more valid scenarios, for example, a driving simulator study, would reinforce the validity of using phase-locked brain responses to acoustic edges as a general tool for objectively investigating effects on hearing aid NR algorithms on neural speech tracking.

Keywords: electroencephalography, event-related potentials, hearing aids, neural speech tracking, noise reduction

Conflict of interest: one or more authors have declared an industry affiliation

P.09.05

318 - DEVELOPMENT OF AN EDUCATIONAL OBJECT TO PROMOTE HEARING HEALTH IN PRESCHOOL CHILDREN

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Background/Rationale: Health education supported by educational technologies is increasingly recognized as an effective strategy to improve population health outcomes, particularly in early childhood. When implemented in school settings, developmentally appropriate educational resources can enhance health literacy and preventive behaviors at scale. Hearing health promotion is especially relevant given the global burden of childhood hearing loss: the World Health Organization estimates that approximately 34 million children worldwide live with disabling hearing loss, much of which is preventable or manageable with early action. Untreated hearing loss in childhood is associated with adverse effects on language acquisition, cognitive and socio-emotional development, and educational participation. Despite advances in early detection policies, preventive educational initiatives targeting preschool children remain limited. Early childhood education settings offer a strategic and underused opportunity for universal hearing health promotion, particularly through teacher-mediated and technology-supported interventions. In Brazil, although child health promotion is a public policy priority, there is still a shortage of validated, age-appropriate tools designed specifically for hearing health education in preschool populations. This study aimed to develop an educational object targeted at children aged 3 to under 6 years to promote hearing health. Materials and Methods: This methodological study focused on the development of an educational object consisting of a short animated video on childhood hearing care for children aged 3 to 6 years in the school setting. The study also included the development of an implementation guide for teachers to support the pedagogical use of the video in the classroom. Prior to implementation with the target audience, the material was evaluated by teachers with classroom experience regarding content clarity, pedagogical adequacy, school applicability, expected impact on children, and suggestions for improvement. The activity was subsequently implemented in the school environment across five preschools, involving 24 classes, 352 children, and 19 teachers. Evaluation data for the educational object were collected electronically. Teachers completed three questionnaires for content validation, assessment of knowledge and attitudes, and satisfaction. Data were analyzed using descriptive quantitative methods. For the Content Validity Index (CVI), a minimum cutoff of 0.78 was adopted to assess agreement among teachers. Percent agreement (PA) was calculated by multiplying the CVI by 100. Results: The Health Content Validation Instrument indicated that the educational object demonstrated a borderline overall Content Validity Index (CVI = 0.77), indicating general adequacy with the need for targeted refinements. Domain-specific analysis showed CVIs of 0.66 for Objectives, 0.85 for Structure/Presentation, and 0.74 for Relevance. Teachers exhibited a good awareness of the importance of hearing health; however, they reported limited practical confidence in addressing the topic. Overall satisfaction with the implementation was predominantly positive, particularly regarding children's learning and engagement. The main barriers identified were insufficient prior teacher training, the need for specialist support, and the need to optimize the video's duration. Conclusion: These findings suggest the need for refinements to the educational material based on teachers' feedback to enhance its attractiveness for children. Furthermore, although the intervention was perceived as relevant and well structured, its effectiveness appears to depend on teachers' prior training, reinforcing the need to strengthen teacher preparation—preferably before the implementation of educational objects for preschool children.

Keywords: Hearing Loss; Health Education; Educational Technology; Child, Preschool; Health Promotion.

P10 - IMPROVING HEARING CARE & SERVICES

P.10.01

44 - ASSOCIATIONS BETWEEN LONG-TERM HEARING AID USE, AND SHORT-TERM REPORTED OUTCOMES AND HEARING-AID FOLLOW-UP CARE AS REVEALED BY ELECTRONIC HEALTH RECORDS

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Adult hearing aid (HA) fitting guidelines and clinical practice documents recommend that patients receive a follow-up appointment within a few weeks (6-12) of a HA fitting. However, whether, how and when patients are offered a follow-up visit varies considerably, perhaps because there is limited evidence demonstrating an independent effect of short-term follow-up care on longer-term outcomes, and whether short-term HA outcome is predictive of longer-term outcome. To address this, we conducted analyses to answer two research questions. RQ1: Is there an association between HA follow-up care and long-term HA outcome? and RQ2: Is short-term HA outcome predictive of long-term HA outcome?
We analysed data from the US VA electronic health record (EHR) system from 284,175 patients for whom HAs had been ordered through the VA system. Our dependent variables were long-term and short-term HA outcome, the independent variable was occurrence of HA follow-up care; demographic, audiometric and health-related variables were used as covariates (Naylor et al., 2025).
Long-term HA outcome (HA use persistence at 24 months post-HA fitting) was estimated from HA battery order information available in the EHR. Short-term HA outcome was assessed using responses to the International Outcome Inventory for HAs (IOI-HA; Cox and Alexander, 2002) completed between 6- and 12-weeks post-HA fitting. CPT and ICD codes were used to determine whether a patient had received a HA follow-up appointment within the first 90 days following the HA fitting ('Short-Term HA Care'; STHAC). All covariates were extracted directly from the EHR or computed from variables in the EHR.
To address RQ1 we used data from the 284,175 patients who had complete data for all relevant variables. To address RQ2 we used data from the subset of 43,568 patients who had returned an IOI-HA questionnaire between 14-60 days after the HA fitting date.
We used regression modelling to examine the associations between a STHAC appointment and HA use persistence at 24 months, and to examine associations between IOI-HA scores obtained within 14-60 days of HA fitting and HA use persistence at 24 months.
The data showed: strong positive effects of a STHAC appointment on HA use persistence at 24-months for new and experienced HA users alike; that a higher proportion of patients with IOI-HA data were persistent HA users than those without IOI-HA data; and that responses to IOI-HA questions 1 (Daily HA use), 2 (Benefit), 4 (Satisfaction) and 7 (Quality of life) were more strongly associated with HA use persistence than responses to questions 3 (Residual activity limitations), 5 (Residual participation restrictions) and 6 (Impact on others - groupings that reflect the established two factors of the IOI-HA.
While our data do not allow us to prove causation, the findings strongly suggest support the view that having a STHAC appointment within 12 weeks of a hearing aid fitting is highly beneficial for long term HA outcome – for new and experienced HA users alike, and that information from short-term outcomes should be used to plan short-term care to optimise long-term outcomes.

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Key words: electronic health records; hearing aid use; hearing aid outcome

P.10.02

156 - DIFFERENCES IN BARRIERS AND FACILITATORS FOR HEARING AID UPTAKE IN ADULTS WITHOUT HEARING DEVICES IN FLANDERS DEPENDING ON AGE

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Background According to the World Health Organization, over 5% of the world's population suffer from disabling hearing loss, which requires hearing rehabilitation. In case of mild to moderate hearing loss, hearing aids can reduce the negative consequences of hearing loss and improve participation in everyday life, enhancing hearing-specific and general health-related quality of life. However, hearing aid adoption in middle-aged and older adults with hearing loss is low. The goal of the current study was to investigate barriers and facilitators related to hearing aid uptake from young to older adults without hearing devices in Flanders (Belgium), whereby here we focus on differences depending on age.
Materials and Methods A questionnaire was developed in Dutch, covering sociodemographic, hearing and health related, and psychosocial factors. Besides validated questionnaires in Dutch (e.g. the hearing-related quality of life questionnaire for auditory-visual, cognitive and psychosocial functioning (hAVICOP)), questions regarding barriers and facilitators for hearing aid uptake were self-developed and pretested. There were 16 and 11 statements related to reasons why hearing aids would not and would be considered, respectively. These statements can be clustered into expected benefit, comfort, esthetics, stigma, journey through healthcare, and financial considerations. Statements were answered using a five points Likert scale from strongly disagree to strongly agree. The questionnaire was administered using RedCap and distributed from October 2025 using flyers and social media. By January 2026, 379 respondents filled in the questionnaire. For statical analysis, mainly chi² testing was performed between the statements and age categories young (18-39 years), middle-aged (40-64 years) and older (65 years and older) adults.
Results Preliminary results based on 345 respondents (227 female, 113 male, 5 other/ unknown) with mean age of 48.15 years (SD 17.28, range 18-81 years) indicate that there are significant differences between age categories (young: n=125, middle-aged: n=151, older: n=69) and statements related to benefit, comfort and the journey through healthcare. More specifically, young and middle aged adults agree more than older adults that having a hearing problem would be a facilitator to hearing aid uptake. Middle-aged adults agree more than young adults that an improvement in quality of life due to hearing aids would be a facilitator and problems with comfort would be a barrier to hearing aid uptake. Young adults disagree more than older adults that difficulties in healthcare trajectory would be a barrier to hearing aid uptake. As data collection is still ongoing, the results based on a larger sample taking into account other variables will be presented at HeAL 2026.
Conclusions: It is important to increase hearing aid uptake in middle-aged and older adults with hearing loss, and to ensure continued use of hearing aids. Gaining more insight into factors against or facilitating hearing aid uptake is necessary. The current study in young to older adults without hearing devices in Flanders stresses the importance of providing correct information regarding hearing aids to older adults and increasing awareness regarding the benefits of hearing aids in the middle-aged and younger population. Targeting these aspects would improve hearing healthcare in current and future generations of individuals with hearing loss.
Keywords: adults, hearing aid uptake; hearing-related quality of life; age

P.10.03

329 - BRIDGING RESEARCH AND PRACTICE: DESIGN THINKING FOR IMPLEMENTING THE EMPAQ-5 IN HEARING CARE PRACTICE

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Background
Empowerment is increasingly recognized as a central principle in person-centered hearing care, extending rehabilitation beyond audibility toward broader psychosocial outcomes. In hearing health, empowerment encompasses five domains: Knowledge, Control, Participation, Skills and Strategies, and Self-efficacy. Through qualitative interviews, our research group identified these five empowerment domains, grounded in psychological empowerment theory. Based on this work, the Empowerment in Audiology Questionnaires (EmpAQ-15 and EmpAQ-5) were subsequently developed and extensively validated to assess empowerment in hearing rehabilitation.
Yet validated measurement alone does not ensure clinical integration. Translating empowerment assessment into routine practice presents practical and professional challenges. Research in hearing care and related health fields suggests that implementing psychosocial and patient-reported tools may be hindered by time constraints, limited psychosocial confidence, uncertainty in interpreting outcomes, and workflow misalignment. Structured implementation strategies tailored specifically to empowerment assessment in hearing care remain limited. To bridge this research–practice gap, this study applied Design Thinking combined with Implementation science frameworks to co-develop feasible and context-sensitive strategies for embedding the EmpAQ-5 (questionnaire with 5 questions), with into routine hearing care.
Methods
As the next translational phase following instrument validation, a participatory co-design study was conducted through three Design Thinking workshops. Sixty-one stakeholders participated, including hearing care professionals, clinic managers, researchers, and industry representatives.
The study aimed to:

1. explore clinical applications of the EmpAQ-5
2. identify implementation barriers and facilitators, and
3. develop structured resources to support integration into routine care.

Three workshops followed the three Design Thinking phases:
• Empathize and Define (n=15): Identified barriers and facilitators to EmpAQ-5 implementation and established guiding design principles. Empathy mapping was used to explore professional perspectives, and the Capability, Opportunity, Motivation–Behavior model (COM-B) supported analysis of behavioral determinants.
• Ideate and Prototype (n=24): Generated and refined potential implementation solutions, including clinical discussion guides and support tools. Structured ideation methods such as Lotus Blossom, prioritization, and dotmocracy were used to prioritize feasible and high-impact resources.
• Test and Implement (n=22): Refined prototypes through simulated clinical scenarios and structured feedback.
A Strength, Weakness, Opportunity and Threat (SWOT) analysis and rapid prototyping ensured alignment with real-world workflows and organizational contexts. The Consolidated Framework for Implementation Research (CFIR) supported overall contextual mapping of intervention characteristics and organizational readiness.
Data included workshop transcripts, field notes, and prototype materials. Reflexive thematic analysis was conducted and subsequently mapped deductively to the COM-B model and CFIR domains to ensure theoretical grounding.
Results
The Design Thinking process translated validated empowerment measurement into structured, context-sensitive implementation supports. Across workshops, key barriers to EmpAQ-5 integration were identified, including limited consultation time, uncertainty in interpreting empowerment scores, discomfort addressing emotional aspects of care, and unclear workflow positioning. Participants emphasized that empowerment tools must feel manageable, align with professional identity, and integrate seamlessly into existing routines. From these discussions, core design principles emerged: simplicity, clarity, visual usability, low cognitive burden, and shared team responsibility. These principles informed the co-development of practical implementation resources, including a structured conversation guide addressing the five empowerment domains, concise domain reference materials, a client reflection sheet for pre-consultation engagement, an administrative introduction script, and clinician training materials. Together, these resources aimed to strengthen clinician capability, enhance workflow opportunities, and support motivation for adoption. Iterative testing and refinement improved usability and contextual fit. Modifications focused on simplifying language, reducing

perceived complexity, and increasing adaptability across diverse clinical settings. Participants highlighted modularity and low-friction integration as central to sustainability. Overall, actively involving end users in identifying barriers and shaping solutions enhanced perceived feasibility, contextual alignment, and readiness for implementation

Conclusion

This study demonstrates that integrating Design Thinking with implementation science offers a structured yet adaptive pathway for translating validated empowerment measurement into clinical practice. Successful integration of the EmpAQ-5 depends not only on psychometric robustness but also on hearing care professional's' capability, contextual alignment, workflow compatibility, and professional identity. Participatory co-design may reduce implementation friction and foster shared ownership, supporting sustainable adoption of empowerment-focused assessment. This work represents a deliberate translational step between instrument validation and real-world implementation evaluation. A subsequent implementation study was conducted to assess feasibility and integration in routine practice, positioning this research within a broader program aimed at embedding empowerment systematically into hearing care.

Keywords: Hearing empowerment, EmpAQ-5, Design Thinking, Implementation science, Innovation

Conflict of interest: one or more authors have declared an industry affiliation

P.10.04

210 - ANALYSIS OF RHEOTAXIS BEHAVIORAL CHANGES IN LATERAL LINE DAMAGED ZEBRAFISH LARVAE FOR DRUG SCREENING APPLICATIONS.

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Aquatic animals have rheotaxis that maintain a balance in response to water flow.
They sense water flow through hair cells in lateral line, thereby leading to behavior changes relevant to damages on hair cells, the primary sensory receptor cells within auditory and vestibular systems.
Zebrafish are efficient animal models for high-throughput drug screening with human-like hair cells along the lateral line.
Their rheotactic behaviors could be assays for hair-cell-targeted drug screening. However, knowledge and tools for rheotaxis analysis along the extent of hair-cell damage have not been fully investigated.
This article aims at characterization of rheotactic behaviors identifying lateral line states via an analysis platform that simultaneously examines multiple zebrafish larvae.
To this end, we developed an automated framework that incorporated animal test hardware equipment and real-time analysis software for monitoring aquatic behaviors of multiple larvae.
Through this framework, a commensurable measure for one-dimensional characterization of rheotactic behaviors was consolidated so that its linear changes could be associated with the population of hair cells remaining intact.
These findings satisfied requests for an automated analysis platform to conduct large-scale screening and a biomarker that discriminate the seriousness of hair cell damage to screen candidates having significant effects in otoprotective drug discovery. This study has been in Expert Systems With Applications.

Keywords: Zebrafish Rheotaxis Hair cells Automated platform Aquatic trajectory analysis Drug screening

P.10.05

316 - AUDIOLOGICAL PROFILE IN PATIENTS WITH FABRY DISEASE

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Fabry disease is an X-linked lysosomal storage disorder. Although males are predominantly affected, Fabry related symphtoms may also manifest in females. The condition is caused by mutations in the GLA gene. This gene is located on the long arm of the X chromosome and responsible of the encoding of the α-galactosidase A (α-Gal A) resulting in either reduced enzymatic activity or the production of a structurally defective and unstable enzyme. This lysosomal enzyme plays a critical role in the degradation of sphingolipids such as globotriaosylceramide (Gb3) and. digalactosylceramide. These sphingolipids are involved in the construction of cell membranes. In the absence or deficiency of the α-Gal A activity, globotriaosylceramide accumulates predominantly, but in the kidneys digalactosylceramide deposition is also observed. The estimated incidence of the disease is approximately 1:50,000, making it one of the more common lysosomal storage disorders.
The accumulation of metabolic substrates leads primarily to microvascular dysfunction, with ischemia and microinfarctions being major contributors to the clinical manifestations. Characteristic symptoms include episodic extremity pain (acroparesthesia), angiokeratomas, cornea verticillata, anhidrosis, proteinuria, progressive renal insufficiency, cardiomyopathy, and atrioventricular block.
Several studies have reported hearing loss, tinnitus, and vertigo in patients with Fabry disease. However, no clear consensus has been established regarding the characteristics of the hearing impairment, including the relative contributions of sensorineural and conductive components and the frequency ranges involved. Studies using objective audiological assessment methods are generally limited by small sample sizes.
Histopathological analysis of cochlear specimens obtained from affected individuals has revealed hyperplastic mucosa and focal seropurulent effusions in the middle ear. Evidence of glycosphingolipid accumulation has been identified in vascular endothelial cells and certain ganglion cells. The most pronounced cochlear abnormalities include atrophy of the stria vascularis and the spiral ligament. Based on the data above , Fabry disease related hearing loss can be sensorineural, conductive, or mixed. All three types have been found in some surveys.
Currently, enzyme replacement therapy (ERT) and chaperone therapy are available for the treatment of Fabry disease. According to the literature, ERT may prevent hearing loss. Patients receiving ERT who developed sudden sensorineural hearing loss (SSNHL) demonstrated a more favorable therapeutic response to corticosteroid treatment.
The aim of our study was to evaluate the results of the audiological assessments performed—impedance audiometry, speech audiometry, pure-tone threshold audiometry, otoacoustic emission testing, and auditory brainstem response audiometry—as well as data derived from medical history and tinnitus handicap questionnaires.
Our findings indicate that the hearing thresholds of patients with Fabry disease were tendenciously slightly elevated across all tested frequencies relative to the normative reference values defined by ISO 7029-2017 standards. The modest difference may be due to the effectiveness of Fabry treatment, which underlines the importance of early diagnosis and effective treatment. We would like to draw attention to the importance of screening for Fabry disease and highlight audiological abnormalities.

Keyworlds: Fabry disease, hearing impairment, hearing screening

P.10.06

344 - NOISE-INDUCED HEARING LOSS IN ZEBRAFISH MODEL: CHARACTERIZATION OF TONOTOPY AND SEX-BASED DIFFERENCES

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Hearing loss caused by frequent and persistent exposure to loud noise is one of the most common diseases in modern society. Many studies have demonstrated the characteristics of noise-induced hearing loss in human and non-human vertebrate models, including frequency-specific noise-induced hearing loss and sex-biased differences. Zebrafish (Danio rerio) is a useful hearing research model because its lateral line is easy to access and because of its detailed perception of sound. Despite the increasing popularity of zebrafish as a model for NIHL, a better understanding of this model is needed to determine sex differences in NIHL. To study the features of zebrafish as they relate to an NIHL model, we tested various phenotypes after frequency-specific noise stimulation. The degree of damage to hair cells and hearing loss were investigated after exposing zebrafish to 200 Hz and 1 kHz continuous waves and broadband white noise with a bandwidth from 50 Hz to 1 kHz. After exposure to all frequencies, the larvae showed lateral line hair cell damage, which is superficially located. In adult zebrafish, the threshold of auditory-evoked potential signals is elevated. Moreover, the number of hair cells remarkably decreased in the rostral region of the saccule, after exposure to 1 kHz and white noise, whereas zebrafish exposed to 200 Hz noise showed a decrease in hair cells in the caudal region. Moreover, male zebrafish were found to be more vulnerable to noise than female zebrafish, as is the case in humans and other mammals. Cortisol levels also increased in the noise-exposed male group, as compared to the noise-exposed female and control male groups. However, there was no difference in cortisol levels when the noise-exposed female group was compared to the control female group. Our study demonstrates not only that noise-induced hearing loss is frequency-dependent but also that the degree of hearing loss is affected by sex in zebrafish, emphasizing the need to consider sex in NIHL studies. This study was published in Hearing Research.

P.10.07

346 - CONTINUING EDUCATION IN HEARING HEALTH: DEVELOPMENT OF QUESTIONNAIRES FOR LEARNING ASSESSMENT

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Rationale: Continuing health education is a fundamental strategy for the ongoing development of healthcare professionals' competencies, contributing to the transformation of practices and work organization. However, the mere transmission of information does not, in itself, ensure knowledge retention or changes in professional behavior. In this context, the use of learning assessment instruments becomes essential to measure the retention and generalization of acquired knowledge. Evaluation questionnaires have proven to be effective tools in this process, as they enable the identification of learning gains, the adjustment of educational strategies, and the improvement of professional practice. Therefore, this report aims to develop two questionnaires to assess knowledge on hearing health, to be administered before and after continuing education interventions with graduate-level healthcare professionals. **Materials and Methods:** The continuing education initiative is linked to a multicenter project involving four universities, whose central focus includes not only educational activities but also the development of accessible and sustainable mobile solutions for hearing health and care across the life course, including hearing health education. Two questionnaires were developed based on a review of scientific literature on learning assessment, as well as on previously used protocols and instruments designed to measure knowledge retention. The target population consisted of healthcare professionals working within the public health system (primary healthcare units, mixed healthcare units, and Family Health Strategy teams). The instruments differ in methodological approach: one is based on objective questions, and the other is structured around problem-based scenarios, both addressing hearing health topics. The questionnaires will be administered at two distinct time points: before and after the educational interventions. **Results:** The questionnaire based on objective questions was organized into eight modules: (1) anatomy and physiology of hearing; (2) general hearing care; (3) hearing loss and risk factors; (4) tinnitus; (5) impact of hearing loss on daily life; (6) relationship between hearing and balance; (7) treatments and interventions; and (8) telemedicine and hearing health. Each module contains one to three questions of varying levels of complexity, in multiple-choice format, with either single or multiple correct answers, totaling 17 questions. An answer key and scoring system were developed, with a maximum score of 17 points. Multiple-selection items allow partial scoring for each correct alternative. The problem-based questionnaire consists of six case scenarios constructed from commonly observed clinical and community conditions, with varying levels of complexity. Each scenario includes one single-answer multiple-choice question. Two points are assigned for each correct response, resulting in a maximum total score of 12 points. The questionnaires will be administered pre- and post-intervention, enabling comparison of scores to measure knowledge acquisition and its progression following continuing education. **Conclusion:** This study proposes a reflection on the importance of evaluation within the context of continuing health education, particularly for measuring knowledge retention and generalization. The developed questionnaires constitute practical, simple, and accessible instruments with the potential to support the assessment of the impact of hearing health educational interventions among healthcare professionals. Furthermore, validation of the questionnaires represents an important direction for future research.

Keywords: Continuing Education; Health Evaluation; Surveys and Questionnaires; Hearing; Speech-Language Pathology.

P.10.08

347 - HEARING HEALTH EDUCATION IN CHILDHOOD: EDUCATIONAL STRATEGIES FOR SCHOOLCHILDREN

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Rationale: Hearing is fundamental to human communication, as it enables the understanding of information, monitoring of environmental events, and social integration. It is an essential sense for the development of speech, receptive and expressive language, as well as reading and writing skills. Early detection of hearing loss and timely intervention are associated with improved auditory, linguistic, academic, emotional, and social outcomes. In this context, hearing health promotion through educational initiatives represents a relevant strategy for fostering health-related knowledge and skills, as well as for preventing hearing disorders from early childhood. The use of play-based strategies in educational interventions with schoolchildren has proven effective in enhancing attention and comprehension of content, as well as positively influencing attitudes and perceptions. Therefore, this report aims to describe educational actions on hearing health conducted with preschool and early elementary school children. **Materials and Methods:** The hearing health education activities were part of a multicenter project involving four universities, whose primary focus includes not only health promotion initiatives but also the development of accessible and sustainable mobile solutions for hearing health and care across the life course. The activities were conducted in two educational institutions located in the countryside of Sergipe, Brazil, involving approximately 70 preschool children aged 2 to 5 years and 85 early elementary school students aged 6 to 10 years. The interventions were carried out by undergraduate students in Speech-Language Pathology under faculty supervision. Educational materials and language were adapted according to the age group. The topics addressed included the anatomy and physiology of hearing, causes, signs, and symptoms of hearing loss, and hearing health care, including the risks associated with improper use of cotton swabs, headphones, and exposure to excessive noise. Play-based strategies tailored to each age group were employed as facilitating tools, including puppet theater, collage, painting, puzzles, memory games, and the activity “friends and enemies of hearing.” At the end of the interventions, informational posters were distributed for display on school bulletin boards. **Results:** The schoolchildren demonstrated positive receptivity and active participation, with high engagement in the proposed activities. Limited prior knowledge regarding hearing health was observed, along with reports of everyday behaviors potentially harmful to auditory health. Age-related factors posed challenges in terms of content comprehension and sustained attention during the sessions. However, the use of age-appropriate play-based strategies facilitated attention, information retention, and overall engagement. Following the educational activities, an increase in knowledge was observed, evidenced by correct responses to questions and the sharing of acquired information among peers and teachers. **Conclusion:** The findings indicate that hearing health educational actions promoted engagement and learning among schoolchildren, particularly when mediated by age-appropriate play-based strategies. Despite limited baseline knowledge, participants demonstrated interest in the topics addressed and improved understanding following the intervention. Educational initiatives therefore represent an important strategy for promoting hearing health among schoolchildren, even in the early stages of development.

Keywords: Hearing; Health Promotion; Health Education; Speech-Language Pathology; Quality of Life.

P.10.09

352 - OPTIMIZATION OF HEARING AIDS IS MISSING IN CANDIDATES FOR COHLEAR IMPLANTATION

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Background: Cochlear Implantation (CI) is a success story in treating patients with profound hearing loss as well as infants who are identified in newborn screening. Adults do have to undergo a trial treatment with hearing aids before they can be considered candidates for CI.
Material and Methods: We report here on 40 adult patients who suffered from progressive hearing loss and were hearing aid users for at least two years.
Results: The aided conditions are compared to their unaided ones. The word recognition scores at 65dB are compared in the aided and unaided conditions. The results are evaluated with an independent hearing aid acoustician.
Conclusions: Optimization of hearing aids is an important step before considering further treatment options and seems to be sometimes omitted by other healthcare professionals.

Hearing aids, cochlear implants, word recognition score

P.10.10

333 - EFFECT OF ACOUSTIC STIMULUS INTENSITY ON AUDITORY BRAINSTEM RESPONSES IN TYPICALLY DEVELOPING INFANTS

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Introduction: The intensity of 80 dB nHL is commonly used to assess the functional integrity of auditory brainstem through the auditory brainstem response (ABR), contributing to the evaluation of central auditory pathway neurodevelopment in infants. However, this intensity level may cause discomfort in infants with normal hearing or hearing loss and potentially compromise electrophysiological recordings. Therefore, investigating lower stimulation intensities that maintain reliable neural responses is clinically relevant.
Objective: To compare the absolute latencies and amplitudes of waves I, III, and V, as well as the interpeak intervals I–III, III–V, and I–V, obtained at stimulus intensities of 70 and 80 dB nHL in ABR of typically developing infants.
Methods: This is an analytical-descriptive study, approved by the Research Ethics Committee (no. 7.190.153). This cross-sectional study included infants recruited from public maternity hospitals in a metropolitan region of northeastern Brazil without risk indicators for hearing loss - confirmed by review of hospital medical records. All participants presented normal middle ear function, confirmed by tympanometry (1KHz) with a positive peak, and bilateral presence of transient evoked otoacoustic emissions (1-4KHz). Click-evoked auditory brainstem responses were recorded using two averages of 2,048 stimuli for wave replication, rarefaction polarity, stimulus intensities of 70 and 80 dB nHL, stimulus duration of 100 µs, and a stimulation rate of 27.7/s. Absolute latencies and amplitudes of waves I, III, and V, as well as interpeak intervals I–III, III–V, and I–V, were analyzed for each intensity and ear. Reference intervals were derived using the Smart Tools for Evoked Potentials (STEP) application. Paired statistical comparisons were performed using the Wilcoxon signed-rank test, with adjustment for multiple comparisons using the Benjamini–Hochberg false discovery rate, and a significance level of 5%.
Results: Sixteen typically developing infants (mean age = 126.3 ± 66.6 days) were included. Significant reductions in absolute latencies of waves I, III, and V and significant increases in amplitudes of waves I and V were observed at 80 dB nHL compared to 70 dB nHL ($p < 0.05$). No statistically significant differences were found for interpeak intervals or between right and left ears after correction for multiple comparisons. Reference intervals derived using the STEP tool were similar across stimulus intensities and between ears.
Conclusion: In typically developing infants, increasing stimulus intensity from 70 to 80 dB nHL results in shorter ABR latencies and higher wave amplitudes, without significant interaural differences. However, the magnitude of these changes was minimal, with latency variations below 1.0 ms and amplitude differences below 1 µV, and preserved interpeak intervals. These findings support the use of lower stimulus intensities in clinical assessments, potentially reducing infant discomfort and optimizing the likelihood that infants with normal hearing or hearing loss with recruitment are not awakened from natural sleep during the examination, while preserving reliable electrophysiological measurements. Optimizing stimulus intensity may therefore enhance both the tolerability and clinical precision of infant ABR assessments.
Key words: Auditory Brainstem Response; Evoked Potentials; Infant; Hearing Tests; Neurodevelopment

Author index

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A

Aaberg Kirsten 48
Abbate Andrea 182
Abdelsamad Yassin 203; 204
Aguera Pierre-Emmanuel 15; 222
Ahumadacanal Ahumadacanale....137
Akgün Nazmiye....216
Aksoy Selin 270
Albera Andrea 43; 166
Albera Roberto....43; 166; 182
Alberti Casas Anna 119
Allen David....130
Almeida-Carneiro Geovana 84
Alnafjan Fadwa 131
Amann Sarah....243
Amaral Maria Isabel Ramos do 296; 297
Ambrósio Albuquerque Bezerra Maria Beatriz .291
Andersen Pernilla Kjær....295
Anderson Erin 83; 87
Anderson Ilona.... 202; 203; 204
Anderson Nicolette 31
Anderson Samira 73
Andin Josefine 90; 140
Andreoli Balen Sheila 267; 328
Andries Ellen....203; 204
Angonese Giulia 77
Anjum Javad 44; 283
Araújo Kaline 317
Archer Karen....171
Ari-Even Roth Daphne....32
Armato Enrico 267
Arrieta-Sagredo Irene 116
Assi Sahar 28
Austeng Marit Erna 18
Aydoğan Zehra 149

B

Badjie Hazel....212
Bai Jinzi....25; 83
Baily Melissa....12; 13
Baker Sandra....194
Balen Sheila Andreoli 234; 236; 239; 280; 317;325; 326
Balling Laura Winther 183; 186
Barbieri Riccardo 97; 162
Bardy Fabrice 33
Barioni Mantello Erika....267
Barker Melinda....78
Barner Svenja 243
Barylyak Roman 111; 181
BAŞ Banu 150
Basire Clémence 47
Başkent Deniz....58
Battaglini Chiara 281
Battista Martina....281
Baumann Uwe 121
Been Ella.... 310
Bellnier Laura.... 117
Bencsik Beáta 311
Bennett Bec 80
Bennett Rebecca 320
Bergerzon Bitton Orly.... 32
Berrettini Stefano 257
Best Lidia 144; 147
Best Sebastian.... 185
Beswick Rachael.... 31; 85; 86; 208; 210
Betz Rebecca.... 152
Bhamborae Mayur 282
Bhatt Ishan.... 250
Bianchi Benedetta.... 257
Bianco-Bortoletto Giselle 84; 244
Biehl Tanja 316
Bieńkowska Katarzyna.... 238
Bille Michael.... 48
Billing Addison 260
Billinger-Finke Mareike 201
Birkenhäger Ralf 243
Bisgaard Nikolai 23; 167
Bisitz Thomas 46
Bjørnnes Ann Kristin 269
Björsne Andreas 155
Blasca Wanderleia Quinhoneiro 317; 325; 326
Boboshko Maria 10
Boedts Michael 35; 37; 38
Boettcher Peter 195
Boisvert Isabelle.... 130
Boldreghini Marco 166
Bolk Elske 92
Bond Vanessa.... 210
Bonfiglio Maria Vittoria 281
Boothalingam Sriram 41
Borin Michela 133
Borra F. 138
Bothe Ellen.... 80
Bottari Davide 11; 235; 256; 257; 281
Bowen Asha.... 206
Boyce Ella 156
Brandt Sigurd 154
Brazorotto Joseli 234; 317
Bredekjær Nielsen Peter.... 154
Breitsprecher Tabita.... 327
Breteler Monique.... 284
Brewer Scott 41
Briaire Jeroen.... 42
Brinkmeyer Heiko.... 292
Britton Philip N 206
Brotto Davide 91
Brown Angela.... 213
Brunelli Nicola 133
Budathoki Lalita 125
Buhl Mareike 77
Bukato Ewelina 232; 264
Burbury Lucy.... 85; 86

Burgoyne Alexander 226
Burns Benjamin 128
Burrell Rebecca 206
Burum Kristina 259
Bush Matthew 117; 159
Byers Sara 117

C

Cabrera Laurianne 47; 116
Caclin Anne 15
Calcus Axelle 277
Callaway Leonie 31
Calloway Regina 73
Calvino Miryam 203; 204
Camara Lara Louise Pinto 280
Campbell-Bell Cherith 214
Campos Jennifer 72
Canale Andrea 166
Candeo Anna 312
Cao Michelle 83; 87
Carbert Jennifer 11
Cardelús Vidal Sara 119
Carey Bridget N. 302
Carlson Matthew 69
Carpena Nathaniel 271
Casali John 187
Castenmiller Anouck 253
Cebulla Mario 152
Chandrasekaran Preethi 25; 206; 241
Chang Jiwon 102; 108
Chang Shih-Lun 300
Chang So Young 271
Charlier Brigitte 252
Chen Fei 75
Cheng Hsiu-Lien 230
Chesnaayne Michael 41
Cheylus Anne 224
Ching Teresa 137; 208; 210
Chini Angela 133
Cho Hyong Ho 240; 271
Chodkiewicz Aleksandra ... 26; 135; 151; 215; 231; 232; 298; 299
Choe Goune 160
Choi June 102; 294; 322; 324
Choi Jung Yoon 160
Choi Soo Jeong 102; 108
Christensen Jeppe Hoy 94
Chuang Yu-Hsuan 227
Ciocca Valter 14
Ciorba Andrea 133
Clark Julia 206
Clarke Anita 22
Clarke Megan 30
Clarke Paul 30
Colavolpe Benedetta 91
Colin Cécile 252
Colin David 224
Collesei Francesca 235; 256; 257; 281
Comerlatto Junior Ademir Antonio ... 239; 325; 326
Comerlatto Mariane Perin da Silva .. 239; 325; 326
Constable Lee 156
Core Cynthia 266
Corona-Strauss Farah I. 282; 315; 316
Costa Eduardo 236
Cotter Jack 284
Couto Christiane Marques do 296; 297
Crawford Carolyn M. L. 164
Creel Liza 117
Croteau Matthew 41; 163
Crow Sarah 101
Csontos Fatime 311
Cuda Domenico 133
Cundy Linda 272
Curet Carlos 129
Czajka Natalia ... 26; 135; 215; 231; 232; 264; 265; 298; 299
Czaplicka Emilia 298; 299

D

Da Cruz Melville 131; 132
Da Silva Nunes Araújo Arielly Dayane 328
Da Silva Pereira Marcos Vinicius 267
Dąbrowski Piotr 122; 123
Dajani Hilmi R. 114
Dallio Matthias 276
Danielsson Henrik 9; 99; 247
Dantas Lana 317
Dantas Pereira Suzane Cristina 328
Dau Torsten 67
Davis Jordann 206
Dawes piers 80
De Almeida Lima Sá Vieira Tatiana 84
De Carvalho Lopes Karen 84; 244
De Geus Eco 94
De Graaff-Korf Karin 20
De la Cruz-Pavía Irene 116
De Melo Maximino Ketlyn Williany 267
De Moura Ferreira Josefa Viviane 267; 328
Deal Jennifer 57
Deckett Angela 212
Decruy Lien 73
Dede Melike Nur 287
Deja Paulina 111
Delgado Rafael 129
Deshpande Pushkar 154
Deutscher Evelyn 22; 210
Devantier Louise 48
Dhanda Nisha 54
Dhar Sumitrajit 60
Di Berardino Federica 133; 305
Di Blasi Eloise 52
Dickner Sydney 95; 272
Dillard Lauren 318
Dimitrijevic Andrew 190
Djupesland Anja 18
Do Nascimento Costa Helington 291
Doclo Simon 63
Dodson Kelley 251
Domont Xavier 63
Dornhoffer James 69

Dougherty Sonia 206
Downie Lilian 83; 87
Drudi Cristian 162
Duarte Eliza 317
Duarte Josilene Luciene 239; 325; 326
Dubno Judy 3
Dunlap Jason 73
Dwyer Noel 139

E

Edwards Brent 41
Egra-Dagan Dana 96
Eikelboom Robert H. 29
El Aouati Hajar 246
Elbar May 14
Elliott Kayla 153; 168; 208; 210
Ellis Rachel 140
Elwér Åsa 90
Eng Mona 21
Engdahl Bo 40
Engelund Gitte 142; 183; 186; 320
Engel-Yeger Batya 104; 105
Epifania Marina Ottavia 133
Escera Carles 280
Eser Busra Nur 278; 279
Ettinger Ulrich 284
Exter Mats 225

F

Fantoni Marta 256; 257; 281
Faściszewska Maria 238
Federici Alessandra 235; 256; 257
Feenstra Vanessa 65
Feller Hollie 208
Feltis Ann 283
Fenske Mark J. 98; 164
Fenwick Eva K. 249
Ferguson Melanie 80; 127; 130; 137; 320
Ferko Anna 24
Fernandes Bianka Cristina Silva 326
Fernandes de Paula Stella 84
Ferrari Deborah 236
Ferrari Deborah Viviane 239; 325; 326
Ferschneider Mathieu 222
Fiedler Lorenz 49; 274
Firszt Jill 139
Fischer Annabelle 205
Fischer Rosa-Linde 183; 308; 314
Fisher Charlie 73
Fitzgerald John 30
Flamme Gregory A. 40
Flanagan Sheila 260
Flynn Christopher 41
Forli Francesca 257
Foster Sheena 171
Fostick Leah 100
Fournier Philippe 109
Francis Kate L. 78
Francisco Ferreira Do Nascimento Gizele 267; 291; 328
Frau Giuseppe Nicolò 51; 133
Freitas Ganança Fernando 84; 244
Friis Ida Jensen 48; 293
Frijns Johan 42
Frugier Tony 241
Fuchten Denise 29; 39; 107

G

Gáborján Anita 311; 323
Galloway James 163
Gallus Silvano 34
Gan Jerry 95; 272
Gao Esther Yanxin 248; 249
Gao Qi 76
Garbaruk Ekaterina 10
Garcia-Morales Emmanuel E. 27; 28
Gardelin Novkovic Beatrice 191
Garnett Hannah 120
Gavrilis Jason 41; 137; 163
Geijsen Daphne 42
Geisler Jürgen 269
Genitsaridi Eleni 214
Gerkmann Timo 42
Germossa Gugsa Nemera 175
Gervain Judit 91
Gessa Elena 51; 52
Gherpelli Chiara 305
Ghiselli Sara 133
Giammarinaro Lola 224
Giguère Christian 114
Gillespie Alanna 158; 206; 210; 241
Gilley Phillip 4
Gilliver Megan 41; 163
Giovanelli Elena 51; 52
Giroud Nathalie 177
Gkiousias Vasileios 115
Goderie Thadé 306
Gorina-Careta Natalia 280
Gosnell Emilee 170; 301
Gößwein Jonathan A. 77
Göthberg Hanna 221
Goverts Theo 92
Grady Jonny 125
Graf Simone 276
Greczka Grażyna 122; 123
Griouach Hassnaa 191
Grov Ellen Karine 269
Gstrein Christian 303
Guest Hannah 6
Gullotta Jessica 133
Gupta Preeti 249
Gurlek Emre 93
Guyonnet Hencke Timothee 192

H

Haapea Marianne 245
Hagen Rudolf 152
Haines Rachel 214
Hall Amanda 54
Hamed- Daher Shaima 104

Hamed-Daher Shaima 105
Handscomb Lucy 33
Hannula Samuli 245
Hans Stefan 121
Harding Eleanor 58
Hare Julie 89
Harkin Hilary 171
Harkus Samantha 208
Harrison Isla 199; 200
Hartley Douglas 214
Hartog Laura 225
Haukedal Christiane 258
Hauth Christopher F. 225
Hayward Denyse 95; 272
Heeren Jan 46; 50
Heineich Antje 196
Helton Camryn 159
Hendel Rebecca K., ... 55
Henshaw Helen 68
Heo Yujin 286
Hervey George 171
Hestbæk Marianne Kyhne 295
Hildebrandt Andrea 77
Hillman Charles H. 302
Hitos Kerry 132
Hodgson Jan 158
Hoes Joske 124
Hoff Maria 21; 221
Hoffman Howard J. 40
Hohmann Volker 220
Holden Laura 139
Hollander Sophia 243
Holman Jack A. 142
Holmer Emil 9
Holube Inga 225
Homman Lina 247
Hong Kyung Taek 160
Hood Felicity 78
Hoppe Ulrich 173
Horev Nitza 310
Horoliuk Dmytro 111; 181
Horváth Mihály 323
Hou Sanna 163
Howard Antonia 83; 87
Howe Madison 169
Høy Konvalinka Christensen Jeppe 165
Hsieh I-Hui 227; 229
Hu Hongmei 76
Hua Xinyang 241
Hughes Sarah 127
Hui Lisa 241
Huizar Alessandra 189
Huizinga Nicole 65
Humes Larry 59; 247
Hunter Michael 29
Huray Katie 262
Hutchinson Nicole 262

I

Ibelings Saskia 225
Ilicic Ana Maria 308
Illg Angelika 201
Im Gi Jung 102; 108
Incerti Lisa 308
Incerti Paola 41; 137; 163; 320
Inerle Kathrin 308
Ingo Elisabeth 7; 90; 99; 140
Innes-Brown Hamish 64
Iob Erica 235; 256; 257
Isarangura Sittiprapa 178; 179
Iseli Claire 210
Ishida Ieda 194
Iven Verena 112

J

Jablonski Greg Eigner 18
Jackson Kyleigh 16
Jacquemin Laure 106; 112
Jagger Alison 78
Jamieson Nikki 200
Jankunaite Dovile 201
Jansen Lotte 19
Jansen Theresa 220; 225
Jarach Carlotta Micaela 27; 28; 34
Jespersen Charlotte 50
Joergensen Mie L. 55
Johns Michael 73
Johnsrude Ingrid 226
Jones Cheryl 158; 206; 241
Jönsson Radoslava 21
Jørgensen Kristoffer Foldager 48; 293
Josvassen Jane Lignel 48
Juhász Béla 36

K

Kadambari Seilesh 241
Kane Madelynn 304
Kang Byung Jae 324
Kang Hyoung Jin 160
Karakoc Arzu Hediye 278
Karimi-Boroujeni Maryam 114
Kasemkosin Nittaya 178; 179
Kaya Sultan Nur 287
Kaynakoğlu Büşra 216
Kayser Hendrik 220
Keady John 187
Kearsey Irene 141
Kecskeméti Nóra 311
Keijzer Merel 58
Keith William 12; 13
Keppler Hannah 198; 319
Kestens Katrien 198; 319
Keukeleire Virginie 252
Keur-Huizinga Laura 65
Khan Aaliyah 146
Khayr Ranin 96
Khnefies Riad 96
Kiechl Stefan 276
Kim Bo Kyung 160
Kim Hong Jin 324

Kim Min Suk....324
Kim R. Kijoon....251
Kim Seeon....161
Kim Taegyeong....136
Kim Young Ho....290
Kimlin Kristy....31
Kiss Rita....36
Kissner Sven....225
Kitterick Padraig....41; 137; 163
Kluk Karolina....208
Knipping Stephan....292
Knoflach Michael....276
Koivuniemi Kalle....46
Kollmeier Birger....74; 75; 76; 77
Kolodziejak Aleksandra....111
Kondé Márton Vilmos....311
Kong Kelvin....208; 210
Kovalyshyn Khrystyna....24
Kramer Sophia E.....19; 64; 65; 92; 97; 246; 306
Kreitmaier Tim....314
Kressner Abigail Anne....55; 295
Kriebel Jonte....225
Krikorian Danaé....94
Kuchinsky Stefanie....73
Kurz Anja....203; 204
Kuske Silke....173
Kutlu Sevgi....145; 216
Kuyateh Sarjo....269
Kwok Catherine....41

L

Lagacé Josée....109
Laird Emma....127; 130
Lammers Marc....106
Lamoureux Ecosse L....249
Landesmann Claire....103; 144
Langerak Nienke....42
Larsson Josefina....320
Latzel Matthias....282; 316
Laugesen Søren....193
Launer Stefan....316
Laureyns Mark....147
Lee Dong Kyu....136
Lee Gayoung....136
Lee Jun Ho....160
Lee Kichol....187
Lee Min Young....271
Lee Sang-Yeon....160
Lee Seunghyeok....102
Lee Sungsu....240
Lee Ye Hwan....324
Lee Yun Ji....136
Leigh Greg....178; 179; 208; 210
Leis Connely....262
Lelesz Beáta....36
Lelic Dina....185
Lemercier Jean-Marie....42
Lerigo-Smith Natalie....68
Lesinski-Schiedat Anke....121; 182
Leung Joan....12; 13
Lewis-Parmar Helen....120
Li Chuan-Ming....40
Li Karen....72
Lickess Sian....212
Liddle Karen....31; 83; 85; 86; 208; 210
Lignar Nina....151
Lilli Giorgio....133
Limberger Annette....173
Lin Yu-Chun....229
Lipscomb Scott....174
Lissenberg-Witte Birgit....19
Littlejohn Jenna....275
Liu Shirley....153
Liu Yinda....194
Lodes Sophia....303
Löfkvist Ulrika....258
Lohi Venla....245
Lopez Carlos....129
Lopez O'Rourke Jesus....31
Lorens Artur....202; 203; 204; 215
Lorprasert Pongsakorn....178; 179
Lucarini Gaia....91
Lucisano Sergio....43
Lugo Alessandra....34
Lugo Vélez Wanda....289

M

Maat Bert....58
Machado Ana....236
Machajdik Viktoria....276
Mackenzie Charlene....241
Macpherson Lucy....168
Magee Catherine....120
Magnusson Karin....18
Magnusson Lennart....221
Mahairas Anthony....159
Mahon Merle....170; 301
Mahshie James....262; 266
Mai Adrian....316
Malerba Paolo....133
Malhi Amrinder....33
Man Ryan Eyn Kidd....249
Manning Mary....161
Mao Yinan....29
Marcandal Gessika Gomes....325; 326
Marentakis Georgios....237
Markelov Oleg....10
Markov-Glazer Alon....79
Marmel Frederic....185; 186
Marrewijk Esther....42
Marsella Pasquale....257
Marsja Erik....99
Martin James....54
Martinez-Amezcua Pablo....27
Martini Alessandro....82; 91
Martyna Kowalczyk Kaja....154
Maslin Michael....125
Mason Kristen....210
Mattsson Tone Stokkereit....126
Mayer-Suess Lukas....276

Mazurek Birgit 308
McCreery Ryan 88
McHugh Lauren 208; 210
McInerney-Leo Aideen 85; 86
McMahon Catherine 131; 178; 179; 208; 210
McNally Jane 206
McPierzie Hannah 217; 218
McQuarrie Lynn 95; 272
Mealings Kiri 178; 179
Mehta Nischay 33
Melas Konstantinos 284
Melville Jacqueline 212
Meng Qingqing 41
Merchant Shaliza 42
Mertens Griet 203; 204
Mesiano Paolo Attilio 49
Messias Reinaldo dos Santos 239; 325; 326
Mey Kristianna 48
Millman Rebecca 67
Milner Stacey 41
Miscevic Filip 190
Mishra Debabrata 41
Mnyanyi Cosmas Boniface 175
Moberly Aaron 70; 128
Molina Saiz Natalia 119
Molinari Luccini Francesca 9
Monaghan Jessica 41
Moncrieff Deborah 16
Monzani Daniele 305
Moon Il Joon 160; 228; 286
Moradi Samin 11
Moreno-Betancur Margarita 241
Morrison Alison 44
Moulin Annie 8; 15; 222; 224
Mualem-Isayev Michal 96
Muigg Franz 276
Mun Seyoung 271
Murray-Smith Charlotte 30
Musumano Lucia Belen 133
Myers Bronwyn 80

N

Nagaraj Vinay Swarnalatha 175
Nakad Phillip 41
Nallet Caroline 91
Nath Shampa 199
Naylor Graham 142; 268; 318
Ng Elaine Hoi Ning 9
Ng Joel Jia Wei 248
Nielsen Michael 185
Niemczyk Kazimierz 17
Nikolić Mina 255
Ning Xia 128
Nocini Riccardo 305
Nordqvist Peter 140
Nunes-Araújo Aryelly 234; 236; 317
Nuttall Helen E 6

O

Obrycka Anita 151; 215
Ockelmann Julian 177
Oetting Dirk 225
O'Keeffe Isabel 208
Oldenburg Jan 269
O'Leary Ryan M. 223
Oleson Jacob 88
Oliveira Junior Mauricio 317
Oliver Jane 41
Ollivier Solenn 114
Ong Vanessa Ching Shuen 248
Orzan Eva 257
O'Shea Amie 153; 208
Ostojić Zeljković Sanja 255
Overmark Mathilde Marie 295
Ozonuk Riza 41

Ø

Øderud Tone 175
Øygarden Jon 175

Ö

Özgünay Eray 63

P

Paglialonga Alessia 97; 162
Palasanthiran Pamela 206
Palma Silvia 305
Panagiotou Elisavet 309
Pang Jermy 137; 153; 168; 208; 210
Pankowska Zuzanna 264
Papadakis Georgina 241
Papakyriakou Emma 212
Papazian Michael 128
Papoutselou Efstratia 214
Park Hong Ju 5; 45; 136
Park Hyun Jin 160
Park Jin Gyun 118
Park Moo Kyun 118; 160
Park Na Kyum 5
Park Sungwon 228
Parker Rachel 156
Parkinson Bonny 137; 208; 210
Parveen Sabiha 283
Pastuszak Andrzej 151
Patel Anushri 212
Patel Chirag 86
Patterson Kelly 213
Pavani Francesco 51; 52; 133
Peelle Jonathan E. 6; 223; 302
Pektas Sjöstrand Alev 191
Perfect Gemma 196
Persson Anna 258
Philips Cato 106
Piccirillo Enrico 138
Pichora-Fuller M. Kathleen 72
Picinali Lorenzo 52; 71
Pinto Câmara Lara Louíse 267; 328
Piros Zsuzsanna 36
Plack Christopher J 6
Polanoski Caroline 262
Polka Linda 11; 281

Polo Edoardo Maria 97; 162
Polony Gábor 311
Pontoni Francesco 51
Popieul Justine 15
Porowski Marek 299
Porter Ann 208
Poulakis Zeffie 78; 158; 208; 210; 241
Powell Kim 241
Pozzi Marco 133
Praetorius Mark 327
Prodi Nicola 51
Pronk Marieke 107
Prud'homme Luna 277
Pryce Helen 54
Purdy Suzanne 12; 13
Puripanyo Kriengkrai 178; 179
Putter-Katz Hanna 310

Q

Qian Whitney Zi-Yang 210
Quan Jinyu 194
Quaranta Nicola 56
Quental Sávia Leticia Menuzzo 296; 297
Quilter Megan 50; 154
Quinhoneiro Flavia Pegorim 317; 325

R

Racine Sophie 307
Rackl Annika 303
Raes Lotte 319
Rajasingam Saima 170; 301
Rajguru Suhrud 129
Ramappa Ravi 199
Ramos Alice Fontes Monteiro 239; 325; 326
Ramsperger Marc 241
Rance Gary 83; 87; 158
Ratuszniak Anna 299
Reavey-Cantwell John 285
Redi Cathrine 237
Reed Nicholas S. 27; 28; 57
Reeder Ruth 139
Rehal Omnia 159
Reid Natasha 31
Reiter Evan 285
Rekswinkel Mats 113
Rennies-Hochmuth Jan 63
Renz Laura 315
Reuter Lisa 201
Rhodes Sarah 67
Ricketts Todd 61
Rivolta Marcelo 214
Robertson Lucy 268
Robinson Lauren 159
Roh Min 194
Rohatyn Stephan 272
Rohatyn-Martin Natalia 95; 272
Rollwage Christian 63
Rosenhall Ulf 21; 155; 221
Rosi Tommaso 51; 52; 133
Rosner Thomas 195
Rossi Sonja 276; 303
Rovetti Joseph 226
Ruigendijk Esther 143
Rullmann Kim Marleen 220
Rumble-Tricker Carson 98
Ruocco Caroline 307
Rupil Jessica 312
Rutledge Kate 41

S

Sadeghi André 21; 155; 221
Sadeghkhani Sajad 114
Sadler Viola 52
Saffery Richard 241
Sandvej Matilde Grønborg 295
Sandvik Anette 258
Sanna Mario 138
Santiago de Snyder Soami 289
Sap Aleyna 279
Sardone Rodolfo 56
Sartorato Edi Lúcia 84; 244
Saunders Gabrielle 67; 196; 318
Savio Guillermo 129
Scharf Max 75
Scheibl Viola 152
Scheper Annette 92
Scherpiet Sigrid 177; 198
Schiavone Francesca 235; 256; 257
Schliermann Rainer 79
Schrøder Charlotte 154
Scorpecci Alessandro 257
Sear Tracey 89
Seebacher Josef 276; 303
Seeon Kim 189
Segovia Alejandro Mondejar 280
Seil elizabeth 137
Selfridge Liz 120
Senanayake Praween 132
Senderski Andrzej 17
Seo Jae-Hyun 160
Şerbetçioğlu Mustafa Bülent 278; 279; 287
Serrão Robert 165
Seydnejad Saeid R. 114
Shahana Rani 248
Shahnaz Navid 14
Shang Xiaoyin 163
Sharma Rajan 137
Sharp Nez 6
Sheehan Jane 78
Shepard Emily 153; 208
Shepherd Daisy 22; 25; 208; 241
Sherman Kerry 80
Shin Min Young 160
Shinn Jennifer 117
Shyng Grace 194
Signoret Carine 7
Silvola Juha Tapio 269
Simeone Davide 97
Simmenroth Anne 152
Simon Jonathan 73

Singh Gurjit 98; 164
Singh Jasleen 62
Skarżyński Henryk 26; 111; 135; 151; 181; 215; 231; 232; 264; 265; 298; 299
Skarżyński Piotr Henryk.... 26; 111; 135; 151; 181; 215; 231; 232; 264; 265; 298; 299
Skoog Ingmar 155
Skyrud Katrine Damgaard 18
Slade Kate 6
Small Emily 262
Smeds Karolina 142; 196
Smit Diane (A.L.) 29; 39; 107
Smith Alyssa C. 164
Smith Hailey C. 223
Smith Libby ... 22; 83; 87; 141; 153; 156; 158; 168; 206; 208; 210; 241
Smithers-Sheedy Hayley 206; 241
Smits Cas 19
Soares Isabelly 234
Socher Michaela 90
Somogyi Anikó 323
Souza da Silva Sabrina 328
Souza Livia 234
Sparacino Giovanni 312
Spinella Domenico 51
Stavrinos Georgios 309
Steele Lindsey 142
Stefancu Ioana 113
Stegeman Inge 29; 39; 107
Steinmetzger Kurt 308
Stenbäck Victoria 9; 99
Stensvold Andreas 269
Stöver Timo 173
Straatsma Thijs 107
Strauss Daniel 282; 315; 316
Ström Isabella 90
Stronks Christiaan 42
Stropahl Maren 177
Strube Michael 139
Sucher Cathy 127; 130
Suh Myung Whan 160
Sundström Simon 258; 259
Sung Valerie . 22; 25; 78; 83; 85; 86; 87; 141; 153; 156; 158; 168; 206; 208; 210; 241
Szalai Nóra 311
Szigeti F. Judit 311
Szilvássy Zoltán 36
Szydłowski Jarosław 122; 123

T

Taevernier Anja 37; 38
Taitelbaum Swead Riki 100
Taitelbaum-Swead Riki 96
Talbot Debbie 200
Tamás László 311; 323
Tamati Terrin 70; 128
Tan Benjamin Kye Jyn 248; 249
Tan Benjamin Yong-Qiang 248
Tan Sidney Wei Zhao 248
Tang Chi Ho 76
Tavora-Viera Dayse 203; 204
Taylor Alon 132
Telischi Fred 129
Tertyshnaia Mariia 88
Themann Christa L. 40
Thibodeau Linda 146; 161; 189
Thomas Julia 67
Thurner Isabella 303
Tien Ling 300
Timmer Barbra 80
Timmesfeld Nina 173
Tinnemore Anna 226
Toft-Nielsen Jonathon 129
Tokgöz-Yılmaz Suna 216
Tollin Daniel 4
Tommila Akseli 233
Topaç Hilal Şüheda 287
Torre Peter 174
Torres Romero Yamile 119
Toscano Dias Rogeria Cristina 291
Trabalzini Franco 257
Trau-Margalit AVital 100
Trevisi Patrizia 91
Trojaniello Diana 162
Tromballi Giuseppina 133
Tronstad Tron Vedul 175
Trübswetter Nicole 314
Tsiolkas Jessica 137
Tsoukala Andromachi 143
Tucker Julie 120
Tuomainen Outi 49
Turnbull Katja 163
Twisk Jos W.R. 246

U

Uhler Kristin 4
Uilenburg Noëlle 124
Undurraga Jaime 113; 193
Urbanelli Anastasia 43
Uus Kai 115

V

Vaez Nara 182
Valzolgher Chiara 51; 52; 133
Van Buynder Patricia 208; 210
Van den Bosch Lion 124
Van der Ploeg Kitty 124
Van Dommelen Paula 20
Van Eeckhoutte Maaike 113; 165
Van Goylen Louise 198
Van Hedger Stephen 226
Van Rompaey Vincent 106
Van Straaten Henrica L.M. 20
Van Wier Marieke 19; 306
Van Wier Marieke F. 246
Van Wieringen Astrid 48
Vanderveken Olivier 106
Vanderveken Olivier M. 112
Vargas Perera Roger 315
Vasenna Saskia 124

Vatti Marianna....165
Vaughan Deidre....212
Verbraecken Johan....112
Verdaasdonk Sophie....306
Verkerk Paul H.....20; 124
Versteeg Marjolein....107
Vettori Gaia....162
Vickers Deborah....71; 89; 170; 260; 301
Vieira Karen dos Santos....239
Vikhnina Sofia....10
Villalon Yohan....224
Visentin Chiara....51
Vital Bianca....236
Vogel Asmus....55
Vogelzang Margreet....143
Völter Christiane....121; 173
Vonk Lisanne....124
Voss Solveig....194
Vuye Cedric....112

W

Wagener Kirsten C.....46; 225
Waight Emma....206
Wake Melissa....25; 208; 241
Walker Elizabeth....88; 197; 304
Wang Jing....25; 83; 141; 210
Wang Yuchen....210
Want Simon....212
Ward Bryan K.....40
Warner-Czyz Andrea....101; 146
Warzybok Anna....75
Warzybok-oetjen Anna....76
Washnik Nilesh....250; 283
Wasser Janice....32
Waters Philip....153; 208
Webb Emma....156; 158
Wechsler-Kashi Deena....53
Weiss Michelle....41
Wendt Dorothea....64; 67; 94; 274
Wengelin Åsa....90
Wennberg Siri....126
Westgate Philip....117
Wettstein Markus....308
Whiston Helen....275
White Stephanie....16
Whittington Oliver....285
Wiegmann Maxima....201
Wienen Johannes....64
Wilding Michael....120
Willberg Tytti....233; 245
Williams-Kane Madelynn....197
Williger Bettina....308; 314
Winther Balling Laura....185
Winzell Juhlin Åsa....155
Wittenback Hannah....101
Wolff Julia K.....308
Wong Chiew Meng Johnny....249
Wong Hayley....168
Wong Lena L N....75; 76
Worsley Alison....212
Wurm Susanne....308
Wysocka Katarzyna....17

X

Xiong Andrew....226

Y

Y.C Ching Teresa....168
Yaakobi Erez....310
Yong Nathania....83
Young Taegan....163
Yousef Mehat....203

Z

Zaar Johannes....49
Zakis Justin....41
Zanetti Diego....133
Zdanowicz Rita....135; 215; 232; 264
Zekveld Adriana....64; 65; 94; 97
Zelger Philipp....276
Zeller Simon....327
Zeng Weiyi....284
Zhang Vicky....41; 137
Zhu Xiuming....194
Zimmerman Deena R.....32
Zobay Oliver....318
Zych Monika....122; 123