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POSTER ABSTRACTS

Topic areas and poster numbers:

AUDITORY PROCESSING / TINNITUS

Category: Auditory Processing / Tinnitus

Poster #: 001

Effects of Brain Injury History on Listening Effort and Fatigue

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Objectives: The objective of the present study was to investigate self-perceived hearing difficulties, listening-related fatigue, and post-speech-in-noise listening effort in adults with a history of traumatic brain injury. It was hypothesized that adults with a history of TBI would report higher degrees of self-perceived hearing difficulties, listening-related fatigue, and listening effort when compared to a control group.

Design: Cross-sectional, between-subjects design. Two groups (TBI and control) of young to middle-aged adults were recruited. The TBI group included 18 adults 20-55 years of age with a history of TBI or concussion. The control group included 16 adults 18-58 years of age without any history of TBI or concussion. Inclusion criteria for both groups included pure-tone thresholds within the clinically normal range of ≤25 dB HL from 250-8000 Hz. Self-perceived hearing difficulty was assessed with the Adult Auditory Performance Scale. Self-perceived listening related fatigue was assessed with the Vanderbilt Fatigue Scale for adults. All participants completed speech-in-noise testing measured with the Listening in Spatialized Noise-Sentences (LiSN-S) test. Post-speech-in-noise subjective listening effort was assessed using the National Aeronautics and Space Administration Task Load Index (NASA-TLX).

Results: Results revealed that adults with a history of TBI perceived significantly greater degrees of hearing difficulty, especially in noise, and listening-related fatigue when compared to the control group. In contrast, speech-in-noise performance was not significantly different between groups. Despite comparable speech-in-noise performance between the TBI and control groups, the adults with a history of TBI reported significantly higher degrees of subjective listening effort compared to the control group.

Conclusions: The findings from the present study suggest that even in the presence of normal audiometric thresholds and comparable speech-in-noise performance, individuals with a history of TBI experience greater degrees of subjective hearing challenges when compared to the control group. These challenges are particularly evident when listening in background noise, which may account for the higher levels of listening-related fatigue observed in the TBI group. These findings underscore the importance of considering self-reported listening experiences in clinical assessments and interventions for individuals with a history of TBI.

Category: Auditory Processing / Tinnitus

Poster #: 002

Interaural Differences and Top-Down Attention Shape Activity in Prefrontal Cortex

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Objectives: The successful deployment of spatial selective attention is necessary for everyday listening, and individuals with hearing loss often struggle with spatial hearing tasks. This study investigated how interaural time differences (ITDs) and interaural level differences (ILDs) shape neural representations of

sound sources and how those representations are influenced by top-down attention. We hypothesized that providing small spatial cues would elicit poorer task performance and greater hemodynamic responses in the prefrontal cortex during an auditory spatial attention task.

Design: Forty normal-hearing adults (ages 18-30) completed a spatial auditory attention task where they selectively attended to one of two concurrent sound streams. Participants were tasked with listening for the target word "bash" in the attended stream while ignoring "dash" and "gash" in either stream. Target and masker word onsets were randomized in time to eliminate the use of rhythm cues. The four spatial separation conditions used in the study include small ITDs (5 degrees), small ILDs (5 degrees), large ITDs (15 degrees), and large ILDs (15 degrees). Behavioral performance was measured using hit and false alarm rates. We also measured hemodynamic activity in both hemispheres of the prefrontal cortex using functional near-infrared spectroscopy (fNIRS).

Results: Participants demonstrated improved behavioral performance with large spatial cues, as evidenced by increased hit rates and reduced false alarm rates. fNIRS data revealed greater changes in oxygenated hemoglobin concentration when participants were presented with large spatial cues, but we observed no differences between ITDs and ILDs. These effects were primarily driven by activity in the left hemisphere, consistent with previous studies that have shown effects in the left inferior frontal gyrus.

Conclusions: Our results suggest that larger spatial separation results in ease of spatial selective attention and increased activity in the prefrontal cortex. An ongoing body of literature suggests that hemodynamic responses in the prefrontal cortex exhibit a non-monotonic relationship with task difficulty, indicating how cognitive resources may be utilized during effortful listening. When extrapolating our results to listeners with hearing loss, we might expect that hemodynamic responses will be greater as listeners engage more cognitive resources when completing a similar listening task. Future work will further investigate the relationship between hearing status, spatial cue size, and activity in prefrontal cortex, thereby contributing to our understanding of the neural mechanisms underlying auditory attention.

Category: Auditory Processing / Tinnitus

Poster #: 003

Exploring THS-H Response Patterns and Considerations Among Bilingual Adults

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Objectives: Audiologists use subjective reports to guide their practice when weighing potential interventions such as hearing aids, when determining hearing aid fitting approaches, and when the best course of clinical action is not straightforward. The recently published consensus study report from the National Academies of Sciences Engineering and Medicine titled "Measuring Meaningful Outcomes for Adult Hearing Health Interventions" highlights the importance of subjective measures, including them in their recommended core outcome set. The Tinnitus and Hearing Survey - Hearing subscale (THS-H) is

one such subjective outcome measure widely used with United States (U.S.) service members and Veterans in both clinical and research contexts, and probes subjective reports of hearing difficulty. For bilingual individuals, it is currently unknown if and how the use of more than one language in daily life may influence the factors considered and the responses made on the survey. In the present study, bilingual adults provide initial and follow-up responses to an administration of the THS-H in order to explore these factors.

Design: Participants include over 300 bilingual U.S. service members aged 18+. All participants completed the THS-H and were subsequently prompted to provide follow-up details including: for each situation presented in the THS-H, which language(s) they considered when making their response, the frequency of occurrence, and the importance of hearing well in each situation. They were then asked to complete the THS-H again while specifically considering situations involving each of their languages separately. Responses are examined with respect to demographic characteristics as well as details of the participants' bilingual language experience (e.g., proficiency, age of acquisition).

Results: Data collection is ongoing. Preliminary findings indicate that bilingual adults make varied considerations with respect to language use when reporting hearing difficulties. For example, participants who report equal proficiency between English and their most-proficient non-English language are more likely to consider interactions in both their English and non-English languages when responding to the THS than participants who reported unequal proficiency between languages. Preliminary analysis of follow-up THS scores shows that for the majority of participants, there was limited change in THS-H scores when instructed to think about a specific language as compared to the language-agnostic initial response. However, for these language specific responses, there are associations between factors such as hearing sensitivity, language variables, and the THS-H score when considering interactions involving only that language.

Conclusions: The goal of this study is to clarify the considerations that bilingual patients may make when completing self-report metrics of hearing difficulty, and to identify any factors that may influence individual responses on these tools. The findings of this study contribute to the growing literature regarding speech-in-noise outcomes in bilingual adults. They also highlight the relevance of querying language history with bilingual patients in order to provide optimal patient-centered care.Disclaimer. The views expressed in this abstract are those of the author(s) and do not necessarily reflect the official policy of the Department of Defense, the U.S. Government, or the Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

Category: Auditory Processing / Tinnitus

Poster #: 004

"Sweaty Audiology": Evaluating Suprathreshold Auditory Function Following Physical Exertion

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Objectives: While in the line of duty, military service members may be exposed to high levels of noise and/or blasts which may cause damage to their auditory system. While many tests of auditory system function have been developed and validated under laboratory and/or clinical testing environments, there is a need to evaluate tests for use in field testing environments to allow for rapid triage of potential auditory injury. The goal of the present study was to evaluate two tests of suprathreshold auditory function in service members under conditions approximating those that could be encountered during field testing, including participants who are fatigued, stressed, etc.

Design: Participants for this study were Sailors serving in the United States (U.S.) Navy who had just completed their annual physical readiness testing, which culminates with cardiorespiratory fitness component (running, biking, rowing, or swimming). A total of 135 personnel were enrolled in the study, including 57 females. Auditory tasks included a masking level difference task, which has been shown to be sensitive to acute auditory injury, and the Spatial Digit Test, a component of the U.S. Army fitness for duty standard. Participants also completed pure-tone threshold testing, a hearing history questionnaire, and reported their current levels of stress and recovery using the Short Recovery and Stress Scale. Data from these participants was analyzed to examine the effects of stress and recovery on the auditory test measures. Data were also validated against a cohort which had completed the same auditory tasks under clinical testing conditions. All field measures were taken using a validated boothless audiometer headset and tablet-based testing.

Results: Preliminary analyses of the data have revealed the following findings. Pure tone thresholds did not differ between testing cohort (clinic vs field), indicating that the fitness component did not have an effect on pure-tone thresholds and that the equipment produced similar results to a clinical setting. The overall distribution of scores on the Spatial Digit Task does not appear to be impacted by testing cohort, and there is no apparent effect of stress/recovery state on performance of this task. Interestingly, performance on the diotic (N0S0) condition of the Masking Level Difference task is associated with participants' current recovery state, where those who reported greater levels of recovery (i.e., more rested and relaxed) had better performance on the N0S0 task. Additionally, as a cohort, participants who were tested immediately following their physical readiness test showed better performance on the N0S0 task as compared to those tested in the traditional setting.

Conclusions: The goal of this study is to clarify the considerations that bilingual patients may make when completing self-report metrics of hearing difficulty, and to identify any factors that may influence individual responses on these tools. The findings of this study contribute to the growing literature regarding speech-in-noise outcomes in bilingual adults. They also highlight the relevance of querying language history with bilingual patients in order to provide optimal patient-centered care.Disclaimer. The views expressed in this abstract are those of the author(s) and do not necessarily reflect the official policy of the Department of Defense, the U.S. Government, or the Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

Category: Auditory Processing / Tinnitus

Poster #: 005

Exploring the Relationship Between Laboratory and Real-World Loudness Perception

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Objectives: This study aimed to investigate the relationship between loudness perception measured in controlled laboratory settings and real-world environments among individuals with normal hearing and experienced hearing aid users. The hypothesis was that loudness ratings obtained in the lab would correlate with those reported in everyday listening situations, thereby informing more effective hearing aid fittings.

Design: A total of 51 participants were recruited: 16 young normal-hearing (NH) individuals (age<35; 5 females) and 35 older hearing aid users (ages 44–88; M=71, SD=9.8; 11 females). Hearing aid users were fitted with Starkey Edge AI 24 Receiver-in-Canal (RIC) devices programmed using the eSTAT 2.0 fitting formula. Loudness perception was assessed using two tools: Revoloud, which presents 60 non-speech everyday sounds in a lab setting, and the Cambridge Aided Loudness Profile (CALP), a questionnaire evaluating loudness and appropriateness of everyday sounds in the field. Normal-hearing participants completed both assessments on the same day, while hearing aid users completed CALP after acclimatization of at least one week.

Results: Loudness ratings from Revoloud and CALP showed weak correlations across both participant groups when categorized into soft, average, and loud subgroups. Spearman's rank correlation coefficients ranged from 0.02 to 0.27 for NH participants and from -0.02 to 0.24 for hearing aid users, depending on sound level. In Revoloud, aided loudness ratings were significantly lower than NH ratings for soft and average sounds, but similar for loud sounds. In contrast, CALP loudness ratings showed significant differences only for loud sounds, with NH participants rating loudness higher than aided users. Despite variability in loudness ratings across individuals and contexts, most eSTAT 2.0 fittings achieved loudness levels within the normal hearing range. Appropriateness ratings in CALP were similar between NH and aided groups, particularly for average sounds. When all sound levels were considered together, strong correlations were observed between Revoloud and CALP ratings for both NH ($\rho = 0.86$) and aided groups ($\rho = 0.81$).

Conclusions: This study found that loudness ratings obtained in laboratory (Revoloud) and real-world (CALP) settings were weakly correlated when categorized by sound level. This suggests that hearing aid users' criteria for evaluating loudness may differ between laboratory and field assessments. This discrepancy may reflect contextual influences, as previous research has demonstrated that loudness perception can be modulated by factors such as memory, cognitive load, multisensory context, and the listener's internal state, which are likely to vary between controlled experimental settings and everyday listening environments. While loudness ratings differed between normal-hearing and aided participants-particularly for soft and average sounds in Revoloud and loud sounds in CALP-appropriateness ratings were similar across groups, especially for average sounds. These findings underscore the importance of incorporating both objective and subjective measures in hearing aid fittings. They also highlight the need for further research to better understand individual loudness preferences and improve fitting strategies that reflect real-world listening experiences.

Category: Auditory Processing / Tinnitus

Poster #: 006

Validation of the High-Definition Spectral-temporally Modulated Ripple Test

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Objectives: The Spectral-temporally Modulated Ripple Test (SMRT) was designed to assess spectral resolution which is essential for speech understanding especially in noise and has been shown to predict individual differences in speech understanding in normal hearing (NH), hearing-impaired, and cochlear implant listeners. The SMRT utilizes a 3-alternative forced choice paradigm (1-down/1-up) where ripple density of the target stimulus is modified until the listener cannot distinguish between the target and reference. The result is the approximate 50% point on the psychometric function. To avoid confounds of loudness cues and edge effects, a shifting spectral centroid is used throughout the task. However, Resnick and colleagues (2020) found an underestimation of spectral resolution thresholds when using the SMRT in NH listeners due to insufficient sine wave carrier densities which created a maximum of 16 ripples per octave (rpo). To mitigate this, a newer version (High-Definition SMRT; HD-SMRT) was created that has a maximum of 200 rpo. This newer version has yet to be validated against the existing version. The purpose of this study was to compare the original SMRT and HD-SMRT in NH adults to determine whether HD-SMRT provides a valid measure of spectral resolution for clinical and research applications. Our hypothesis is that for lower performers (< 6 rpo), scores will be similar across the two versions but for performers that can detect a higher number of rpo, there will be a strong but compressive relationship between the two tests.

Design: This cross-sectional study will test fifteen NH listeners (puretone thresholds< 25 dB HL 250 to 4000 Hz) with both test versions presented diotically at 65 dB (A) through insert earphones. Relationships between test versions will be probed using correlation and regression (linear and non-linear) analysis.

Results: Preliminary results found that a group of five NH listeners (average 37 years old) have a mean SMRT threshold of 9.00 rpo (SD 1.93) and a mean HD-SMRT threshold of 15.33 rpo (SD 1.93) with a Pearson's rho of 0.72.

Conclusions: This preliminary dataset revealed differences in absolute threshold between the SMRT and HD-SMRT. The strong correlation between tests suggests that both tests are probing the same underlying ability, supporting its use as a replacement for the SMRT with improved resolution. More data is needed including those with higher spectral resolution thresholds. However, validation should also be performed on a range of hearing-impaired including cochlear implant listeners. If validated, the HD-SMRT may serve as a more sensitive tool for identifying subtle differences in spectral discrimination ability among NH listeners.

Category: Auditory Processing / Tinnitus

Poster #: 007

Music Perception, Cognition, and Auditory Function in Older Adults

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Objectives: The objective of this study was to evaluate whether individual differences in music perception (specifically, pitch, melody, and rhythm discrimination) systematically predict variability in peripheral and central auditory outcomes in older adults, controlling for differences in cognitive skills. Importantly, we aimed to investigate this question in a well-characterized, lab-based cohort using validated measures of music perception, cognitive skills, and hearing abilities. Grounded in recent interdisciplinary theories, we hypothesize that stronger musical perception abilities will be correlated with more sensitive hearing and better central auditory function. We also aim to characterize any differential patterns of associations between music perception and hearing abilities in older adults.

Design: Participants aged 65 years and above (N = 79, data collection ongoing) who self-reported no hearing impairments or use of assistive listening devices completed a series of music perception; peripheral and central auditory; neurocognitive assessments, and demographic questionnaires. Music perception was assessed using the validated Swedish Musical Discrimination Test (melody, rhythm, pitch subtests). Central auditory processing was assessed using validated tests of speech perception-in-noise (SPIN), here speech recognition of sentences from the PRESTO set; and measures of spectral, spectrotemporal, and temporal resolution (here Q-SMD; SMRT; MDT). Four-frequency pure-tone averages (PTA) were computed in the better and worse hearing ear. Additionally, non-verbal cognition (i.e. executive function) and verbal cognition (verbal learning and immediate recall memory) were measured using the validated NIH Toolbox-Cognition battery. Multiple linear regression models were tested, regressing hearing sensitivity (i.e., PTA scores) and central auditory function scores onto music perception scores; accounting for the effects of age, sex, and cognitive abilities.

Results: Regression models showed that temporal processing (MDT) in older adults was positively associated with musical rhythm (beta = -0.32, p = .0054) and musical pitch perception (beta = -0.37, p = .0025), where lower scores show better resolution. Additionally, differential relationships emerged between hearing abilities and musicality, wherein: (1) spectrotemporal processing (SMRT) was positively associated with melody perception (beta = 0.23, p = .0030); (2) SPIN was positively associated with rhythm perception (beta = 0.22, p = .036; N = 45); and (3) greater peripheral hearing sensitivity (worse hearing ear) was positively associated with pitch perception (beta = -0.25, p = .026). Music perception did not significantly predict variability in other peripheral or central auditory measures in our cohort.

Conclusions: Stronger music perception abilities are positively associated with both peripheral and central auditory function in older adults, as predicted by recent theories, over and above the effects of cognition. Of the music perception skills tested, rhythmic sensitivity was most relevant for SPIN; melodic sensitivity for spectrotemporal processing; and pitch sensitivity for peripheral hearing sensitivity. Additionally, both rhythm and pitch perception abilities are correlates of temporal auditory processing.

These results represent associations rather than causal directionality, offering correlates worth exploring in future research and providing evidence for individual differences in music perception as a potential clinically-relevant predictor of hearing health in aging.

Category: Auditory Processing / Tinnitus

Poster #: 008

Head Injury and the Neural Encoding of Binaural Temporal Cues

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Objectives: The mechanisms underlying speech understanding difficulties in normal-hearing individuals with a history of mild traumatic brain injury (mTBI) are poorly understood. Previous work suggests that mTBI may impact binaural processing abilities, which are important for localization and the detection of signals in noise. However, many common measures of binaural hearing rely on auditory as well as cognitive processes. Therefore, it is unclear whether impaired performance is due to mTBI-related deficits in auditory processing, cognitive processing, or both. To begin disentangling the effects of mTBI on these mechanisms, this work used a pre-attentive neural measure that does not depend on cognitive processing to examine the auditory encoding of a binaural interaural phase difference cue. It was predicted that participants with mTBI would show reduced neural response strength when compared to participants with no history of head injury. It was also predicted that variability in the response within the mTBI participant group would be related to factors such as the number of head injuries or the time since injury.

Design: This work includes data from the interaural phase modulation following response (IPM-FR), a passive neural response elicited by an ongoing amplitude modulated tone in which the phase of the carrier frequency shifts between the two ears at a rate of 6.8 Hz. The resulting steady state response at 6.8 Hz is thought to reflect sensitivity to the temporal fine structure of the signal. The magnitude of the IPM-FR was measured from over 30 normal-hearing participants with and without a history of mTBI. Participants also completed a control condition that contained no interaural phase shift. Responses to this condition were used as an estimate of "noise" to calculate the signal-to-noise ratio of the neural response.

Results: Preliminary analysis revealed that IPM-FRs are present across participants, but that there is large variability in response amplitude and signal-to-noise ratio. Linear regression will be used to determine the effect of mTBI on the IPM-FR magnitude and signal-to-noise ratio after accounting for potential effects due to age or hearing sensitivity. In the subset of participants with mTBI, linear regression will be used to explore relationships between IPM-FR metrics and individual mTBI characteristics to identify factors that explain variability in neural responses from the sample of participants with a history of mTBI.

Conclusions: This work provides important information about the effect of mTBI on the auditory encoding of binaural cues. Future work will explore relationships between the IPM-FR, behavioral measures of central auditory processing and speech understanding in noise, as well as self-reported auditory difficulties to better understand how this neural response relates to functional hearing abilities in this unique patient population. This is part of a larger body of work that aims to use a combination of neural and behavioral measures to tease apart the relative contribution of auditory and/or cognitive deficits that underlie speech understanding difficulties and self-reported auditory difficulties in patients with mTBI. This work will have important implications for the future development of clinical tools and protocols for assessing and managing auditory difficulties in this patient population.

Category: Auditory Processing / Tinnitus

Poster #: 009

Hearing Loss, Social Isolation and Dementia

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Objectives: Hearing loss and social isolation are considered independent, modifiable risk factors for dementia. However, the synergy between HL and SI remains unclear. We aimed to examine the joint impact of hearing loss and social isolation on dementia. We hypothesize that the combined association of the two risk factors exceeds the sum of their independent effects.

Design: We conducted a cross-sectional analysis of community-dwelling adults aged 65 years and older in the U.S. from the nationally representative 2022 National Health and Aging Trends Study (NHATS) (n=4,712). Hearing loss was defined as a better-ear pure-tone average >25 dB on a tablet-based auditory assessment. We measured binary SI using a four-domain questionnaire (living arrangement, core discussion network, religious services attendance, and social participation). Dementia was evaluated using the NHATS dementia algorithm (reported dementia diagnosis, AD8, and neurocognitive tests). We used survey-weighted Poisson regressions to assess the combined association of hearing loss and social isolation with dementia.

Results: The weighted prevalence of hearing loss alone, isolation alone, both combined, and dementia was 41.4%, 7.5%, 14.4%, and 9.2%, respectively. Compared to those without hearing loss or isolation, the prevalence ratio for dementia was 1.95 (95% CI: 1.38, 2.75) for hearing loss alone, 1.30 (95% CI: 0.75, 2.25) for isolation alone, and 2.42 (95% CI: 1.66, 3.52) for those with both conditions. The super-additive interaction between the two factors was not statistically significant (Synergy Index = 1.1, 95% CI: 0.4, 1.9).

Conclusions: These findings suggest that the presence of both hearing loss and social isolation is associated with a higher prevalence of dementia compared to either factor alone. However, the combined association did not exceed the sum of their independent effects. While no significant interaction was observed, hearing management should consider coexisting isolation as a dementia prevention strategy.

Category: Auditory Processing / Tinnitus

Poster #: 010

Hearing Loss and Plasma Biomarkers of Alzheimer's Pathology and Neurodegeneration

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Objectives: Hearing loss is highly prevalent among older adults and is associated with poorer cognitive function. Whether hearing loss is a cause or consequence of pathological brain changes with aging is debated in the field, and studies are mixed. We examined the association between audiometric hearing and plasma biomarkers of Alzheimer's disease neuropathology (Amyloid β42 to Amyloid β40 ratio [Aβ42/Aβ40], phosphorylated tau [p-tau181]) and neurodegeneration and neuroinflammation (glial fibrillary acidic protein [GFAP], neurofilament light chain [NfL]) in older adults. We hypothesize that poorer audiometric hearing is associated with measures of neurodegeneration and neuroinflammation (GFAP and NfL), but not with Alzheimer's disease specific biomarkers (Aβ42/Aβ40 and p-tau181).

Design: We analyzed 1,139 participants from the Atherosclerosis Risk in Communities (ARIC) study. A 4-frequency pure tone average (PTA) (Visit 6, 2016–2017) of audiometric thresholds of the better-ear (0.5, 1, 2, and 4 kHz) was the independent variable, modeled continuously. Standardized plasma biomarkers were the dependent variables, measured at Visit 5 (2011-2013, N=474), Visit 6 (N=551), or Visit 7 (2018-2019, N=130). Plasma biomarkers were transformed to account for non-normality if needed. We conducted weighted multivariable linear regression models for each biomarker adjusted for time (years) between measures of hearing and plasma, eGFR, BMI, APOE ε4, age, sex, race and study center, educational attainment, hypertension, diabetes, smoking status, coronary heart disease, high-density lipoprotein, total cholesterol, and hearing-aid use among participants with hearing loss. Global cognition (factor scores derived from 10 neurocognitive tests) served as a positive control and paralleled the analyses for plasma biomarkers. Multiple imputation by chained equations was used for missing exposure and covariate data. We also modeled hearing as clinical categories (<25 dB HL, 26-40 dB HL, and >40 dB HL). In sensitivity analysis, we restricted the sample to participants with plasma measured at Visits 6 or 7 (n=596) and at Visit 5 (n=543).

Results: Participants had a mean age of 80.1 years at Visit 6, 60.2% were women, and 27.4% were self-identified Black race. After full adjustment, each 10 dB HL increase in PTA (worse hearing) was statistically significantly associated with higher plasma log2(NfL) (β=0.057, 95% CI: 0.007-0.107) and lower global cognition (β=−0.061, 95% CI: -0.106 to -0.017). No statistically significant associations emerged with Aβ42/Aβ40, GFAP, or p-tau181. Inference was unchanged when hearing was modeled as clinical categories. Inferences were of similar magnitude but showed variation in estimates and confidence intervals, while maintaining the same direction of association for plasma biomarkers measured at Visits 6 and 7. Associations with higher log2(Nfl) and log2(GFAP) at Visit 5 was associated with worse hearing.

Conclusions: Among community-dwelling older adults aged 71-93 years, worse peripheral hearing correlated with plasma markers of neurodegeneration after adjustment for demographic and clinical factors, but not with amyloid pathology. Our finding supports a pathway in which hearing loss accelerates cognitive decline via neurodegenerative processes rather than Alzheimer's disease-specific pathology. Whether neurodegeneration in the brain is a cause or consequence of hearing changes should be investigated in future studies.

Category: Auditory Processing / Tinnitus

Poster #: 011

A Computational Re-Examination of Noise-induced Cochlear Synaptopathy

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Objectives: Based on our prior work in animal models of noise-induced cochlear deafferentation/synaptopathy, we have hypothesized that auditory nerve fibers with low spontaneous rates (SR) of firing are preferential targets of injury, that their loss may render the system less able to decode signals in noise, and may contribute to development of abnormal auditory perceptions like tinnitus and loudness intolerance, common in human sensorineural hearing loss. Such changes could occur through loss of fibers with specific response profiles or through a change in phenotype of fibers remaining after noise. To test these hypotheses, we performed in vivo assessments of cochlear and auditory nerve (dys)function correlated with underlying histopathology in a gerbil model of noise-induced temporary threshold shift. In parallel, we developed an in silico mathematical model to simulate different scenarios of low- vs high-SR fiber loss and of altered low- vs high-SR phenotypes for those that remain. This model simulates the degree and nature of underlying deafferentation and predicts cochlear outputs.

Design: Two groups of gerbils received a 2-hour exposure to an octave-band noise centered at 4 kHz. Noise-band sound pressure level (SPL) was set at 100 dB or 103 dB. Distortion product otoacoustic emissions (DPOAEs), auditory-nerve compound action potentials (CAPs), and counts of immunostained synapses and hair cells were obtained at 5 time points post exposure from 24 hours to 36 weeks, and in

age-matched, unexposed controls (n=115 animals across groups). An in silico modeling approach was used to simulate different types and degrees of deafferentation and potential changes in the functional phenotypes of remaining fibers. Here, in ears with confirmed normal outer hair cell status, CAPs were simulated across a range of different degenerative scenarios including deafferentation without or with phenotypic change in remaining fibers.

Results: Both noise-exposed groups exhibited DPOAE and CAP thresholds that were acutely diminished but fully recovered within two weeks, ruling out lasting damage to outer hair cells. After 100 dB exposure, DPOAE and CAP amplitudes also fully recovered and CAPs even exceeded controls at longer post-exposure times, although 25% of synapses in the noise-injury region were lost. To investigate this paradox, we simulated the selective deletion of low-SR fibers. The model reproduced the recovery of CAP thresholds and amplitudes, suggesting that low-SR loss had little impact on these metrics. In contrast, gerbils exposed at 103 dB SPL showed full recovery of thresholds over two weeks, but CAP amplitudes remained significantly depressed-despite synaptic loss comparable to, or even less than, that observed after 100 dB SPL noise. Simulating the deletion of low-SR fibers failed to replicate this outcome. However, for both exposures, modifying the phenotype of surviving fibers in the model yielded a successful fit for the CAP amplitudes.

Conclusions: This study demonstrates a promising model for the study of synaptopathic outcomes either without or with a change in the phenotype of surviving fibers. Single unit confirmation will follow, with future work extending to perceptual outcomes. Supported by: Agence Nationale pour la Recherche, Inserm, Cochlear France, Gueules Cassées, Fondation Pour l'Audition, US Department of Defense

Category: Auditory Processing / Tinnitus

Poster #: 012

Effects of an Acute Noise-Exposure Sporting Event on Audiometric Measures

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Objectives: Noise exposure is one of the most common, and preventable causes of acquired hearing loss, yet much remains unknown about short-term effects on auditory function. Exposure to high-intensity noise can damage peripheral and central auditory structures, including outer hair cells and auditory-nerve-fibers synapses, resulting in loss of outer-hair-cell function, which elevates thresholds and reduces frequency selectivity. Even in the absence of overt, permanent hearing loss, noise exposure can lead to cochlear synaptopathy. This study's objective was to evaluate immediate functional changes in the auditory system following a real-world high-intensity noise-exposure event. It was hypothesized that individuals exposed to elevated sound levels during a Purdue University basketball game would exhibit short-term changes in audiometric and physiological measures of hearing function. Most human studies assessing sporting-event-related noise-induced hearing loss include delays between the noise exposure

and testing (e.g., next-day testing), whereas this study was designed to capture immediate noise-exposure effects.

Design: This prospective, within-subject study recruited college-aged adults with normal hearing who were already planning to attend Purdue basketball games. Each participant completed a hearing assessment, including standard and high-frequency audiometry, wideband tympanometry, distortion product OAEs, and MEMRs just prior to the game, having been out of noise >48 hours. Testing was completed in Purdue's mobile hearing unit equipped with a sound booth parked close to the arena. During the game, participants wore a calibrated, personal sound dosimeter that measured overall noise exposure. Within one hour, participants completed post-exposure testing replicating baseline measures to assess acute auditory changes. A subset of participants received full diagnostic testing in Purdue's Audiology Research Diagnostic Core Lab before and within one week after noise exposure to assess recovery. Participants also completed online surveys assessing noise-exposure history, demographic information, perceived hearing abilities, and details of their event attendance. Data were analyzed using paired t-tests and linear mixed-effects models to evaluate changes between baseline and post-exposure sessions and to examine correlations between sound-exposure dose and perceptual reports.

Results: Results will include estimates of average noise levels experienced during basketball games and post-exposure changes in audiological measures, including thresholds, OAEs, MEMRs. Analyses will explore whether participants exposed to higher average sound levels exhibited greater temporary changes in auditory function. Findings are expected to show (once basketball seasons starts) small but measurable short-term auditory changes in some participants, with variability related to exposure dose and individual susceptibility. These findings will provide insight into how acute, recreational noise exposure influences peripheral auditory function and how individual exposure history contributes to outcome variability.

Conclusions: By testing participants within an hour of a major sporting event using FDA-approved portable equipment, this project provides a more precise assessment of immediate effects of noise exposure. The results contribute to a growing understanding of how acute noise events affect the auditory pathway and demonstrate the potential value of portable diagnostic tools for rapid post-exposure assessment. Clinically, these findings may support earlier detection of noise-related auditory changes, inform counseling about safe listening practices, and guide development of improved hearing-conservation strategies for young adults frequently exposed to high-intensity recreational noise.

Category: Auditory Processing / Tinnitus

Poster #: 013

Heated Reactions: Mapping Misophonic Responses to Trigger Sounds

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Objectives: Misophonia is characterized by intense negative emotional reactions to specific sounds, yet limited research has systematically examined the multidimensional nature of how emotional reactions, reaction intensity, and trigger sounds differ between individuals with and without misophonia. This

study used novel heat map visualizations to compare which sounds triggered reactions and what emotions were experienced across groups. We separately examined reaction intensity for each sound and group, as well as effects of age, sex, and mental health diagnoses. influenced these patterns within and between groups.

Design: 168 adult participants completed an online survey, recruited through posted campus flyers and misophonia support forums. The Duke-Vanderbilt Misophonia Screening Questionnaire (DVMSQ) classified participants into control and misophonia groups (n = 84 each) Participants rated emotional responses to 37 trigger sounds from the Selective Sound Sensitivity Syndrome Scale Trigger Checklist (S-Five-T), selecting one of emotion categories (no feeling, irritation, anger, disgust, distress, panic) and rating intensity (0-10) for each sound. Participants also reported demographics (age, sex, gender identity) and mental health conditions.

Results: Demographic factors (age, sex, mental health diagnosis) showed no significant effects on misophonia severity, trigger count, or emotional reaction patterns. The top 10 triggers differed between groups in both frequency and intensity. The misophonia group's top triggers were predominantly eating-related sounds, with loud chewing ranking first (92.8% of participants), while controls' top triggers included more environmental sounds, with snoring ranking first (60.2%). Seven sounds appeared in both groups' top 10 but ranked differently. The misophonia group's highest intensity rating in the misophonia group (loud chewing, 8.3) significantly exceeded controls' highest (yawning 5.3, snoring 4.6). Heat maps displaying emotion-sound combinations and intensity analyses revealed divergence in emotional patterns between groups., For sounds like loud chewing and teeth sucking, heat maps showed controls predominantly reported irritation at low intensity, while the misophonia group reported anger and disgust at significantly higher intensities. In the group difference heat map, anger distinguished groups most clearly. Statistical analysis confirmed 18 sounds elicited significantly higher frequencies of anger in misophonia participants. Every eating-related sound showed at least one emotion at significantly higher rates in the misophonia group, most commonly anger, disgust, or irritation.

Conclusions: Both control and misophonia groups experience negative emotions to many common sounds, particularly eating-related ones. However, the emotion profiles and intensities distinguish the groups. Heat maps and intensity analyses revealed that controls predominantly report irritation at low intensities, while the misophonia group reports high-intensity anger and disgust to the same sounds, with anger most clearly differentiating groups. These findings demonstrate that misophonia is defined by the convergence of specific sounds, emotions, and intensities. Heat maps can guide future research by revealing which sound-emotion combinations best isolate misophonic responses. Clinically, treatment may benefit from targeting the specific the specific emotion-intensity profile characterizing each individual's presentation.

COCHLEAR IMPLANTS

Category: Cochlear Implants

Poster #: 014

Effect of Cochlear-Implant Stimulation Rate on Speech Cues

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Objectives: Cochlear implants (CIs) can be highly successful at restoring recognition in some but not all users. One programming choice that can affect speech recognition is stimulation rate. There is some support that lowering the stimulation rate can improve sentence recognition for CI users that are older or have long durations of severe-to-profound hearing loss. However, the effect is highly inconsistent across listeners. This study used a speech cue discrimination task to exact more control over the stimuli. It was hypothesized that discrimination of words with primarily temporal cues would improve with increasing stimulation rate and discrimination of words with primarily spectral cues would become worse with increasing stimulation rate. It was also hypothesized that the optimal stimulation rate would be individualized; specifically, older individuals and those with longer durations of severe-to-profound hearing loss would have improved performance using lower stimulation rates.

Design: Temporal cue discrimination, spectral cue discrimination, and sentence recognition were measured in 17 adult CI users using Cochlear Ltd. devices. Their ages ranged from 19-83 years. An audiology graduate student programmed a research processor with five stimulation rates: 250, 500, 720, 900, and 1800 pulses per second. Using a phoneme categorization task, temporal and spectral cue discrimination abilities were evaluated with single word stimuli that varied primarily in a single cue: Dish-Ditch (silent interval duration), Beak-Peak (voice onset time), Wheat-Weed (vowel duration), and Bid-Bed (formant frequency). Sentence recognition was evaluated using sentences from the Perceptually Robust English Sentence Test Open-set (PRESTO).

Results: Silent interval (Dish-Ditch; i.e., temporal change) perception improved with increasing stimulation rate for younger, but not older participants. Formant frequency (Bid-Bed; i.e., spectral change) perception improved at higher stimulation rates for younger participants and at lower stimulation rates for older participants. The other contrasts did not show significant rate and age effects. The effect of stimulation rate on sentence recognition was not significant at the group level; however, individual participants demonstrated large performance changes across stimulation rates.

Conclusions: The results demonstrate that rate can greatly affect speech perception with a CI; however, it is still difficult to predict performance at an individual level based on patient characteristics because the optimal stimulation rate varies across the type of speech cue being assessed. Furthermore, performance is not readily predicted by participant age or duration of severe-to-profound hearing loss. Based on these results, one approach to improve speech recognition with a CI would be to analyze the types of cues that are problematic for the individual user, along with consideration of patient age. Together, these factors can guide audiologists when deciding whether or not to change the stimulation rate away from a default rate.

Category: Cochlear Implants

Poster #: 015

Heat Map Patterns: Predicting Array Position, Map Stabilization, & Outcomes

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Objectives: Impedance telemetry is a valuable tool during cochlear implant programming that may be underutilized. The addition of the impedance heat map matrices with color-coded grid visualization may provide insight into electrode placement and map stabilization and subsequently may predict hearing outcomes in patients. Impedances, measured in kOhms, often change in the early stages of activation of the device. There is a direct correlation of kOhms measured to the required electrical current needed to ensure audibility. A change in electrical stimulation can impact hearing outcomes therefore the time to impedance stabilization is important. The goal of this study is to determine how impedance heat map matrices can provide information to audiologists on electrode placement, including extra cochlear contacts, as well as evaluate the relationship between impedance and map level stimulation as a factor of patient demographics.

Design: Our retrospective study identified 68 patients implanted with a Med El cochlear implant from 2023 to 2025 at our center. We identified and analyzed various demographics, mapping parameters, and objective measures to determine their relationship with impedances levels, impedance and map stabilization, and patient outcomes over time. We analyzed age, gender, etiology, implanted array, side of implantation, impedance kOhms, most comfortable (M) charge units, and angular insertion depth as well as speech outcomes scores (CNC, Az Bio Quiet and Az Bio Noise) at each visit within the first year. Quantitative analysis will be performed to analyze heat map patterns and impedance matrix values by imaging classification group (full vs partial insertion) to evaluate common patterns. Average time to impedance stabilization will also be calculated as a function of days. Lastly, Impedance stabilization results will be stratified based on demographic factor and patient outcome scores.

Results: It is expected that heat map patterns will be identified by imaging classification groups. It is expected that those patients who reach impedance and map stabilization at a faster rate, will perform better on speech outcome measures.

Conclusions: This data will highlight how impedance measures can be used to provide information on electrode array placement as well as provide insight on demographic factors that may impact time to impedance stabilization.

Category: Cochlear Implants

Poster #: 016

Cochlear Implant Electrode Effects on Spectral Representation and Resolution

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Objectives: Recent directions to improve cochlear implant (CI) outcomes include anatomy-based fitting, channel deactivation based on perceptual or objective measures, and electroacoustic stimulation (EAS).

These methods often involve changing the frequency range allocated to the CI, utilizing different electrode lengths, or changing the number and/or location of electrodes in the cochlea. Whether intentionally or not, these adjustments frequently alter the spectral representation of the signal. Spectral representation refers to the physical output of the CI, independent of perceptual ability. Spectral resolution refers to the ability to process spectral information perceptually. Given that spectral coding is a critical component of outcomes with a CI, it is likely that changes in spectral representation contribute to (if not completely explain) the benefits observed in studies where the frequency allocation, electrode length, or number of active electrodes are manipulated. For instance, anatomy-based fitting reduces the mismatch between spiral ganglion place-pitch and CI place-pitch by increasing the electrode length or reducing the frequency range. However, both manipulations improve spectral representation through greater separation of frequency information presentation in the cochlea. Similarly, raising the low-frequency cutoff in EAS patients to increase the amount of acoustic information presented improves spectral representation by reducing the frequency range for a fixed electrode length. This study examines how electrode length, number of channels, and frequency range affect spectral resolution, the perceptual correlate of spectral representation.

Design: We derived models of spectral representation within the cochlea using estimates of various electrode insertion depths (161, 279.9, or 380.5 degrees), number of electrodes (11, 17, or 22) and frequency ranges (188-7938 Hz or 438-7938 Hz). Multiple combinations of these parameters were created to isolate the effect of each variable. Two common broadband tests (SMRT and QSMD) were used to measure spectral resolution for standard-length electrode maps corresponding to each model.

Results: As predicted by models, longer electrodes, more electrodes, and smaller frequency range all improved performance on both SMRT and QSMD. Scores for both tests were highly correlated, indicating both are sensitive to spectral resolution. As a proxy for spectral representation, we calculated the slope of the angle-to-frequency function. These slopes were very highly correlated with SMRT and QSMD scores ($r^2 = 0.81$ and 0.89, respectively), implying a strong relationship between models of spectral representation and measures of spectral resolution.

Conclusions: Methods such as anatomy-based fitting or EAS result in enhanced spectral representation, which was strongly correlated with improved spectral resolution. Given that speech perception is highly dependent on spectral resolution, our findings provide good evidence that improvements in speech outcomes seen from anatomy-based fitting or EAS may be at least partially driven by improvements in spectral resolution.

Category: Cochlear Implants

Poster #: 017

MarkeTrak25-Survey of Cochlear Implant Users: Use, Satisfaction, and Benefits

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Objectives: The objectives of the study were 1) to provide insights into the current state of satisfaction, use, and quality of life improvements for implant users 2) to investigate the age of implants, listening situations where implant users feel the implant is helpful..

Design: Since 1989, HIA has been collecting data on the estimated incidence of hearing loss within the U.S., education related to hearing aid use, satisfaction with hearing instruments, new user rates by age, mental and physical health effects of hearing loss, and many others. Every three to four years, HIA commissions a detailed survey with comprehensive findings on these topics. In the current complete version of the MarkeTrak survey (2025) over 15,000 households were contacted, resulting in 2079 non-owners of hearing aids, 1134 owners of hearing aid and eighty-three cochlear implant owners were identified. The implant owners were surveyed about the following: their use of the devices, the age of the implant, if the implant was bilateral, if the implant was fitted monaural, did they also wear a hearing aid, and what financial assistance was received.

Results: This poster will review the findings of the latest version of the MarkeTrak25 survey, with a focus on the cochlear implant users in regards to wearing time, satisfaction, improvement in quality of life. The data reveals that the expanded criteria for implantation may have impacted patient wearing time, satisfaction and quality of life improvements. Compared to previous data from the 2022 MarkeTrak survey, several of these measures deceased. These results may be related to new implant users that may have single-sided deafness, or implant wearers with opposite ear hearing aid use that can depend on alternative methods of hearing/communication.

Conclusions: The expanded implant criteria may have had an impact on wearing time as compared to previous implant users. These may relate to the nature of some of these patients using the implant less frequently due to other means of hearing communicating e.g. hearing aids or normal opposite ear. These poinnts will be discussed with attendees.

Category: Cochlear Implants

Poster #: 018

A Perception-Production Link for Emotional Prosody in Cochlear-Implanted Children

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Objectives: School-age children with cochlear implants (CIs) show high individual variability in emotional prosody identification. In recent studies, we have found that factors such as duration of device experience and cognitive function are significant predictors of emotion perception outcomes in this population. Emotional productions by children with CIs also show unexplained variability. We hypothesize that emotional prosody perception shapes emotional prosody productions, and that earlier age at implantation allows for emotional productions by children with CIs to be more strongly shaped by their perceptions. The objective of the present study is to test this hypothesis.

Design: Participants were 20 children with CIs, 6-18 years old, all implanted by age 3 and with no usable acoustic hearing at birth. Emotional prosody identification and production were tested using previously published methods. For identification, stimuli comprised 12 sentences (semantically emotion-neutral) read by an adult female talker in five emotions (angry, happy, neutral, sad, scared). Participants heard the resulting 60 sentences in random order at a mean level of 65 dB SPL. The task was to indicate which of the five emotions the listener thought was being expressed, with no feedback. Accuracy scores (% correct) were used in data analyses. For production, participants were asked to read a list of 20 simple sentences in a happy way and a sad way, with no feedback and no exemplars or training. In acoustic analyses of the recordings, we focused on the average acoustic contrast between the standard deviation of the voice pitch contour for happy vs. sad productions (F0SDratio) in each individual participant, as this measure has been shown to be significantly correlated with emotion perception outcomes in our previous work.

Results: Perception and production measures were significantly correlated. We categorized participants into four groups: those implanted earlier than the mean age at implantation and with less than or more than the mean number of years of experience with the device (Groups 1 and 2 respectively); those implanted later than the mean age at implantation and with less or more than the mean number of years of experience with the device (Groups 3 and 4 respectively). Results showed that F0SDratio and Group significantly predicted perception accuracy, with a significant interaction between the F0SDratio and participant Group. Specifically, Group 1 (earlier implanted and with less device experience) showed a significantly stronger positive association between F0SDratio in the productions and the emotion identification accuracy than Group 4 (later implanted and with more device experience).

Conclusions: These results suggest a stronger perception-production link in children who were implanted earlier and have less experience with the CI (younger in age), compared to children implanted later and with more CI experience (older in age). This supports our hypothesis that perception may shape production more strongly in those who are earlier implanted. It is possible that the window for this influence is limited, which would account for children with less experience showing a stronger perception-production link than children with more device experience. Results should be interpreted with caution as findings are preliminary.

Category: Cochlear Implants

Poster #: 019

Impact of Cochlear Implant Simulation on Singing and Speech Production

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Objectives: The primary goal of this study was to assess the impact of cochlear implant simulation on auditory feedback for singing and speech production. A secondary goal was to examine potential relationships between singing and speech production under cochlear implant simulation conditions to levels of musical training and sophistication, pitch perception, melody identification, and the ability to segregate interleaved melodies.

Design: Twelve young hearing adults sang three common nursery rhymes and produced speech of varying lengths and complexity in quiet and while listening via a cochlear implant simulator. The intensity of the auditory vocal feedback via the simulator was sufficient to the mask bone-conduction of the participants' voices. The participants also completed a music sophistication questionnaire, a pitch discrimination task, a melody identification task, and an interleaved melodies segregation task in quiet and while listening with the simulator. The pitch, intensity, rate and formant characteristics of the speech and singing samples were evaluated acoustically and compared across listening conditions and to the questionnaire and perceptual task results.

Results: The speech and singing of those participants with greater levels of music training and sophistication were less impacted by the simulator than those participants with little or no musical training. They also demonstrated more accurate pitch and melody perception and were less impacted by the simulator during the interleaved melody segregation task.

Conclusions: The results of this study suggest that musical training and sophistication allows listeners to compensate for the degraded speech and vocal auditory feedback from the cochlear implant simulator. Pitch and melody perception skills may relate to this ability to compensate.

Category: Cochlear Implants

Poster #: 020

Machine Learning vs Human Responses to Predicting Post-Implantation Speech Perception Outcomes

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Objectives: There is substantial heterogeneity in cochlear implant (CI) speech perception outcomes, making individualized patient counseling challenging. Hearing health providers currently rely on clinical experience, patient history, and subjective interpretation of available data to estimate postoperative performance. While these individualized predictions represent the current standard of care, they are highly variable and frequently misaligned with true measured outcomes. Recent advances in machine learning (ML) offer the potential to support data-driven prediction of CI outcomes; however, the generalizability and real-world performance of these models across clinical settings remain uncertain. In this study, we compare the predictive performance and confidence levels of an internally validated ML model against expert clinician estimates to compare accuracy, confidence, and potential future utilization.

Design: An ML model previously trained, validated, and published on a 1,877 patient dataset was used to make predictions on 6-month post implantation CNC and AzBio scores for an external, pilot dataset of 15 patients. Demographic, medical, audiological, and preoperative speech perception scores were used as inputs. ML predictions were compared to predictions made by 65 clinicians given the same information from a prior study.

Results: Mean average error, confidence, and interclass correlation coefficients between the ML model's predictions and clinician predictions were evaluated. For the model, preliminary analysis showed that AzBio scores for 13 of 15 patients were predicted within one quintile (+/- 20% AzBio in quiet) of their true value. Both raw speech perception scores, as well as the difference between pre- and post-operative scores, were determined for AzBio and CNC.

Conclusions: Comparing clinician and machine learning performance on an external dataset provides insights on the generalizability and usability of such models. While the current pilot dataset is small, results from this analysis help inform the feasibility of future implementation of ML models as a support tool for clinical counseling. Future work will need to evaluate its performance in larger heterogenous datasets with larger proportion of good and poor CI speech perception outcomes, and understand clinicians attitudes, barriers, and facilitators to its potential utilization.

Category: Cochlear Implants

Poster #: 021 **Mentored Student Research Poster Award**

Effect of Neuroticism on Speech-Perception Performance in Adults CI Users

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Objectives: Cochlear implants (CIs) are an effective treatment for moderate-to-profound hearing loss, yet outcomes in speech perception vary widely across recipients. While factors like duration of deafness and etiology of hearing loss partially explain this variability, they account for only a small fraction of the variance in outcomes, suggesting the influence of additional patient-specific traits on speech-perception performance. This study examines the effect of neuroticism-one of five personality traits within the gold-standard "Big Five" personality framework-as a potential predictor of CI speech-perception outcomes. In a variety of medical contexts, neuroticism-a person's tendency to experience distress-has been shown to predict rehabilitative outcomes in multiple clinical populations. We hypothesized that CI users with lower neuroticism (i.e., individuals that are less likely to experience negative reactions to distress) will outperform those with higher neuroticism traits on demanding speech-perception tasks.

Design: Fourteen CI users completed the gold standard personality assessment (NEO-FFI-3) to determine their scores in the domain of neuroticism. Speech perception was assessed using AzBio sentences in quiet and in noise at +10-dB SNR. Functional near-infrared spectroscopy (fNIRS) neuroimaging and full-body physiological measures (heart rate, respiratory rate, skin conductance) assessed real-time listening-induced cortical engagement and physiologic stress responses during speech-perception testing. Additional co-variates were collected, including cognitive ability in the domain of inhibition-control using the Flanker task and an estimate of spectrotemporal resolution using the Spectro-Temporal Ripple for Investigating Processor EffectivenesS (STRIPES) task.

Results: Results revealed that CI users with higher neuroticism achieved significantly poorer speech-perception scores in noise compared to those with lower neuroticism ($\beta = -2.08$, $SE = 0.71$, $t(5) = -2.92$, $p = .033$), when accounting for duration of deafness, chronological age, cognition, and spectrotemporal resolution. CI users with high neuroticism demonstrated heightened activation of the sympathetic nervous system during the more challenging, speech-in-noise condition, evidenced by increases in heart rate and skin conductance. CI users demonstrating greater listening-induced stress also had decreased activity in executive-functioning brain regions during challenging listening (speech-in-noise), suggesting that activation of the autonomic nervous system (fight-or-flight response) impaired their ability to access higher-level cognitive resources that could aid in successful speech perception in noise. A reduction in activity within executive-function brain regions triggered by a heightened physiologic stress response could explain the limitation in speech-perception ability in individuals with high neuroticism.

Conclusions: CI users that have higher neuroticism scores scored more poorly on speech-perception testing in-noise. Neurophysiological differences consistent with increased activation of the sympathetic nervous system were observed in the high neuroticism group. Findings from this project add to the current knowledge of the biological factors that influence CI outcomes, while also providing a more holistic understanding of CI individual differences. More directly, these findings will allow clinicians to identify specific personality traits that may put individual CI users at a disadvantage for performing well with their device. Our results could also inform CI candidacy assessments by identifying personality profiles that may contribute to positive outcomes, offering insight into preoperative counseling and post-implantation support strategies.

Category: Cochlear Implants

Poster #: 022 **Mentored Student Research Poster Award**

Effects of Spectral Resolution on Phoneme Perception with Cochlear Implants

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Objectives: Cochlear implant (CI) technology has significantly improved hearing and language outcomes for individuals with moderate sloping to profound hearing loss. However, despite continued technological improvements, the clarity of the frequency information in the CI signal is still limited. Better spectral resolution (i.e. an individual's ability to discriminate differences in the frequency content) is associated with better speech understanding outcomes among adult CI recipients. However, the specific acoustic-phonetic cues and categories of speech sounds that are directly affected by spectral resolution remain unclear. Therefore, this project aims to examine the effect of altering spectral resolution by systematically reducing the number of frequency channels in the CI on phoneme perception. We will test the hypothesis that phoneme categorization and the perception of vowel contrasts are affected by acute changes to width of electrode bandwidths and an individual's spectral resolution capabilities.

Design: This study included 30 (anticipated N = 45) post-lingually deafened adult CI users with Cochlear brand devices. We also plan to include 15 typically hearing (TH) adults as a comparison group. CI participants completed tasks of spectral resolution, voicing perception, place of articulation perception, and vowel recognition in the following five conditions: all electrodes active, 10 electrodes active, 8 electrodes active, 6 electrodes active, and 4 electrodes active. TH participants completed the same battery of assessments, including in vocoded CI simulation conditions.

Results: Linear mixed-effects models assessed whether spectral resolution predicts: (1) accuracy, category boundaries, and discrimination of voicing and place of articulation features; (2) vowel recognition accuracy and confusion patterns. Preliminary results from CI users showed that spectral modulation detection performance was a significant predictor of both consonant place of articulation and vowel recognition accuracy. Spectral modulation detection performance was not related to consonant voicing accuracy. Electrode deactivation was associated with poorer performance on the spectral modulation detection task; poorer spectral modulation detection performance was associated with reduced accuracy for place of articulation and overall vowel recognition. Data collection to assess changes in consonant identification function category boundaries and slopes, as well as changes in vowel-specific perception, is ongoing.

Conclusions: These results will help inform not only our understanding of a mechanism contributing to the variability in CI benefit, but potentially the acquisition of phoneme categorization among children with CIs who develop spoken language with an altered auditory signal. This research is an important first step in developing appropriate paradigms and stimuli to assess phoneme categorization using other methodologies, for example neuroimaging, that can be used with young children. Furthermore, these results can guide the development of targeted programming techniques and aural rehabilitation to address phoneme confusions.

Category: Cochlear Implants

Poster #: 023 **Mentored Student Research Poster Award**

Cochlear Implant Perception of Contrastive Focus is Tied to Pitch Access

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Objectives: Prosodic variations mark important information in speech and guide the listener's understanding of meaning that cannot be obtained by recognizing the words alone. Prosody is carried by multiple acoustic cues but is generally dominated by F0 (pitch). Pitch perception is known to be limited for cochlear implant users, and their performance on prosody perception tasks accordingly reveal relatively poor performance. The current study tested the hypothesis that listeners with cochlear implants would compensate for reduced access to pitch information by upweighting duration or intensity cues in a new paradigm for assessing prosody perception using whole-sentence stimuli and a multiple sliding scale granular response method. Psychoacoustic measures of voice pitch discrimination were also collected to determine if perceptual weighting was constrained specifically by perceptual acuity. Outcomes will contribute to the understanding of mechanisms underlying difficulties in accessing meaning "beneath the surface" of speech reported by CI users.

Design: In the main experiment, 28 CI users and 32 TH listeners (all adults) listened to stimuli where voice pitch, intensity, and duration were independently controlled to signal targets of prosodic focus within full sentences. Participants reported granular perception of emphasis for words in each trial, giving the opportunity to observe different strengths of perception rather than an all-or-none choice. Acoustic cue weighting was calculated as a difference in scaled perception responses for words that were aligned with targets of prosodic focus cues vs. not aligned. In the psychoacoustic experiment, 20 CI users and 15 TH listeners were tested for F0 difference limens (F0DLs) for single-word speech stimuli at 90, 200, and 280 Hz, which spans a range from levels where F0 is accessible for CI users, to a range reflective of the talker in the main experiment, up to a range where F0 is hypothesized to be mostly inaccessible for CI listeners. F0DLs were then included in model analyses of cue weighting to examine contributions of perceptual access to cue weighting strategies.

Results: TH and CI listeners both primarily relied on voice pitch cues when perceiving prosodic focus, with significantly smaller reliance by CI users. Compensatory upweighting of intensity and duration cues was observed for CI users. In the psychoacoustic experiment, CI listeners displayed F0DLs that were significantly poorer than those for TH listeners, and also more variable. Inclusion of F0DLs improved the cue weighting statistical model, indicating that perceptual access to F0 contributes to cue weighting strategies. Conversely, age and duration of device experience did not contribute.

Conclusions: CI users do not make as effective use of voice pitch when perceiving prosody compared to TH listeners, putting them at risk for misunderstanding a talker's intended meaning, even when words are accurately perceived. Perceptual cue weighting of F0 appears to be constrained by absolute acuity and is related to compensatory upweighting of intensity and duration cues, which are relatively less reliable in natural speech.

DIAGNOSTIC AUDIOLOGY / OTOLOGY

Category: Diagnostic Audiology / Otology

Poster #: 024

Tone Detection in Remote-Frequency Noise in Individuals with Down Syndrome

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Objectives: Previous research has demonstrated that the ability to listen selectively in the frequency domain is immature during infancy and early childhood. One consequence of immature frequency-selective listening is that infants and children younger than about 7 years of age show elevated detection thresholds for a pure-tone in the presence of remote-frequency noise that does not produce masking for adults. This study tested the hypothesis that frequency-selective listening skills take longer to develop in individuals with Down syndrome relative to peers who are neurotypical due to impairments in executive function and/or inconsistent listening experience (e.g., fluctuating hearing loss due to middle ear fluid or wax impaction).

Design: Participants were children and young adults (5-25 years) with Down syndrome (DS) with varying degrees of hearing sensitivity. Children who are neurotypical (NT; 4-10 years) with normal hearing (250-8000 Hz) were tested for comparison to prior research. An adaptive, two-interval, forced-choice (2IFC) observer-based psychophysical procedure was used to estimate detection thresholds for a 1000-Hz tone in quiet and in the presence of a remote-frequency band of noise (4-10 kHz, 60 dB SPL) that was presented to the same (ipsilateral) ear as the pure-tone signal. The signal was randomly presented during one of two 500-ms temporal windows, separated by an interstimulus interval of 1000 ms.. The examiner was blind to which interval contained the signal and made their decision based solely on the participant's behavior. Data collection also included a hearing evaluation at standard clinical frequencies (250-8000 Hz) and extended high frequencies (11.2, and 16 kHz), tympanometry and wideband acoustic immittance, and a standardized measure of executive function (BRIEF).

Results: Results:Detection thresholds for the 1000-Hz tone tended to be higher for participants with DS than participants who are NT in both quiet and in the presence of remote-frequency noise. This pattern of results is consistent with elevated audiometric thresholds observed for most participants with DS. In agreement with prior studies, results for NT participants older than 7 years of age indicate similar or lower (better) thresholds in the remote-frequency noise masker relative to thresholds in quiet. Preliminary data collected on four participants with DS (14-20 years) show similar detection thresholds in quiet and in noise.

Conclusions: Tone detection thresholds in a remote-frequency noise masker and in quiet are currently being collected to characterize the time course of development for remote-frequency masking in children and young adults with DS relative to their NT peers. Early results from the NT sample are consistent with previous work showing better thresholds in noise than in quiet for children 7 years of age and older. Ongoing data collection efforts are focused on testing additional participants with DS and NT 4- to 6-year-olds.

Category: Diagnostic Audiology / Otology

Poster #: 025

Effects of Respiratory Alkalosis with Persistent Postural-Perceptual Dizziness Diagnosis

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Objectives: Persistent Postural-Perceptual Dizziness (PPPD) is a condition characterized by chronic functional dizziness, typically starting after a vestibular insult and requiring psychiatry referrals. The dizziness characteristics of PPPD, including swaying, rocking, and disorientation, also resemble the symptoms seen in patients with clinically symptomatic chronic respiratory alkalosis (CSCRA). CSCRA is a state of reduced carbon dioxide (CO2) levels causing an alkaline blood pH. Dizziness and lightheadedness occur with CSCRA because reduced CO2 directly affects brain oxygenation, but this condition is little-known in vestibular care settings. Low CO2 levels are often the result of altered breathing patterns due to an underlying condition (e.g. post-infectious changes, sleep disorders, right-to-left shunting, medications, lung disease). While PPPD and associated anxiety disorders can contribute to dizziness and imbalance, undiagnosed CSCRA could be driving a patient's symptoms. Appropriate referrals and treatment can significantly improve quality of life, as evidenced by the chosen case study.

Design: A case study was selected from a large-scale population study of patients seen for vestibular assessments and Aerospace Medicine consultations at a tertiary medical center. A 23-year-old male patient was first seen for a vestibular assessment at the request of his neurologist. The patient's dizziness presented after an episode of febrile illness and was characterized by sensations of unsteadiness, swaying, and rocking, with onset a year prior to his vestibular evaluation. A vestibular test battery, including videonystagmography, oculomotors, video head impulse testing (vHIT), rotary chair testing, and subjective visual vertigo (SVV) testing, was completed along with an end-tidal CO2 screening. Vestibular testing indicated hyperactive peripheral vestibular system responses and some central integration issues. The patient was also referred to Aerospace Medicine for evaluation, including acid-base analysis (arterial blood gas testing), symptom provocation testing, and consultation.

Results: The patient exhibited a prolonged processing time during oculomotor tasks, abnormal perception of verticality to the right, and increased gain during rotary chair testing. Overall results revealed atypical visual and vestibular processing, indicating central vestibular system involvement and possible PPPD. The patient was referred to Vestibular Rehabilitation, Psychiatry, Integrative Medicine, and Aerospace Medicine. Based on the Aerospace Medicine consultation, the patient was diagnosed with CSCRA, with predisposing factors of a childhood history of asthma, dysfunctional respiratory mechanics, and significant alteration of breathing due to his febrile illness. Following treatment with a carbonic anhydrase inhibitor (acetazolamide), breathing and physical rehabilitation techniques, and CO2 supplementation, the patient's dizziness significantly improved in nine months.

Conclusions: The manifestations of PPPD can be exacerbated by underlying acid-base disorders. Recognizing CSCRA as a contributor to anxiety (due to threatening physical symptoms) and dizziness can facilitate appropriate referrals. Utilizing referral pathways to Aerospace Medicine or Pulmonary Medicine can assist with proper diagnosis and treatment, reducing symptom loads by managing underlying conditions. Further investigation should focus on the role of altered breathing patterns in patients with a history of anxiety affecting balance testing performance. Previous literature has consistently reported variability in Sensory Organization Testing results among patients with anxiety. This could provide novel information on manifestations of CSCRA in the vestibular clinic.

Category: Diagnostic Audiology / Otology

Poster #: 026

Objective Hearing-Threshold Prediction Based on Acoustic Measurement of Cochlear Reflectance

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Objectives: Cochlear reflectance (CR) is the cochlear contribution to ear-canal reflectance (ECR). The objective of this study was to assess potential of CR to predict audiometric hearing thresholds.

Design: CR was measured in 46 adult ears with hearing loss and 16 with normal hearing. The eliciting stimulus was pseudo-random noise presented at three levels: 30, 40, & 50 dB SPL. Analysis of principal components of CR spectrograms generated regression weights that were used to predict audiometric hearing thresholds.

Results: When each of the three stimulus levels was presented three times, the total data collection time was about 35 minutes on average. Initial assessment of the agreement between CR-predicted and audiometric threshold across frequency and ears showed a mean-absolute-difference (MAD) of about 5 dB. MAD increased with stimulus level, stimulus frequency, and with degree of hearing loss.

Conclusions: Although cross-validated threshold predictions are likely to be higher than our initial assessment, CR measurements have potential clinical value when (1) audiometric thresholds are not possible and (2) time allows measurements lasting several minutes.

Category: Diagnostic Audiology / Otology

Poster #: 027

Prevalence of Hearing Loss among Older Adults and Family Caregivers

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Objectives: The United States faces a surge in demand for disability-related care needs due to population aging, a demographic shift that also drives the occurrence of hearing loss. We aim to estimate the longitudinal change in prevalence of hearing loss on a national level among two populations: older adults receiving unpaid family care and their caregivers.

Design: The National Health and Aging Trends Study (NHATS) and linked National Study of Caregiving (NSOC) provide nationally representative samples of Medicare beneficiaries (65 years and older) and their family caregivers at five study rounds between 2011 and 2022. Hearing loss was initially measured subjectively through self-reported functional hearing questions in both NHATS and NSOC. Starting from 2021, NHATS introduced pure-tone audiometry that captured hearing loss objectively. A cut off point of 25 dB HL or greater was used to define hearing loss. Hearing aid use status among older care recipients was collected through self-report. A composite variable of hearing concern was further defined by self-reported functional hearing difficulty or hearing aid use.

Results: In a nationally representative sample of older adults receiving family care, the prevalence of hearing concern remained relatively stable (33~37%) over a 11-year period, despite a substantial growth in the absolute population size (from around 1.5 to 2.5 million). In 2022, the prevalence of audiometric hearing loss among older care recipients was over 70%, which translated to 4.7 million older adults, among whom only 45% recognized their hearing loss condition. In 2022, more than 7 million unpaid family caregivers were involved in the daily assistance of older adults with hearing concern, this number raised to over 13 million when taking under recognized audiometric hearing loss into account. Major health disparities were observed regarding hearing aid adoption among the care recipient population. Relative to their male and White counterparts, the percentages of hearing aid use were disproportionally lower among female care recipients and non-Hispanic Black/Hispanic care recipients.

Conclusions: Our findings suggest that hearing loss is highly prevalent among both older adults and caregivers, given the growth in population size, 3.0 million older care recipient (6.3 million in terms of objective hearing loss) and 2.4 million family caregivers could potentially be influenced by hearing loss condition. In contrast to the population-level burden of hearing loss among older care recipients, the prevalence of hearing aid use has been disproportionally low, especially for racial/ethnical minorities.

Category: Diagnostic Audiology / Otology

Poster #: 028

Reported vs. Audiometric Hearing Loss and Cognition in Older Adults

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Objectives: To determine whether audiometric-measured and/or concordantly reported and audiometric-measured hearing loss are associated with poorer global and domain-specific cognition in older adults, and whether age and education moderate these associations.

Design: We analyzed data from Round 12 (2022) of the National Health and Aging Trends Study. The analytic population included 6,311 participants (mean age, 77SD years; 57% female). Audiometric hearing loss was defined as a better-ear pure-tone average (PTA) exceeding 25 dB HL across 0.5, 1, 2, 4, and 8 kHz, requiring at least three valid frequencies per ear. Sensitivity analyses used alternative PTA thresholds of 20 dB HL and 40 dB HL to assess robustness. Reported hearing was defined based on difficulty hearing (aided, if participants reported hearing aid use) on the telephone, in quiet conversation, or with radio or television; any difficulty indicated functional poor hearing. We created four categories: Type A, audiometric-only loss; Type B, audiometric plus reported loss; Type C, reported-only loss (included for sensitivity analysis only); and Type D, no loss. Cognitive outcomes were measured with neurocognitive assessment of three domains: memory, orientation, executive function, and the CogState digital testing assessment. The global cognitive score was the mean of standardized scores across domains and CogState performane. Covariates included age, sex, race and ethnicity, education, income, body mass index, smoking status, PHQ-2 score, history of stroke, comorbidity count excluding stroke, Medicaid enrollment, living arrangement, and use of hearing and vision aids. Survey-weighted linear regression was used to estimate adjusted associations and examine interactions with age and education.

Results: The weighted distribution of hearing-concordance types was 42% Type A (audiometric only), 26% Type B (audiometric and reported), 5% Type C (reported only), and 27% Type D (no loss). In fully adjusted, survey-weighted models using Type D as the reference, both Type A (β = −0.10; 95% CI, −0.15 to −0.05; P< .001) and Type B (β = −0.10; 95% CI, −0.19 to −0.01; P = .029) were linked to lower global cognitive z-scores. A direct comparison of Type A versus Type B showed no difference (β = 0.00; P > .99), indicating similar associations regardless of reported hearing loss. Across cognitive domains, memory exhibited the largest deficits (Type A β = −0.19, P< .001; Type B β = −0.28, P = .006), followed by slower CogState identification speed for Type A (β = −0.15, P = .006). Age modified the association, with stronger effects of Type B among adults aged 75–89 years compared to those aged 65–69 years (β_add = −0.21 to −0.39; P = .03 to .003). Conversely, higher educational attainment buffered the impact of hearing loss, as shown by a significant Type B × education interaction (β_int = +0.34 for high-school education; P = .006). Results remained consistent across different pure-tone thresholds (20–40 dB HL), cognitive composite definitions, and strata of hearing-aid use.

Conclusions: Audiometric and reported hearing loss were independently associated with poorer cognition, especially in memory and processing speed. The lack of difference between audiometric-only and concordantly measured loss suggests that objective auditory decline, rather than awareness, drives the association. Older age intensified, and higher education attenuated these effects, highlighting the importance of routine hearing screening, access to hearing aids, and lifelong cognitive health education in aging populations.

Category: Diagnostic Audiology / Otology

Poster #: 029

Effects of Auditory Injuries on Audiogram Response Times

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Objectives: Previous research has shown that blast exposure and temporary threshold shifts can negatively impact objective performance on tone-in-noise detection and can increase subjective hearing complaints, even for individuals with "normal" hearing thresholds. Preliminary evidence suggests that response time on speech-in-noise tests may also be affected in individuals with blast exposure and temporary threshold shifts as well. The aim of this study was to quantify the effects of blast exposure and temporary threshold shifts on response time data collecting during an audiogram.

Design: Over 4,000 United States Service Members were recruited to participate in this study. Service Members had their air-conduction audiometric thresholds measured using a Hughson-Westlake procedure. Response times were collected for their button presses and presentation level of the tone was recorded. Following the audiogram, they completed a pair of short surveys to determine their blast exposure and temporary threshold shift histories. Thresholds were calculated for the participants. Presentation levels were converted to sensation level based on the thresholds. Modeling of the response times was performed controlling for threshold with the three-way interaction between sensation level, blast exposure history, and temporary threshold shift history as the primary independent variables of interest.

Results: Effects of blast exposure and temporary threshold shift history on the response times were observed. Temporary threshold shift history was weakly associated with response time such that individuals with a history of more temporary threshold shifts had slightly longer response times. Blast exposure history, however, showed the opposite effect. Individuals with a history of blast exposure responded more quickly, especially at and near threshold.

Conclusions: These results suggest that the injuries caused by temporary threshold shifts and blast exposure affect different portions of the auditory system. Faster response times at and near threshold for individuals with a history of blast exposure suggest that those individuals may have a more lax criterion for detecting the tone, whereas individuals with a history of temporary threshold shifts may have sustained damage that requires slightly more processing time to detect the tone.Disclaimer: The views expressed in this abstract are those of the authors and do not necessarily reflect the official policy of the Department of Defense or the U.S. Government.

Category: Diagnostic Audiology / Otology

Poster #: 030

Using Artificial Intelligence to Classify the Audiogram Shape

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Objectives: The audiogram is inherently multi-dimensional since it provides thresholds at different frequencies. Clinically, the dimensionality is reduced by describing the audiogram in terms of the degree of hearing loss (normal, mild, moderate, ...) and/or the shape of the audiogram (flat, sloping, notched, ...). When attempting to account for varying degrees of hearing loss in subject populations, a pure-tone average (PTA) is often used, but there is no consistency in how the PTA is defined (e.g., 3-frequency PTA, 4-frequency PTA, high-frequency PTA, low-frequency PTA). The objective of this study is to use artificial intelligence (k-means clustering) to identify the different shapes of audiograms in the general population and then investigate the extent to which hearing performance of US Service Members (SMs) is impacted by the audiogram shape and interaural asymmetries in the audiogram.

Design: The publicly available National Health and Nutrition Examination Survey (NHANES) dataset includes audiograms from over 15,000 people in the United States. K-means clustering was used to identify common shapes in these audiograms. These clusters were then used to partition various datasets collected on SMs including the audiograms from nearly 250,000 SMs obtain during annual monitoring, over 56,000 SMs for which audiograms were available at both the start of and 6 years after active duty service, over 5,000 SMs for which both an audiogram and speech-in-noise scores were available and over 12,000 SMs for which both an audiogram and a binaural tone-in-noise detection score were available.

Results: The distribution of the audiogram shapes differed between the general population captured in the NHANES dataset and SMs with SMs more likely to have flat audiograms than the general population. This is not surprising since SMs are younger than the general population and all have at least some occupational noise exposure. The rate at which SMs experienced a significant threshold shift after 6 years of service depends on both the shape of the audiogram and the presence of interaural asymmetries. Speech-in-noise performance depends on the shape of the audiogram while the presence of interaural asymmetries complicates the analysis since SMs with asymmetric hearing have a "good" ear and a "bad" ear. Binaural tone-in-noise detection performance is less affected by the shape of the audiogram and interaural asymmetry than speech-in-noise performance. This may be because tone-in-noise detection is more dependent on the hearing ability at the test frequency than at remote frequencies.

Conclusions: Audiogram shapes can be identified with machine learning and there is good correspondence between the audiogram shapes in the general population and SMs. The shape of the audiogram and the presence of interaural asymmetries has an impact on the rate at which significant threshold shifts occur and behavioral performance.[Disclaimer: The views expressed in this abstract are those of the author and do notnecessarily reflect the official policy of the Department of Defense or the U.S. Government.]

Category: Diagnostic Audiology / Otology

Poster #: 031

Clinical Audible Contrast Threshold (ACT) Efficacy in Measuring SNR Loss

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Objectives: This study aims to examine the clinical implementation of the Audible Contrast Threshold (ACT) test and its accuracy measuring signal-to-noise ratio (SNR) loss. Difficulty understanding speech-in-noise is a chief complaint for many people with hearing loss and has traditionally been measured with tests that mimic real-world scenarios. However, the lack of language neutrality associated with the aforementioned tests poses a problem for many patient populations including non-native English speakers and individuals with speech production or working memory difficulties. The ACT test was created to circumvent this problem by creating a universal, binaural testing modality of SNR loss that involves subjects detecting a spectro-temporal modulation amid background noise. When developing the ACT, researchers used Matlab software to administer two studies: Study A included 28 subjects ages 46-82 with symmetric hearing losses of varying degrees while study B tested 25 participants aged 18-25 with normal hearing. Speech-in-noise testing performance was not included in inclusion criteria. In assessing the test-retest reliability of the clinical ACT test and comparing signal-to-noise ratio scores between the ACT and QuickSIN, this study aims to assess the efficacy of the ACT test as a clinical tool using clinical-grade equipment.

Design: Our potential subjects were recruited for a broader study to undergo a comprehensive hearing evaluation, including the Quick Speech-in-Noise test and ACT. ~ 250 subjects completed the test battery, all were 18 or older, neither native language nor hearing status were recruitment considerations, though non-native English speakers were analyzed separately in some cases. Testing took place at the Purdue University Main Campus and at the Accessible Precision Audiology Research Center (APARC) in Indianapolis. All measures were conducted using the GSI AudioStar Pro audiometer and RadioEar DD450 headphones.

Results: Comparison of SNR loss between a participant's best QuickSIN scores averaged over two lists and best ACT results yielded a correlation factor of 0.35 between measures. Normative data suggests that a normal ACT score is a threshold less than or equal to 4 dB nCL while a QuickSIN SNR loss of 3 dB or less is considered normal. Of the 175 participants with a normal QuickSIN score, 83.4% also had a normal ACT score. However, alarmingly only 36.3% of the 77 subjects with an abnormal QuickSIN score also had an abnormal ACT score. In addition to comparisons between the ACT and QuickSIN, preliminary data suggest ACT results are not always consistent between two consecutive trials. 74% of participants saw an improvement in ACT score by an average of 2 dB nCL while 21% saw poorer score with an average difference of 1.1 dB nCL. Additionally, some subjects could not undergo ACT testing due to equipment limitations as the stimulus level is determined based on the subject's air conduction pure tone average.

Conclusions: Tests involving speech perception are not accessible to all populations or clinics. A quicker, language-neutral test theoretically overcomes these barriers. However, our data suggest GSI's implementation of the ACT test may add un-necessary sources of variability that limit it's effectiveness as a replacement for clinical speech-in-noise tests like the QuickSIN.

Category: Diagnostic Audiology / Otology

Poster #: 032

MEMR Thresholds Show Little Association With Speech-in-noise Testing

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Objectives: A significant subset of patients report difficulty understanding speech in noisy environments despite having normal audiometric findings. This disconnect between subjective listening difficulty and the audiogram has been termed 'hidden hearing loss'. One proposed explanation is cochlear synaptopathy, a loss of synapses between inner hair cells and auditory nerve fibers. Synaptopathy has been produced in animal models through exposure to moderate noise levels and aging, with low-spontaneous rate fibers being disproportionately vulnerable. This loss of low-spontaneous-rate fibers reduces the neural population available for temporal and intensity coding, particularly at higher sound levels. Because the high-spontaneous rate fibers are typically preserved, this damage may not be reflected in audiometry. This synaptic loss is thought to produce deficits in the processing of complex sounds, leading to difficulties with spectrotemporal modulation detection and speech-in-noise perception. Consequently, patients may present with normal hearing thresholds, but report difficulty with speech in noise.The middle-ear-muscle reflex (MEMR) appears to be sensitive to cochlear synaptopathy in noise-exposed animals and is reduced in middle-aged individuals or young adults with a history of noise exposure compared to young unexposed controls, even when hearing is normal. These studies have primarily used wideband MEMR measurements, which are not used clinically. In this study, we examined the relationship between clinical MEMR thresholds and measures of suprathreshold hearing ability, including clinically available speech-in-noise and spectrotemporal modulation detection tests in listeners with normal-hearing sensitivity to determine whether clinical measures were sensitive to these same effects.

Design: Data collected through the Purdue Accessible Precision Audiology Research Center (APARC) was used for analysis. Subjects completed a comprehensive audiological test battery that included extended-high-frequency audiometry, wideband tympanometry, ipsilateral and contralateral acoustic reflexes with pure-tone elicitors, and speech testing. In addition, participants completed surveys of self-reported noise exposure history and subjective hearing difficulty. Preliminary data from both ears of 524 participants were screened to include only ears with normal audiometric thresholds (<25 dB HL) and normal distortion product otoacoustic emissions, resulting in a dataset of 613 ears. Comparisons were made between MEMR thresholds, QuickSIN, Audible Contrast Threshold (ACT) test results, and other demographic factors.

Results: Pearson's correlations revealed no significant relationships between the best MEMR thresholds and either QuickSIN ($r = 0.098$, $p = 0.057$) or ACT ($r = -0.159$, $p = 0.086$). Multiple linear regression analyses using MEMR thresholds as predictors showed no significant models for QuickSIN ($R2 = 0.034$, $p = 0.116$) or ACT ($R2 = 0.108$, $p = 0.119$). The average difference in SNR loss from the QuickSIN in the normal MEMR group vs elevated MEMR group was<1dB. Future analyses will evaluate how these measures relate to reported difficulty and noise exposure, and the power of multi-metric models.

Conclusions: These preliminary data suggest that in individuals with normal audiometric thresholds and normal outer-hair-cell function, MEMR thresholds were not significantly associated with current clinical tests of either speech-in-noise performance or spectrotemporal-modulation detection. These findings are consistent with either a poor correlation between MEMR thresholds obtained using clinical procedures/equipment and cochlear synaptopathy or a weak link between cochlear synaptopathy and clinical measures of speech-in-noise performance. Wideband MEMR testing likely provides a more sensitive measure of MEMR function needed to detect cochlear synaptopathy.

ELECTROPHYSIOLOGY

Category: Electrophysiology

Poster #: 033

Modified Chirps Improve Auditory Nerve/Brainstem Responses by Limiting Excitation Spread

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Objectives: Estimates of evoked potential latency, threshold, and amplitude are central to non-invasive, objective measures of hearing status. Clicks, commonly used as evoked-potential stimuli, elicit synchronous responses from auditory nerve fibers; however, synchrony is limited by the delay of the cochlear traveling wave. Rising-frequency chirps are designed to compensate for these delays, thereby eliciting greater synchrony of auditory nerve responses compared to clicks. This increased synchrony often results in larger amplitudes and lower thresholds for chirp-evoked responses. At high sound intensities, however, the spread of cochlear excitation may limit the benefits of chirps. Instead of producing a synchronous response, high-level chirps may result in temporally smeared responses from basal neurons activated by both on- and off-frequency components. This study tested the hypothesis that attenuating low-frequency components of chirps (i.e., using modified chirps) would yield larger evoked potential amplitudes than standard chirps, consistent with reduced cochlear spread of excitation.

Design: Recordings were obtained from 12 adults with normal hearing to simultaneously measure the compound action potential (CAP) and auditory brainstem response (ABR). Active electrodes were placed on the eardrum and high forehead; reference and ground electrodes were placed on the earlobe and lower forehead, respectively. Responses were recorded for clicks, standard chirps, modified chirps, and time-reversed versions of all chirps, presented at 50, 60, 70, 85, and 100 dB peSPL.

Results: At high sound levels (85 and 100 dB peSPL), the standard chirp produced weaker amplitudes and shorter latencies than the modified chirps, consistent with spread of excitation. At lower sound levels (50 and 60 dB peSPL), the standard chirp produced amplitudes similar to or larger than those of the modified chirps. This pattern was observed for both CAPs and ABR wave V. Chirps and modified chirps typically evoked amplitudes 1.5 to 2.5 times larger than those evoked by clicks, with the amplitude advantage decreasing slightly as sound level increased.

Conclusions: These findings suggest that progressively reducing low-frequency energy as a function of chirp level enhances synchrony and yields larger evoked potential amplitudes than clicks for CAPs and ABR waves I and V.

Category: Electrophysiology

Poster #: 034

Mismatch Negativity Evidence for DNN Denoising in Hearing Aids

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Objectives: Deep neural network (DNN) denoising in hearing aids is designed to selectively remove environmental noise while preserving the clarity of speech. It was hypothesized that, by enhancing the signal-to-noise ratio (SNR) to provide a cleaner speech signal, the DNN would enhance the brain's bottom-up encoding of speech sounds. To test this hypothesis, the mismatch negativity (MMN), a robust neural marker of pre-attentive auditory discrimination, was used to objectively measure the brain's processing of speech stimuli.

Design: Seventeen experienced hearing aid users (13m, 4f; aged 46 to 81 years) with moderate-to-severe sensorineural hearing loss and normal cognitive function took part in this study. This investigation was conducted using a 2x2 within-subjects design. Using a passive oddball paradigm, MMN responses to the speech syllables /ba/ (standard, 85% probability) and /la/ (deviant, 15% probability) were recorded under four conditions: in quiet and in 70 dB of collocated cafeteria noise, with the DNN feature of the hearing aids either activated (DNN-ON) or disabled (DNN-OFF).

Results: Traditional event-related potential (ERP) analysis revealed significant effects. Background noise significantly prolonged MMN peak latency ($p < .001$), indicating degraded neural processing. Critically, activating the DNN significantly shortened these latencies in both quiet ($p < .05$) and, most profoundly, in noise ($p < .001$), effectively mitigating the neural processing delay.Noise also significantly reduced MMN amplitude, making the response weaker (less negative). However, activating the DNN in the noise condition led to a recovery of MMN amplitudes towards the levels observed in quiet. Although this change did not meet statistical significance ($p = .0852$), the data do show a restorative trend in the neural responses in noise.Further time-frequency analysis provided deeper insight into the neural dynamics. Analysis of response power in the theta band (4-8 Hz), measured by Event-Related Spectral Perturbation (ERSP), revealed no significant effects. In contrast, the phase consistency of the neural responses across trials, measured by Inter-Trial Coherence (ITC), was severely degraded by noise when the DNN was disabled. Crucially, activating the DNN in noise fully restored ITC, yielding a stable, phase-locked neural response that was statistically indistinguishable from the quiet conditions.

Conclusions: The DNN-based denoising feature effectively restores the brain's automatic encoding of speech in noisy environments. This is demonstrated by the significant shortening of neural response latencies, suggesting more efficient processing. The time-frequency results pinpoint the underlying mechanism for this benefit: the DNN enhances the integrity of the neural signals primarily by increasing the phase consistency and temporal precision of the brain's responses (ITC), rather than by boosting its signal power (ERSP). More generally, this study demonstrates that combining traditional ERP measures with time-frequency metrics provides a powerful, objective framework for validating the neural benefits of advanced hearing aid technologies.

Category: Electrophysiology

Poster #: 035

Describing Early Auditory Brainstem Response Waves in Very Preterm Infants

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Objectives: Auditory brainstem responses (ABRs) are an excellent metric to track auditory brainstem development through absolute and interwave latencies. Reports of Wave I latencies in early literature (1980's and 1990's) from preterm infants are highly variable; it seems likely that Wave II was labelled as Wave I, and amplitude of Wave I was a measure of the I-II complex, confounding measures of interwave latencies. With the rise of clinical diagnostic use of ABR in the 1990's, Waves I, III, and V became popular, resulting in a dearth of information on Waves II and IV in current literature. Moreover, data reported in the previous literature were collected 40 years ago, and characteristics of those preterm infants are dramatically different then infants born preterm today. Therefore, defining Waves I and II, in addition to Waves III, IV, and V are critical for studying brainstem maturation. It is imperative that brainstem maturation be studied in the current preterm population, which includes extremely and very preterm infants, and that the cadre of canonical ABR measures be considered. The goal of the current study is to (1) characterize the process of determining latencies and amplitudes for ABR waves; (2) define whether the presence/absence of early waves change with age; (3) describe the development of ABR latencies, interwave latencies, and amplitudes with particular attention to the Wave I-II complex.

Design: 119 preterm infants were tested at 33, 35, 48-52, and 62-66 weeks gestational age (WGA) at Crouse Hospital and the Pediatric Audiology Laboratory in Syracuse, NY. Gestational ages for infants at birth ranged from 23 to 32 weeks. Middle-ear status was assessed via Wideband Acoustic Immittance (WAI). ABRs were recorded in response to condensation and rarefaction clicks presented at 27.7/second at an intensity of 70 dB nHL. ABRs from infants having WAI outside of normal limits were excluded from ABR analysis. ABR waveform latencies and amplitudes were evaluated independently by research team members. Strict rules were in place to judge replicability of waves. Replicable condensation waveforms were averaged and wave latencies and amplitudes were determined for ipsilateral Waves I-VI.

Results: Based on agreement of wave latencies and amplitudes by team members, Wave II was judged to be present more often than Wave I for infants tested at 33 and 35 WGA. At older test ages, Waves I and II were more equally observable. Grand averages of ABR responses for each test time indicated Wave I

increased in amplitude and all wave latencies decreased with increasing test age. Wave II was robust and observable for all test ages.

Conclusions: Wave II is a more robust measure of peripheral neural functioning than Wave I in infants born extremely and very preterm. Wave II, rather than Wave I, which are both modeled to be arising from the auditory neurons before synapse with the cochlear nucleus, should be considered for studying development of brainstem conduction in time in this population. [Research supported by NIH-NIDCD R01DC011777].

Category: Electrophysiology

Poster #: 036

Band Interaction in Simultaneous Recording of Multiple Auditory Brainstem Responses

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Objectives: This study examines how the morphology of auditory brainstem response (ABR) wave V changes when ABRs are elicited by four frequency-specific stimuli presented simultaneously to both ears at varying intensity levels. It is hypothesized that masking effects, resulting from the upward and downward spread of excitation along the basilar membrane, influence the waveform morphology of wave V.

Design: Recordings were obtained from 20 young adults with normal hearing. Initially, four narrow-band (NB) CE-Chirps centered at 500, 1000, 2000, and 4000 Hz were presented simultaneously to both ears at a clinical discharge level of 30 dB eHL, serving as the baseline condition. Subsequently, the intensity of one NB CE-Chirp in the designated ipsilateral ear was incrementally increased from 10 to 40 dB above the discharge level, while the remaining NB CE-Chirps were maintained at 30 dB eHL. Stimuli in the contralateral ear were consistently presented at the discharge level throughout. The same experimental paradigm was implemented within an evoked potential modeling framework to investigate the underlying mechanisms in the case of elevating the 2 kHz NB CE-Chirp.

Results: Both the experimental and modeling results revealed that increasing the level of a narrow-band (NB) CE-Chirp within a specific frequency band resulted in the expected increase of ABR wave V amplitude and reduction in latency. In adjacent frequency bands, however, wave V morphology exhibited opposite effects-namely, prolonged latencies and reduced amplitudes. NB CE-Chirps presented simultaneously to the contralateral ear showed no significant changes in wave V latency or amplitude compared to baseline recordings.

Conclusions: These findings indicate a masking effect on neural responses from adjacent off-frequency NB CE-Chirps, driven by both upward and downward spread of excitation along the basilar membrane.

This masking effect increases with increasing stimulus level, as excitation broadens and encroaches on neighboring frequency regions, leading to altered latency and amplitude in the adjacent NB CE-Chirp responses. While this phenomenon contributes to a more frequency-specific representation of each NB CE-Chirp response, it also imposes constraints on the permissible level differences between adjacent stimulus bands.

Category: Electrophysiology

Poster #: 037

Listening Strategy Directly Affects Auditory Cortical Responses

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Objectives: This study investigated how listening strategy influences neural responses to spatially separated sound streams. We measured behavioral and neural (EEG) responses while participants completed a spatial auditory attention task. We hypothesized that participants would perform better with larger spatial separations compared to smaller spatial separations. We expected that sensory (P1-N1) responses would be larger for attended than ignored sound onsets. Finally, we hypothesized that target recognition (P300) responses would be larger for the target word than the distractor words, with greater amplitudes for the attended stream than for the unattended stream.

Design: Forty normal-hearing participants (ages 18-30) completed a spatial auditory attention task in which they were instructed to selectively attend to one of two concurrent sound streams. Participants were asked to detect the target word "bash" in the attended stream while disregarding distractor words ("dash", "gash") and ignoring occurrences of "bash" in the masker stream. Target and masker word onsets were randomized in time to eliminate the use of rhythm cues and both sound streams used the same male speaker. Electroencephalography (EEG) data was recorded using a 32-channel array, and we calculated early sensory (P1-N1) and late-latency (P300) responses across four spatial separation conditions: small ITDs (±5 degrees), small ILDs (±5 degrees), large ITDs (±15 degrees), and large ILDs (±15 degrees).

Results: Participants more readily identified "bash" in the attended stream and ignored "bash" in the masker stream with 15 degrees separation than 5 degrees separation. Contrary to our original hypothesis, P1-N1 responses did not differ between target and masker streams. However, the target word "bash" elicited a larger P1-N1 response than "dash" or "gash", regardless of whether it occurred in the attended or ignored stream. Late latency target recognition P300 amplitudes were larger for the target stream "bash" than for the masker stream "bash". P300 amplitudes were also smaller in response to distractor words ("dash" and "gash") compared to the target word "bash". The differences in P300 amplitudes were exaggerated with greater spatial separation.

Conclusions: These findings suggest that early sensory responses, as reflected by the P1-N1, were not strongly influenced by spatial attention on this task but were larger for task-relevant words. This conflicts with previous findings, which show strong effects of spatial attention. Later cortical processing, reflected by the P300, was more sensitive to both target relevance and spatial separation. These findings demonstrate that task demands and spatial cues interact to shape neural processing. Because listeners with hearing loss appear to adopt different listening strategies on selective attention tasks, immediate future work should explore the relationship between hearing status, speech in noise outcomes, and the underlying neural mechanisms.

Category: Electrophysiology

Poster #: 038

Neural Markers of Speech Intelligibility Using EEG and fNIRS

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Objectives: To identify neural markers of speech intelligibility and meaningfulness using functional near-infrared spectroscopy (fNIRS) and single-channel EEG, with the broader aim of developing more informative objective measures of hearing.

Design: It was hypothesised that neural responses would differ systematically across a continuum of speech intelligibility and meaningfulness, ranging from (1) Natural: fully intelligible, meaningful speech with a coherent narrative; (2) Scrambled: intelligible, meaningful words, presented in random order; (3) Pseudo: intelligible, non-meaningful words, created by substituting phonemes in real words (preserving phonetics but removing lexical meaning); and (4) Noise, spectrally and temporally matched to the Scrambled condition. Each stimulus condition was presented at 65 dB SPL to 21 normal-hearing adults as either (i) continuous ~6-minute stories or (ii) ten 15-second sentences with ~15-second inter-stimulus intervals. During both paradigms, participants performed an auditory vigilance task, pressing a button whenever the male voice was briefly (~1 s) replaced by a female voice, providing a proxy for alertness and engagement. Concurrent fNIRS (temporal and prefrontal regions) and single-channel EEG (Cz-mastoids; BioSemi) were recorded.

Results: In the story paradigm, EEG temporal response function (TRF) analysis showed reliable neural tracking of the speech envelope in all four stimulus conditions (r = 0.063–0.075). Natural speech evoked the largest amplitudes (median waveform RMS = 0.92 μV) as well as the largest inter-subject waveform variability (median cross-correlations = 0.54) and smallest r values (median 0.063), suggesting responses were larger but possibly less linearly related to the speech envelope. Pseudo and Scrambled conditions evoked smaller but more consistent responses (median RMS = 0.60–0.65 μV; cross-correlation = 0.65–0.66), and Noise yielded moderate amplitudes with the strongest neural tracking of the speech envelope (median RMS = 0.68 μV, r = 0.075). Friedman tests revealed near-significant trends for TRF amplitude (p = 0.09) and cross-correlation (p = 0.06).At the group level for the fNIRS data, preliminary analysis of the

sentence paradigm using general linear modelling with a canonical haemodynamic response function (15-second box car function) revealed significant activation of the left superior temporal gyrus (STG) in response to Natural, Scrambled, and Pseudo speech, but not for Scrambled Noise when compared to silence. For the right superior temporal gyrus (STG), there was significant activation in response to Scrambled and Pseudo speech, but not for Natural and Scrambled Noise, relative to silence.

Conclusions: The stimuli and test paradigms successfully elicited robust EEG and fNIRS responses to speech. Ongoing, preliminary analyses suggest that the test paradigms and stimuli have potential to differentiate speech from non-speech stimuli (Noise versus Natural, Scrambled, Pseudo conditions) but struggle with discriminating between speech meaningfulness (comparisons between Natural, Scrambled and Pseudo were small). EEG results from the Natural speech condition—large amplitudes, high inter-subject variability, and lowest predictability from the speech envelope—suggest that additional neural processing could be present that is not yet fully captured in the current analysis. Future work might aim to identify predictors that are more specific to speech intelligibility and/or speech meaningfulness, explore causal connectivity measures in fNIRS, and integrate EEG and fNIRS to obtain more sensitive measures.

Category: Electrophysiology

Poster #: 039

Objective Detection of Cochlear Dead Regions Using Auditory Brainstem Responses

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Objectives: Cochlear dead regions (CDRs) result from partial or complete loss of inner hair cells or spiral ganglion cells within specific cochlear areas, leading to disrupted auditory signal transmission. Behavioral diagnostic tools such as the Threshold Equalizing Noise (TEN) test are limited by their reliance on active participation, making them unsuitable for infants or individuals with cognitive or dexterity impairments. The objective of this mentored project is to evaluate the feasibility of using auditory brainstem responses (ABRs) elicited by frequency-specific narrowband chirps in Notched Threshold Equivalent Noise (TEN) as an objective measure for detecting cochlear dead regions. We hypothesize that ABR Wave V amplitude and latency will vary systematically as a function of notched-noise center frequency, revealing patterns that can objectively identify CDR boundaries.

Design: Fifteen adults with normal hearing, ages 18-30, will participate in two sessions. Due to time constraints, only normal-hearing individuals are initially included to assess correlations between Frequency-Specific Auditory Brainstem Response (ABR) thresholds with TEN notched noise (objective) and behavioral TEN test thresholds (subjective) under optimal conditions. Establishing this baseline, following Perugia et al. (2023), will guide future applications to hearing-impaired populations with potential cochlear dead regions. Session one will include audiologic screening (≤20 dB HL from 250-8000 Hz) to confirm normal hearing thresholds and behavioral TEN testing from 500–4000 Hz to verify the absence of cochlear dead regions (CDRs). Session two will involve electrophysiologic recordings of ABRs using 2 kHz narrowband chirp stimuli presented under multiple TEN notched-noise conditions. Wave V

amplitude and latency will be measured for each masking condition, and mixed-effects modeling will evaluate relationships among masking frequency, response amplitude, and latency to determine sensitivity to simulated dead-region effects.

Results: Preliminary findings are expected to show peak ABR Wave V amplitude when the notched-noise center frequency aligns with the narrowband chirp frequency, followed by a systematic decrease in amplitude as the notch shifts beyond that region. Similarly, ABR Wave V latency would also be most aligned with unmasked ABR Wave V latency when the notched-noise center frequency aligns with the narrowband chirp frequency, with a systematic prolongation as the notch shifts beyond that region. This relationship is predicted to differ for conditions simulating cochlear dead regions, demonstrating reduced neural synchrony and smaller response amplitudes near the affected frequency range.

Conclusions: This study aims to establish a feasible electrophysiologic method for objectively detecting cochlear dead regions without requiring behavioral input. Developing this approach could enhance diagnostic efficiency and accuracy, facilitate individualized hearing aid fittings and cochlear implant mapping, and expand clinical testing capabilities to populations that are unable to perform behavioral tasks. The project demonstrates the potential of TEN-masked ABRs as a precision audiology tool bridging basic auditory neuroscience and clinical application.

HEARING HEALTH CARE

Category: Hearing Health Care

Poster #: 040

Preparing Audiologists for Supervising a Community Health Worker Service Model

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Objectives: Hearing care remains out-of-reach for many older populations and additional models of care are needed to close the gap. Community health worker (CHW) programs with audiology supervision represent a promising approach with evidence-based results. However, a training curriculum for preparing audiologists to work within a CHW model is currently lacking in theory and practice. This presentation introduces a first-in-kind curriculum developed through interdisciplinary collaboration that will be implemented for an upcoming feasibility trial.

Design: A series of four semi-structured interviews were completed with stakeholders with varied expertise to identify key components of an appropriate training program for audiologists. Additional themes were identified through a literature review to inform the development of a novel training curriculum. Feedback from two assembled scientific- and community advisory boards were solicited to further refine the preliminary curriculum.

Results: A total of seven modules spanning approximately 10-12 hours were finalized for the feasibility trial. The curriculum comprises learning objectives, workshop-based presentations with role-play and breakout group-based activities, competency assessments, and a final practicum evaluation for certification. The goal of the training program is to equip audiologists with the respective knowledge and skills to train, supervise, and mentor CHWs in delivering community-based hearing care for older adults using commercially available hearing amplification technologies.

Conclusions: A novel training program informed by principles of adult learning (andragogy) for preparing audiologists to work within a CHW hearing care model was developed. The audiologist curriculum addresses the current absence of such a program for the goal of scaling up interdisciplinary service models of hearing care that leverages over-the-counter technologies for promoting the accessibility of care for older populations.

Category: Hearing Health Care

Poster #: 041

Evolving Higher Education: Rethinking Audiology Faculty Author Impact Metrics

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Objectives: We aimed to explore institution and author-level impact of audiology faculty across all accredited AuD programs in the United States (US) and critically evaluate their value amid changes in academia.

Design: Using the methodological framework of previous researchers, we conducted a quantitative bibliometric study with the online data of 343 audiology research faculty across the US from 73 academic institutions. We gathered author-level impact and demographic data through public university webpages and multiple academic databases including Google Scholar, ResearchGate, and Scopus. We collected institutional-level impact data through college ranking sites such as the U.S. News Program ranking system and the Carnegie ranking websites.

Results: Descriptive statistics serve as the foundation of our results-highlighting faculty's online presence, in the context of their gender, academic ranks, and institutions. We couch the results in an ecological framework derived from sociology, examining academia through micro, meso, and macro lenses.

Conclusions: Our study provides insight into the current author impact metrics in audiology academia across the US. This data is increasingly important today given the systematic fluctuation and vulnerability of academia. Rethinking current metrics and their value at the level of the individual author, the field of audiology, and the public at large could empower academics to reshape what impact means across all levels and enhance both research and clinical care moving forward.

Category: Hearing Health Care

Poster #: 042

Barriers and Decision-Making Factors in Applying to Doctor of Audiology Programs

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Objectives: This study examined barriers encountered during the Doctor of Audiology (Au.D.) application process and identified factors that influenced final program selection. The goal was to understand how financial, academic, personal, and interview-related factors affect access to audiology education and shape enrollment decisions. In particular, interviews have become more common in the Au.D. application process and it was hypothesized that these interviews may be considered a logistical, financial, or psychological barrier to student applications.

Design: A survey was sent to directors of all active Au.D. programs in the United States in 2024. They were asked to distribute the survey link to their students and recent graduates. The survey included multiple-choice, ranking, and open-ended questions related to respondent demographics, any barriers experienced during the application process, and priorities for deciding to attend their chosen program. Two questions additionally asked about interview experiences when applying to Au.D. programs and whether interview requirements influenced decisions to apply to or ultimately attend a program.

Results: A total of 125 individuals from 23 Au.D. programs across the United States completed the survey. Four main categories of barriers while applying emerged: financial (76 responses), academic (28 responses), difficulty accessing accurate program information (19 responses), and personal (17 responses). Financial barriers included application and transcript fees, tuition, and cost of living. Academic barriers involved prerequisite coursework, GRE and clinical experience requirements, and inconsistent program requirements. Personal barriers included balancing applications with work or school responsibilities and limited support and guidance for the application process.Most survey respondents (81.6%) reported that one or more of the programs they applied to required an interview. Most interviews were conducted virtually (42.1%) or offered in both virtual and in-person formats (36.8%), while 3.5% were exclusively in person. In contrast to the study hypothesis, interview requirements had minimal influence on application or enrollment decisions, with only 26.5% of participants reporting that interviews affected their decision. Of these respondents, 61.8% described a positive impact, noting opportunities to connect with faculty, learn more about the program, or feel welcomed. Other respondents (30.4%) described a negative impact, such as being intimidated by the interview; 8.7% reported mixed or neutral effects, and one respondent avoided programs requiring interviews altogether. When deciding which program to attend, respondents most frequently emphasized cost (24.2%), followed by clinical training opportunities (17.2%), preparation for employment (14.8%), geographic location (13.4%), and proximity to relatives (12.1%). Other considerations included program reputation, supportive faculty, and mentorship opportunities.

Conclusions: Applicants to Au.D. programs reported financial, academic, and personal barriers influencing access and decision-making. Financial strain, inconsistent academic standards, and unclear program information were the most common barriers. Interview requirements had minimal impact, though most who were influenced viewed them positively. When choosing programs, respondents prioritized affordability, clinical training, and job preparation, with location and family proximity also important. Overall, financial and academic factors played the greatest role in shaping access and final program selection among Au.D. applicants, with interviews not reported as a significant barrier in the application process.

Category: Hearing Health Care

Poster #: 043

Student Knowledge and Decisions Regarding Patients with Unexplained Hearing Difficulties

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Objectives: It is estimated that unexplained hearing difficulties-cases in which the patient reports difficulty hearing but audiometric testing suggests normal hearing- affects up to 10% of adults seeking audiological care. Students of audiology in accredited doctoral programs (i.e., AuD programs) are trained to meet the American Speech-Language-Hearing Association's professional guidelines for diagnosing and treating hearing loss and related disorders. However, it remains unclear how AuD programs are preparing students to manage patients with unexplainable hearing difficulties who fall outside of established guidelines. In this study we surveyed AuD students across the country to explore their knowledge of patients with unexplained hearing difficulties, as well as how they may interact with and approach care for such patients in a clinical setting.

Design: A total of 123 students currently enrolled in AuD programs in the United States participated in the online, mixed-methods vignette study. The study began with an online survey including demographic questions regarding year of study, US state of their program, and the number of adult patients they see in the clinic per week. Participants were then given a case vignette of an adult patient with significant hearing difficulties but test results within normal limits. As the text of the case unfolded, students were presented with questions interspersed throughout. The open-ended questions prompted participants to do things like describe their interactions or share their clinical decision-making. We analyzed the data using a mixed methods approach, including thematic analysis and summary statistics.

Results: We present themes that emerged from the students' responses to questions about how they would first interact with the patient given the case history information; how they would inform the patient of the test results; what their next steps and recommendations would be; and what, if any, are the barriers to helping patients with unexplained hearing difficulties? All themes found across the qualitatively analyzed questions saturated within 7 participants, suggesting sufficient sampling. We present what students believe to be the underlying causes of unexplained hearing difficulties, whether

they recall being explicitly taught about similar patients in the classroom, and how confident they feel in helping patients with unexplained hearing difficulties.

Conclusions: This study offers insightful information about what AuD students are learning regarding unexplained hearing difficulties, and how they might approach a patient with such challenges. These responses from current AuD students provide a hint into the future of the field with regards to how knowledge of unexplained hearing difficulties may be implemented into clinical practice and where there are remaining gaps in knowledge and barriers to care.

Category: Hearing Health Care

Poster #: 044

Accessibility and Affordability of Hearing-Healthcare for Adults: A Mapping Review

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Objectives: Hearing aids are grossly underutilized by Americans with only 16-30% of individuals who could benefit from a hearing aid using one. Given their poor utilization, the National Institute on Deafness and other Communication Disorders (NIDCD) convened a working group on Affordable and Accessible Hearing Health Care (HHC) for Adults with mild-to-moderate hearing loss in June 2024. The working group recognized the need for a mapping review to systematically examine research conducted on affordable and accessible HHC since 2009 with the goal of identifying areas requiring increased attention and dedicated research efforts. Thus, the objective of this review was to identify and map the evidence generated on the accessibility and affordability of HHC for adults with mild-to-moderate hearing loss and/or self-reported hearing difficulties since 2009.

Design: The mapping review followed the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis (2024) methodology for scoping reviews. Mapping reviews are distinct in that they tend to employ higher level data extraction using predefined coding categories. The following were the pre-defined coding categories identified by the 2024 NIDCD working group: consequences of unaddressed hearing loss, stigma, screening and assessment, care seeking, care delivery systems, outcomes, OTC hearing aids, technology, economics and policy, and workforce. Studies included: 1) were published in 2009 or later, 2) had direct application to the US, (3) broadly related to the topic of accessibility and affordability of HHC, (4) focused on at least one of pre-defined coding criteria, (5) were related to individuals 18 years and

older with mild-to-moderate hearing difficulties (either objectively measured, subjectively measured, self-reported etc.), and (7) were published in English. After pilot testing, an independent title and abstract screening using Rayyan was completed by expert reviewers in various subfields of hearing, hearing health, hearing healthcare, health economics, as well as a consumer of and advocate for hearing healthcare. Citations were divided among seven teams of reviewers. Once resolving for conflicts, full-text review along with data extraction charting was completed following JBI guidelines. All papers were also categorized to one of the pre-defined codes and then assigned to expert reviewers to synthesize a narrative summary.

Results: Following the search, 2876 papers were screened for inclusion. After resolving for conflicts, 759 articles were included for full-text review and data extraction. The narrative summaries for each pre-defined theme will be discussed with emphasis on areas for future research. A dynamic tabular format will be presented alongside the narrative summaries.

Conclusions: This mapping review draws on the expertise of an interdisciplinary team to map the available evidence on the accessibility and affordability of HHC in the United States. The results will be relevant to a wide range of stakeholders including researchers, clinicians, public health policy decision makers, and consumers of hearing healthcare. Furthermore, the findings from this mapping review will highlight the current gaps in the literature providing insights to the future directions of research programs in the field of accessibility and affordability of HHC.

Category: Hearing Health Care

Poster #: 045

What Audiologists Need to Know about Gene Therapy

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Objectives: The otoferlin gene (OTOF) encodes otoferlin, a protein critical for signaling at the inner hair cell synapse. Individuals with OTOF-mediated hearing loss typically present with congenital, severe to profound sensorineural hearing loss, with preserved otoacoustic emissions early in life. Recent advances in gene therapy and intracochlear delivery support the potential to restore physiologic hearing in individuals with OTOF-mediated hearing loss using a one-time, local administration of AK-OTOF (AAVAnc80-hOTOF). The objective of this gene therapy trial for OTOF-mediated hearing loss is to assess the safety, tolerability, and bioactivity/preliminary efficacy of escalating doses of AK-OTOF.

Design: Clinical trial participants have absent or abnormal diagnostic auditory brainstem response (ABR) at baseline and receive a one-time intracochlear administration of AK-OTOF using a minimally invasive transcanal approach and the Akouos Delivery Device. Safety assessments and auditory function tests, including ABR, behavioral audiometry, and patient/parent-mediated questionnaires are performed over the trial and long-term follow-up periods.

Results: The preliminary safety profile is favorable, with no related serious adverse events and no adverse events related to AK-OTOF gene therapy or the Akouos Delivery Device. Initial clinical evidence

shows that AK-OTOF gene therapy has the potential to restore physiologic hearing in individuals with OTOF-mediated hearing loss. Safety and efficacy data (through at least 3 months post-administration) from participants will be presented.

Conclusions: Available data suggest that AK-OTOF may be safely administered to participants, with onset of restoration of physiologic hearing as early as one month following administration.

Category: Hearing Health Care

Poster #: 046

Designing AI Assistants to Enhance Patient Autonomy with Hearing Devices

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Objectives: The learning curve for hearing aid adoption is steep for some individuals whether devices are obtained through traditional or over-the-counter pathways. Many users are older adults who may be less comfortable with technology, more inclined to rely on established help-seeking routines, and more likely to manage comorbidities. This pilot study assessed the opinions of individuals with and without hearing aid experience when using a personalized artificial intelligence (AI) assistant. We hypothesized that using an assistant would strengthen patient autonomy, reduce barriers to hearing healthcare, and improve independent device management.

Design: We designed a prototype hearing aid assistant enhanced with AI and a retriever-generator architecture. The retriever included an encoder that chunked and embedded documents from a researcher-developed database and an index that returned the top five text chunks semantically related to the user's prompt. The retrieved context was then appended to the user's prompt and passed to the generative model. When appropriate, conditional logic triggered searches for relevant database multimedia to supplement the response. At present, five participants from our targeted recruitment number of twenty between 40-90 years old completed information-seeking tasks using the assistant. Half had hearing aid experience and half had no experience. All interactions were logged to characterize prompt and response patterns, and brief post-session interviews assessed the perceived usefulness of the assistant relative to Google and ChatGPT.

Results: Participants submitted on-task prompts related to hearing aid use, features, and maintenance as well as off-task prompts related to hearing aid pricing and manufacturer comparisons. On average, participants found the AI assistant helpful (4/5) and easy to use (5/5) but likely most useful for new hearing aid users in its current iteration. For participants experienced with Google and ChatGPT, the assistant's concise and accurate responses were appreciated as well as the inclusion of relevant instructional videos and webpage links. While the average response length was approximately 65 words and tailored to the user's selected device, Google and ChatGPT's responses were between 115-350 words and included information for multiple hearing aids. In addition, experienced hearing aid users believed that storing device-related details with the assistant was empowering because they could retrieve the information and purchase supplies with increased confidence. Finally, for continued use and broader uptake, participants believed that users would need additional support to set up the assistant,

demonstrate its use, and explain its value over resources like Google and ChatGPT. Participants were also mixed on giving providers access to chat transcripts to improve counseling or to trigger appointments.

Conclusions: Both hearing aid users and non-users easily obtained device-specific answers and counseling through a curated AI assistant. While successful integration of AI assistants will likely require onboarding and/or a clear value proposition that differentiates them from established help-seeking routines, AI assistants have the potential to save costs and improve efficiency by reviewing troubleshooting techniques and answering device-related questions without the need for appointments. Future work should evaluate the best candidates for this technology, including users of over-the-counter devices and cochlear implants, as well as the responses that best meet users' expectations.

HEARING LOSS / REHABILITATION

Category: Hearing Loss / Rehab

Poster #: 047

Phosphoproteomic Quantification Uncovers Mechanisms that Underlies Resistance to Hearing Loss

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Objectives: The discovery of molecular signaling cascades that render resistance or vulnerability to hearing loss may lead to new approaches for preventing or treating acquired hearing loss. The objective of this research was to quantify phosphorylated signaling cascades that differentiate noise-resistant from noise-vulnerable cochleae.

Design: A 2 x 3 factorial experimental design was employed, where a noise-resistance mice strain (129S6/SvEvTac) and a noise-vulnerable mice strain (CBA/Caj) served as subjects. These subjects were staged across three conditions: pre-noise exposure, noise exposure and post-noise exposure. Distortion product otoacoustic emissions and neurophysiologic assessments were used to characterize pre-neural and neural cochlear functions. Affinity-purification coupled to liquid chromatography tandem mass spectrometry was used to purify and quantify all target phosphoproteins from the cochleae.

Results: The noise-resistance mice strain showed exceptional resistance to noise-induced hearing loss following broadband noise exposure. Phosphoproteomic quantification revealed that specific kinase substrates were enrich in resistant mice cochleae over vulnerable mice cochleae. Bioinformatic analysis of these substrates further uncovered unique signaling networks that mediated resistance to hearing loss.

Conclusions: Vulnerability or resistance to noise induced hearing loss is modulated by molecular signaling cascades. Specific networks of phosphoproteins conspire to endow noise-resistance within the cochleae of 129s mice. By uncovering these precise network nodes, future research can now validate them and target them for therapeutic research and development.

Category: Hearing Loss / Rehab

Poster #: 048

Hearing Loss Simulator: Hearing through the Patient's Ears

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Objectives: Communication partners often misunderstand the impact hearing loss has on their loved ones' speech understanding. Moreover, many medical professionals are unaware of how hearing loss affects patient compliance, follow-up care, and information retention. There is a significant market gap for a simulation tool that can be tailored for audiologists to use with their patients, while also being generalizable with presets for medical training purposes. Hearing loss simulation has been identified as an effective tool for counseling patients and their families, setting realistic expectations for hearing aids, and training medical students. Despite these benefits, simulation is rarely used clinically. Contributing to this gap, providers report a lack of effective simulation tools. The purpose of this research is to investigate the effectiveness of a hearing simulator in demonstrating the impacts of hearing loss, from the perspectives of providers, patients, and communication partners.

Design: A mixed-methods study was conducted to investigate the utility of a hearing loss simulator on patient and family counseling as well as provider education. All 80 participants completed a trial with a web-based hearing loss simulator, either in one-on-one or group settings and subsequently completed a questionnaire regarding their experiences. The simulation provided listening to demonstrations of hearing loss and amplification in the following listening environments: speech in quiet, speech in noise, speech at a distance, and instrumental music. Audiologists, ENT providers, and medical students (n=40) experienced the simulator using a model of sloping sensorineural hearing loss. Patients and/or their communication partners (n=40) also participated in demonstrations tailored to the patient's own hearing loss or a sloping sensorineural hearing loss. Participants then completed a questionnaire regarding their experience with the simulator. The questionnaires included both Likert-scale questions and free responses.

Results: Patients reported that the hearing loss simulator provided a realistic replication of their lived experiences with hearing loss. Patients who were not currently using hearing aids expressed greater motivation to pursue them after trialing the hearing simulator. Communication partners reported that they gained a better understanding of their partner's hearing loss, with all expressing increased feelings of empathy towards their partner and individuals with hearing loss. Audiologists, ENT medical providers, and medical students found the simulator easy to use and understand, generally considering it somewhat realistic. Among providers, 95% indicated they were very likely or likely to recommend the use of a hearing loss simulator to other providers with their patients. However, providers reported that distortion and listening fatigue were elements of hearing loss that were not captured in the current iteration of the simulator.

Conclusions: Simulating hearing loss can be beneficial for medical training and patient counseling. Clinically, such simulations can set realistic expectations for amplification, foster empathy, and promote discussion about effective communication strategies. Despite these benefits, there are inherent limitations of web-based technologies meant to simulate hearing loss. Further development of features that demonstrate distortion and loudness recruitment are necessary for a more accurate representation of sensorineural hearing loss.

Category: Hearing Loss / Rehab

Poster #: 049

Ear Level Cooling for Otoprotection

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Objectives: Mild therapeutic hypothermia (MTH) has shown significant promise for otoprotection from ototoxic drugs, noise exposure, and iatrogenic injury. We have previously demonstrated significant reduction in cisplatin induced ototoxicity with ear level MTH delivered via a Peltier cooled ear bar. In the present work, we characterize mechanisms for ear level MTH for protection from cisplatin induced injury and vestibular end organs.

Design: Adult Guinea pigs were anesthetized with isoflurane and delivered cisplatin. Ten minutes before the cisplatin delivery, during, and thirty minutes post-delivery the ear canal was cooled (15C) using our custom thermoelectric cooling system and compared to sham controls. Post cooling, cochlea and vestibular tissue was retrieved for immunohistochemical analysis. We assessed cisplatin uptake via immunostaining for cisplatin DNA-adducts and using a BODIPY-tagged cisplatin. Adults Long-Evans rats were also exposed to cooling as described and tissue retrieved to characterize presence of cold shock proteins (CSP) of the inner ear [RNA-binding motif protein 3 (RBM3) and cold-inducible RNA-binding protein (CIRP)].

Results: We observed reduced cisplatin DNA-adduct expression in cooled ears. This was most pronounced in the stria vascularis. BODIPY-tagged cisplatin was mainly limited to the stria vascularis and reduced fluorescence was observed in our cooled ears. The CSP RBM3 was expressed in cochlear tissue with enhanced expression in cooled ears, however low expression of CIRP was observed which was likely related to experimental timing.

Conclusions: Simple cooling of the ear canal can provide otoprotection from cisplatin. A primary mechanism is reduced uptake of cisplatin. Further research is needed to characterize how cooling affects entry of cisplatin into the inner ear.

Category: Hearing Loss / Rehab

Poster #: 050

Hearing Loss and Dementia in Cancer Survivors

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Objectives: Cancer survivors face health challenges with accelerated aging. Hearing loss, an established risk factor for dementia and cognitive decline, is more prevalent among cancer survivors than in the general population, perhaps due to the phenotypic age acceleration observed in survivors and/or treatment-induced ototoxicity. This study examined the association between hearing loss and 9-year risk of incident dementia among cancer survivors.

Design: This prospective cohort study analyzed data from the ongoing Atherosclerosis Risk in Communities Study (ARIC). 834 cancer survivors attended Visit 5 (2011-2013), baseline for this study. Better-ear hearing status, assessed using 4-frequency pure tone audiometry at Visit 6 (2016-2017), was categorized into typical hearing (≤25 dB HL), mild hearing loss (>25-40 dB HL), or moderate or greater hearing loss (>40 dB HL). Standardized algorithmic dementia diagnosis was adjudicated through Visit 9 (2021-2022) incorporating longitudinal cognitive data, proxy report, and hospital and death certificate dementia codes, with expert committee review. Cox regression estimated the association of hearing loss with incident dementia using the Efron method for ties. The proportionality assumption was verified using Schoenfeld residuals. Models controlled for age (years); sex (female/male); race (Black/White); diabetes (yes/no); education (less than high school/high school/greater than high school); hypertension (yes/no); prevalent stroke (yes/no); BMI (kg/m2); smoking status (never/former/current); APOE e4 carrier status (≥1 vs. 0 alleles); and hearing aid use (yes/no). Sensitivity analyses stratified by cancer type and used the most recent WHO definition for hearing loss.

Results: Of 834 ARIC cancer survivors (mean age 75.2 years [SD, 4.8] ; 51% female; 81% White), the mean pure tone average was 34.0 (SD, 13.6) dB HL; 29% had typical hearing, 41% had mild hearing loss, and 29% had moderate or greater hearing loss; and 22% used hearing aids. Over a mean follow-up of 8.7 years, 8.8% (n = 73) of the survivors developed dementia; by hearing status, 13.6% (n = 33) of those with moderate or greater hearing loss developed dementia, compared to 7.2% (n = 24) of those with mild hearing loss and 6.8% (n = 16) of those with typical hearing. After covariate adjustment, hearing loss (vs. typical hearing) was associated with a 57% greater risk of dementia (adjusted hazard ratio [aHR], 1.57; 95% CI, 1.03-2.39). Estimated associations were stronger for cancer survivors with mild hearing loss vs. typical hearing (aHR, 1.62; 95% CI, 1.06-2.49), followed by moderate or greater hearing loss vs. typical hearing (aHR, 1.40; 95% CI, 0.87-2.25).

Conclusions: In this prospective community-dwelling cohort, cancer survivors with even mild hearing loss had a higher 9-year risk of dementia vs. those with typical hearing. Our findings support an important role for hearing healthcare for cancer survivors and the need to examine hearing rehabilitation in this growing aging population.

Category: Hearing Loss / Rehab

Poster #: 051

A Comparison of Two Sound Therapy Approaches for Hyperacusis

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Objectives: Sound therapy as a treatment for hyperacusis is controversial, yet research conveys its effectiveness in increasing one's tolerance to bothersome sounds. In our remotely delivered counseling and sound therapy program, Hyperacusis Activities Treatment-Online, we compared two sound therapy approaches using successive approximations to gradually expose participants to sounds. We tested the effectiveness of these two approaches in reducing reactions to hyperacusis.

Design: We created a four-week remote counseling program, Hyperacusis Activities Treatment-Online (HAT-Online), that aimed to educate and equip participants with coping skills in an engaging format. Following counseling, we compared two sound therapy approaches over four weeks. Participants were randomly assigned into one of two groups: 1) Group 1: listen to everyday sounds that trigger hyperacusis and 2) Group 2: listen to low-level, continuous background noise (i.e., white noise) from sound generators. Both groups of participants used successive approximations to increase the level and duration of the sound, and coaching was provided. During the first week of sound therapy, participants listened to their respective sounds for 15 minutes per day and increased to 60 minutes per day by week 4. Participants were instructed to set the sound level slightly above their hearing threshold as a starting point. Participants gradually increased the sound level every four days or as they were able. We tracked sound usage and reactions to sounds using daily listening logs. Hyperacusis and reactions to hyperacusis were measured using the Inventory of Hyperacusis Symptoms and a psychoacoustic sound test. The questionnaire and sound test were administered online at intervals before, during, and after the counseling and sound therapy interventions. We enrolled 50 participants in the study in cohorts of 8-15 to facilitate discussion and connection. Here, we report on 43 participants who finished the study.

Results: A repeated measures ANOVA showed a significant decline in overall hyperacusis symptoms ($F(3) = 8.65$, $p < .01$, $\eta^2 = .19$). There were significant declines in perception of excess loudness ($p = .01$), negative emotional arousal ($p = .01$), psychosocial impairment ($p = .01$), and functional impairment ($p = .01$). Problems with communication did not improve significantly ($p = .06$). There were no significant differences between the two sound therapy groups in rates of change for the IHS total ($F(3) = 2.23$, $p = .09$, $\eta^2 = .06$) or the subscale scores (all $p > .05$). Combining the sound therapy groups, 10 participants experienced a large improvement in hyperacusis symptoms, 7 experienced a moderate improvement,

and 4 experienced a small improvement. Only 3 participants experienced a moderate or large exacerbation of symptoms, whereas 9 people had no change on the IHS.

Conclusions: The preliminary data from our remote counseling and sound therapy program, HAT-Online, indicated a significant improvement in hyperacusis symptoms for 43 participants. There was no difference in results between the two sound therapy groups. More participants are working through the program and we continue to gather evidence to assess effectiveness of HAT-Online.

Category: Hearing Loss / Rehab

Poster #: 052

Testing the Effectiveness of Communication Strategies Counselling for Better Communication

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Objectives: To investigate the effect of delivering communication strategies advice to people with listening difficulties to improve communication using personalised counselling alongside an advice booklet versus using an advice booklet alone.

Design: Our previous work investigated strategies that people with listening difficulties found useful when communicating in challenging listening situations. Based on these results we created an advice booklet listing the strategies found to be most useful. The effectiveness of the booklet alongside personalised counselling was investigated in the current study. 90 participants aged 60 or over were randomised into 3 groups of 30. All participants reported difficulty hearing conversations. Some participants wore hearing aids, others did not. All participants attended two face-to-face sessions with an audiologist where they were interviewed regarding their listening difficulties and use of communication strategies, and completed four questionnaires: the Revised Hearing Handicap Inventory (RHHI), the Hearing-Related Lifestyle Questionnaire (HEARLI-Q), the Image-Based Questionnaire for Hearing (IBQ-H), and the Empowerment Audiology Questionnaire-5 (EmpAQ-5). Groups differed in the extent of counselling they received for their reported communication difficulties. At the first session Group 1 were asked to bring photos depicting personally challenging communication situations. They received the booklet of communication strategies advice alongside personalised counselling advice. The personalised advice entailed discussing areas of listening difficulties as depicted in their photos and entering into shared agreement on new strategies to try in these situations. At follow up, Group 1 were asked whether they had used the strategies they had agreed to try previously; reasons surrounding the use or non-use of these strategies and opinions of their effect on communication success were explored. Group 2 participants were not asked to bring any photos; they received general advice about strategies that may work in a range of situations and were provided with the booklet to take home. At the follow-up visit, Group 2 were asked whether they had tried any strategies from the booklet since they first attended and their views on the effectiveness of these strategies. Group 3 served as a control group. They received

neither booklet nor counselling at the first visit, and were only given the booklet and general counselling at the end of their participation.

Results: Data collection remains ongoing with completion anticipated in January 2026. With 74 of 90 participants' data collected so far, preliminary analysis indicates that participants who received personalised counselling (Group 1) were more likely to try new communication strategies than participants who received the booklet alone (Group 2). Moreover, receiving non-personalised communication strategy advice (Group 2), still appears to be better than no advice at all (Group 3). Quantitative analysis of questionnaire responses and qualitative analysis of reasons for the implementation of strategies across the groups is ongoing .

Conclusions: Initial results appear to support the effectiveness of personalised counselling over general advice, and general advice over no advice at all. By tailoring advice based on a person's individual circumstances and motivations, clinicians can ensure that advice is both optimally acceptable and relevant to patients' needs, resulting in more successful intervention outcomes.

Category: Hearing Loss / Rehab

Poster #: 053

Associations Between Jet Fuel and Auditory Function in Military Personnel

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Objectives: Jet fuel used by the U.S. military contains aromatic, ototoxic hydrocarbons. Active duty servicemembers (ADSMs) and Veterans with jet fuel exposure are often concomitantly exposed to harmful levels of noise. Animal studies have demonstrated that jet fuel alone and in combination with noise exposure can affect peripheral and central auditory function. However, the independent contribution of jet fuel exposure on human auditory function remains unclear. The purpose of the current study is to examine the association between jet fuel exposure and auditory function in ADSMs and Veterans (n = 1683), while accounting for concomitant noise exposure.

Design: This analysis included participants from the baseline evaluation of the Noise Outcomes in Servicemembers Epidemiology (NOISE) Study. Exposure classification was based on military occupational specialty. Study participants who served in one or more military occupational specialties with jet fuel exposure were categorized as exposed (n=387), and those with no record of service in occupations with known exposure as unexposed (n=1296). Outcomes included measures of peripheral auditory function (audiometric thresholds from 0.25 to 16 kHz and distortion-product otoacoustic emissions from 1000-8000 Hz at L2/L1=65/55 and L2/L1=55/40), hearing handicap (Hearing Handicap Inventory for Adults), and tinnitus presence (Tinnitus Screener). Associations between jet fuel exposure and auditory function were examined using multivariable regression analyses. Mean difference in hearing thresholds and DPOAE amplitudes, and odds ratios for hearing handicap (yes/no handicap) and tinnitus (present/absent) were estimated with corresponding 95% confidence intervals (CI). Models were adjusted for age, sex, race, military noise exposure, service branch, and service length.

Results: The study sample had a mean age of 34 years and was predominantly male (76%) and non-Hispanic White (61%), and almost half had served for 10 or more years in the military at the time of baseline evaluation (47%). Regression analyses indicated that audiometric thresholds were significantly higher for jet fuel exposed participants from 250 - 3000 Hz (mean threshold differences ranged from .8 - 1.1 dB; p-values< 0.05), with no significant differences observed above 3000 Hz. No significant differences were observed in DPOAE amplitudes between those exposed and unexposed to jet fuel. Participants exposed to jet fuel reported higher perceived hearing handicap (OR=1.44, 95% CI: 1.13, 1.84) compared to those unexposed. Although the odds of prevalent tinnitus among those exposed to jet fuel were slightly elevated (OR=1.2; 95% CI: 0.9, 1.5), this difference was not statistically significant.

Conclusions: Overall, results suggest that jet fuel exposure is associated with subtle but measurable differences in audiometric hearing thresholds at lower frequencies and in perceived hearing handicap, after adjusting for important confounders including noise exposure. These findings highlight the need for military hearing conservation programs to consider chemical exposures, such as jet fuel, alongside noise exposure in protecting ADSMs' and Veterans' hearing health.

Category: Hearing Loss / Rehab

Poster #: 054

The Role of Cognitive-Affective Predictors in Hearing Aid Adoption

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Objectives: 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 (Connect Hearing Canada). 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.

Conclusions: Our results suggest that the subjective experience of hearing loss has cognitive-affective components that also affect hearing aid adoption.

Category: Hearing Loss / Rehab

Poster #: 055

Cardiovascular Health and Hearing Loss in Older Adults

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Objectives: Hearing loss is a common and disabling condition in older adults, yet modifiable risk factors remain poorly defined. Cardiovascular health may influence auditory function through vascular and metabolic pathways. We examined whether higher Life's Essential 8 (LE8) scores, a measure of overall cardiovascular health, are associated with better hearing thresholds and lower prevalence of hearing loss in U.S. adults aged 60 years and older. We hypothesized that higher LE8 scores would correspond to lower pure-tone averages (PTA) and reduced odds of both any and moderate-to-severe hearing loss.

Design: Hearing loss is a common and disabling condition in older adults, yet modifiable risk factors remain poorly defined. Cardiovascular health may influence auditory function through vascular and metabolic pathways. We examined whether higher Life's Essential 8 (LE8) scores, a measure of overall cardiovascular health, are associated with better hearing thresholds and lower prevalence of hearing loss in U.S. adults aged 60 years and older. We hypothesized that higher LE8 scores would correspond to lower pure-tone averages (PTA) and reduced odds of both any and moderate-to-severe hearing loss.

Results: Hearing loss is a common and disabling condition in older adults, yet modifiable risk factors remain poorly defined. Cardiovascular health may influence auditory function through vascular and metabolic pathways. We examined whether higher Life's Essential 8 (LE8) scores, a measure of overall cardiovascular health, are associated with better hearing thresholds and lower prevalence of hearing loss in U.S. adults aged 60 years and older. We hypothesized that higher LE8 scores would correspond to lower pure-tone averages (PTA) and reduced odds of both any and moderate-to-severe hearing loss.

Conclusions: Better cardiovascular health, as reflected in higher LE8 scores, was consistently associated with better hearing thresholds and lower risk of hearing loss in older adults, particularly for the better ear. Although several associations did not reach conventional statistical significance, the consistent inverse patterns across multiple models suggest that cardiovascular health may contribute to preserving auditory function in later life. These findings highlight the potential for interventions targeting cardiovascular health to also reduce the burden of age-related hearing loss.

Category: Hearing Loss / Rehab

Poster #: 056

Listeners Readily Exert Physical Actions to Avoid Expending Listening Effort

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Objectives: 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.

Design: 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.

Results: 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.

Conclusions: 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.

Category: Hearing Loss / Rehab

Poster #: 057

Hearing Loss Predicts Dementia Patients' Sundowning Symptoms Before/After Music-Listening

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Objectives: Recent studies have suggested that hearing loss is a risk factor for dementia (Cantuaria et al., 2024; Loughrey et al., 2018). In adults with dementia, daily changes in sensory stimulation could be linked to sundowning symptoms such as agitation and confusion (Canevelli et al., 2016). The goal of the current study was to determine whether hearing loss is linked to sundowning symptoms in older adults with dementia. We hypothesized that hearing would be related to degree of sundowning symptoms, and that hearing ability would be positively correlated with improvements in sundowning following music and conversation interventions.

Design: Student researchers are collecting data from 50 participants ages 75-100 years with mild-severe dementia in local nursing homes. Nursing home staff advertised the study to residents who had dementia but still could hold a conversation. Participants received both music-based and conversational interventions across multiple sessions, with sundowning symptoms being recorded before and after each session. Prior to any interventions, we administered the Mini-Mental State Examination (MMSE), the Hearing Handicap Inventory for the Elderly proxy report (HHIE-S; Demers, 2012), and the Quality of Life for Alzheimer's Disease questionnaire (QoL-AD; Logsdon, Gibbons, McCurry, & Teri, 2002). The HHIE can be used as a proxy for PTA in work with older adults where functional hearing (social and emotional impact of hearing difficulties) may be more clinically relevant to outcomes than degree of loss (Humes, 2021; Humes et al., 2024).Pre-Intervention: One student researcher had a 5-minute conversation with the participant and rated the degree of seven sundowning symptoms (restlessness, disengagement, agitation, aggression, repetitiveness, unresponsiveness, and confusion). Intervention: A second student researcher introduced one of two conditions, either music listening or dyadic conversation for approximately 20 minutes. In the music listening condition, participants listened to a playlist comprised of songs from their late adolescent and early adult years. In the conversation condition, the student researcher used conversation prompts to guide the discussion with participants.Post-Intervention: The first student researcher returned to the room and conversed with the participant for an additional 5 to 10 minutes. The researcher rated sundowning symptoms again and noted any changes observed.

Results: Preliminary results are based on 28 participants who have completed at least one session of music intervention and one session of conversation intervention. HHIE scores were not significantly correlated with MMSE or QoL-AD scores. HHIE scores negatively correlated with only one sundowning symptom (flexibility/repetitiveness; $r = -.432$, $p = .028$). We also found a significant correlation between HHIE scores and change in repetitiveness level ($r = .410$, $p = .034$) in the music condition.

Conclusions: These results suggest that more hearing loss (higher HHIE score) was related to less flexibility and more repetitiveness (greater sundowning), and that listening to music from their youth improved repetitiveness in adults with more hearing loss (higher HHIE score). The results of this study will help scholars and clinicians to understand the relationship between hearing loss and dementia and to develop interventions that will improve the lives of adults with dementia.

Category: Hearing Loss / Rehab

Poster #: 058

Engagement with Audio-Driven Digital Media in Hearing Loss

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Objectives: Hearing loss (HL) is the third leading cause of disability worldwide and can significantly affect communication and social participation. In today's digital world, online platforms offer social environments that support connection, learning, and participation, and can supplement or partially replace in-person interaction. Although digital environments often involve multimodal input (visual and auditory), hearing is essential for active engagement in many contexts. There is growing use of audio-driven platforms and tools such as podcasts, audiobooks, voice-assistant technologies, and music-streaming services. Most hearing-health research has examined digital media use for information and support, with studies showing that social media engagement can improve social support and emotional well-being in the HL population. However, little is known about how individuals with HL engage with audio-driven content that requires sustained listening and speech understanding. The objective of this study is to characterize digital participation and engagement across age groups in individuals with HL compared to normal-hearing (NH) peers, with an emphasis on audio-driven content. We hypothesized that individuals with HL would report lower engagement with audio-driven content despite similar preferences for traditional social media use compared to NH peers.

Design: A cross-sectional online survey was conducted in Türkiye with 126 participants (50 HL; 76 NH; 18-75 years). The HL group included 13 hearing aid users, 34 cochlear implant users, and 3 unaided individuals. HL participants were recruited via social media groups and clinic referrals, while NH participants were primarily recruited through the networks of colleagues and acquaintances of the study team. The 24-item online survey assessed engagement with audio-only platforms (e.g., podcasts), audio-visual media (e.g., YouTube), and social media platforms (e.g., Facebook), as well as demographics, hearing status, and device use. All responses were self-reported, and digital media behaviors were compared across hearing groups.

Results: No significant group differences were observed in the use of traditional social media platforms (e.g., Instagram, YouTube, Facebook, Twitter; $p > 0.05$). However, a significant group difference emerged, with participants with HL engaging less and experiencing more difficulty with audio-driven media (e.g., podcasts, audiobooks; $p < 0.05$). Among participants with HL, 42% reported difficulty understanding podcasts and audiobooks, 21% indicated challenges when visual cues were unavailable, and 25% experienced fatigue or increased listening effort after engaging with audio-based media. In contrast, NH participants did not report these challenges.

Conclusions: These preliminary findings suggest that while adults with HL actively use visually supported social media platforms, they use audio-driven media less than their NH peers. Adults with HL report

facing greater challenges with audio-only content due to speech-understanding demands and increased listening effort. This work extends real-world communication research in HL by examining digital participation in everyday life. Understanding how people with HL navigate online platforms is essential for promoting inclusive communication and improving strategies to better support this population. These insights may guide the development of more accessible and user-centered digital platforms and hearing technologies, ultimately improving online communication experiences and digital participation for individuals with HL.

Category: Hearing Loss / Rehab

Poster #: 059

Perception of Emotions in Voices and Faces in Children with Hearing Aids

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Objectives: Emotion recognition plays a crucial role in human communication and is fundamental to children's social development. Children with hearing loss who use hearing aids may have difficulties perceiving relevant acoustic cues that convey emotions. However, the combined effects of neuroplasticity, physiological consequences of hearing loss, and the compensatory features of hearing aids are not yet fully understood. As a result, it remains unclear whether difficulties in vocal emotion perception primarily reflect reduced access to relevant acoustic cues, an acute effect, or whether they also arise from differences in the developmental trajectory of emotion processing skills, an accumulated effect over a longer period of time that may be less directly related to hearing difficulties. If the latter is true, children with hearing loss may experience broader difficulties in emotion perception beyond the auditory domain, such as in visual emotion recognition or general emotion understanding. This research investigated both auditory and visual emotion recognition in children with hearing aids to study the development of these skills throughout childhood and correlated these perceptual measures with general social and emotional functioning as measured through questionnaires.

Design: Children with hearing aids (aged 6-18 yr) and age-matched peers without hearing loss participated in this study. The EmoHI test was used the assess vocal emotion recognition, using non-language specific pseudospeech sentences expressing three basic emotions: happiness, sadness, and anger. Facial emotion recognition was assessed by presenting photographs of individuals expressing the same three basic emotions. Data on broader socioemotional functioning of children with hearing aids was collected through he Emotion Awareness Questionnaire, the Strengths and Difficulties Questionnaire and an emotion vocabulary measure.

Results: Preliminary findings from children with hearing aids show developmental effects on vocal emotion recognition, but not on facial emotion recognition. These children performed close to ceiling on the facial emotion recognition test across the full age range. In the vocal emotion recognition test, there

was a general group difference between children with hearing aids and age-matched children with normal hearing.

Conclusions: While vocal emotion recognition continues to develop in children with hearing aids, these children demonstrate intact facial emotion recognition of basic emotions. These results suggest that emotion perception difficulties in children with hearing aids are specific to the auditory domain. Potential contributing factors to the development of emotion perception in children with hearing loss will be discussed based on questionnaire data, hearing status and hearing aid use.

Category: Hearing Loss / Rehab

Poster #: 060

Acoustic and Behavioral Analysis of Emotional Responses to Non-Speech Sounds

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Objectives: A full range of emotional responses in everyday life is important for quality of life and overall well-being. Yet, our work to date has demonstrated that listeners with hearing loss show a compressed range of emotional responses towards nonspeech sounds. The compression has been partially attributed to reduced access to spectro-temporal modulations in the sounds for listeners with hearing loss. One limitation in this past work relates to the duration of the test stimuli. All of these previous studies used 1.5-second-duration sounds from a published corpus, instead of the original 6-second version. It is not clear if the shorter duration contributes to the findings demonstrating differences in emotional responses between adults with and without hearing loss. Currently, we aim to evaluate the potential consequences of using shortened stimuli on emotional responses to non-speech sounds for adults with and without hearing loss.

Design: Participants included 26 listeners (52 - 75 y.o., 11 female) with varying degrees of bilateral sensorineural hearing loss and 10 listeners with normal hearing (50 - 72 y.o., 10 female). Better ear pure tone average (PTA) hearing thresholds (average of 0.5, 1, 2, and 4 kHz) ranged from 23 to 72 dB HL for participants with hearing loss. Participants provided ratings of valence and arousal, each on a scale of 1 to 9, in response to two versions of non-speech sounds from the International Affective Digitized Sound corpus. The sounds were the 1.5-second and 6-second versions and were presented at 65 dB SPL from a loudspeaker located in front of the listener. A multilevel model was constructed to assess the effects of sound duration, expected sound category, and PTA on ratings of valence and arousal. Spectro-temporal analysis was completed on sounds of both durations to explore the potential of frequency-specific amplitude modulations cue for ratings of valence.

Results: The duration of stimulus did not significantly impact either valence or arousal rating, nor did it interact with PTA or sound category. Consistent with previous work, there was significant interaction between PTA and sound category for both ratings. Specifically, a 10-dB increase in pure tone average values led to a 0.22-point decrease in perceived valence of pleasant sounds, and a 0.24-point increase for unpleasant sounds. In contrast, the same increment in PTA led to a 0.3-point and 0.4-point decrease in

arousal ratings for pleasant and unpleasant sounds, respectively. Spectro-temporal analysis of the 6-second sounds was also consistent with previous findings with 1.5-second sounds. These findings suggest that the observed compression in emotional responses to valence and arousal for adults with hearing loss is not likely attributable to the use of short duration stimuli in previous studies.

Conclusions: The current results with longer sounds demonstrate remarkable consistency with previous findings. Therefore, it may be appropriate to use shorter version of the stimuli for testing emotional responses to non-speech sounds. The use of the shorter sounds allows for more efficient laboratory testing, which will be beneficial for future mechanistic works and those to improve current interventions.

Category: Hearing Loss / Rehab

Poster #: 061

Examining Cognitive-Linguistic Skills and Effort in Children with Hearing Aids

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Objectives: School-age children often communicate and learn in difficult listening environments. For children who are hard of hearing, the presence of noise can have major impacts on their ability to understand speech and process educational content. Thus, children who are hard of hearing are at risk for exerting extra effort during listening, especially when in noisy environments. Furthermore, children who are hard of hearing have limited access to auditory signals and need to rely on their developing cognitive-linguistic skills to understand speech. The current project aims to better understand how auditory access influences the relationship between cognitive-linguistic abilities and listening effort in children with hearing aids. In the first experiment, we hypothesized that auditory access, measured by the speech intelligibility index, would moderate the relationship between cognitive-linguistic factors (working memory and vocabulary) and listening effort. In the next experiment, we examined differences in listening effort between children with typical hearing and children who are hard of hearing.

Design: Thirty school-age children with typical hearing and fifty-nine children with hearing aids participated in a dual-task paradigm. During the task, each child listened to sentences in +6, +2, and -2 signal-to noise ratios (SNR) while simultaneously performing a simple visual reaction time task. Dual-task cost was calculated from the response times across the various listening conditions and baseline (secondary task without listening to speech). Children also reported their subjective listening effort and completed measures of expressive vocabulary, working memory, and auditory access.

Results: Children with hearing aids showed greater dual-task cost than children with typical hearing, indicating greater effort. For children with hearing aids, dual-task cost and subjective ratings of effort increased as a function of more difficult SNRs. Preliminary analysis reveals that auditory access does not moderate the relationship between vocabulary and effort, but does moderate the relationship between working memory and listening effort.

Conclusions: The current study highlights the importance of hearing aid use and how better access to sound provides children with more of an opportunity to exert less effort during listening. The results of this study align with previous work, indicating that more difficult listening environments can yield greater effort in children and that children with hearing loss exert more effort than their typical hearing peers.

Category: Hearing Loss / Rehab

Poster #: 062

K-HEARS: Community-Engaged Recruitment in Partnership with Ethnic Faith-Based Communities

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Objectives: Age-related hearing loss is highly prevalent and associated with adverse health outcomes for older adults. In particular, low-income, racial and ethnic minority, and linguistically isolated older adults can experience differential access to hearing health and have historically been underrepresented in hearing-related research. However, many older adults are well-connected and involved in their local community centers, residential associations, and faith-based communities, particularly among older Korean Americans. Harnessing this connection, we worked with key community stakeholders within the Korean ethnic church community to recruit for several community-based studies. In this poster presentation, the aim is to share methods used and lessons learned in the recruitment process for a 12-month observational hearing screening study (K-HEARS Screen) and an ongoing cluster randomized controlled trial (K-HEARS RCT).

Design: The K-HEARS studies (including K-HEARS screening and K-HEARS RCT) recruited community-dwelling older adults of Korean ethnicity from the greater Baltimore and DMV (D.C., Maryland, and Virginia) areas. Study sites were selected for their proximity to the primary study site and suitability for study activities, such as having a private room for hearing screenings. Key to recruitment were strong community site relationships and support from a dedicated community-based staff and Community Advisory Board (CAB). A key drawing point was offering hearing screenings at each partner community site. Anyone who passed the basic eligibility criteria would be eligible to have their hearing screened and results shared. The team ensured clear, frequent communication with partners and participants and developed attractive branding and printed materials in partnership with the CAB. Recruitment efforts included being featured in community newsletters and being present at community events. Recruitment was conducted in "waves" to strategically manage efforts, apply lessons learned, and meet recruitment goals.

Results: The K-HEARS Screen study partnered with 18 sites over seven months, holding 34 events (15 large and 19 small) that screened 514 individuals at a cost of 414 staff hours, primarily recruiting using newsletters and word-of-mouth. Finally, the KHEARS RCT (Year 1) successfully partnered with 6 of the 11 churches contacted. Reasons some churches were unable to participate in the study include lack of CHW support, concerns of reception, and declined participation due to other reasons. In the participating churches, 11 community health workers, who were recruited from the churches, were trained and certified. The community health workers screened 105 dyads (72 eligible), with 58 dyads enrolled in the study. Recruitment for the K-HEARS RCT is ongoing.

Conclusions: While recruitment across the K-HEARS studies have been successful thus far, not all site partnerships have been equally effective. Mismatch in expectations or communication difficulties can contribute to recruitment difficulties. Our experience underscores the critical importance of cultivating and protecting positive relationships with community partners throughout study startup and execution. Feedback from participants highlighted that the success of the screening was rooted in its community-based nature and its value in facilitating access to hearing care that may not otherwise be available.

Category: Hearing Loss / Rehab

Poster #: 063

Repurposing Statins: Candidates to Protect Against Cisplatin Ototoxicity

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Objectives: Cisplatin, while highly effective, carries a substantial risk of permanent sensorineural hearing loss with few proven countermeasures. Building on prior work from our group demonstrating a significant association between atorvastatin use and reduced incidence and severity of cisplatin-induced hearing loss (CIHL) in head and neck cancer patients, we aimed to confirm and extend these findings using a larger cohort, enabling further stratification by statin type and dose and improving generalizability.

Design: This was a retrospective cohort study using the NIDCD Enhancing Cancer Hearing Outcomes (ECHO) dataset combining oncology and audiology records across multiple U.S. centers. Adults with at least one pre-treatment and one post-treatment diagnostic audiogram were included (n=918; 77% male; median age 59 years [IQR 52–65]). Exclusions were incomplete data, no follow-up audiogram, or bilateral profound baseline loss. Statin exposure was defined according to use at start of chemotherapy; among the 332 statin users (37%), atorvastatin was most common (50%), followed by simvastatin (23%), rosuvastatin (13%), pravastatin (10%), lovastatin (4%), and pitavastatin (<1%). High-frequency pure-tone averages (HF PTA, 4–12 kHz) were computed; ototoxicity was classified using ASHA criteria and CTCAEv5. Primary analyses compared incidence of CIHL by statin use and type; multivariable logistic regression adjusted for age, sex, cumulative cisplatin dose, and baseline hearing. Prespecified post-hoc Dunnett–Hsu tests evaluated dose-specific effects versus non-statin users.

Results: HF PTA was smaller among statin users versus non-users (11.15±15.6 dB vs 14.06±17.6 dB), with the lowest mean shift in atorvastatin users (9.01±12.8 dB). Using ASHA criteria, the incidence of clinically meaningful CIHL was significantly lower with statin use 58.1% vs 67.5% (χ^2=8.07, p<0.01). In adjusted models, atorvastatin (χ^2=5.71, p<0.02) and rosuvastatin (χ^2=7.12, p<0.01) were independently associated with reduced risk of cisplatin-induced hearing loss; similar findings were observed using CTCAE criteria. Similarly, the incidence of CTCAE grade ≥1 hearing loss was 47.6% vs 58.1% for statin users compared to non-statin users, with atorvastatin (χ^2=5.51, p<0.02) and rosuvastatin (χ^2=5.17, p<0.03) independently associated with reduced risk of a hearing loss. Post-hoc Dunnett–Hsu comparisons indicated atorvastatin 40 mg was associated with lower incidence as defined by both ASHA and CTCAE grade ≥1, while rosuvastatin 10 mg was associated with reduced ASHA-defined ototoxicity. The incidence of CTCAE grade ≥2 hearing loss, a moderate severity, clinical change in hearing, was significantly reduced from 36.8% to 23.9% among atorvastatin users relative to non-statin users (χ^2=9.43, p<0.003), where 40 mg proved to be the most effective dose (t=-2.67, p<0.04).

Conclusions: In this multi-center cohort, concurrent statin therapy—particularly atorvastatin and rosuvastatin—was associated with reduced incidence and severity of CIHL, with evidence of dose-dependent effects. These findings support the clinical plausibility of statin repurposing as a low-cost, widely available otoprotective strategy during cisplatin therapy and can immediately inform risk counseling and shared decision-making. Because not all statins performed similarly, agent selection and dose may matter. Confirmation in larger cohorts and randomized studies is warranted; notably, a Phase II trial in head and neck cancer (NCT04915183) is ongoing to test efficacy prospectively and could define a practical pathway to implementation.

Category: Hearing Loss / Rehab

Poster #: 064 **Mentored Student Research Poster Award**

Sociodemographic Factors Related to Hearing Loss Stratified by Rural/Urban Residence

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Objectives: Previous research has shown that hearing loss (HL) is more prevalent in rural communities compared to urban communities, yet few studies have explored how HL varies by sociodemographic characteristics within each of those areas. This study aimed to examine the differences in both subjective and objective HL in rural and urban communities as well as how they differ across sociodemographic characteristics among a cohort of middle-aged and older adults in the US.

Design: Cross-sectional data from adults aged 51 and older were analyzed from waves 13 and 14 (2016-2018) of the nationally representative Health and Retirement Study (N=16,335). Subjective HL was present if participants self-reported ever using a hearing aid or self-rating their hearing as poor or fair (versus good, very good, or excellent). Objective HL was measured using the Siemens HearCheckTM screening device which plays 6 tones in each ear (20, 35, 55 dB at 1kHz and 35, 55, 75 dB at 3kHz) with participants instructed to raise a finger when they heard each tone. Participants were considered to have objective HL if they missed at least 2 tones at 1kHz and at least 1 tone at 3kHz since data were not

available on which specific tones were heard correctly. Rural/urban household status was determined by matching participant addresses to 2013 Beale Rural-Urban Continuum codes. Sociodemographic factors included age, gender, race, education, veteran status, marital status, household wealth, health insurance, occupational noise exposure, and number of comorbidities. Weighted complex survey frequencies calculated crude prevalence of subjective and objective HL for the total sample and stratified by rural/urban areas. Stratified adjusted weighted complex survey modified Poisson models with robust variance estimated prevalence ratios for subjective and objective HL.

Results: Subjective HL was more prevalent among those living in rural areas (28.25%, 95% CI: 26.33-30.24) compared to those living in urban areas (23.54%, 95% CI: 22.29-24.82). Objective HL was twice as high as subjective HL and more common in rural areas (57.99%, 95% CI: 54.47-61.46) than in urban areas (49.56%, 95% CI: 47.71-51.42). For those living in urban areas, Hispanic individuals were 42% more likely to have subjective HL (95% CI: 1.22-1.65) and 31% more likely to have objective HL (95% CI: 1.25-1.38) compared to Whites, after adjusting for wave, age, and gender; these differences were not observed in rural areas. In rural areas, objective HL was 12% more prevalent (95% CI: 1.07-1.16) for those with moderate occupational noise exposure and 14% more prevalent (95% CI: 1.05-1.23) for those with high noise exposure, compared to those with mild exposure, after adjusting for age, gender, race, education, veteran status, marital status, household wealth, and health insurance; these differences were not observed for those living in urban areas.

Conclusions: Differences in both subjective and objective HL were observed among sociodemographic factors that differed according to urban/rural household status. These results provide insight into how HL may impact different groups of people differentially depending on where they live, which could be used to influence public health outreach programs aimed at helping those with hearing loss.

HEARING TECHNOLOGY / AMPLIFICATION

Category: Hearing Technology / Amplification

Poster #: 065

Characterizing Hearing Health Benefit Generosity in Medicare Advantage Plans

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Objectives: Two-thirds of adults aged 70 years and older have hearing loss, yet it's widely undertreated. High costs and limited insurance coverage, especially in Traditional Medicare, may contribute to hearing loss undermanagement- nearly 90% of Medicare beneficiaries with hearing difficulty do not own hearing aids (HAs). Most Medicare Advantage (MA) plans offer hearing coverage, but the generosity of these benefits has not been characterized. Our objective is to characterize MA plan hearing benefit coverage to understand the availability and variability of coverage in the MA market.

Design: We used 2018 MA plan benefits data from the Centers for Medicare & Medicaid Services to examine Health Maintenance Organization (HMO) and Preferred Provider Organization (PPO) plans.

Descriptive statistics (means, medians) were used to assess cost containment strategies (CCSs) including: copayments, coinsurance, deductibles, prior authorization, referrals, maximum plan benefit coverage, and maximum plan periodic coverage across hearing exam (HEs) and hearing aid (HAs) benefits.

Results: A total of 3,131 unique MA plans were included (96% HMO; 4% PPO). All HMO plans required copayment for HEs, and 49.8% required copayment for HAs. In contrast, all PPO plans required a copayment for HAs, but 63% required copayment for HEs. 99% of HMO plans required coinsurance for HAs, and 31.67% for HEs. No PPO plans required coinsurance for HAs, and required 44.54% for HEs. Prior authorization was required in 69% of PPOs for HEs and 2.72% for HAs vs. 36.51% for HEs in HMOs, and 17.21% for HAs. Regardless of plan type, the average minimum/maximum HE copayment was $7.48/$8.06, and the average per HA was $267.06/ $661.88. The average maximum plan benefit was $977.47 for HEs and $1,203.35 for HAs. HA coinsurance ranged from 33.58%-37.25%, and the average coinsurance for HEs was 14.58%.

Conclusions: MA plans offer broad hearing benefits supporting beneficiaries' hearing healthcare needs. HMO plans had more evenly distributed CCSs, while PPOs applied more to HEs than HAs. PPO enrollees may face fewer cost-related barriers to hearing healthcare as plans offer more benefits for monitoring and maintaining hearing health as applied to HEs. Whether HMO or PPO, studies suggest MA coverage may reduce patient out-of-pocket costs for hearing health services and devices. However, despite MA coverage, patients may still face costs that are sufficiently high, perpetuating barriers to accessing needed hearing healthcare for older adults. Consideration of the role of hearing healthcare awareness and environment on understanding quality coverage for hearing healthcare could impact if beneficiaries take advantage of MA plan coverage. Examining how beneficiaries use their coverage can provide context for understanding how policy and market changes may shape future access to hearing care. In ongoing research, we plan to analyze MA benefits related to the introduction of over-the-counter hearing aids and the evolving landscape of hearing healthcare and policy in recent years, to explore whether benefit generosity has changed for beneficiaries.

Category: Hearing Technology / Amplification

Poster #: 066

Effects of Hearing Loss and Hearing Aids on the Perception of Environmental Sounds in the Lab and Real World

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Objectives: Although speech improvement is the main clinical goal of hearing aid fitting, one of the most striking post-fitting changes is renewed awareness of environmental sounds. However, little work has examined how hearing loss and hearing aids affect the perception of environmental sounds. In this preliminary investigation, we aimed to characterize how perceptual ratings of environmental sounds varies as a function of hearing status (normal hearing, non-hearing aid users with hearing loss, and hearing aid users in aided and unaided conditions) and determine whether these differences are

modulated by sound category and sound category identification. Then, we investigated whether the effects of hearing status on perceptual ratings observed in the lab extend to the real world using ecological momentary assessment.

Design: The study followed the soundscape framework, which defines perception of environmental sounds along pleasantness and eventfulness axes, yielding a circumplex with vibrant, calm, chaotic, and monotonous quadrants. Using these dimensions and standard sound categories of geophony (nature), biophony (animals), and anthrophony (people and machines), participants rated sounds in the lab and identified their categories, then completed one week of ecological momentary assessment, rating environmental sounds every two hours. Forty-four adults (17 normal hearing, 14 unaided hearing loss, 13 aided hearing loss) completed the study. Ratings were quantified as vectors on the circumplex, and effects of group, category, and identification on vector magnitudes and angles were analyzed.

Results: In the lab, there were significant main effects of group, sound category, and identification accuracy, with interactions among them on rating magnitude. Normal hearing listeners gave stronger ratings than those with hearing loss, particularly when sounds were misidentified and for machine sounds. Hearing aid users showed a small but reliable increase in magnitude when aided. Across groups, animal sounds were rated most strongly. For rating orientation, angle was influenced by sound category and identification accuracy, but not by group. When sounds were correctly identified, categories showed distinct directions-for example, animal sounds were oriented toward the vibrant quadrant, nature sounds toward calm, and machine sounds toward monotonous. When misidentified, orientations moved toward the center, producing smaller and more variable angles. On ecological momentary assessment, sound category was the primary determinant of rating magnitude and angle, with the same orientation pattern observed as in the lab. Group main effects were not significant, but the group-category interaction showed that hearing-aid users rated machine sounds with greater magnitude when aided.

Conclusions: Across listener types and listening contexts, sound category was the dominant driver of environmental sound perception. Animal and nature sounds evoked the strongest and most pleasant ratings. In the lab, listeners with normal hearing gave stronger ratings than those with hearing loss, and hearing aids partially restored this strength. In daily life, these group effects largely disappeared except for an increase in perceived intensity of machine sounds with hearing aids. These findings lay groundwork for applying the soundscape framework to understanding how hearing loss and hearing aid use shape perception of everyday sounds.

Category: Hearing Technology / Amplification

Poster #: 067

Clinical Benefit of Integrating Cochlear Synaptopathy in Personalized Hearing-Aid Algorithms

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Objectives: State-of-the-art hearing aid compensation algorithms frequently demonstrate suboptimal performance, particularly in challenging acoustic environments where users need it most. Traditional hearing-aid fitting approaches primarily rely on audiometric thresholds, neglecting individual variations in cochlear synaptopathy (CS) that significantly impact speech perception, especially at supra-threshold levels and in noise. This study develops and validates a personalized hearing aid fitting platform that integrates physiologically-based estimates of CS via computational auditory models to personalized algorithms aimed to improve speech recognition outcomes.

Design: We developed a novel approach integrating computational auditory modeling and machine-learning with personalized hearing aid algorithms. CS assessment is performed using auditory physiology recordings and the audiogram from which personalized computational models that incorporate each patient's individual hearing parameters are developed. A deep neural network (dCoNNear) is fitted to these personalized parameters, allowing compensation for both outer hair cell (OHC) damage, derived from audiogram measurements, and auditory nerve fiber (ANF) losses assessed via envelope following response (EFR) and frequency following response (FFR) measurements. Patients perform a speech recognition task (Matrix) using the CoNNear performance metric, evaluated as percentage correct at their individually measured speech reception threshold (SRT) for unprocessed stimuli, ensuring a valid assessment at levels matched to each participant's hearing profile.

Results: Preliminary results from our ongoing study include data from 28 patients with varying degrees of hearing loss. Our findings demonstrate measurable improvements in speech recognition performance (percentage correct scores) when using personalized dCoNNear algorithms compared to baseline performance. The clinical benefit is more pronounced in the CS-informed dCoNNear algorithms compared to fitting strategies that do not incorporate CS. Additionally, the greatest clinical benefit is observed when both noise reduction and CS assessments are considered together.

Conclusions: The integration of individual CS assessment into personalized hearing aid fitting shows considerable promise for improving speech recognition outcomes in noise for individuals with hearing loss. However, several challenges and opportunities for optimization remain, including refinement of the dCoNNear loss function to better capture perceptual objectives, optimization of individualization strategies using alternative CS assessment methodologies, and acceleration of algorithm training procedures. To address these challenges and facilitate rapid iteration, we have developed a cloud-based application platform that enables researchers and clinicians to test diverse fitting strategies and quickly validate them with volunteers experiencing hearing loss. This platform represents a crucial step toward more efficient development and validation of personalized hearing aid technologies, ultimately aiming to deliver greater real-world benefit to hearing aid users, particularly in the noisy environments where improvement

Category: Hearing Technology / Amplification

Poster #: 068

Candidacy and Hearing Aid Use Among Individuals with Down Syndrome

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Objectives: Individuals with Down syndrome (Ds) experience high rates of hearing loss, with prevalence estimates ranging from 40-90% across the lifespan. While transient conductive hearing loss due to middle ear dysfunction is common, persistent conductive, sensorineural, and mixed hearing losses are also frequently observed. Additionally, pressure equalization tubes, tympanic membrane perforations, and abnormal middle ear function are common. Despite the high prevalence of hearing loss and middle ear differences, limited literature exists on hearing aid candidacy and use across the lifespan in this population. This study aimed to explore the patterns of hearing aid candidacy and uptake by applying an audibility-based approach in our population-based cohort of children and adults with Ds. A secondary objective was to characterize parent or caregiver awareness of hearing loss.

Design: We used Speech Intelligibility Index (SII) values as a criterion for hearing aid candidacy, with unaided SII less than 80 considered indicative of candidacy based on prior research showing increased risk for language delays in neurotypical children with similar audibility levels. Hearing profiles have been collected to date on 103 individuals with Ds (ages 5.1-55.8 years; mean = 23.6 years). The comprehensive test battery included participant or caregiver surveys, otoscopy, standard and wideband tympanometry, and conventional and extended high-frequency audiometry.

Results: Unaided SII values were calculated for 174 ears using either the average real-ear-to-coupler difference (RECD; n = 107) or measured RECD (n = 67). Of the ears tested, 93 (47.0%) had unaided SII values less than 80, and 46 (23.3%) had SII equal to or less than 50. Among ears with SII less than 80, only 32 (34.4%) were using amplification; for ears with SII equal to or less than 50, 23 (50%) were aided. Parents or caregivers completed a hearing health questionnaire that explicitly asked whether their child or adult family member had a known hearing loss. Reported awareness of hearing loss was 100% for ears in which the best hearing threshold was in the moderately-severe to profound hearing loss range. Awareness declined with lesser degrees of hearing loss, with 83%, 66.7% and 50% respectively for moderate, mild, and near-normal best thresholds.

Conclusions: These findings highlight a significant gap between audibility-based hearing aid candidacy and hearing aid use for individuals with Ds. Additionally, parent or caregiver awareness of hearing loss is very limited, particularly in cases of mild hearing loss. Nearly half of the ears assessed had unaided SII values less than 80, which is a level of audibility that has been associated with communication delays in neurotypical children with hearing loss who have not received hearing aids, but only one-third of those ears were using amplification. These results suggest that many children and adults with Ds could be at risk for language delays due to limited audibility. Future work will investigate the appropriate SII criterion for audibility-based hearing aid candidacy to support optimal speech and language outcomes and identify barriers to hearing aid use.

Category: Hearing Technology / Amplification

Poster #: 069

Comparison of Signal Processing Strategies on Speech-in-Noise Performance

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Objectives: Commercial hearings aids differ in the signal processing strategies they use to improve speech intelligibility in challenging listening situations. The current study evaluated speech-in-noise (SiN) performance across five premium hearing aids in adults with mild to moderate-to-severe hearing loss. In addition, the study investigated whether individual differences, such as demographic factors, cognitive capacities, and psychophysical or psychoacoustic abilities, could predict any observed variations in SiN performance among the devices.

Design: Twenty-nine adults with mild to moderate-to-severe hearing losses participated in a single-blind within-subjects design study. Their SiN performance was assessed using five commercially available premium HAs across two phases. In the first phase, each participant's complete SiN performance-intensity (P-I) function was estimated using a newly developed Bayesian-guided adaptive procedure for easy estimation of speech reception thresholds (ezSRT). Target speech was presented from multiple loudspeakers located in front of the listener in the presence of a mixture of babble-like noise and cafeteria noise presented from loudspeakers located behind and to the side of the listener. In the second phase, SiN performance was measured at fixed, individualized SNRs corresponding to 50% and 90% intelligibility, based on the best-performing hearing aid from the first phase. Participants also provided subjective ratings of listening effort and estimated how long they would be willing to remain engaged in communication under these test conditions.

Results: Overall, SiN performance was significantly better with two of the five hearing aids, a trend that appeared to be very robust with most individuals showing better performance with the top performing devices. In contrast, one device underperformed all other devices. Subjective outcome measures generally followed SiN performance patterns across the five hearing aid conditions. However, the listening effort ratings did not reflect differences in SiN performance among the three poorest performing devices. For speech recognition and listening effort measures, differences between the five study hearing aids were greater in listeners with moderate-to-severe hearing loss than those with mild hearing loss. Linear regression analysis revealed that differences in objective SiN performance between hearing aids were most strongly predicted by listeners' backward digit span and age.

Conclusions: These results suggest that the premium hearing aids evaluated in the current study may be categorized into three distinct tiers according to their SiN performance. In the context of this stratification, we found that individual differences in working memory capacity and age positively predicted the degree of SRT benefit that listeners experienced when tested with Tier 1 devices over Tier 2 devices. This could suggest that individuals with stronger cognitive abilities may derive greater benefit from the advanced signal processing features available in the highest-performing premium hearing aids.

Category: Hearing Technology / Amplification

Poster #: 070

Influence of Financial Toxicity on Hearing Aid Feature and Service Delivery Preferences

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Objectives: Financial hardship related to healthcare, often termed financial toxicity, can significantly influence patient choices. Individuals with hearing loss who experience financial strain may opt for lower-cost hearing devices despite preferring advanced features or professional support. Understanding how financial distress affects preferences for hearing aid (HA) technology and service models can help tailor patient-centered hearing care and guide equitable policy development. This study examined associations between financial toxicity, demographic and audiologic factors, and preferences for HA features and service delivery models among adults with self-reported hearing disability.

Design: Using a cross-sectional design embedded within a four-arm randomized clinical trial, data were collected from 114 adults with self-reported hearing difficulties. Participants completed a patient profile and the Comprehensive Score for Financial Toxicity (COST) questionnaire. Preferences for HA features and service delivery options were analyzed in relation to demographic and financial variables. Spearman correlations and standardized mean differences were used to assess associations.

Results: Most participants (76%) reported minimal financial burden (COST Grade 0; score ≥26). Higher financial toxicity was moderately correlated with having Medicaid coverage and with identifying cost as a key factor in selecting a service delivery model. Participants who prioritized affordability when selecting over-the-counter (OTC) HAs were typically younger and employed at least part-time, compared with those who prioritized an initial fitting by a hearing care professional. Those with higher incomes tended to favor OTC devices offering advanced features. Preference for online-only support was more common among Medicaid-insured individuals and those living alone compared with participants preferring in-person or hybrid assistance.

Conclusions: Financial strain influences both the type of HA features and service delivery options adults prefer. Although affordability drives some interest in OTC devices, many individuals continue to value professional input and advanced functionality. Addressing financial barriers is essential to ensure that emerging OTC pathways promote equitable and patient-centered hearing care.

Category: Hearing Technology / Amplification

Poster #: 071

Assessing Listener Preference Between Commercial Hearing Aids Through Paired Comparison

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Objectives: Modern hearing aid development is at a stage where increasingly sophisticated algorithms are being combined and selectively applied to provide wearers with "optimal" signal processing for whatever auditory environment they may encounter. The goal of these efforts is to encourage continued use of the hearing aids by maintaining positive subjective impressions of aided listening across many real-world scenarios. However, different hearing aid manufacturers adopt different design philosophies for what they consider to be optimal signal processing in a given sound scenario. Listeners themselves may also hold yet unknown preferences for how they expect hearing aids to sound/perform depending on their hearing loss profiles, lifestyle needs, and cognitive abilities, among other factors. While selecting the hearing aid brand that best suits a given listener's preferences would theoretically promote adoption, comparison of different devices during clinical fitting is often not practical. Here we examine whether paired comparisons involving pre-recorded samples of different sound scenarios as processed by different commercial hearing aid brands might identify factors that contribute to preference for a given brand.

Design: Single-blind within-subjects design involving 30 participants with mild to moderate-to-severe hearing loss. Participants are to complete a series of paired comparison tasks involving KEMAR recordings of 24 common sound scenarios as processed through four current generation commercial hearing aids programmed for each participant's hearing loss using each brand's default fitting settings. The sound scenarios involve different speech-in-noise situations, environmental sounds, and various media (i.e., television/sports/music). For every sound scenario, participants are asked to compare two hearing aids at a time by rating each on a 9-point scale and selecting the one they most prefer. Listeners are also asked to provide justifications for their selections. A battery of cognitive and auditory psychophysical tests is also administered to each participant along with questionnaires assessing hearing-related lifestyles and desired hearing aid benefits.

Results: Data collection is presently ongoing. Preliminary analysis suggests that the paired comparison task is able to capture listener preference between at least two of the four study devices. Moreover, the ratings assigned to different study hearing aids reveal individual differences in the magnitude of preference for some hearing aids over others that depend on the category of sound scenario being used for comparison. Chi-squared test of expected frequency will be used to formally assess the significance of preference differences between the different study hearing aids. Analysis of justifications provided for preferences will focus on the most common adjustives used to support overall preference, as well as the adjectives that were most unique to each study device. Lastly, the magnitude of preference (i.e., difference in ratings) between different study aids will be compared against participants' hearing-related lifestyles, desired hearing aid benefits, and their demographic, cognitive, and psychoacoustic profiles.

Conclusions: In a paired comparison, listeners with hearing loss are sensitive to differences in the signal processing philosophies and fitting rationales of different hearing aid manufacturers and exhibit variable magnitudes of preference for one hearing aid over another depending on the specific category of sound scenario being evaluated.

Category: Hearing Technology / Amplification

Poster #: 072

Music Listening Preferences Among Experienced Hearing Aid Users

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Objectives: Hearing aids are typically optimized for speech, often neglecting music-a vital part of everyday listening. Despite its emotional significance, music is rarely addressed in clinical fittings: 58% of audiologists never discuss it, and 67% of users report difficulty enjoying music with hearing aids. Prior studies have examined gain and compression preferences, but few have explored responses to dedicated music programs or customizable equalizers. This study investigates individual preferences for music listening among hearing aid users with diverse hearing profiles, musical backgrounds, and acoustic couplings of the hearing aids, aiming to better understand how personalization affects music satisfaction.

Design: Twenty experienced hearing aid users (mean age: 68 years; 4 females) participated in this study. Eleven of the participants reported playing musical instruments at least occasionally. All individuals were fitted with hearing aids using clinically appropriate couplings. Following a one-week acclimatization period, participants returned to the laboratory and completed paired-comparison and equalizer tasks. The paired-comparison task involved participants comparing their personal program to a dedicated music memory, which was designed specifically for music enjoyment. The music memory has a music-specific fitting rationale and a custom dynamic range compressor that provides linear amplification for loud music and shaped gain for soft music. This paired-comparison task was conducted with six pre-selected musical excerpts (each 10 seconds in duration and representing different genres), presented at two sound pressure levels (60 and 75 dB SPL). Each condition was repeated three times, and participants were asked to select the setting they preferred. For the equalizer task, participants were given an equalizer to adjust the gain for bass, middle and treble frequency regions when listening to the same music. For each condition, they selected their preferred equalizer settings across three distinct trials. These settings, along with the personal memory program, were later presented again in a blinded format, and participants rated their satisfaction with each option.Real-ear measurements and scores from the Abbreviated Profile of Hearing Aid Benefit (APHAB) were also collected during the study to provide additional audiological context.

Results: Substantial individual variability in hearing aid setting preferences was observed for music listening. In the paired-comparison task, preference was significantly associated with pure tone average (PTA): participants with better hearing tended to prefer the music program over their personal program. Additionally, 54% of the participants who identified as musicians preferred the dedicated music memory over the default personal memory, 36% of them preferred personal memory, and the rest showed no preference. In the equalizer task, only 25% of participants showed a noticeable difference in satisfaction between their personal program and the equalizer settings they had previously selected.

Conclusions: In conclusion, hearing aid setting preferences for music listening show considerable individual variability. While the majority of participants reported equal satisfaction with both their personal memory and the equalizer settings they selected, a subset of users experienced enhanced satisfaction with personalized equalizer adjustments. These findings suggest that incorporating music programs and customizable equalizer settings may enhance the music listening experience for hearing aid users.

Category: Hearing Technology / Amplification

Poster #: 073

Adjusting Hearing Aid Time Constants for Temporal Processing Deficits

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Objectives: Are there measurable differences in attack and release times across time constant (TC) options (syllabic, fast, moderate, slow) in ReSound hearing aids, and is a specific TC likely to support improved access to speech for patients with temporal resolution deficits using mild-gain hearing aids? We hypothesize there will be measurable differences and at least one TC will support improved access to speech with use of mild gain amplification.

Design: A ReSound VI960S-DRWC hearing aid with an LP receiver was programmed with 20 dB HL thresholds across 250-8000 Hz. Insertion gain was set from 1000-4000 Hz with +10 dB for soft inputs, +5 dB for conversational inputs, and +0 dB for loud inputs; MPO not exceeding 100 dB SPL. Verifit 2 testbox with ANSI S3.22.2003 protocol was used (without setting into ANSI test mode). The device was set to each time constant (TC). Attack and release times for 1000, 2000, and 4000 Hz were measured. Three trials were completed and were averaged and were compared with the Gaps-in-Noise test gap durations and normative approximate gap threshold cutoff. Statistical analyses were completed in SPSS (IBM) using a multivariate generalized linear model and ANOVA.

Results: Mean attack times were slowest at 1000 Hz and fastest at 4000 Hz, ranging from 10-110 msec (syllabic), 10-136.67 msec (fast), 50-85 msec (moderate), and 31.67-113.33 msec (slow). Mean release times did not demonstrate a clear pattern for speed re: test frequency. Release times ranged from 63.33-70 msec (syllabic), 120-180 msec (fast), 120-190 msec (moderate), and 3756.67-3943.33 msec (slow).Regardless of test frequency, attack time for syllabic time constants (TC) was significantly faster compared to attack times for moderate and slow. Attack time for syllabic TC did not differ from that of the fast. Syllabic TC release time was significantly faster than all three other TC. Release time for fast TC was significantly faster compared to the release time for slow TC but was not significantly different compared to moderate TC. The moderate TC release time was significantly faster compared to the slow TC release time, and the slow TC release time was significantly slower compared to all three other TCs.

Conclusions: Individuals with gap thresholds at 8 msec or less may still perform adequately with syllabic or fast compression (5-10 msec attack times), as their temporal resolution is sufficient to process rapid changes in speech processed by hearing aids. However, those with greater gap thresholds (>8-10 msec) may struggle with syllabic and fast compression, as their auditory system cannot resolve rapid changes,

leading to distortion or loss of speech cues. These individuals may benefit from moderate or slow compression (attack times >10 msec), which better accommodate their reduced temporal resolution ability. While attack time is important to how GIN performance relates to the time constant (TC) chosen, attention should be drawn to the very slow release time observed. Showing the approximate value of 4000 msec may shift attention to how a slow release time could yield better amplification outcomes for someone with abnormal temporal resolution.

PEDIATRIC AUDIOLOGY / OTOLOGY

Category: Pediatric Audiology / Otology

Poster #: 074

Effects of Background Noise on Word Learning in Preschool-Age Children

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Objectives: The everyday environments where children learn unfamiliar words, such as classrooms, have multiple sources and intensity levels of background noise. Yet, children's word learning has been primarily studied in quiet laboratories or in real-world settings where the background noise was not quantified. Thus, we currently lack a thorough understanding of how the characteristics of background noise affect word learning. Additionally, we lack an understanding of whether some learning protocols are more supportive of learning in background noise than others. We present two experiments that explore how young children learn words in different background noise conditions and learning protocols.

Design: In Experiments 1 and 2, we presented 4- to 6-year-old children (Exp. 1, n = 80; Exp. 2, n = 46, data collection is ongoing) with four lab-created word forms linked to unfamiliar objects across three training sessions on consecutive days. In Exp. 1, children completed an active learning protocol whereby they were asked to actively retrieve word forms during training (i.e., retrieval-based learning). Children participated in one of four between-subject listening conditions: quiet or background noise of two-talker child speech at +10 dB, +5 dB, or 0 dB SNR. In Exp. 2, children were assigned to one of four between-subject conditions that included (1) an active or passive learning protocol, and (2) background noise that contained two-talker child speech or speech-shaped noise (SSN), both at +5 dB SNR. In the passive learning protocol, children were presented with word forms but were not asked to actively retrieve them during training. In both experiments, we assessed word learning by asking children to name target objects. For all child productions, we coded the percentage of phonetic features produced correctly relative to the target form.

Results: In Exp. 1, at the end of each training session children in the 0 SNR condition produced forms with less phonological precision than children in the other listening conditions. However, there is not a

difference in learning rate across conditions. Age, verbal working memory (NWR), and receptive vocabulary (PVT) were positively related to performance during training. In Exp. 2, preliminary analyses suggest that at the end of training children in the active learning protocol produced forms with more phonological precision than children in the passive learning protocol. There is a trending training protocol (active, passive) by background noise type (SSN, 2 talker) interaction, suggesting that the active training protocol is more effective than passive training in SSN. We will test that interaction once we have our final sample (n = 80).

Conclusions: Children appear to be more resilient to background noise when they actively retrieve word forms during training (i.e., retrieval-based learning). Additionally, children are more resilient to background noise when learning words in a more favorable SNR. However, less favorable listening conditions (e.g., 0 SNR) negatively affect children's overall ability to learn the words. Understanding both the group-level and individual-level effects of background noise on word learning will inform classroom practices to support word-learning in real-world environments.

Category: Pediatric Audiology / Otology

Poster #: 075

Teaching Old Dog New Tricks: An OAE-based Hearing Screening Test

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Objectives: Newborn hearing screening programs typically use auditory brainstem responses (ABRs) or otoacoustic emissions (OAEs) to detect hearing loss. While ABRs are preferred for their ability to identify neural deficits such as auditory neuropathy spectrum disorder (ANSD), they are costlier and resource-intensive. We have developed a novel approach, MOKA, that repurposes the click stimulus and its evoked emissions (CEOAEs) to estimate auditory brainstem reflex magnitude and kinetics. We hypothesized that MOKA could differentially identify ANSD using only clicks and CEOAEs. This study aimed to generate proof-of-concept data supporting the use of MOKA for assessing cochlear and auditory nerve health.

Design: Sixty-four children (0-17 years) participated: normal hearing (n=24), sensorineural loss (n=23), conductive loss (n=12), and ANSD (n=5). In MOKA, CEOAEs and OAE-evoking clicks (80 and 90 dB ppSPL) were monitored over 1 s to elicit and quantify medial olivocochlear (MOCR) and middle ear muscle (MEMR) reflexes, proxies for auditory neural integrity, alongside cochlear function (OAEs). Ear canal and middle ear reflectance were characterized using chirps used for Thévenin calibration of clicks in-ear. Previously acquired data from ~100 normal-hearing adults were reanalyzed to assess variability and test-retest reliability.

Results: Data from adults confirmed the feasibility of MOKA, showing superior test-retest reliability compared with conventional MOCR measures. Children with hearing loss exhibited absent reflexes, while

those with ANSD showed preserved OAEs but no reflexes. Conductive loss, particularly in children with PE tubes, produced distinct ear canal and middle ear reflectance patterns compared with non-conductive groups.

Conclusions: Clicks and OAEs can effectively identify both cochlear and neural pathologies. The proposed MOKA method, using standard OAE equipment and minimal additional resources, offers a cost-effective alternative for newborn and post-newborn hearing screening and diagnostics.

Category: Pediatric Audiology / Otology

Poster #: 076

Longitudinal Audiologic Profiles of Children with Otitis Media with Effusion

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Objectives: Otitis Media with Effusion (OME) is the accumulation of non-infected fluid in the middle ear space. OME can persist for days to months and is often accompanied by a fluctuating conductive hearing loss (CHL). It is a common condition affecting up to 80% of children by 4 years of age, where behavioral assessment and monitoring hearing can be challenging. Current assessment procedures are unable to predict whether an effusion will persist or clear. As such, it is not well understood if and how OME characteristics and associated CHL change over the course of an episode of OME. Understanding this could help identify objective prognostic indicators to improve its diagnosis and management. Wideband Acoustic Immittance (WAI) is a measure of middle-ear mechanics that has shown strong potential as a non-invasive and objective diagnostic tool for OME and related CHL. This study utilizes WAI alongside traditional audiological measures to monitor and characterize OME and its associated CHL over time. To achieve this, long

Design: Participants include children diagnosed with OME by an otolaryngologist at Boys Town National Research Hospital along with age-matched control participants without a recent history of OME. Individuals were invited to participate in the study regardless of management strategy (tube placement, watchful waiting, or antibiotics). Participants underwent an initial hearing assessment visit promptly following diagnosis of OME. Weekly visits continued for at least four weeks using a mobile research van, unless tubes were placed prior to this endpoint. Additional visits were scheduled if the episode continued to persist beyond four weeks. Following the weekly monitoring period, monthly visits were completed for up to 12 months. At the initial visit, participants underwent a comprehensive testing protocol, including behavioral audiometry, WAI, tympanometry, and otoacoustic emission (OAE) testing. Middle-ear status was monitored weekly and monthly in the research van using WAI, tympanometry, and OAEs. Behavioral testing

Results: Data collection is ongoing, with weekly monitoring from 32 children and 24 age matched controls, and monthly monitoring from 23 children and 23 age matched controls thus far. Analyses will examine each child's audiologic profile, including audiometry, OAEs, tympanometry, and WAI, to characterize stability or variability in effusion and hearing status over time. We will also evaluate whether specific features of an initial episode of OME or the corresponding WAI response are predictive of the episode's trajectory and prognosis. Finally, WAI data from the initial visit will be compared between ears with effusions that resolve without surgical intervention and those with persistent effusions to identify WAI characteristics that may predict failure to clear.

Conclusions: The results of this work will improve our understanding of the trajectory of OME and its associated CHL as well as the prognostic value of WAI. Improvements in the diagnosis and prognosis of OME and its related hearing loss will help refine clinical protocols and improve auditory outcomes for children affected by OME.

Category: Pediatric Audiology / Otology

Poster #: 077

Otoacoustic Emissions as Predictors of Middle-Ear and Hearing Status

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Objectives: This work examines the clinical utility of distortion product otoacoustic emissions (DPOAEs) in understanding middle-ear and hearing status in children with otitis media with effusion (OME). Despite their objectivity, non-invasiveness, and potential to corroborate other audiologic assessments, our clinical experiences have shown that DPOAEs are not regularly evaluated in children with middle-ear dysfunction. Literature has shown that, like wideband tympanometry, otoacoustic emissions are sensitive to variations in middle-ear effusion characteristics, including effusion volume. Effusion volume also has a systematic effect on hearing in children with OME, allowing clinicians to predict whether a given episode of OME might coincide with transient conductive hearing loss. Although DPOAEs are not a measure of hearing, they have the potential to serve as a screening tool that could gauge whether hearing status is impacted by an episode of OME, particularly when behavioral audiometric findings are unattainable.

Design: A retrospective analysis of DPOAE data, wideband tympanometry, and behavioral audiometric findings was completed. These measures were collected as part of two longitudinal studies conducted by our laboratory - one of which is still ongoing. Both experiments involved audiological monitoring of children with OME and children with healthy, normal-hearing ears at multiple time points. Data from 187 participants (n = 374 ears) between 6 months and 12 years were analyzed. The proportion of present DPOAE responses across three effusion volume categories: clear, partial, and full, was quantified and compared to healthy control ears and ears with negative pressure. DPOAE amplitude and SNR values were also analyzed to determine how these variables were impacted by middle-ear dysfunction at specific frequencies.

Results: Data collection and analysis are ongoing. Preliminary analyses indicate a systematic reduction in DPOAE amplitude and the number of DPOAEs present from 2000-8000 Hz as middle ear status deteriorates and effusion volume increases. Very few ears with full effusions exhibit any present DPOAEs, consistent with the moderate degree of transient conductive hearing loss often observed in these ears. Ears with partial effusions tend to have 10-50% of DPOAEs present and often coincide with a slight or mild degree of hearing loss. Clear ears with a recent history of OME and ears with negative pressure tend to have more than 50% of DPOAEs present from 2000-8000 Hz and normal to near-normal hearing sensitivity. Significant differences in DPOAE amplitude were observed between healthy control ears and ears with middle-ear dysfunction.

Conclusions: Ears with middle-ear dysfunction based on tympanometry and with a majority of OAEs present in the 2000-8000 Hz range are expected to have hearing generally unaffected by the middle ear disorder. Conversely, ears with less than 50% of OAEs present can be expected to have an effusion significant enough to affect hearing to a mild or moderate degree. In the absence of behavioral audiometric findings, tympanometry and DPOAEs can be used to screen children with suspected middle-ear dysfunction for associated hearing loss. This information may be used to triage medical management of middle-ear dysfunction in cases where hearing loss is present.

Category: Pediatric Audiology / Otology

Poster #: 078

Spatial Hearing Acuity in Children and Adults with Down Syndrome

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Objectives: Hearing impairments are pervasive (up to 80% reported) in individuals with Down syndrome (DS), and may result from anatomical abnormalities in the peripheral auditory system, and/or sensorineural impairment. The auditory system provides significant input to brain regions that encode sound and convert it into meaningful signals for communication, learning, and everyday functioning. In typically developing (TD) individuals, spatial hearing abilities emerge beginning at birth and continue to mature and refine throughout childhood and adolescence. Importantly, the time course of spatial hearing maturation and plateau in improvement has not been fully documented. This study investigated spatial hearing using a right-left discrimination paradigm in children and adults with DS and in a cohort of TD individuals ranging from 5-24 years of age. Importantly, while prior work in TD individuals focused on measuring thresholds such as minimum audible angles, here we investigated sub- and supra-threshold performance, as these performance levels are hypothesized to reveal maturational changes throughout childhood and into adulthood. Two studies were conducted: Study 1 examined age-related changes in performance in TD children and adults; Study 2 compared performance in children and adults with DS with that of TD peers.

Design: Study 1: TD individuals (60 children ages 5-17 years; 49 adults ages 18-24 years).Study 2: Individuals with DS (6 children ages 12-17 years; 7 adults ages 18-25 years), and 8 age-matched TD children.Experimental Paradigm: The task involved a 1-interval, 2-alternative forced-choice paradigm, with loudspeakers on the horizontal plane at ⍰10°, ⍰5°, or ⍰2.5° right or left of center. Pink noise (4 bursts, 25 ms duration each) was presented at 65 dB SPL. Each testing block consisted of 20 trials at a fixed angle, with the stimulus randomly presented from left or right. D-prime (d′) values were computed for each participant at each tested angle.

Results: Study 1: Pearson correlation revealed a significant relationship between age and d' at 10° ($r=0.19$, $p<0.05$), at 5° ($r=0.58$, $p<0.001$), and at 2.5° ($r=0.42$, $p< 0.001$), indicating that higher age was associated with higher d'.Study 2: Preliminary visual observation of the data revealed a trend for lower d′ in children with DS at 5° and 2.5° compared to their age-matched TD peers. Compared with TD adults, adults with DS showed a trend toward comparable d′ values at 10° and 5°, but lower d′ at 2.5°.

Conclusions: Children with DS might exhibit poorer discrimination of source location than age-matched TD peers, possibly due to delayed maturation of spatial hearing abilities. In contrast, adults with DS demonstrate performance that more closely resembles that of TD adults for several conditions, indicating continued maturation of spatial auditory processing in late adolescence and early adulthood. Nonetheless, under higher spatial resolution demands, adults with DS continued to show reduced performance, indicating slower maturation of fine spatial hearing abilities.Work supported by NIH-NIDCD R01 DC019511 and R01 DC019511-S (RY Litovsky, A Alexander, and S Hartley), and in part by a core grant from NIH-NICHD to the Waisman Center (P50HD105353).

Category: Pediatric Audiology / Otology

Poster #: 079

Detecting Acoustic Leaks in WAI Measurement with Machine Learning

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Objectives: This study aims to develop and evaluate machine learning (ML) approaches for the automatic detection of acoustic leaks in wideband acoustic immittance (WAI) measurements. WAI measurements assess how ears absorb and reflect sound energy in the frequency domain, which can be used to detect middle-ear pathologies. The accuracy of the measurements depends on the quality of the ear-canal probe seal. Leaks can distort WAI measurements, especially in the low frequency range. Thus, detecting leaks is critical to inform when a probe should be reinserted and the measurement repeated for an accurate diagnosis. Here, we systematically tune and assess ML models to detect leaks in ambient WAI using absorbance, impedance angle, and impedance magnitude.

Design: We used an online database of published WAI measurements to obtain leak-free data from 716 normal ears and then applied an impedance-based canal–probe leak model to generate 716 matched

measurements with synthetic leaks. These sets of leak–no-leak measurements were used to train four supervised classification k-nearest neighbors (KNN), support vector machines (SVM), random forests (RF), and convolutional neural networks (CNN). The models were tested on an independent dataset, not part of the training process, with 263 measurements and 6 conditions: No leak and 5 controlled leaks with radii of 0.25, 0.4, 0.5, 0.6, and 0.75 mm. The models were also tested using the NHANES dataset labeled by Sun et al. (2023), where leak sizes were unknown. Models were trained and tested on two frequency ranges 275-500 Hz (12 total frequencies) and 275-1000 Hz (34 total frequencies). The models were evaluated via the metrics of accuracy, precision, recall and F1 score. Principal component analysis (PCA) was used to reduce the dimensionality of the features and help to explore characteristics associated with leaks.

Results: Cross-validation on the WAI training dataset identified optimal model parameters based on the highest F1 scores. All models achieved high training performance, with accuracy, precision, recall, and F1 scores exceeding 99%. Retraining the models using the full WAI dataset and testing on the independent dataset yielded strong performance, with most metrics above 90% and many exceeding 95%. Final parameters were selected based on the highest F1 scores from the independent dataset. As the smallest leaks were often not discernable by the models, due to the minimal effect of the leak on WAI measures, models were also tested excluding the smallest leaks, which improved the results. Finally, relabeling the NHANES dataset using the trained CNN and RF models produced improved classification results compared to the labels assigned by Sun et al., which were based on the rules from Groon et al. (2015).

Conclusions: We applied machine learning models to WAI measurements with absorbance, impedance angle, and impedance magnitude and built models that can be applied to identify leaks in real time during a WAI measurement in clinic. These models can be designed to optimize their decisions based on the relative importance of false-positives vs. false negatives.

Category: Pediatric Audiology / Otology

Poster #: 080

A Systematic Review and Quality Assessment of Clinical Practice Guidelines for Congenital Hearing Loss

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Objectives: Congenital hearing loss affects a child from birth in various ways and is associated with poor receptive and expressive language skills, which could lead to limited socialization and a poorer quality of life. To support the creation of the Package for ear and hearing care interventions (PEHCI), led by WHO, a systematic review was conducted to identify clinical practice guidelines related to congenital hearing

loss, assess their quality, and determine key interventions related to the prevention, diagnosis, and management of congenital hearing loss.

Design: A search was carried out in PubMed, CINAHL, ClinicalKey, Cochrane, and TRIP databases, and websites of otolaryngology and audiology professional associations, to identify guidelines on congenital hearing loss published in English since 2014. In addition, we hand searched for guidelines published in Spanish, French, Chinese, and Russian languages. A total of 464 articles were retrieved. The quality of the guidelines was evaluated using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) tool by two independent reviewers. Nine pre-specified AGREE II items (numbers 4, 7, 8, 10, 12, 13, 15, 22 and 23), most of which focus on the methodological rigour of the guidelines, were used to determine the final inclusion of the guidelines. Guidelines were excluded if the average score for items 4, 7, 8, 12, or 22 was less than three points or if the total sum of average scores across all nine items was less than 45 points

Results: A total of 15 guidelines passed the full-text screening and underwent quality assessment. Eleven guidelines were excluded after quality assessment, generally due to their methodological limitations. Therefore, four high-quality guidelines, published in English, Spanish, French and Russian, were included in this review. The following are key interventions identified from the guidelines. First, the guidelines underscored the importance of universal newborn hearing screening to identify cases of hearing loss and diagnostic approaches to determine the aetiology of hearing loss. During the assessment, a detailed case history and medical evaluation, and in some cases, genetic counselling and family-to-family support were recommended. One guideline focused on early hearing detection and intervention programs and recommended that the hospitals/facilities which have already achieved 1-3-6 timeline for screening, diagnosis, and intervention, respectively, should move towards achieving a 1-2-3 timeframe. Several rehabilitative options are stated in the guidelines, although most recommendations focus on the provision of hearing aids and, when indicated, cochlear implants. It was recommended to evaluate the resources, challenges, and needs of the family environment of the child and to actively encourage family involvement, including providing support in management and rehabilitation for hearing loss.

Conclusions: In general, many existing guidelines for congenital hearing loss are limited in their methodological rigour, and few high-quality guidelines exist. Among the few high-quality guidelines, key interventions emphasize early identification and rehabilitation of congenital hearing loss. Results from this review can serve as a resource for hearing healthcare providers at all levels of care in terms of evidence-based interventions for congenital hearing loss and will inform the development of the WHO PEHCI.

Category: Pediatric Audiology / Otology

Poster #: 081

Communication Outcomes Among Culturally/Linguistically Diverse Children with Hearing Loss

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Objectives: One in 4 children in the U.S. is Hispanic, and the prevalence of hearing loss among Hispanic children is up to 3-4 times higher than among non-Hispanic children. However, most research on

communication outcomes in children with hearing loss has focused on White, non-Hispanic, monolingual English-speaking families. There is a critical need to characterize outcomes among diverse children and adolescents with hearing loss to identify approaches that support optimal development across a wide range of children. Previous research has shown that Spanish-English bilingual adolescents use their hearing aids less than peers who are monolingual English speakers. However, it is unclear if this difference is due to factors related to language barriers, cultural differences, and/or individual child characteristics. Furthermore, it remains unknown if culturally and linguistically diverse children with hearing loss show differences on functional communication outcomes in everyday life. We examined the effects of family factors (maternal education level, caregiver language status, ethnicity) and child factors (age, better-ear pure-tone average [BEPTA], word recognition in noise, hearing loss laterality) on datalogged daily device use, listening-related fatigue (measured with the Vanderbilt Fatigue Scales [VFS]), and real-world auditory skills (measured with the Speech, Spatial and Qualities of Hearing Scale [SSQ]). We hypothesized that both family- and child-related factors would predict device use and communication outcomes.

Design: Participants were 55 children ages 4 months to 18 years, including 47 hearing aid users, four bone conduction device users, three contralateral routing of signal users, and one cochlear implant user. Thirty-six (65%) participants were Hispanic or Latino, and 20 (36%) participants did not have an English-speaking caregiver. Participants were recruited from the House Children's Hearing Center in Los Angeles, CA, which employs Spanish-speaking clinicians and office staff. Participants completed the VFS Child questionnaire and the Children's English and Spanish Speech Recognition test (ChEgSS, a task that measures speech recognition in noise), while caregivers completed the parent-report versions of the SSQ and VFS questionnaires. Audiograms and datalogging information were retrieved from the medical record.

Results: Data collection is ongoing; univariate associations between all predictor and outcome pairs were conducted as preliminary analyses. BEPTA was significantly negatively correlated with all SSQ sub-scores (speech, $r=-0.61$; spatial, $r=-0.41$; qualities, $r=-0.58$; all $p<0.05$). No other relationships between SSQ sub-scores and predictor variables were observed. There were no significant relationships between any of the predictors and VFS (caregiver and child report) scores. There were marginally significant correlations between device use and BEPTA ($r=0.27$, $p=0.07$) and age ($r=0.26$, $p=0.07$), but not caregiver language status, ethnicity, or maternal education.

Conclusions: Higher device use and poorer auditory skills on the SSQ were shown by children with higher degrees of hearing loss. In contrast to previous research, factors related to language status or ethnicity were not associated with device use, listening-related fatigue, or real-world auditory skills. Minimizing language and cultural barriers between families and hearing health providers may support more equitable communication outcomes in children with hearing loss.

Category: Pediatric Audiology / Otology

Poster #: 082

Early Postnatal Development of the Human Ear Canal: Ages 0-24 Months

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Objectives: Ear-canal geometry and its maturation remain poorly characterized despite their impact on many clinical applications. Better geometrical descriptions could inform standards for pediatric earmold-replacement schedules, strengthen assumptions used in wideband acoustic immittance (WAI) measures, and quantify the size of the surgical corridor available for transcanal endoscopic ear procedures. Recent work from the Voss Lab shows that the canal widens and lengthens throughout childhood, likely until puberty, with the fastest growth occurring in the first months of life. To address these gaps, this study undertook detailed measurements in ears 0-24 months old, quantifying changes in canal area and length and documenting early postnatal development of the cartilage and bony canal walls.

Design: High-resolution CT scans were analyzed in OsiriX using methods summarized in Voss et al. (2025). We evaluated 117 ears from infants age 0-24 months. Cross-sectional canal area was sampled at 1-mm intervals along the canal's central axis, beginning at the tympanic annulus and ending at the canal entrance, and the bone-to-cartilage (B2C) transition was identified along the superior, anterior, inferior, and posterior canal walls in the sagittal plane. Scans were obtained retrospectively at Boston Children's Hospital; both Smith College and BCH were exempt from IRB oversight.

Results: Measurements from 117 subjects were grouped into six age cohorts (0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.5, and 1.5-2.0 years). Canal area and length increased systematically with age, with multiple measures differing across cohorts. For example, comparing the 0-0.25-year cohort (n=8) with the 1.5-2.0-year cohort (n=12), mean (±SD) canal area at 5 mm from the annulus increased from 10.8±2.2 to 25.8±6.1 mm2, the minimum area along the canal was larger for the older group (8.7±2.3 vs. 18.5±4.1 mm2), and the same was true for entrance area (32.9±11.0 vs. 68.2±20.0 mm2) (all $p < 0.0001$). Canal length was also larger (19.1±1.5 vs. 24.1±1.3 mm, $p < 0.001$). Consistent with prior work, tympanic annulus area did not vary with age group (overall mean 62.8±7.1 mm2). Bone-to-cartilage (B2C) transitions showed surface-specific patterns: along the superior wall, the B2C location occurred 8.0±1.4 mm from the annulus without a significant age effect, whereas along the anterior, inferior, and posterior walls the B2C transition shifted laterally with age. Notably, in the youngest cohort the inferior wall was cartilaginous along its entire length in 7 of 8 ears, shifting to 7.0±1.2 mm in the 1.5-2.0-year cohort.

Conclusions: This study characterizes ear-canal geometry and early maturation in ears 0-2 years old, showing rapid, significant increases in canal area and length while tympanic annulus area remains stable after birth. The data indicate that the canal adds length and bone from its medial aspect, with bone-to-cartilage transition points shifting laterally with age along the anterior, inferior, and posterior walls. These findings provide age-specific reference values that can inform audiologic standards (e.g., pediatric earmold replacement schedules, assumptions in WAI) and guide transcanal surgical planning in infants.

Category: Pediatric Audiology / Otology

Poster #: 083

Empirically Investigating Methods to Mitigate Effects of Ear-canal Geometry on Wideband Acoustic Immittance Measurements

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Objectives: Absorbance, a wideband acoustic immittance (WAI) measure, is calculated from impedance measurements made at the plane of an ear-canal probe tip (Z_ec). Absorbance is valued diagnostically because it is assumed to be independent of probe location and ear-canal geometry, so serves as a proxy for middle-ear input impedance at the tympanic membrane (Z_me). However, estimation of Z_me from Z_ec may be a better clinical measure than absorbance because it is independent of canal area and includes phase information. This work examines how variations in ear-canal geometry affect the transformation from Z_ec to Z_me and examines factors that influence absorbance measurements across ears.

Design: We measured Z_ec in four 3D-printed ear canals and a 50mm^2 cylindrical cavity, each terminated by the same artificial ear (Z_me). The canals were either cylinders or anatomical canals generated from high-resolution CT scans. Because Z_me was identical for all canals, this design allowed experimental testing of the Lewis and Neely (2015) method for deriving Z_me from Z_ec. Under this design, the calculated Z_me should be identical across measurements using different canals and probe locations. Z_ec was measured with the Interacoustics Titan at ambient pressure, with the eartip inserted at varying depths into each canal. The artificial ear was designed with two resonances matching the acoustic characteristics of the Larson Davis AEC304 coupler. Z_me was then estimated from the measured Z_ec by fitting parameters of an electrical-analog model of the canal and middle-ear input impedance (Merchant and Neely 2023).

Results: Within a given canal, Z_ec varied with probe location due to standing waves, whereas the calculated Z_me remained consistent across locations. Across multiple cylindrical and anatomical canals, the computed Z_me was consistent up to about 3000 Hz. Additionally, across multiple cylindrical and anatomical canals with varying cross-sectional areas, the calculated absorbance varied in magnitude, and remained comparable for each subject at different insertion depths. The values of the fitted model parameters used to calculate Z_me varied across canals and will be described further.

Conclusions: Our experimental results support the modeling approach of Merchant and Neely (2023) for transforming ear-canal impedance (Z_ec) to middle-ear impedance (Z_me). Z_me may be a more useful measure of middle-ear function by having less dependence on anatomical variation of the canal compared to absorbance.

SPEECH PERCEPTION

Category: Speech Perception

Poster #: 084

Effect of Talker on AzBio Scores in Cochlear Implant Users

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Objectives: The AzBio sentence corpus is widely utilized in clinical and research settings and has been adopted as part of the Minimum Speech Test Battery (MSTB) to evaluate speech recognition abilities in cochlear implant (CI) users. The AzBio sentence lists include two female talkers and two male talkers. In efforts to quantify individuals' real-word hearing abilities, it is important to consider how cochlear implant users perform on speech perception tests using female and male talkers. Anecdotally, many CI users perceive female voices as easier to understand than male voices, and AzBio sentence vocoder data support these comments. This study focuses on speech perception performance in CI users specifically between the four talkers on the AzBio sentence corpus. The first hypothesis was that there would be a main effect of talker on sentence recognition scores. The second hypothesis was that there would be an interaction between talker and presentation level, with increasing speech recognition scores corresponding with increasing talker fundamental frequency (F0).

Design: Participants included twenty adult MED-EL cochlear implant users that visited the MED-EL North American Research Lab. Participants sought out participation and were selected based on availability for in-person testing. Participants were consented under WCG IRB Protocol #20100066. Participants completed sentence recognition testing with the AzBio lists presented at 35-, 45-, 55-, 65-, and 75-dBA. Each AzBio lists has five sentences from each of the four talkers. List 23 was utilized prior to testing for the participant to determine a comfortable processor volume for listening. The main effect of talker was evaluated using a non-parametric repeated measures Friedman test. The interaction between talker and presentation level was evaluated using generalized estimating equations. Additional talker characteristics will be reported as they relate to possible effects on speech perception.

Results: Preliminary data demonstrates a main effect of talker: CI users demonstrated better speech perception scores for female talkers compared to male talkers on the AzBio sentence corpus. The mean F0 per talker across sentences was determined and talkers listed from low to high F0 are as follows: Male 1 (77 Hz), Male 2 (140 Hz), Female 1 (167 Hz), and Female 2 (203 Hz). The interaction between talker and level was not significant.

Conclusions: Preliminary data analysis supports the hypothesis that the female talkers in the AzBio sentence corpus elicit better speech perception scores than the male talkers. This work helps to better understand the AzBio sentence corpus which is an important and widely utilized speech perception measure recommended in the MSTB-3 guidelines for audiologists. This data may prove useful for future development of cochlear implant technology to improve performance across a broader variety of talkers. These data provide a better understanding of the effect of talker F0 and other talker characteristics on speech perception. Future study of speech perception in cochlear implant users could further investigate the encoding of the male voice in a cochlear implant and how effectively the two male talkers in the AzBio sentence corpus generalize to real-world speech perception.

Category: Speech Perception

Poster #: 085

Error Patterns in Non-Native English Speech Recognition-in-Noise

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Objectives: Although percent-correct scores in speech-in-noise tests indicate overall performance, they do not reveal which words or sounds are misheard or omitted by listeners. For non-native English speakers, analyzing specific types of errors provides clearer information about how speech perception and production interact under challenging listening conditions. This study examined detailed error patterns in native and non-native English listeners across talker gender (male and female) and signal-to-noise ratio to characterize how listening environments influence speech recognition and repetition accuracy.

Design: A total of 30 young adults with normal hearing participated in the study, including 15 native English speakers and 15 non-native English speakers. Participants were selected based on their language background to compare speech recognition performance across groups. All participants completed a sentence-recognition task using customized QuickSIN materials and a questionnaire adapted from the Hearing Handicap Inventory for the Elderly. The QuickSIN sentences were drawn from the standard lists but were modified to include both male and female talkers, resulting in twelve sentence lists (six male-voice, six female-voice). Stimuli were randomly presented in quiet and at SNRs of -5, 0, +5, +10, and +15 dB. Participants' verbal responses were recorded and aligned with target sentences. Errors were classified as omissions, insertions, or substitutions and analyzed for both key and non-key words. Substitution errors were examined based on how listeners replaced words from the target sentences (e.g., "wipe" for "wife," "a" for "the"). Error positions within sentences were also analyzed to determine whether specific word locations were more susceptible to misperception. Group comparisons were conducted across talker gender, SNR, and error-type categories.

Results: Recognition accuracy decreased as SNR worsened. Non-native English listeners showed relatively better performance with female talkers compared with male talkers. Analysis of word position within each sentence revealed that non-native listeners tended to give correct responses for the first and last words of the key five-word segments but showed lower accuracy for the third and fourth words. Across SNR conditions, omission errors increased substantially in noise, particularly for grammatical function words such as plural -s, tense markers, and articles. Substitution errors primarily involved lexical replacements among semantically or grammatically related words, such as verbs of similar meaning or interchangeable articles and pronouns. These substitutions occurred more frequently for non-native listeners at lower SNRs. Overall, non-native listeners demonstrated greater variability in word accuracy across sentence position and noise level compared with native listeners.

Conclusions: This study demonstrates that analyzing lexical errors provides meaningful information about how non-native listeners process speech in noise. The pattern of omissions and substitutions indicates increased listening effort and reduced linguistic precision under degraded conditions. Word position effects suggest that listeners rely on temporal and contextual cues to maintain comprehension. Overall, the findings highlight the usefulness of error-pattern analysis as a complementary approach to

percent-correct scores for understanding speech perception and for improving assessment strategies in linguistically diverse populations.

Category: Speech Perception

Poster #: 086

Audibility-Based Speech Intelligibility Prediction During Noise Tolerance Testing

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Objectives: The Tracking of Noise Tolerance (TNT) test measures the level of background noise an individual is willing to tolerate while still perceiving to understand more than 90% of the spoken content. Determining how much speech a listener comprehends at this self-selected noise level would help clinicians confirm whether the listener is following test instructions and genuinely understanding and following the speech. It would also offer insight into the listener's personal criteria for what constitutes a tolerable level of background noise. Although the TNT test does not directly measure speech identification performance during the noise tolerance measurement, speech intelligibility during the task can be estimated indirectly. This study explored the feasibility of using predictions based on Speech Intelligibility Index (SII) to estimate speech recognition performance during the TNT test in adults with hearing loss.

Design: Nineteen adults with hearing impairment (HI) and twenty with normal hearing (NH) participated. In the first phase of the study the SII-to-intelligibility functions were developed using speech identification data from NH listeners measured using the TNT materials in the presence of speech shaped continuous noise (SSN) and babble noise (BAB). In the second phase, the TNT test was administered to HI participants to determine each individual's range of tolerable noise levels. Individualized performance-intensity (P-I) functions for the TNT materials were measured for each listener to estimate speech intelligibility at these levels. Additionally, intelligibility at the tolerable noise levels was calculated using the SII-to-intelligibility transfer functions derived in the first phase. These SII-based estimates were then compared to those obtained from the individualized P-I functions for each participant at the tolerable noise levels measured during the TNT test.

Results: Compared to speech intelligibility estimates derived from each listener's own P-I function, the SII based method overestimated speech intelligibility by 7.6% at TNT tracing valleys and 4.8% at TNT tracing peaks under the SSN condition. In contrast, under the BAB condition, the SII based method underestimated intelligibility by 1.8% at TNT tracing valleys and 10.2% at TNT tracing peaks. Overall, the SII based predictions fell within 20% margin of error in 74% to 79% of the trials at both TNT valleys and peaks for both SSN and BAB noise conditions.

Conclusions: The method of using audibility-based speech intelligibility prediction provides a useful tool to supplement the TNT results. The noise level at which speech becomes unintelligible during the TNT task is different for different listeners based on their hearing status. Thus, it is not possible to define noise level range that would indicate intelligible speech for all listeners. Some listeners may, incorrectly, allow

the noise to be as loud as they can tolerate, with no regard to understanding the speech passage. Predicting speech intelligibility during noise tolerance task provides a tool for the clinician to verify that the listener follows the test instructions and adheres to the >90% intelligibility criterion.

Category: Speech Perception

Poster #: 087

Age-Related QuickSIN Performance Decline in Normal Hearing Patients

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Objectives: Difficulty understanding speech in noise is among the most common auditory complaints reported by adults. Traditional audiometric measures, such as pure-tone thresholds and word recognition scores (WRS) in quiet, often fail to capture these real-world communication challenges. The Quick Speech-in-Noise (QuickSIN) test, which estimates a listener's signal-to-noise ratio (SNR) loss, provides a functional measurement of one's auditory function. Previous research suggests that aging affects temporal and neural auditory processing. Additionally, sex differences have been reported, e.g. females often demonstrate better auditory processing functions than their male age-matched counterparts. However, age- and sex-matched normative data for QuickSIN performance remain limited. This study aimed to characterize age-related and sex-related changes in QuickSIN performance in adults with hearing thresholds within the normal range for their age and sex. Establishing such age- and sex-matched QuickSIN norms could finetune the clinical interpretation of QuickSIN results, and potential provide clinicians with a more sensitive tool for assessing patients within different age and sex groups.

Design: De-identified audiometric data were retrospectively analyzed from a total of 519 patients from the University of the Pacific Hearing and Balance Centers in Stockton and San Francisco. Participants underwent comprehensive audiological assessment, including otoscopy, immittance testing, air- and bone-conduction audiometry, speech recognition threshold (SRT), word recognition score (WRS), and QuickSIN testing. Individuals whose pure-tone averages (4F-PTA) fell between the 5th and 95th percentiles for their age and sex according to ISO 7029:2017 norms were included. Descriptive statistics, Student's t test and Two-Way ANOVA with post hoc analysis were utilized for the statistical analysis on the patients included in this study and their sex- and age- group differences.

Results: A total of 58% of male and 61% of female ears exhibited hearing levels within the normal range for their age and sex. Hearing thresholds increased with age for both sexes, but no statistically significant difference in 4F-PTA was observed between males and females. WRS scores remained stable across age groups for males (90-95%) and showed a slight but statistically significant decline in females (98% to 95%). However, QuickSIN results revealed a robust age-related increase in SNR loss for both sexes, with males performing significantly worse than females in the 71–80-year age group (mean SNR loss = 7.3 dB vs. 5.7 dB, $p = 0.0157$). Correlation analyses showed a mild negative relationship between WRS and 4F-

PTA (r = –0.2 females; r = –0.1 males) and a strong positive correlation between SNR loss and 4F-PTA (r = 0.58 females; r = 0.53 males; p< 0.0001).

Conclusions: Results from this study indicate that age-related declines in speech-in-noise performance occur even among individuals with hearing thresholds considered normal for their age and sex. QuickSIN was more sensitive than WRS in detecting these subtle changes, supporting its clinical value as a diagnostic tool for assessing auditory functions in all patients. The observed sex differences highlight the importance of developing normative reference values that account for both age and sex to improve diagnostic precision and individualized patient care.

Category: Speech Perception

Poster #: 088

Examining Bilingual Language Experience Patterns and their Impact on Speech-in-Noise Recognition

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Objectives: Nearly 21% of the United States population (64 million individuals) aged 5 years and older is bilingual, speaking both English and a non-English home language. Considerable literature indicates that recognizing speech in the presence of background noise (SiN) may be less accurate for bilinguals than monolinguals. However, differences in SiN performance vary across studies, depending in part on the particular language experiences of the bilingual participants in the study sample. Most studies of bilingual SiN recognition have considered the influence of specific aspects of language experience in isolation, for example by defining discrete bilingual groups based on pre-selected ages of English acquisition and ranges of current English language proficiency. It is less clear how gradient differences across these and other aspects of language (e.g., current patterns of language use) that are present in the larger U.S. bilingual population may influence SiN recognition. Therefore, the goal of this study is to characterize variation in language experiences of a large sample of U.S. bilingual adults and to assess how this variation influences recognition of speech in noise.

Design: This study aims to enroll 600 bilingual U.S. service members across the adult age range and a comparably sized group of monolingual peers. Participants provide detailed history pertaining to aspects of language acquisition, proficiency, and use, and pertinent demographic and educational factors. Participants also complete a battery of speech- and non-speech auditory tasks, including the English language Modified Rhyme Test (MRT). In the MRT, participants listen to words presented in silence or in the presence of speech-shaped noise presented at two different signal-to-noise ratios and select the word that they perceived from a set of six alternatives that differ from the target in either the initial or final phone. Trial level accuracy and response time are recorded.

Results: Data collection is ongoing. Preliminary findings for a sample of over 700 monolinguals and 300 bilingual adults reveal substantial variation in the language experiences of bilinguals in both English and their non-English languages. Differences in MRT accuracy and response time were related to multiple

language experience factors, including English age of acquisition, proficiency, and use factors. The observed relationships among language experience variables and the effects of these variables on MRT performance will be discussed.

Conclusions: The goal of this study is to identify the extent to which variation in distinct aspects of bilingual language experience may impact English-language SiN recognition among a representative sample of U.S. bilingual adults. The findings of this study provide novel insights into variation across specific aspects of language experience among U.S. bilingual adults and quantify the impact of gradient differences in these experiences on SiN performance.Disclaimer. The views expressed in this abstract are those of the author(s) and do not necessarily reflect the official policy of the Department of Defense, the U.S. Government, or the Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

Category: Speech Perception

Poster #: 089

High-Frequency Fricatives Increase the Efficacy of Interaural Level Differences

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Objectives: This study investigated how magnifying interaural level differences (ILDs) influences sound source segregation and spatial selection. Previous work suggests that ILD magnification can enhance spatial selection in normal-hearing listeners and bilateral cochlear implant users by improving their ability to distinguish target sounds from competing maskers. Briefly, ILD magnification enlarged ILDs to larger-than-natural magnitudes in discrete time-frequency bins based on instantaneous interaural time differences. We examined whether the presence or absence of high-frequency fricative information modulates the effect of ILD magnification.We hypothesized that subjects would have low hit rates and high false alarm rates without magnified ILDs and when high-frequency frictative information is not present, suggesting that they struggle to separate and select the target sound. Conversely, in the presence of magnified ILDs and with high-frequency fricative information, subjects can use ILDs to segregate and select the target.

Design: 14 young normal hearing English speakers participated in this study. Subjects performed a spatial auditory attention task using competing target and masker streams. Target and masker onset times were randomized to eliminate rhythmic cues. Stimuli were spatialized using the magnitude spectrum from non-individualized head-related transfer functions (HRTFs) corresponding to source locations at ±5 degrees and ±15 degrees azimuth. Target and masker streams comprised words chosen randomly from either the set<"bash", "gash"> or the set<"bæ", "gæ">, spoken by the same male talker. Target and masker word onsets were randomized in time to control for rhythm cues. Subjects responded

via button press when they heard the word "bash" or "bæ" in the target stream. We calculated hit and false alarm rates in each of four spatial conditions: ±5 degrees natural ILDs, ±5 degrees magnified ILDs, ±15 degrees natural ILDs, or ±15 degrees magnified ILDs.

Results: Participants performed better at the task (i.e. higher hit rates and lower false alarm rates) when target and masker were spatialized with ±15 degrees HRTFs than with ±5 degrees HRTFs. We found that ILD magnification resulted in higher hit rates and lower false alarm rates at both ±5 and ±15 degrees azimuth. We also found that hit rates were significantly higher and false alarm rates were significantly lower when high-frequency fricative information was present (i.e. higher for “bash” than “bæ”). Overall, performance with natural ILDs improved with the leading syllable than the lagging syllable. This finding was not true for magnified ILDs.

Conclusions: Our results are consistent with the hypothesis that larger-than-natural ILDs aid in source spatialization and segregation. Additionally, when stimuli contained high-frequency fricative information, ILDs-which are largest a high frequencies-were more effectively utilized by listeners to segregate target sounds. Because ILDs play a critical role in spatial perception at high frequencies, hearing devices must accurately preserve and transmit these cues. Given the prevalence of high-frequency hearing loss, maintaining ILD fidelity is essential for effective spatial hearing. This is especially important for cochlear implant users, where precise ILD representation can enhance spatial hearing and everyday communication in complex listening environments.

Category: Speech Perception

Poster #: 090

Impact of Low-Intensity Auditory Maskers on Real-Time Spoken Word Recognition

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Objectives: To comprehend speech, listeners must efficiently process spoken words and access word meaning in real time. This dynamic process includes lexical access (word form recognition) and semantic activation (word meaning recognition). In daily life, listeners often must recognize speech in the presence of competing noise. It is well established that poor signal-to-noise ratios (SNRs) decrease speech recognition accuracy. However, it is unclear if relatively low levels of competing noise impact the processes underlying real-time speech recognition, including lexical access and semantic activation. Even when speech recognition accuracy is high, listening in the presence of low-intensity competing maskers may require increased cognitive resources, relative to listening in quiet. We predicted that listening to masked speech at favorable SNRs would cause slower lexical access and semantic activation, relative to listening in quiet.

Design: Twenty adults ages 20-35 with normal hearing are expected to participate. All participants were native English speakers without a history of ear surgery or recent middle ear dysfunction.The experimental task used eye-tracking in the visual world paradigm (VWP). On each trial, four images appeared on a computer screen. Participants heard the target word at 65 dBA, then clicked the

corresponding image. Gaze was recorded throughout the task. Half the trials included a cohort competitor, which shared initial phonology with the target (e.g., puppy, puppet). The other half included a semantic competitor, which shared semantic features with the target (e.g., helmet, armor). Two unrelated items served as baselines for looking behavior. Fixations to each item type were averaged across trials and used as an index of lexical activation; fixations were only analyzed for accurate trials.Each participant completed three VWP conditions: one in quiet, one with competing speech-shaped noise (SSN), and one with competing two-talker speech (TTS). Participants completed preliminary adaptive tasks to determine the SNR at which the masked VWP conditions would be administered. The adaptive task provided an SNR expected to correspond to 70% accuracy in each task (SNR-70); VWP conditions were presented at SNRs that were a fixed amount (15 dB for SSN, 20 dB for TTS) above the SNR-70 in each condition to ensure high accuracy in the VWP. Each condition included 224 trials. Condition order was counterbalanced.

Results: Data collection is ongoing; preliminary analyses include 4 participants. Average SNR used in the VWP was 11.4 dB for SSN and 10.0 dB for TTS. Mean accuracy was 99.4% in Quiet, 98.9% in SSN, and 98.2% in TTS. Visual inspection of eye fixation patterns does not indicate differences between the Quiet, SSN, and TTS conditions in terms of fixations to the target item, cohort competitor, or semantic competitor. When data collection is completed, we will use a Bootstrapped Differences of Timeseries approach to statistically compare fixation pattern across the three listening conditions.

Conclusions: Preliminary findings suggest that low-intensity SSN and TTS do not affect real-time speech recognition processing in normal hearing adults. Additional investigation will examine if this is similarly the case for children with and without hearing loss, whose cognitive abilities are still developing.

Category: Speech Perception

Poster #: 091

Multitalker Processing Cost in Individuals with Normal Hearing

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Objectives: There is much individual variability in speech perception in normal hearing individuals, and some individuals are more susceptible than others to the effects of noise. There is evidence that variability of talker voice can affect speech perception; speech perception speed and accuracy are higher when listening to single than across multiple talkers. This multitalker processing cost arises due to drawing of cognitive resources during speech processing. However, previous research on talker variability has primarily used single words/digits in speeded identification or classification tasks. In the real-world, listeners must understand and respond to speech in whole sentences. Thus, the purpose of the study is to examine if and to what extent multitalker processing cost persists in ecologically valid conditions such as in sentence contexts, and to study the cognitive factors that may mediate speech perception performance in individuals with normal hearing.

Design: The study involves a within-subjects design where all participants undergo speech perception testing in low and high talker variability blocks. Twenty adult native English speakers with normal hearing complete a dual-task paradigm experiment using the University of Washington/Northwestern

University Corpus 2.0 sentences in multitalker babble at 5 dB SNR. To measure reaction time, the task will be to indicate the first word of the sentence they heard as fast as possible, and participants will then repeat the entire sentence to arrive at accuracy. Additionally, cognition will be assessed using the NIH Toolbox Cognition Battery, and correlations between these scores and speech perception accuracy and reaction time with high and low-variability sentence materials will be examined.

Results: The data collection for this study is ongoing and will be completed at the latest by January 30, 2026. The hypothesized results are that Individuals with normal hearing will have longer reaction times and/or lower accuracy for high-variability relative to low-variability sentence materials and high accuracy/low reaction times scores will be positively correlated to cognitive scores.

Conclusions: This study is expected to inform routine audiological assessment and rehabilitative strategies. In the clinic, speech perception ability is generally tested using word or sentence materials that have limited variability. This does not take into account real-world considerations where listeners must comprehend sentences from a large number of different talkers. The speech perception ability estimated through these tests could thus be erroneously inflated due to lack of variability and thus might not accurately reflect the difficulties faced by individuals when listening in real-world environments. Testing individuals with stimuli with greater variability would thus have higher ecological validity and the scores measured in this manner would be more consistent with individuals' daily experiences and difficulties surrounding speech communication.

Category: Speech Perception

Poster #: 092

Cortical Responses to Spectrally Degraded Vowels from Functional Near-infrared Spectroscopy

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Objectives: The goal of this study was to investigate cortical activation evoked by vocoder simulations of speech approximating cochlear implant (CI)-like spectral degradation. Cortical activation patterns in response to 10 vowel stimuli were compared across conditions simulating varying numbers of spectral channels and degrees of channel interaction. We also investigated relationships between vowel identification scores and vowel-evoked cortical activation across these conditions. We predicted that conditions with fewer spectral channels and greater channel interaction would evoke reduced cortical activation in the bilateral superior and middle temporal gyri than less degraded and unprocessed conditions. We also hypothesized that vowel identification scores would be positively associated with temporal cortical activation across conditions.

Design: Twenty normal-hearing adults aged from 18 to 30 years were enrolled in the study (mean age = 21.10 ± 2.32), none of whom had a history of speech, language, hearing, or neurological disorders. The experiment took place in a sound-attenuated booth. Stimuli were presented through a free-field speaker. Stimuli consisted of 10 vowels spoken by a female talker in /h-vowel-d/ contexts, presented in quiet and in multi-talker babble at a 10 dB signal-to-noise ratio. Noise-vocoder processing was conducted,

manipulating number of spectral channels (4 vs. 16 channels (CH)) and analysis filter slope (-2 vs. -24 dB/Octave (dB/Oct)), using slope as a proxy for channel interaction. This yielded 10 conditions (Unprocessed, 16CH-24dB/Oct, 16CH-2dB/Oct, 4CH-24dB/Oct, 4CH-2dB/Oct; all in quiet and in background noise). Participants were presented with blocks of 30 trials plus 10 identical familiarization trials for each of these conditions, which were presented in random order. In each trial, rest was randomly jittered to vary stimulus onset asynchrony. Functional near-infrared spectroscopy (fNIRS) measured cortical activation bilaterally in the superior and middle temporal gyri. Low-quality channels were excluded, and preprocessing involved motion artifact correction, bandpass filtering, and short-separation regression. A general linear model was used to evaluate changes in oxygenated hemoglobin over time. Comparisons in cortical activation were made across conditions, and relationships between cortical activation and vowel identification scores were made within each condition.

Results: Preliminary results demonstrate that, in quiet, unprocessed speech evoked greater activity than the most spectrally degraded condition (4CH-2dB/octave) in the left ($n = 16$, $p < .0001$) and right ($n = 15$, $p < .001$) temporal regions. Additionally, a trend toward a positive association between vowel identification scores and vowel-evoked cortical activity was observed in the left ($n = 17$; $r = 0.61$; $p = 0.009$) and right ($n = 16$; $r = 0.69$; $p = 0.003$) temporal regions, most prominently among unprocessed stimuli presented in background noise.

Conclusions: These results suggest that fNIRS can detect differences in cortical activation elicited by vowels with varying degrees of spectral degradation. This provides a basis for future research to further establish a relationship between channel interaction, spectral resolution, vowel-evoked fNIRS-measured cortical activation, and speech outcomes in CI listeners. Doing so could help assess sources of individual CI outcomes and determine whether reducing channel interaction improves cortical representation of speech sounds.

AUDITORY PROCESSING / TINNITUS

Category: Auditory Processing / Tinnitus

Poster #: 093 **Mentored Student Research Poster Award**

Olivocochlear Function in Normal-Hearing Adults with Versus Without Speech-in-Noise Difficulties

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Objectives: It is estimated that 26-84 million U.S. adults have normal hearing but self-reported speech-in-noise (SIN) difficulties, which may negatively impact socialization, workplace performance, and quality of life. However, it is unclear what auditory mechanisms are responsible for these SIN difficulties. One physiological component that may contribute to SIN abilities is the medial olivocochlear reflex (MOCR), which reduces cochlear gain in the presence of noise and reduces masking of sounds. This study examined the MOCR function in two groups of normal-hearing young adults: one group with self-reported SIN difficulties and another group without SIN difficulties. It is hypothesized that individuals

with self-reported SIN difficulties will have significantly weaker MOCR strength than adults with no self-reported SIN difficulties.

Design: This study utilized a case-control design. Healthy, normal-hearing adults 18-40 years old were recruited from a university campus and surrounding community using flyers, electronic postings, ResearchMatch.org, and word of mouth. Two groups of individuals were recruited: those with self-reported SIN difficulties (case) and those without self-reported SIN difficulties (control). Group assignment was determined by responses to a yes/no question about SIN difficulties and a modified Speech, Spatial and Qualities of Hearing Scale (SSQ12). Participants in each group were matched for age and sex. Participants underwent an audiologic screening that included otoscopy, tympanometry, pure-tone air-conduction thresholds from 250-16,000 Hz, word recognition in quiet, and transient-evoked otoacoustic emissions (TEOAEs). MOCR strength was assessed using contralateral inhibition of TEOAEs using an ipsilateral click level of 65 dB pSPL and contralateral speech-shaped noise levels of 50 and 60 dB SPL. A control measurement of TEOAEs with no contralateral noise was also conducted. MOCR shifts were quantified by the change in TEOAE waveform amplitude with versus without contralateral noise. MOCR growth functions were also computed across the two contralateral noise levels.

Results: Preliminary results were obtained from 11 participants in the case group and 8 participants in the control group. Results indicated a large separation in SSQ12 scores between groups. There were minimal differences in audiologic screening results between groups. Visual inspection of the data revealed robust TEOAE signal amplitudes and low noise floors in both groups. The control measurements revealed that TEOAE amplitudes were stable when no contralateral noise was presented. Results also revealed that the median MOCR shift was lower in the case group at both contralateral noise levels compared to the control group. Additionally, there were shallower MOCR growth functions for the case group compared to the control group. Differences in MOCR strength between the two groups will be compared statistically after data are collected from a larger number of participants.

Conclusions: Preliminary results showed that the case group exhibited overall weaker MOCR strength compared to the control group. These preliminary results suggested that reduced MOCR strength may contribute to SIN difficulties when hearing thresholds are normal. These results have implications for understanding the functional relevance of the MOCR and for developing diagnostic tests to assess auditory function in individuals with normal hearing who report significant SIN difficulties.

Category: Auditory Processing / Tinnitus

Poster #: 094 **Mentored Student Research Poster Award**

Relationships Between Listening Effort and the Medial Olivocochlear Reflex

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Objectives: Some adults with normal hearing report significant difficulty understanding speech in noise (SIN), which may also be accompanied by increased listening effort. The medial olivocochlear (MOC)

reflex may be a mechanism that supports SIN performance and potentially reduces listening effort. Listening effort typically decreases as signal-to-noise ratio (SNR) improves. MOC reflex activation can be viewed as increasing the effective SNR at the level of the cochlea; however, the impact of the MOC reflex on listening effort remains unclear. Because behavioral and subjective measures may evaluate different aspects of listening effort, the current study used both measures to examine associations between listening effort and MOC reflex strength. We hypothesized that greater MOC reflex strength was associated with lower listening effort, and that the strength of this relationship depended on SNR.

Design: This study used a case-control design. Healthy, normal-hearing adults ages 18-40 were recruited through newsletters, flyers, ResearchMatch.org, and word of mouth. Participants were divided into two groups: those reporting substantial SIN difficulties (case) and those reporting minimal SIN difficulties (control). Group classification was determined using a modified Speech, Spatial and Qualities of Hearing Scale. All participants passed an audiologic screening. MOC reflex strength was assessed using contralateral inhibition of otoacoustic emissions, defined as the change in response amplitude with contralateral noise. SIN performance was measured with NU-6 words presented at 0 and -6 dB SNR. Verbal responses were recorded and used to calculate verbal response times. These provided a behavioral measure of listening effort, with longer times suggesting greater effort. Subjective effort was assessed using the NASA Task Load Index (NASA-TLX), with higher scores suggesting greater effort.

Results: Preliminary data were obtained from 18 participants (11 case; 7 control). Visual inspection of the data revealed that NU-6 scores increased with SNR improvement and that median scores were slightly higher for the control group than the case group. Likewise, median MOC reflex strength was higher in the control group than the case group. Median response times were longer at -6 dB SNR than at 0 dB SNR, with greater variability observed in the case group than the control group. At ‚àí6 dB SNR, NASA-TLX ratings were higher than at 0 dB SNR, consistent with increased listening effort at the poorer SNR. At both SNRs, median NASA-TLX ratings were higher in the case group than the control group, although the distributions overlapped. Associations between MOCR reflex strength and listening effort, as well as associations between behavioral and subjective measures of listening effort, will be examined statistically after data are collected from a larger number of participants.

Conclusions: Preliminary results suggest that behavioral and subjective measures of listening effort were sensitive to SNR changes and may differentiate listeners with and without SIN difficulties. These patterns may provide insight into auditory mechanisms underlying listening effort and SIN difficulties. We anticipate that stronger MOC reflexes will predict lower effort, a finding that could motivate clinical assessment of the mechanisms underlying SIN difficulties and inform interventions to reduce listening effort in normal-hearing individuals experiencing SIN challenges.

Category: Auditory Processing / Tinnitus

Poster #: 095 **Mentored Student Research Poster Award**

Evaluation of Screening Tools to Identify Somatosensory Tinnitus

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Objectives: Tinnitus, the perception of sound without an external source, is one of the most common service-connected disabilities among Veterans. Some individuals with tinnitus experience somatosensory tinnitus (ST), a subtype of tinnitus in which the tinnitus perception (e.g. loudness, pitch) is influenced by head, neck, or jaw movements and is associated with an underlying musculoskeletal dysfunction. Despite evidence that ST is common, there is no standardized clinical diagnostic tool or screening procedure and many audiologists are unfamiliar with this subtype of tinnitus. Instead, audiologists often rely on patient self-report and/or a physical therapy-based diagnosis. A physical therapist diagnoses ST when the following criteria are met: 1) tinnitus characteristics change with maneuvers; 2) tinnitus changes are reproducible; 3) maneuver(s) that elicited tinnitus changes is associated with movement restrictions and/or pain. This outcome confirms the tinnitus modulation(s) corresponds with movement limitations, pain, or tissue dysfunction, indicating a somatosensory origin. This work aims to evaluate the clinical utility of two screening tools, a self-report survey screener and a maneuver screener to predict the physical therapist diagnosis. The diagnostic accuracy of both screeners in identifying ST among Veterans will be evaluated against the physical therapy diagnosis, with at least one screener expected to show good sensitivity and specificity compared to the physical therapy diagnosis.

Design: Veteran candidates who meet the study eligibility criteria (e.g. tinnitus diagnosis in electronic medical record, >18 years of age, residing in Portland metro area) received an emailed study flyer through a local listserv. Individuals who screened positive for constant tinnitus via phone then completed in-person baseline screening assessments, which over 100 Veterans have completed thus far. Participants completed two screening assessments: (1) an online survey screener capturing self-reported tinnitus changes with head, neck, or jaw movements, and (2) a maneuver screener involving 18 head, neck, and jaw movements and/or pressure applications to assess if tinnitus characteristics changed with maneuvers. A study member guided the participant through maneuvers and recorded tinnitus changes. The study used a modified standard physical therapy exam to evaluate tinnitus changes with range of motion and strength maneuvers to confirm the presence or absence of ST. Sensitivity and specificity were determined by comparing the proportion of positive and negative screener results with the physical therapist's results.

Results: Preliminary results revealed different true positive rates for each screener, with the maneuver screener providing greater accuracy in identifying ST compared to the survey screener (87.9% vs. 48.5% respectively). Comprehensive results will include estimates of diagnostic accuracy for each tool and the level of agreement with physical therapy evaluations.

Conclusions: This study aims to establish a validated screening approach for identifying ST in Veterans. Developing tools with strong sensitivity and specificity will improve diagnostic accuracy and allow audiologists to recognize ST sooner. Results will inform future development of standardized tinnitus assessments and a clinical care pathway that integrates audiology and physical therapy practices. By improving identification and triaging, this work has the potential to streamline tinnitus management, facilitate targeted rehabilitative interventions, and enhance quality of life for Veterans affected by tinnitus, specifically ST.

Category: Auditory Processing / Tinnitus

Poster #: 096

Spatial Release from Effort at a Fixed Signal-to-Noise Ratio

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Objectives: Spatial release from masking refers to the improvement in speech understanding when target and maskers are spatially separated. This speech understanding benefit has been well documented but less is known about potential spatial release from listening effort. Previous studies have varied the signal-to-noise ratio (SNR) across spatial conditions in order to measure listening effort at a fixed performance level. This was done because performance level is known to impact listening effort. However, the difference in SNR across conditions could also impact the effort observed, and poorer SNRs with spatial separation may explain previous findings of a lack of spatial release from effort. It was hypothesized that at a fixed SNR, spatial release from masking and spatial release from effort would both occur.

Design: Eighteen young adults with normal hearing participated in this study. They engaged in a listening task, recalling color and number keywords in target sentences presented with competing talkers while seated with their heads stabilized in a head support. Pupillometry was used as an index of listening effort. There were two spatial conditions examined, with target and maskers co-located and spatially separated (20 trials per spatial condition). In the co-located condition, three female talkers (one target and two maskers) were presented at 0 degrees azimuth. In the spatially separated condition, one female talker (target) was presented at 0 degrees azimuth and two female talkers (maskers) were presented at 90 degrees azimuth. Spatial locations were simulated over headphones using head-related transfer functions. The SNR was kept constant across conditions at 5 dB, chosen as a realistic SNR for communicating in noisy environments.

Results: The behavioral results showed that performance was significantly higher in the spatially separated condition than in the co-located condition ($p < 0.001$), consistent with the hypothesis. Performance approached ceiling but spatial release from masking was observed. Pupil dilation was not significantly larger in the co-located condition ($p = 0.48$), inconsistent with the hypothesis. However, the time course of pupil dilation differed significantly between the two conditions ($p < 0.001$). During auditory perception, there was a time window of significantly higher pupil size for the spatially separated condition. When responding to what was heard, the opposite occurred, where there was a time window of significantly higher pupil size in the co-located condition.

Conclusions: When spatial release from masking occurred at a fixed SNR, there were also significant differences in how listening effort was deployed over time. Higher effort during auditory perception for spatially separated target and maskers could reflect directed auditory attention to the target and inhibition of maskers. This early effort in use of spatial hearing information occurred with the benefit observed of lower effort during sentence recall. Further research is needed to explore the possible mechanisms contributing to these changes in listening effort. This research improves our understanding

of listening effort with spatial hearing in populations with normal hearing, which gives context for optimizing both performance and listening effort in populations with hearing loss.

Category: Auditory Processing / Tinnitus

Poster #: 097 **Mentored Student Research Poster Award**

Peripheral Auditory Dysfunction and Cognitive Processing Deficits in Hyperacusis

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Objectives: Individuals with hyperacusis experience heightened sensitivity to everyday sounds. Despite the significant impact of hyperacusis on quality of life, the specific etiology of this disorder in humans is not well-understood. This study examined the relationship between sound sensitivity and peripheral and central mechanisms that may either contribute to or be associated with increased sensitivity to sound. Many individuals with hyperacusis have normal hearing thresholds within the standard audiometric frequency range (250-8000 Hz). However, emerging evidence suggests that extended high-frequency (EHF) audiometry may reveal cochlear changes not captured by conventional audiometry. These elevated EHF thresholds may contribute to sound sensitivity. In addition, a prevailing theory of hyperacusis is that a loss of sensory input leads to abnormally heighted responses to sound in the central auditory system. Thus, peripheral auditory degradation, as indicated by elevated EHFs, may predict upstream changes in central auditory processing. Cognitive abilities, such as working memory, also depend on central nervous system integrity. If the symptoms of hyperacusis result from central processing impairment, performance on cognitive tasks may therefore also be affected. In this study, we examined peripheral auditory function (i.e., EHF hearing thresholds) and performance on cognitive tasks in young adults with and without heightened sound sensitivity.

Design: Participants included 138 young adults with normal hearing thresholds within the standard audiometric frequency range (0.25-8 kHz). Participants completed the Hyperacusis Questionnaire (HQ), an assessment of sound sensitivity severity and its impact on concentration, emotional well-being, and social scenarios. Participants were also asked whether they felt they were more sensitive to sounds than the average person and were assigned to groups based on whether they answered "yes" or "no." Peripheral auditory sensitivity was assessed using standard and EHF (10-16 kHz) audiometry. A subset of participants (80) also completed NIH Cognitive Toolbox tasks to assess cognitive flexibility, inhibitory control, working memory, and processing speed. Regression analyses were used to examine whether HQ scores or sound sensitivity group membership predicted hearing thresholds at individual frequencies and cognitive task performance.

Results: Participants who reported heightened sound sensitivity had significantly poorer hearing thresholds and working memory task scores compared to individuals who did not feel that they were more sensitive to sound than the average person. Thresholds at both standard and EHF were elevated in the group with greater sound sensitivity but the effect was stronger for the EHF range. HQ scores did not significantly predict any hearing threshold or cognitive task measures. Interestingly, comparison of HQ scores to self-report of heightened sound sensitivity indicated a mismatch, where many individuals who reported abnormal sensitivity to sound had relatively low HQ scores and vice versa.

Conclusions: The findings from this study support the theory that subtle peripheral auditory dysfunction and central cognitive deficits are associated with heightened sound sensitivity in young adults with clinically normal hearing. This shows the importance of evaluating both peripheral auditory function and cognitive abilities in patients with sound tolerance complaints, as standard clinical assessments may not capture the range of deficits that contribute to challenges associated with hyperacusis.

Category: Auditory Processing / Tinnitus

Poster #: 098

Evidence for Subclinical Cochlear Dysfunction in Young Adults with Tinnitus

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Objectives: Reduced cochlear output due to hair cell damage leads to enhanced central gain that may give rise to tinnitus. Tinnitus is characterized by the perception of sound in the absence of a corresponding external sound and affects around 740 million people worldwide. There are no effective treatments due to a knowledge gap regarding its underlying pathophysiology. The role of outer hair cell (OHC) function in individuals with tinnitus remains unclear. The purpose of this study is to assess whether OHC function is reduced in normal hearing young adults with tinnitus compared to matched controls without tinnitus. We hypothesize that individuals with tinnitus will exhibit reduced stimulus-frequency otoacoustic emissions (SFOAEs) and reduced signal-to-noise ratios (SNRs) for the SFOAEs compared to controls. We also hypothesize that those with tinnitus will exhibit elevated pure-tone audiometric thresholds compared to controls. These findings would provide evidence consistent with subclinical cochlear dysfunction that may lead to increased central gain underlying tinnitus pathophysiology.

Design: A mixed-design analysis was conducted for each hypothesis, with group as the between-subjects factor and frequency as the within-subjects factor. Participants included young adults (19-33 years of age) with clinically normal hearing (pure-tone audiometric thresholds ≤ 20 dB HL from 125 Hz to 8 kHz): 5 tinnitus participants (≥ 6 months duration) and 7 matched controls without tinnitus. All participants completed a comprehensive audiological evaluation including pure-tone audiometry, tympanometry, and auditory brainstem responses to rule out other hearing impairments. SFOAEs were measured for each ear with a continuous frequency-swept tone (2 sec/octave, 8 sec/sweep) over 96 sweeps from 0.5 to 16 kHz using OAEToolBox. Suppressor tones (50 Hz above that of the probe tone, 55 dB SPL) were

presented with the probe tone (35 dB SPL) along with the probe tone only in each odd-numbered trial. A least squares fit was conducted to assess SFOAE amplitude, noise floor, and the SNR. A mixed analysis of variance was used to test for main effects of group and frequency as well as the group x frequency interaction.

Results: In support of our hypotheses, individuals with tinnitus exhibited reduced SFOAE amplitudes (group effect, $p<0.05$; frequency effect, $p<0.001$; interaction, $p<0.001$) and SNRs (group effect, $p<0.001$; frequency effect, $p<0.001$; interaction, ns) and elevated pure-tone audiometric thresholds (group effect, $p<0.001$, frequency effect, ns; interaction, ns) compared to controls.

Conclusions: Individuals with tinnitus exhibit reduced outer hair cell function compared to controls, as reflected by lower SFOAE amplitudes and signal-to-noise ratios. Individuals with tinnitus also show higher pure-tone audiometric thresholds than controls. These findings suggest reduced peripheral auditory function in young adults with tinnitus despite clinically normal hearing and support the notion that tinnitus may represent an early indicator of hidden hearing loss.

Category: Auditory Processing / Tinnitus

Poster #: 099 **Mentored Student Research Poster Award**

Subclinical Hearing Loss, Neural Encoding, and Cholinergic Modulation in Tinnitus

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Objectives: Many individuals with tinnitus demonstrate clinically normal hearing with conventional audiometric testing, suggesting underlying auditory dysfunction beyond standard clinical measures. This study investigated whether young adults with tinnitus and normal audiometric sensitivity exhibit differences in (1) extended high frequency (EHF) hearing thresholds, (2) hyperacusis markers, (3) speech-in-noise performance, and (4) auditory neural encoding as measured by the frequency following response (FFR). Additionally, we examined whether activating cholinergic mechanisms via acute nicotine administration could enhance FFR measures. We hypothesized that tinnitus participants would demonstrate elevated EHF thresholds, evidence of hyperacusis, poorer speech-in-noise performance, and impaired FFR measures compared to controls, and that nicotine would selectively improve FFR responses in the tinnitus group.

Design: This study employed a between-subjects comparison and a randomized, double-blind, placebo-controlled, mixed-effects design. Participants included young adults (18-39 years of age) with clinically normal hearing (pure-tone audiometric thresholds ≤20 dB HL from 125 Hz to 8 kHz): 5 tinnitus participants (≥ 6 months duration) and 9 age-matched controls without tinnitus. All participants underwent comprehensive audiological assessment including EHF audiometry (10-18 kHz), uncomfortable loudness levels (ULLs, 125 Hz-10 kHz) to assess hyperacusis, QuickSIN to assess perception of speech-in-noise, and electrophysiological FFR recordings to assess F0 amplitude responses

and signal-to-noise ratios (SNRs: steady-state amplitude / pre-stimulus amplitude). Participants completed two sessions (spaced >48 hours) receiving either 6 mg nicotine gum or placebo in counterbalanced order. FFR was recorded using a vertical electrode montage (Fz active, Fpz ground, A2 reference) in response to 6000 presentations of a 170 ms /da/ syllable (100 Hz F0) to the right ear presented at 80 dB SPL and sampled at 4803 Hz with online filtering (70-2000 Hz).

Results: Tinnitus participants exhibited elevated EHF audiometric thresholds compared to controls, indicating worse hearing at extended frequencies despite normal conventional audiograms. No differences were observed between groups for ULLs or QuickSIN performance, suggesting EHF deficits alone may not result in hyperacusis or reduced speech intelligibility. Contrary to our hypothesis, FFR analyses revealed a trend toward greater SNRs in the tinnitus group. This could reflect either enhanced neural synchrony to the speech stimulus or reduced background neural noise, both suggesting altered rather than degraded auditory encoding fidelity. Acute nicotine administration did not significantly enhance FFR F0 amplitude or SNR in either group relative to placebo, indicating that cholinergic modulation may not improve auditory encoding under quiet listening conditions.

Conclusions: Young adults with tinnitus and clinically normal hearing exhibited elevated EHF thresholds, suggesting early-stage auditory dysfunction. Despite this, they showed no deficits in loudness tolerance or speech-in-noise perception, indicating that tinnitus alone may reflect hidden hearing loss, supporting the need for routine EHF audiometry in tinnitus evaluations. Unexpectedly, tinnitus participants demonstrated enhanced FFR neural encoding, possibly reflecting compensatory neural adaptation rather than degraded processing. The absence of nicotine effects suggests that cholinergic modulation may not enhance subcortical auditory encoding or may require more demanding listening conditions to yield benefit. Future studies should test nicotine's effect under adverse listening conditions using cortical measures (40 Hz ASSR) and across tinnitus subtypes.

Category: Auditory Processing / Tinnitus

Poster #: 100

Shared Cognitive Predictors of Speech-in-babble Recognition in Tinnitus and ADHD

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Objectives: Tinnitus, the phantom perception of sound without external stimuli, and attention-deficit/hyperactivity disorder (ADHD) share several similar neurocognitive features, including cortical hyperactivity and reduced inhibitory control. In complex auditory environments, such as a "cocktail party" scenario, successful speech recognition relies on selectively focusing on a single speaker and retaining that information while suppressing competing voices - processes that may be impaired in both tinnitus and ADHD. This study investigates speech recognition performance and underlying cognitive mechanisms in multi-talker conditions among individuals with tinnitus, ADHD, and neurotypical controls. We hypothesize that participants with tinnitus and ADHD will demonstrate reduced speech recognition accuracy in multi-talker environments than neurotypical controls due to shared deficits in selective attention.

Design: This study included four participant groups: 15 individuals with chronic tinnitus (duration >6 months), 15 with clinically diagnosed attention-deficit/hyperactivity disorder (ADHD), and two age- and sex-matched neurotypical control groups (n = 15 each). All participants had normal hearing thresholds and no additional cognitive or psychiatric disorders. Limiting recruitment to normal-hearing individuals ensured that differences in speech recognition reflected cognitive rather than auditory factors. Speech recognition was evaluated using speech reception thresholds under two noise conditions: (1) two-talker babble, simulating a cognitively demanding "cocktail party" environment, and (2) steady-state noise, representing a less demanding non-speech interference. Cognitive performance was assessed across three domains: selective attention, short-term memory, and working memory. All cognitive tasks were administered both in quiet and under noise conditions matching those of the speech recognition test to enhance predictive relationship with speech recognition performance as suggested by a recent finding.

Results: Contrary to our hypothesis, participants with tinnitus and ADHD performed similarly to their respective neurotypical controls on speech recognition tasks in both two-talker babble and steady-state noise conditions ($F(1,3) = 0.65$, $p = 0.59$). However, both clinical groups showed significant deficits in selective attention, short-term memory, and working memory compared to their controls (post hoc pairwise comparisons, all $p< 0.05$). In tinnitus and ADHD groups, speech recognition in babble was best predicted by selective attention and working memory (adjusted $R2 = 0.78$ and 0.63 respectively). No cognitive measures significantly predicted speech recognition in steady-state noise for any group (adjusted R2 ranges from 0.01 to 0.12).

Conclusions: This study demonstrates that tinnitus and ADHD share similar cognitive deficits, particularly in selective attention, short-term memory, and working memory. Selective attention and working memory were the strongest predictors of speech recognition in multi-talker environments. However, these deficits did not lead to poorer speech recognition performance, suggesting that individuals with tinnitus and ADHD may rely on compensatory cognitive strategies to maintain effective speech perception in challenging listening conditions.

Category: Auditory Processing / Tinnitus

Poster #: 101

WITHDRAWN

Category: Auditory Processing / Tinnitus

Poster #: 102

Predicting Auditory Brainstem Response Stimulus Selection Using Deep Neural Networks

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Objectives: The auditory brainstem response (ABR) is an evoked potential commonly used to evaluate the hearing sensitivity of infants and other patients who are unable to participate in behavioral testing. Clinical diagnosis typically involves determining the hearing threshold, i.e., the lowest stimulus level that evokes a response, often measured across a range of frequencies. To find the threshold for a given frequency, a clinician presents a stimulus at a suprathreshold level to visualize waveform morphology and establish the presence of an ABR. An expert clinician will analyze the waveform characteristics and adaptively choose subsequent stimulus levels based on the characteristics of the accrued waveforms. These sequential testing skills are acquired during formal training, developed over time, and clinician decision strategies may vary between providers and across clinics. However, we assert that a database of ABR records collected over many patient-sessions may hold clinical conversance intrinsically curated by the clinicians who performed these diagnostic tests.

Design: To test this hypothesis, we analyzed an ABR database from the Seattle Children's Hospital comprising approximately 2000 clinical ABRs collected from infants with and without hearing impairment. Using these ABR data, we trained deep learning models to mimic the efficient testing procedure of experienced audiologists by predicting the sequential stimulus selection based on the ABR data accrued in a given patient-session. In general, inputs to the model are extracted features of the ABR waveforms, stimulus frequency and level, and previous stimulus decisions. Model predictions include increasing or decreasing the level by, e.g., 5-, 10-, 15-, 20-dB steps, repeating the level [0 dB], or ending testing. We compare several deep learning models with increasing complexity. The input for our baseline model is the extracted waveform features of the most recently collected ABR. These features are used to predict what the clinician's choice would be for the subsequent stimulus level. This baseline model is then compared against recurrent neural networks for which the input includes session history, i.e., the extracted features and clinician decisions of all ABR waveforms collected previously for the same patient and test frequency.

Results: Two metrics are used to evaluate the performance of the model predictions: absolute-accuracy and quasi-accuracy. The absolute-accuracy is reported as a percentage of model predictions in the test set that matched the ground truth clinician's decision during the clinical session. The quasi-accuracy is reported as the percentage of model predictions that are within 10 dB of the ground truth clinician's decision. Initial testing indicates that the recurrent neural network architecture results in more accurate model predictions for both categories. Absolute accuracy is approximately 60 % while the quasi-accuracy is in excess of 85 %.

Conclusions: It is possible to model clinician's stimulus choice during ABR testing within a clinically acceptable tolerance (10 dB) for most test cases. These initial models demonstrate the feasibility of providing assisted or automated stimulus selection during ABR testing, which could have applications in clinician decision support systems, telehealth, and clinical training.

Category: Auditory Processing / Tinnitus

Poster #: 103 **T35 Research Trainee Poster**

Adolescents' Emotional Responses to Non-Speech Sounds and Pictures

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Objectives: Affective reactions, also called emotional responses, occur when encountering auditory and visual stimuli; they are important because they influence perception, communication, and well-being. Emotional responses can be described along two dimensions: valence (pleasantness) and arousal (intensity). Prior research indicates that factors such as hearing loss can disrupt emotional response to sounds. Specifically, adults with hearing loss have a reduced range of valence ratings. However, most studies have focused on adults, and little is known about emotional responses in adolescents. Understanding this younger age group is critical for building a complete picture of emotional processing across the lifespan. However, testing adolescents in the laboratory can be logistically challenging. The aims of this study were: (1) to confirm the validity of a remote testing method for assessing emotional responses in adults with normal hearing, and (2) to establish normative normal hearing adolescent emotional response data for non-speech sounds and pictures with exploration of age-related trends using remote and laboratory testing.

Design: Two experiments were conducted. In both experiments, some participants completed testing in the laboratory and some completed testing remotely (on a personal computer with headphones). Experiment 1 included 44 adults with normal hearing, with 20 completing testing remotely and 24 in the laboratory. Experiment 2 included 129 adolescents (ages 9-17 years, normal hearing), with 112 completing testing remotely and 17 in the laboratory. All participants rated 65 non-speech sounds from the International Affective Digitized Sounds-2 and 65 pictures from the International Affective Picture System. Stimuli were categorized a priori as pleasant, neutral, or unpleasant. Valence and arousal ratings were obtained using the Self-Assessment Manikin, where participants rated valence and arousal on a scale of 1 to 9; with higher scores indicate higher valence or more arousal. Regardless of setting (laboratory, remote), participants provided a rating of both valence and arousal after each stimulus presentation. In both experiments, data was analyzed using linear mixed-effects models to evaluate the effects of stimulus category (pleasant, neutral, unpleasant), stimulus modality (sounds, pictures), and setting (laboratory). In Experiment 2 (adolescent-focused), age was included as a predictor variable.

Results: In Experiment 1 (adult participants), no significant differences were observed between remote and laboratory settings for mean valence or arousal ratings. In Experiment 2 (adolescent participants), analyses also revealed no effects of test setting on ratings of valence or arousal. In addition, normative valence and arousal ratings were established for all stimulus categories. Notably, there were age-related changes in valence ratings, with older adolescents providing higher (more pleasant) ratings than younger adolescents. Additionally, there were age-related changes in arousal ratings for unpleasant stimuli; older adolescents tended to rate stimuli as more arousing (exciting) than younger adolescents. Comparisons with adult data indicated differences in valence and arousal patterns, suggesting potential developmental effects on emotional responses to sounds and pictures.

Conclusions: Remote testing produced emotional response ratings comparable to laboratory testing, supporting the remote testing's validity and feasibility for both adults and adolescents. Age-related differences in valence patterns emerged among the adolescents; therefore, there were differences between adolescent and adult valence patterns. These findings demonstrate developmental changes in

emotion perception. This work provides the first normative adolescent data for emotional responses to non-speech sounds and pictures, offering a valuable reference for future studies. Building on these findings, future research will examine emotional responses in adolescents with hearing loss.

Category: Auditory Processing / Tinnitus

Poster #: 104 **T35 Research Trainee Poster**

Spectral Cues for Auditory Source Width Judgements

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Objectives: Measure spectral weighting functions for auditory source width judgments. The auditory source width is known to increase as interaural phase coherence decreases. In this experiment, width was controlled by indirectly manipulating the interaural phase coherence through changing the correlation values of sounds presented over two speakers. It is expected that lower frequency components will have a higher weight, and will more strongly influence width judgments, than higher frequency components.

Design: Participants were adults with normal hearing across 250 - 16,000 Hz. Stimuli were partially-coherent pairs of reproducible noise bands centered on 500, 1000, 2000, or 4000 Hz, presented in an anechoic chamber over loudspeakers positioned 45¬∫ left and right of midline. Experiment 1 measured the range of width and location judgments across random noise tokens. Findings from Experiment 1 were used to inform token selection for Experiment 2. Experiment 2 measured the repeatability of width and location judgments across different noise tokens. In Experiment 3, the tokens from Experiment 2 were combined and presented together as wideband noise. Participants' judgments were analyzed to measure spectral weighting functions.

Results: Auditory source width increased as interaural correlation value decreased. Frequency components centered at 500 and 1000 Hz were found to have higher weight on auditory source width judgments compared to 4000 Hz; minimum weight was observed for 2000 Hz.

Conclusions: Data were consistent with previous findings that indicate auditory source width increases as the degree of interaural phase coherence decreases, especially for low frequency sounds.

Category: Auditory Processing / Tinnitus

Poster #: 105 **T35 Research Trainee Poster**

Development of Sensitivity to Interaural Coherence for Binaural Fusion

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Objectives: Binaural fusion reflects the ability to combine signals from the two ears into a single percept. For normal-hearing adults, increasing interaural coherence, or the statistical similarity of the signals at the two ears, promotes binaural fusion. How children fuse binaural signals of varying interaural coherence is unexplored. The goal of this study was to investigate the developmental effect of the influence of interaural coherence on binaural fusion in normal hearing children.

Design: Thirty-five children between 7 and 17 years old with normal hearing (NH) completed this study. All participants passed a hearing screening from 125 to 8000 Hz at 25 dB HL. Each participant completed a binaural fusion task where the interaural coherence of the signal envelope was systematically manipulated between 0.4 and 1.0. A single-channel vocoder with 20 logarithmically spaced sine wave carriers was applied to a continuous discourse. Each 500 ms token was extracted from the vocoded discourse with peak amplitude around 6 kHz and a 20 dB/octave roll-off with an envelope that had the target interaural coherence. On each trial, a single interval was presented. Children were asked to rate the perceived auditory image size using a fusion dispersion scale of 1 to 17, displayed pictorially with the punctate auditory image broadening from a single image (1-9) to two images (10-17). On trials with single-image responses, children were also asked to indicate the intracranial position of the perceived image. Catch trials with monaural signals only to the left or right ear were randomly presented.

Results: Preliminary results showed that, similar to NH adults, children on average showed changes in binaural fusion as a function of interaural coherence, reporting lower fusion dispersion ratings (more binaurally fused percepts) with increasing interaural coherence. On average, NH adults and children aged 12-17 years old had similar fusion dispersion as a function of interaural coherence values, reporting a fused image beginning at ~0.92 interaural coherence. Young children aged 7-11 years old reported fused binaural signals starting at a lower interaural coherence of ~0.83 compared to older children and NH adults-suggesting a poorer ability to detect unfused percepts at low interaural coherence. Young children also made more frequent reports of single-image precepts at very low interaural coherence levels of ~0.4. Catch trials presenting monaural signals show consistent rating of a fused single-image percept across the school-age years.

Conclusions: Preliminary results show emerging age effects for binaural fusion in NH children such that younger children report interaurally decorrelated signals to appear more fused. This may stem from immature auditory and cognitive skills in the detection and reporting of a second, less salient auditory image.

COCHLEAR IMPLANTS

Category: Cochlear Implants

Poster #: 106

Masked Speech Recognition for Bilaterally Implanted Children

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Objectives: Bilateral cochlear implant (CI) users typically perform poorly on tasks assessing temporal sensitivity when listening with clinically available processors. Temporal sensitivity for bilateral CI users may be influenced by physiologic processing limitations, as well as sensory experience and training. It is currently not well understood whether early access to temporal fine structure cues influences performance on tasks of temporal sensitivity. The objective of the present study was to assess whether children benefited from temporal cues provided by CIs if they had access to these cues during auditory development. We hypothesized that better masked speech recognition in spatially-separated conditions would be observed for maps with temporal cues versus maps with envelope information alone for children with CIs implanted bilaterally before 3 years of age.

Design: Recruitment included bilateral CI recipients (6 - 18 years) who were activated before 3 years of age and were fit with a coding strategy that provided temporal fine structure cues (e.g., FS4 strategy). Participants were recipients of a MED-EL device and were fit with an FS4 coding strategy during auditory development. Participants listened consistently (>8 hours per day) with their CIs, as documented via datalogging. Masked speech recognition was assessed using the Bamford-Kowal-Bench (BKB) sentences in three target-to-masker configurations: target and masker co-located, target from the front and masker towards the right ear, and target from the from the front and masker towards the left ear. Participants completed the task twice, once while listening with the FS4 coding strategy and once while

Results: Preliminary results (n=3) suggest that some children benefit from the FS4 coding strategy over the HDCIS coding strategy for masked speech recognition, particularly in the spatially separated conditions. Data collection is ongoing to explore this relationship while accounting for other factors such as age, device placement, and map settings.

Conclusions: Children implanted bilaterally during auditory development and fit with a coding strategy that provided temporal fine structure cues may be able to use these cues later in life.

Category: Cochlear Implants

Poster #: 107 **Mentored Student Research Poster Award**

Effects of Semantic Context on Neural-Activation Patterns in CI Users

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Objectives: Cochlear implant (CI) users experience acoustic degradation due to the characteristic processing of sound through their devices, making listening in noisy environments more difficult. To

compensate for this degradation, CI users typically rely more heavily on top-down processing, including semantic context, to accurately perceive speech. When semantic context is lost, CI users may recruit additional brain regions in an effort to compensate for the increased listening demands. The aim of this study is to investigate individual differences in CI users' reliance on semantic context to comprehend speech and respond to open-ended questions that model realistic listening experiences. We hypothesized that CI users would maintain high accuracy when asked questions in which semantic context is reliable (congruent) but would perform more poorly when asked questions with unreliable semantic context (incongruent). Additionally, we expected CI users to exhibit an increase in cortical activation when processing incongruent stimuli, as greater neural resources may be required to decode and respond to contextually unrelated speech.

Design: Five adult CI users completed a pilot behavioral portion of the study; additional data collection is ongoing. Speech stimuli were presented in 4-talker babble noise. Stimuli consisted of congruent and incongruent comprehension questions. Congruent questions were preceded by contextually related sentences, whereas incongruent questions were preceded by contextually unrelated sentences. An example of a congruent trial is: "It is dark at night. It can be hard to see because the sun isn't out. What shines in the sky at night?" An example of an incongruent trial is: "Tigers can be found in the jungle. They are cats with orange and black stripes. What comes out of a sink faucet?" The signal-to-noise ratio (SNR) for each participant was predetermined as the SNR at which 50% accuracy was achieved for BKB SIN sentences (SNR50). Additionally, a concurrent behavioral and neuroimaging paradigm collected real-time cortical activation in response to congruent and incongruent stimuli using functional near-infrared spectroscopy (fNIRS). Comprehension accuracy scores were calculated for both congruent and incongruent question types.

Results: Participants achieved an average of 94% correct when presented with congruent stimuli and 74% correct with incongruent stimuli. One CI participant completed the functional neuroimaging task. This participant scored 80% correct when presented with congruent stimuli and 60% correct for incongruent stimuli at their SNR50 of 9-dB SNR. Preliminary neuroimaging results revealed an increase in cortical activity while processing incongruent questions in the prefrontal cortex, potentially reflecting greater allocation of neural resources when the preceding semantic context was unrelated to the following questions.

Conclusions: Results showed that participants experience greater difficulty in responding to comprehension questions that follow contextually unrelated stimuli, indicating that CI users rely on the semantic context for successful speech comprehension in noise. Neuroimaging results revealed increased activation in the prefrontal cortex for incongruent stimuli, suggesting recruitment of additional neural resources for contextually unrelated stimuli. Identifying the degree of additional neural resource allocation for incongruent compared to congruent stimuli may reveal individual differences in CI users' underlying listening strategies for challenging speech-comprehension tasks in noise.

Category: Cochlear Implants

Poster #: 108

Cochlear Implant Outcomes in Adults with Vestibular Schwannoma

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Objectives: A vestibular schwannoma (VS) is a benign tumor of the cochleovestibular nerve with an approximate prevalence of 1 in 2000 people. The presence of VS is routinely associated with tinnitus, imbalance or dizziness, and hearing loss. For individuals with hearing loss who no longer benefit from hearing aids, cochlear implantation (CI) can restore hearing and speech recognition. Cochlear implants are highly successful in most patients. As such it is often recommended to patients with degraded hearing associated with a VS. To date, several studies suggest that speech recognition is possible in CI recipients with a VS (VS-CI), and may approximate that observed in individuals without a VS. However, while positive outcomes have been observed in VS-CI patients, results are highly variable and may be influenced by a number of variables related to the tumor itself, or management of the tumor. Here we examine outcomes in VS-CI patients relative to age-matched non-VS controls and examine these results as a function of the VS size and location, and the management of the VS itself (e.g., surgery, radiation, or observation).

Design: A retrospective chart review identified 31 patients with a VS who subsequently received CI. Individuals with VS were managed either by surgical resection, stereotactic radiosurgery, or observation. These patients included those with NF2, and sporadic VS. Each participant was age-matched with a non-VS CI recipient (1:1 ratio). Our outcome measures included aided speech-recognition scores, CI wear time, impedance levels, stimulation levels, and incidence of adverse events during programming such as facial stimulation which required modification to the map.

Results: While preliminary and ongoing, our results show considerable variability in CI outcomes, particularly regarding speech recognition. First and most important, a subset of patients displayed speech-recognition outcomes that were similar to those of age-matched controls. However, a number of patients also displayed no open-set speech recognition (7 out of 31 participants), suggesting that outcomes may be limited in a subset of VS-CI patients.

Conclusions: These results suggest that when speech-recognition is observed in CI recipients with VS, their performance is largely similar to that of patients without a VS. However, a number of VS-CI patients showed no speech recognition whatsoever , suggesting that either the VS itself, or the management of the VS may have compromised the nerve sufficiently to preclude speech recognition. We are presently examining the tumor characteristics, and the management of the tumor to determine which variables are associated with a reduced likelihood of achieving open-set speech recognition similar to that of CI recipients without a VS.

Category: Cochlear Implants

Poster #: 109

Spatial Benefit of Hearing Devices for Single-Sided Deafness

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Objectives: We aimed to quantify speech-in-noise benefit across three device options for adults with sensorineural single-sided deafness (SSD): contralateral routing of signal (CROS) hearing aids, bone conduction devices (BCD), and cochlear implants (CI). Spatial hearing supports communication by separating speech from noise, yet most clinical tests overlook this ability. Most audiology sound booths include two loudspeakers, and spatially separated speech-in-noise testing could be easily implemented. This study used a spatial Words-in-Noise (WIN) test to evaluate spatial hearing by device, either by re-routing sound through a single auditory pathway (CROS, BCD) or by restoring input to both pathways (CI). We hypothesized that the CI, as the only device stimulating the deaf ear, would uniquely improve spatial release from masking (benefit when speech and noise are spatially separated) and squelch (benefit when noise originates from the deaf side). In contrast, BCD and CROS were expected to support head-shadow (benefit when noise is directed toward the better-hearing ear) through re-routing of the target signal

Design: Adults with SSD, defined as having a ≥60 dB HL four-frequency pure-tone average (PTA) interaural difference and a PTA ≤25 dB HL in the better ear were included. Speech reception thresholds (SNR-50, dB HL) were measured using the spatial WIN test, which uses NU-6 target words presented in six-talker babble. During a run, babble was presented at a fixed level of 58 dB SPL, while the target speech varied in level to evaluate SNRs ranging from +24 to 0 dB. Speech was presented from 0°, and noise was positioned at 0° (summation), or spatially separated, with noise 90° toward the better ear (head shadow), or 90° toward the poorer ear (squelch). Aided and unaided conditions were tested for each device, and spatial release from masking (SRM) was derived: SRMn when noise moved from the front toward the better ear, and SRMd when noise moved toward the poorer ear.

Results: Eighty-four patients met inclusion criteria: 65 CROS, 9 BCD, and 10 CI. Complete data were available for 77 summation, 70 head-shadow, and 67 squelch conditions. Across devices, summation effects were minimal, indicating little benefit when speech and noise were co-located. CROS and BCD users showed small advantages when noise was directed toward the better-hearing ear, but reduced performance when noise originated from the deaf side, reflecting interference from re-routed input. CI users uniquely benefited in squelch and SRMd conditions, showing improved performance when noise was presented toward the deaf ear, consistent with restoration of binaural processing through stimulation of both auditory pathways.

Conclusions: All three devices provided measurable benefit for adults with SSD, but through distinct spatial mechanisms. CROS and BCD users showed modest improvement when noise was directed toward the better ear, but reduced performance when noise was on the deaf side. CI users were the only group to show benefit when noise originated from the deaf side, reflecting restored binaural processing in squelch

and SRM conditions. These findings highlight the value of spatialized speech-in-noise testing for counseling SSD candidates and how this testing can be integrated into clinical speech testing protocols.

Category: Cochlear Implants

Poster #: 110

Investigating Binaural Cue Processing in Individuals with Typical Hearing and Bilateral Cochlear Implants: Neural and Psychophysical Perspectives

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Objectives: Typically hearing (TH) listeners localize sounds using binaural cues, including interaural time differences (ITDs), which are conveyed via low-frequency temporal fine structure (TFS) or temporal envelope modulations (ENV) in high-frequency sounds. Bilateral cochlear implant (BiCI) users have limited access to TFS-ITDs because implant processors operate asynchronously and replace TFS with high-rate pulsatile stimulation that exceeds neural resolution. However, BiCI users maintain robust ILD sensitivity and some ENV-ITD access; children with BiCIs may retain some TFS sensitivity if they were exposed to acoustic hearing early in life. How perceptual sensitivity relates to neural processing of these cues remains unclear. This study used electroencephalography (EEG) to explore associations between neural measures of ITD sensitivity and perceptual measures using identical stimuli. The study focuses mostly on TH adults, providing normative foundations for studies in individuals with BiCIs, and a small cohort of BiCI users.

Design: Novel acoustic stimuli were developed to simulate binaural CI stimulation in TH listeners, capturing temporal and excitation properties of apical (TFS) and basal (ENV) stimulation. TFS stimuli were 100 pulses/s; ENV stimuli were 4000 pulses/s amplitude modulated at 125 Hz. Both were presented in spectrally notched noise centered at 500 Hz (TFS) and 4000 Hz (ENV) for TH listeners. ITD thresholds were measured behaviorally using a 3-interval, 2-alternative, forced-choice task. EEG was recorded in passive listening and in an active oddball paradigm with ITD of 0 and +750μs (standard, 75%; deviant, 25%). In the active task, participants indicated detection of deviants by pressing a button; accuracy and reaction times were recorded. P300 amplitudes across all time-points and channels were compared statistically and were corrected for multiple comparisons using cluster-based permutation.

Results: Data from 15 TH participants [mean (SD) = 20.81 years (1.79)], show that smaller (better) behavioral JNDs for TFS were associated with higher accuracy and faster reaction times during active oddball task, suggesting that ITD sensitivity correlates with the success of detecting the oddball. Cortical responses for the two stimuli revealed distinct neural patterns: TFS stimuli elicited larger N1 and P300 responses, while ENV stimuli elicited relatively larger P2 responses. These patterns suggest stronger early encoding and more robust discrimination of TFS-ITDs, whereas increased difficulty in discriminating ENV-ITD despite greater attentional engagement. Preliminary data from BiCI users with

research processors that deliver synchronized stimulation revealed similar trends. Further evaluations in a larger BiCI cohort are underway.

Conclusions: These findings support associations between neural measures of ITD processing and perceptual sensitivity data, using novel acoustic stimuli as a tool to probe cortical processing of binaural cues. In TH adults, higher JNDs, longer responses, and reduced/delayed P300 amplitudes suggest diminished access to ENV cues compared with TFS cues. Cortical measures complement behavioral data, offering insights into binaural cue utilization that behavior alone cannot provide. This approach lays critical groundwork for extending investigations to children with BiCIs to assess how auditory experience shapes binaural development.Work supported by a grant from NIH-NIDCD (R01020355 to R.Y. Litovsky) and in part by a core grant to the Waisman Center from NICHD (P50HD105353).

Category: Cochlear Implants

Poster #: 111

Context Mitigates Talker Variability during Speech Recognition in CI Users

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Objectives: Speech communication involves substantial acoustic-phonetic variability within and across talkers. While listeners with normal hearing can often compensate using top-down mechanisms, cochlear implant (CI) users experience compounding difficulty due to their poor spectrotemporal resolution. Since CI users report challenges understanding multiple talkers and accented speech, this study examined how talker variability and linguistic predictability jointly influence speech recognition. We hypothesized that CI users would better compensate for talker variability when provided with rich contextual support.

Design: Forty adult CI users completed 120 sentence and 120 word recognition trials. Monosyllabic words were categorized as "easy" or "hard" based on their frequency of occurrence in the language and their number of competitors when misheard. Sentences were categorized as highly, minimally, or not predictable based on the number of words that could contribute to correct prediction of the sentence-final word. Stimuli were spoken by a single native talker, multiple native talkers, or multiple nonnative talkers and presented in quiet and noise. In noise, individualized signal-to-noise ratios targeted approximately 50% accuracy across conditions. Accuracy was analyzed using mixed-effects logistic regression with linguistic context and talker condition as fixed effects and participant as a random intercept. Odds ratios (OR) and predicted probabilities were calculated with statistically significant results summarized below.

Results: Predicted baseline recognition was 87% for sentences and 68% for words spoken by a single talker in quiet. While increased talker variability significantly reduced performance, these effects were partially mitigated by contextually enriched speech in quiet and noise. Compared to low-predictability sentences, high-predictability sentences were recognized 3.74x more accurately when produced by multiple native speakers (OR: 3.74 [2.47, 5.67]), 9.78x more accurately when produced by multiple

nonnative speakers (OR: 9.78 [6.12, 15.64]), and 12.32x more accurately when produced by multiple native speakers in noise (OR: 12.32 [7.31, 20.75]). Significant performance boosts of 2-4x were also observed for multi-talker word tasks when lexical difficulty was reduced. In addition, these trends persisted when participants were divided into higher- and lower-performing CI users based on a broad array of speech perception tasks using k-medoids clustering. In other words, higher and lower performing CI users both benefited substantially from context. Finally, significant context x talker interactions indicated that while contextual benefits were often pronounced, they were diminished when multiple degradations (e.g., talker variability and background noise) were present. Under both multi-talker conditions, performance on low-predictability and anomalous sentence trials did not differ significantly suggesting these materials were equally difficult for CI users even before nonnative speakers were introduced.

Conclusions: In CI users 1) speech recognition relied heavy on contextual cues due to the limited spectrotemporal resolution of their devices, 2) context-rich speech partially mitigated multi-talker effects including those involving nonnative speakers, and 3) talker variability and background noise interacted to markedly reduce speech recognition performance. Since word recognition tests in quiet were less sensitive to top-down compensatory mechanisms, clinical assessments should incorporate multi-talker sentence measures to better represent everyday listening demands and to better counsel patients, family members, and caregivers on the advantages of providing additional contextual support during conversations.

Category: Cochlear Implants

Poster #: 112

Enhancing Bimodal Speech Perception Through Truncating Cochlear Implant Low-Frequency Gain

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Objectives: Many individuals choose to wear a hearing aid in one ear and a cochlear implant in the other, also known as bimodal listening. These individuals often benefit from acoustic stimulation of low frequencies and electrical stimulation of the mid to high frequencies. Previous research has shown that low frequency information is not well preserved using a cochlear implant. The likely reason is a frequency mismatch between the place where the implant array is seated and the frequency bands being delivered. This study aims to compare speech outcomes between traditional bimodal programming (standard manufacture allocation tables) and truncated low frequency programming. Rather than acute reprogramming and testing, this study included a four-week trial with the new truncated program. We tested the following hypotheses for speech perception by truncating low-frequency electrical stimulation of the cochlear implant: 1) Improved speech performance in quiet and in co-located noise in the bimodal listening condition. 2) Improved speech perception in noise when the noise is presented on the cochlear implant side. 3) Decreased or unchanged speech perception in noise when the noise is present on the hearing aid side. 4) Decreased speech perception in the cochlear implant only condition.

Design: Adults with bimodal hearing were included in the study. Each participant attended two clinical visits, four weeks apart. Hearing aids were verified to match prescriptive output targets before speech testing and the truncated frequency trial. Speech testing was collected at the first visit with the baseline clinical program; and at the second visit with the truncated programming for comparison. All speech testing was conducted in a clinical sound booth and included: CNC word recognition in quiet with only the cochlear implant and the following tests in the bimodal condition: 1) CNC words in quiet 2) AzBio Sentences in quiet 3) Words in Noise (WIN) co-located 4) WIN spatially separated with noise on Cochlear Implant side 5) WIN spatially separated with noise on Hearing Aid side

Results: This research intends to collect data from 15 participants. To date, four subjects have been seen for pre-/post-testing. Of the four, two subjects demonstrated little change in speech perception between their first and second visit. One subject demonstrated slightly improved speech perception in the bimodal condition using the truncated program. However, their speech perception performance in the cochlear implant alone condition dropped significantly. The last subject demonstrated worse speech performance in the bimodal and cochlear implant only condition.

Conclusions: This study is in its early stages and more participants need to be seen. It is interesting to note one participant reported improved own-voice quality using the truncated program. The same participant demonstrated a significant decrease in CNC word recognition in the CI only condition. The differences across individual bimodal listeners indicate the importance of individual factors that can influence the effects of removing low frequencies from cochlear implants.

Category: Cochlear Implants

Poster #: 113

Critical Period Windows for Aural Rehabilitation in Cochlear Implant Recipients

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Objectives: To investigate the temporal dynamics of aural rehabilitation in adult cochlear implant (CI) recipients and determine whether early-post-activation performance and usage patterns are stronger predictors of 12-month outcomes than aggregate device usage hours alone.

Design: Retrospective longitudinal cohort study of adult CI recipients (N=205) implanted between 2018-2024 at a tertiary academic medical center. Audiometric testing and device datalogging were collected at activation, 1-, 3-, 6-, and 12-months post-activation. A sub-cohort (n=11) with complete longitudinal data at all four follow-up timepoints was analyzed for within-subjects trajectory comparisons. The primary outcome was 12-month CNC word recognition. Early rehabilitation period was defined as 0-3 months post-activation; late rehabilitation period as 6-12 months. Device usage patterns were classified as consistently high (≥10 hours/day throughout), persistently low (<10 hours/day throughout), or variable.

Results: Overall, early-rehabilitation improvement rates (4.85 points/month) significantly exceeded late-rehabilitation rates (-0.64 points/month; U=666.0, p<0.001), representing a 7.6-fold difference. The within-subjects cohort (n=11) demonstrated an even stronger temporal effect, showing 3.2-fold faster improvement during early versus late periods (3.73 vs 1.15 points/month; W=8.0, p=0.094) despite similar average daily usage between periods (13.0 vs 13.6 hours). This pattern persisted even among patients without ceiling constraints: those with 6-month CNC scores below 70% (n=9) continued to improve throughout follow-up, with mean scores progressing from 39.3% at 3 months to 44.4% at 6 months to 53.1% at 12 months. However, their late-period improvement (8.7 percentage points) remained substantially slower than early-period gains, confirming temporal effects independent of performance ceilings. Furthermore, 1-month word recognition performance strongly predicted 12-month outcomes (ρ=0.750, p<0.001), outperforming aggregate usage hours as a predictor (ρ=0.515, p=0.017) with 1.46-fold greater correlation strength. In this cohort (median 1-month CNC: 30% [IQR: 15%-46%]; median 12-month CNC: 46% [IQR: 36%-65%]), 1-month scores ≥30% predicted favorable 12-month outcomes (mean: 69%), while scores<30% were associated with lower 12-month outcomes (mean: 42%). This predictive power manifested in ultimate performance differences: consistently high device users achieved 54.3% CNC versus persistently low users' 17.2% (37.1-point difference, p=0.016). However, analysis of raw usage quartiles demonstrated no significant dose-response relationship (ρ=0.203, p=0.265), confirming that usage quantity alone is insufficient to predict success.

Conclusions: Adult CI recipients exhibit a critical window of rapid neuroplastic adaptation within the first 3 months post-activation, where performance gains are 3- to 8-fold faster than in later periods, independent of device usage hours or performance ceilings. Early (1-month) word recognition is a more robust predictor of overall 12-month word recognition score outcomes than aggregate daily hours of device use. These findings suggest that optimal rehabilitation involves intensive, front-loaded CI use and the use of the 1-month visit as a critical prognostic checkpoint (≥30% CNC indicating favorable trajectory toward ≥50% functional speech recognition at 12 months) may help guide counseling and intervention.

Category: Cochlear Implants

Poster #: 114

Impacts of Truncating Cochlear Implant Low-Frequency Access on Bimodal Hearing

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Objectives: Cochlear implants (CIs) improve access to sound and speech perception, but low frequency cues, such as voice discrimination and emotion recognition, remain difficult for a variety of reasons. Previous work suggests that 48% of implanted adults are bimodal using a hearing aid in the non-implanted ear in addition to their CI. It is possible that in cases of bimodal hearing where patients have access to low frequency sounds through their acoustic hearing ear, that it may be beneficial to exclude low frequency sounds from the CI to avoid any interference. Removing low frequency sounds from the CI using a truncated frequency allocation has the potential to improve overall sound quality, including music perception, as well as the perception of emotion in voice pitch. The goal of this project was to complete a trial with a truncated Map to determine if adult CI listeners have improved hearing outcomes

using frequency allocation tables that exclude low frequency information compared to standard frequency allocation tables. We tested the following hypotheses: 1) Auditory outcomes will be higher when bimodal participants listen through truncated frequency allocation tables compared to standard frequency tables because low frequency sounds from the hearing aid will be more salient, and 2) head-shadow benefit and bimodal speech recognition will be maintained with the truncated program.

Design: Bimodal hearing listeners completed a 4-week trial with a frequency truncated program, removing low frequencies from their CI input based on their residual hearing in the non-implanted ear and average insertion depth in the literature of their individual electrode array. Baseline testing was completed using their clinical CI Map after verifying a well-fit hearing aid. Testing with their new truncated CI Map was completed after the 4-week trial. Outcome measures included speech recognition in quiet, co-located and spatially separated noises, emotion recognition, music sound quality, and the Speech, Spatial and Qualities (SSQ) and the Music-Related Quality of Life (MuRQOL) questionnaires.

Results: Preliminary results indicate variable speech perception results, with one participant having worse performance in almost all conditions with the truncated program, with one participant having poorer performance with the implant alone but better bimodal performance, and two participants with limited change. Subjective reports included less noise perceived in noisy environments and a mix of preference, ambivalence and dislike for the truncated programs. Emotion recognition showed no effects of frequency truncating in any participant. Music sound quality ratings varied across types of music, with a preference for the truncated program with some music but not others. EMA and questionnaire data are continuing to be collected.

Conclusions: Preliminary data indicate that truncated Maps can provide subjective and objective benefits for bimodal hearing listeners but only for some individuals. Individual characteristics that drive these benefits, such as shape and degree of hearing loss, CI performance, and other factors will be critical in using truncated Maps for bimodal listeners in clinical CI care.

Category: Cochlear Implants

Poster #: 115 **T35 Research Trainee Poster**

Determining Meaningful Reductions in Listening-Related Fatigue Following Cochlear Implantation

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Objectives: Cochlear implants (CIs) can, on average, significantly reduce listening-related fatigue for adults with hearing loss. However, whether any individual's benefit is statistically significant or clinically meaningful remains unknown. The purposes of this study were to 1) derive Minimal Detectable Differences (MDDs; smallest statistically significant change) and Minimal Clinically Important Differences (MCIDs; smallest clinically meaningful change) for the 10- and 40-item versions of the Vanderbilt Fatigue Scale for Adults (VFS-A-10/40) and 2) use these MDDs and MCIDs to determine the proportion of

individual CI users who demonstrated statistically and clinically meaningful reductions in their fatigue post-implantation.

Design: We used four extant data sets to derive VFS-A-10/40 MDDs and MCIDs. Two data sets were collected during development of the VFSs, and two data sets were collected during research studies examining post-implantation changes in fatigue in new CI users (275 participants). VFS-A-10/40 MDDs were derived using five distribution-based methods. In addition, one data set included Hearing Handicap Inventory (HHI) scores, which allowed for the calculation of MCIDs using anchor-based methods. "Small" and "moderate" MCIDs were estimated using post-implantation changes of ½ and 1 HHI Auditory Wellness categories, respectively, as anchors. These values were then used to quantify the proportion of CI recipients (in data sets with pre- and post-implantation VFS scores) whose fatigue reduction post-implantation was statistically significant (i.e., ≥MDD) or clinically meaningful (i.e., ≥MCID).

Results: MDD & MCID Calculations: After reviewing MDDs derived using multiple approaches, final MDDs were based on small (.2), moderate (.5), and large (.8) “effect size” calculations, as these encompassed the range of MDDs derived using other distribution-based approaches. Small, moderate, and large MDDs were 9, 22, and 35 (VFS-A-40) and 2, 5, and 8 (VFS-A-10), respectively. Likewise, anchor-based MCIDs varied across calculation methods. Final values were based on the average of two MCID calculations. Small and moderate MCIDs were 35 and 45 (VFS-A-40) and 9 and 11 (VFS-A-10), respectively. CI-related Fatigue Reduction: At one-month post-activation, ~74% of new CI users experienced at least a small reduction in fatigue (change ≥ "small" MDD) while ~33% showed a large reduction (change ≥ "large" MDD). By 12 months ~80-88% had experienced a small, and ~60% a large, fatigue reduction. Additionally, many new CI users experienced fatigue reductions at one-month post-activation that were ≥ small (~38%) and moderate (~28%) MCID cutoff values. This suggests their fatigue reduction was not only statistically significant but clinically meaningful. By 12 months this had increased to ~60% (small) and ~49% (moderate) of new CI users.

Conclusions: MDDs and MCIDs are required for clinicians to know whether an intervention has made a statistically significant or clinically meaningful change in an outcome for an individual. Our analyses showed that receiving a CI resulted in a clinically meaningful reduction in listening-related fatigue for ~50%-60% of CI recipients by 12 months post-activation. The MDD and MCID values of the VFS-A-10 and VFS-A-40 can be used in future studies and in clinical settings to estimate if observed changes are statistically significant or clinically meaningful for individual patients.

DIAGNOSTIC AUDIOLOGY / OTOLOGY

Category: Diagnostic Audiology / Otology

Poster #: 116

Large Language Models as a Decision-Support Tool in Audiology

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Objectives: Artificial intelligence (AI) language models, such as ChatGPT, are increasingly used in education and research. However, their performance in specialized medical domains, such as audiology, remains unclear. The objective of this study was to evaluate the accuracy and consistency of ChatGPT responses to questions about the Auditory Brainstem Response (ABR) test, a key objective method in hearing assessment. The hypothesis was that newer ChatGPT versions would demonstrate higher accuracy and repeatability in ABR-related knowledge.

Design: Six versions of ChatGPT (3.5, 4, 4o mini, 4o, 4o1 mini, and 4o1 preview) were tested using 30 single-answer, multiple-choice questions derived from a graduate-level course on ABR diagnostics. Each question was posed 10 times to each model across two consecutive days (5 times per day). Accuracy was determined using a validated answer key. Consistency (response repeatability) was assessed using percent agreement and Cohen's Kappa statistics.

Results: The accuracy of ChatGPT responses improved markedly with successive model versions, from 51% for version 3.5 to 87% for version 4o1 preview. The largest performance gain occurred with the introduction of version 4o, which showed a 20% accuracy improvement over its predecessors. Consistency followed a similar trend, with Cohen's Kappa increasing from 0.42 (moderate agreement) in version 3.5 to 0.76 (substantial agreement) in version 4o. However, the lightweight 4o1 mini version showed reduced repeatability compared to both 4o and 4o1 preview, despite faster response generation.

Conclusions: ChatGPT demonstrates a progressive improvement in ABR-related knowledge with newer versions, suggesting enhanced capability for audiological education and support. However, response variability remains a limitation, particularly in smaller model variants. Clinicians and educators should interpret AI-generated information with caution, especially when using compact or optimized model versions. The observed variability underscores the need for careful verification of AI-assisted learning in hearing sciences.

Category: Diagnostic Audiology / Otology

Poster #: 117

Auditory Dysfunction: Self-Reported Effects of ART Exposure in Veterans

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Objectives: Human Immunodeficiency Virus (HIV) is a virus that attacks the body's immune system, contributing to weakened immune responses to infection. HIV is treated with regimen of either antiretroviral therapy (ART) drugs or pre-exposure prophylaxis (PrEP). Public health agencies highlight the glaring concern and impact of HIV which, if left untreated, can lead to acquired immunodeficiency syndrome (AIDS). Treatment of HIV requires consistent and lifelong medication, which is known to penetrate the blood-brain barrier as well as have effects on the auditory system. Effects of HIV

treatments on the auditory system are not well established, but evidence is tied to impaired auditory outcomes. This research seeks to identify the relationship, if any, between HIV, ART, and self-reported hearing handicap scales. Self-reported hearing handicap scales, such as the Hearing Handicap Inventory (HHI) seek to quantitatively assess hearing outcomes. Our team hypothesizes that individuals receiving drug treatments will exhibit greater auditory dysfunction and worsened performance on auditory perception tasks.

Design: Participants of this study fell within three study arms: individuals with HIV receiving ART (HIV+), individuals without HIV receiving PrEP (PrEP), and a control group (Control). Within the groups, the total participants are listed as follows: HIV+: n=60, PrEP: n=33, and Control: n=32. This study was completed at the National Centers for Rehabilitative Auditory Research (NCRAR) in Portland, Oregon. Inclusion criteria was set as individuals who are age 18 or older and are receiving ART or control matched group. In addition, participants were excluded from this study if they are cognitively unfit, have a history of middle ear dysfunction, or a history of Ménière's Disease.

Results: From our study, we found that individuals receiving drug treatment for HIV reported higher degrees of auditory dysfunction. From our study, both the HIV+ and HIV- groups were more likely to report mild-moderate or severe impairments, as measured by the hearing handicap inventory. In other words, self-perceived auditory dysfunction was found to be greater in our HIV+/HIV- groups beyond explained parameters found from objective testing. As found in our data: each 1 dB increase in PTA resulted in 10% greater odds of reporting worse hearing handicap (p=<.001). HIV status (p=.013) and ART exposure (p=.018) were found to be significant predictors of increased auditory dysfunction. Interestingly, when ART is held constant, HIV+ subjects had significantly reduced odds of reporting auditory dysfunction when compared to HIV- subjects (OR: 0.15, p=. 013). Most strikingly, HIV subjects receiving ART were 14.8% more likely (95% CI: 1.5–142.9, p=.018) to self-report moderate-to-severe levels of hearing handicap.

Conclusions: As anticipated, veterans receiving ART reported greater difficulty in auditory-related tasks, despite overall better performance on objective auditory measures, such as pure-tone average audiometric measures. These findings imply that ART exposure in HIV- individuals is significantly correlated with an increase in self-perceived hearing handicap outside of explained increases in audiometric thresholds. Additionally, HIV disproportionately affects marginalized communities, with unmet needs of care for Black/African American and Hispanic/Latinx individuals. Future research should continue to explore the effects of antiretroviral therapies, as well as increased efforts to prevent the transmission of HIV.

Category: Diagnostic Audiology / Otology

Poster #: 118

Exploration of Evaluation Practices for Patients with Unexplained Hearing Difficulties

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Objectives: Up to 10% of adults seeking audiological care will have unexplained hearing difficulty, or perceived hearing difficulty that cannot be confirmed by standard clinical tests. In a prior interview study, we found that patients with unexplained hearing difficulty reported dismissal by their healthcare providers and a misalignment between their primary concern of speech in noise and the assessments they were given during their evaluation appointment. Having heard from patients, we were interested in learning clinicians' perspectives on this evaluation appointment. In the present study we used a case vignette to explore audiologists' clinical decisions and interactions with patients with unexplained hearing difficulties when seeking hearing healthcare.

Design: Forty-nine audiologists participated in this online case vignette study employing a mixed-methods design. All audiologists responded to demographic questions and questions regarding clinical care and decision-making centered on a case vignette describing a patient with unexplained hearing difficulties. After reading the case vignette, audiologists answered questions pertaining to counseling, test battery selection, and suspicions as to the cause of the patient's concerns. We analyzed the data using a mixed-methods approach- summarizing quantitative data and thematically analyzing open-ended responses.

Results: Our sample included audiologists from 24 states, with lengths of practice ranging from 1 to 42 years (mean = 16). We present themes on the clinicians' responses to the following questions: how they would first interact with the patient prior to testing, how they would review test results with the patient, what they recommend as next steps, and what barriers, if any, they see to helping patients with unexplained hearing difficulty. We also present on what clinicians believe to be the underlying cause of unexplained hearing difficulty, and how confident they felt in their ability to treat the patient and how much benefit the patient received.

Conclusions: The results of this study shed light on the decision-making processes of clinicians working with patients with unexplained hearing difficulty, in turn giving valuable insight into current test batteries and treatments implemented for these patients. Clinicians also outlined barriers to care, which should be taken into consideration by researchers of unexplained hearing difficulties when suggesting implementation of tests or treatments.

Category: Diagnostic Audiology / Otology

Poster #: 119

The Role of Skin Pigmentation on Hearing and Vestibular Function

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Objectives: Past research has shown that race and ethnicity are tied to audiological outcomes with black individuals having better hearing than white individuals. There is limited research on how skin pigmentation, another possible biological indicator of race/ethnicity, may be able to predict hearing or vestibular outcomes. The objective of this study was to determine if skin pigmentation ratings can predict hearing and vestibular outcomes in adults. We also aimed to determine if three skin pigmentation palettes correlated to each other. We hypothesized that adults with darker skin pigmentation would have better hearing thresholds, better vestibular function, and lower fall risk than those with lighter skin pigmentation, and there would be differences in the strength of prediction across the three scales due to discordance and variation in the undertones of the scales.

Design: Data were analyzed for 102 adults aged 18-59 years (mean ~ 34.8). Participants in this study were recruited from a healthy control group participating in a larger ongoing study examining the effects of substance misuse on hearing and balance. Outcome measures included a questionnaire with skin pigmentation scales, tympanometry, standard and extended high frequency (EHF) pure-tone air-conduction thresholds, standard and EHF distortion-product otoacoustic emissions (DPOAEs), standing balance tests, and cervical and ocular vestibular evoked myogenic potentials (c- and o-VEMPs).

Results: Results showed a significant difference among skin pigmentation tests (PERLA, Monk, and Massey-Martin (MM; $F_{1.89, 380.69} = 282.38$, $p<0.001$). Participants rated themselves darker than the examiner did on the MONK, whereas the examiner rated the participant darker on the MM; however, these differences were not significantly different ($p=0.28$ for MONK and $p=0.20$ for MM). There was no significant difference in ratings between the examiner and participant for the PERLA, so that was the scale used in further analyses. The PERLA score was not a significant predictor of standard-frequency PTA, EHF PTA, or standard-frequency DPOAE SNR; however, PERLA scores were significant predictors of EHF DPOAE SNR in the positive direction ($p = 0.042$). EHFOAE SNR was therefore largest for darker skin tones, which supported the hypothesis of better cochlear function in darker participants. For vestibular data, there was no significant effect of average PERLA score on failing or passing a standing balance test ($p = 0.594$). For VEMP, there was no effect of the PERLA scores on cVEMP corrected ($p = 0.993$) or oVEMP ($p = 0.765$) peak-to-peak amplitudes.

Conclusions: Individual and examiner scores were incongruent across two of the three skin pigmentation scales. The PERLA had the greatest agreement between examiner and participant and was used to predict audiometric and vestibular outcomes. The PERLA had no significant association to hearing or vestibular outcomes other than EHF DPOAEs. Future work should explore skin pigmentation in people with active hearing or vestibular loss and equal representation across skin pigmentation levels.

Category: Diagnostic Audiology / Otology

Poster #: 120 **Mentored Student Research Poster Award**

The Quick Speech-in-Noise Test: Does Practice Matter?

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Objectives: The Quick Speech-in-Noise (QuickSIN) is a prevalent speech-in-noise (SIN) test for clinical and research settings assessing speech understanding in noise, providing diagnostic information beyond the standard audiogram. Typical administration involves two consecutive QuickSIN lists per ear condition (e.g. right ear), with the final score calculated as the average of both. Our online survey (52 audiologists) revealed that while 75% of participating audiologists use QuickSIN, only 29% of them utilize a practice list, even though the manual recommends practice use. This suggests that patients may experience procedural learning between the first and second list, potentially inflating the second-list score and introducing variability that reduces reliability of the final score. The purpose of the present study was to investigate the extent of the procedural learning effect and its impact on the test-retest reliability of the QuickSIN score.

Design: One hundred and five listeners (18-78 years old; 30 male) with clinically normal hearing (PTA ≤ 25 dB HL) completed the standard QuickSIN task, without practice. Testing was conducted over headphones in a soundproof booth, and the dB SNR loss was calculated by averaging two lists for three listening conditions (monaural left, monaural right, and binaural), totaling 6 lists per listener. The testing ear order was randomized for listeners. Each listener was assigned a SIN hearing loss category based on normative data (dB SNR loss): 0-3 dB =. normal/near normal, 3-7 dB = mild, 7-15 dB = moderate and >15 dB = severe.

Results: The average SNR loss improvement from the first to sixth list was evaluated using Wilcoxon rank-sum test. The test revealed the largest improvement in SNR loss from the first (mean 3.95 dB; SD 2.78 dB; 75th percentile 4.5 dB; 25th percentile 1.5 dB) to second list (mean 1.8 dB; SD 2.61 dB; 75th percentile 3.5 dB; 25th percentile 0.5 dB) and smaller or no effect afterward. Average improvement from the first to second was statistically significant (p= 3.917e-09), even though there was large individual variation. The number of listeners in normal category increased from 49 to 77 from the first to second list. Further analyses revealed (1) 71.4% of listeners (75 out of 105) improved in SNR loss from the first to second list [$P(X \geq 75 | n=105, p0=0.5) \approx 0.000009$], (2) 49% of listeners (37 out of 75) changed diagnosis category due to improvement in SNR loss, and (3) compared to the averaged SNR loss of two lists, 43% of listeners (32 out of 75) changed diagnostic category from their first list and 12% of listeners (9 out of 75) had change in diagnostic category from their second list.

Conclusions: Our study shows QuickSIN scores can improve from the first to second list enough to change diagnosis category, suggesting there is a procedural learning effect among some listeners. Even the average QuickSIN score of two lists (as done in the clinic) was not accurate for the diagnosis compared to either the first or second list. These results suggest that QuickSIN score might mislead diagnosis due to learning effect.

Category: Diagnostic Audiology / Otology

Poster #: 121

Assessing the Diagnostic Value of Pure Tone Averages

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Objectives: More than 38 million adults in the United States and 1.5 billion people worldwide have hearing loss and prevalence increases with age such that nearly two-thirds of adults over 70 have hearing loss. Hearing loss is associated with increased risk of social isolation, depression, and cognitive decline. Given the public health importance, there is a need for simple vital signs and figures to help the public become familiar with their own hearing and guide care-seeking behaviors. The World Health Organization suggests using the 4-frequency PTA (4-freq PTA) to identify categories of hearing difficulty, and data broadly suggest that as 4-freq PTA values increase, speech-recognition abilities in quiet and noise are reduced, and self-reported hearing difficulty increases. However, the magnitude and precision of these correlations remain unclear, and there is considerable heterogeneity in the association between 4-frequency PTA and these outcomes in individuals. Thus, rigorous data-based cutoffs to guide recommended action based on 4-frequency PTA have yet to be established. In addition, it is unknown whether other PTA calculations or cutoffs might be more accurate at predicting hearing difficulties. Here we address these issues by examining the accuracy of PTA to identify 1) individuals with deficits in speech recognition in quiet and noise, 2) self-reported hearing difficulties, and 3) hearing aid acquisition.

Design: This retrospective study included data from more than 120,000 patients seen at Stanford University. All participants completed pure-tone audiometry; more than 100,000 completed monaural word-recognition in quiet (WRQ), and more than 12,000 completed a monaural QuickSIN. Finally, more than 2400 of these patients also completed the 12-item version of the Speech, Spatial and Qualities of Hearing questionnaire (SSQ-12). We analyzed these data by completing receiver operating characteristics (ROC) to determine the accuracy of various types of PTA (4-freq PTA, traditional PTA, HFPTA, and 4-freq HFPTA) to identify deficits in speech recognition or self-reported auditory disability. We began with a 20 dB cutoff per the WHO designation that this value represents hearing loss. Finally, we examined HA adoption rates as a function of these PTA values. We explored differences in model results by demographic, socioeconomic, and health variables.

Results: While preliminary and ongoing, our results suggest that for all PTA measures, a 20 dB HL cutoff is only partially accurate at identifying auditory deficits in speech recognition or perceived auditory disability. Increasing amounts of hearing loss are associated with a greater likelihood of speech recognition deficit or hearing difficulty. Hearing aid acquisition rates were only partially predicted by PTA and varied with payment type (e.g., self-pay vs. insurance). Finally, the ceiling effect observed on WRQ with less hearing loss suggests that measures of speech in noise are a better choice to examine deficits in speech recognition.

Conclusions: PTA measures, while easy to calculate and use, may miss some patients with observed hearing difficulties. Preliminary analyses suggest that PTA calculations that incorporate high-frequency information appear to have greater utility for predicting deficits, and guiding appropriate intervention. Ongoing analysis, including alternative cutoffs, will be completed prior to the presentation.

Category: Diagnostic Audiology / Otology

Poster #: 122 **Mentored Student Research Poster Award**

A Sex-Differentiated Comorbidity Atlas of Age-Related Hearing Loss

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Objectives: Age-related hearing loss (ARHL) is the most prevalent form of permanent hearing loss affecting aging adults. The overall prevalence of ARHL is estimated to be approximately 17%, increasing sharply with age to around 58% in the ninth decade of life. The global economic burden of hearing loss exceeds $980 billion/year, with 32% of costs estimated to be driven by comorbidities. Uncovering the comorbidity landscape of ARHL is crucial for enhancing prevention and early detection, refining treatment strategies, improving patients' quality of life, and reducing economic and healthcare burdens. Given that comorbidities and underlying genetic factors of many diseases vary between sexes, it is essential to investigate the comorbidity landscape of ARHL in a sex-specific manner to uncover the most accurate and effective map possible.

Design: We investigated the comorbidities of ARHL across the health phenome using the UK Biobank sample, stratified into female and male cohorts (total N = 500,000; Female = 273,037; Male = 228,901). ICD-10 codes were obtained from electronic health records and systematically converted into over 2,000 non-redundant phecodes representing possible comorbid health conditions. For each cohort, we performed multiple logistic regression analysis with each phecode along with covariates of age, ethnicity, and genomic ethnicity as predictors and ARHL as an outcome variable to determine whether each phecode was significantly associated with ARHL. Phecodes were then grouped into trait categories. We performed enrichment analysis for each trait category for each cohort to determine whether an unexpectedly number of phecodes in that category were significantly associated with ARHL. Follow up genomic correlation and latent causal variant analyses were performed using summary statistics from previous genome-wide association studies (GWAS) to investigate genetic comorbidity and possible casual relationships between associated traits.

Results: 310 phecodes were significantly associated (FDR-adjusted $p < 0.05$) with ARHL for females, while 225 phecodes were significantly associated for males. Enrichment analysis revealed sex differences in enriched trait categories for males and females. In males, significant enrichment was found for sense organs, gastrointestinal, and respiratory phecodes, while in females, significant enrichment was found for respiratory, gastrointestinal, symptoms and signs, and mental health phecodes. Genomic analyses uncovered similar sex differences in genetic comorbidity and revealed causal relationships between traits.

Conclusions: These results show differences in the comorbidity landscapes of ARHL between females and males for both phenomic and genomic comorbidities. These findings indicate differences in both the broader life effects associated with ARHL and in the underlying biology of ARHL for males and females. Both males and females showed significantly enriched associations for respiratory and gastrointestinal traits, while only males showed significantly enriched association with sense organs traits and only females showed enriched associations with mental health and systems and signs traits. These findings emphasize the need for differentiation in risk assessment and early detection, treatment strategies, and understanding ARHL's effects on patients' quality of life.

Category: Diagnostic Audiology / Otology

Poster #: 123

DPOAE Amplitude Differences: A Race-based Difference or A Public Health Crisis?

King Chung, PhD, MGH Institute of Health Professions, Charlestown, MA

Objectives: Distortion product otoacoustic emissions (DPOAEs) is often used in onsite school screenings to examine inner ear health because the test is fast, it does not require responses from the child, it is resistant to background noise, and it can detect cochlear insult before hearing threshold changes. An examination of the DPOAEs results discovered that children living in different countries may have different DPOAE amplitudes. The objectives of this study were to 1) compare the DPOAEs amplitudes of children in Cambodia and those in the United States from ages 3 to 18, and 2) to determine further research is warranted to establish country-based DPOAE norms.

Design: A total of 493 children from Cambodia and 506 children from the US between 3 and 18 years were administered otoscopy, tympanometry, distortion product DPOAEs at 6 frequencies from 1.5-6 kHz. Present DPOAEs are defined as those with a signal-to-noise ratio of +6 dB. The DPOAEs of children with unremarkable otoscopy findings, Type A tympanogram, and present OAEs at 4 of 6 test frequencies were included in the analysis. Results from ears with excessive wax or less than 4 present DPOAEs were excluded. The DPOAEs of children with Tympanograms other than Type A were also excluded because middle ear conditions can change the recorded DPOAE amplitudes and some may not be compensated by the test equipment (e.g., Type B tympanograms).

Results: Results showed that Cambodian children generally had lower DPOAE amplitudes than US children at frequencies above 3000 Hz. Our previous results comparing the DPOAE amplitudes of children ages 10-13 years living in Brazil, Poland, and US also showed that children from Brazil had lower DPOAE amplitudes in high frequencies than children from Poland, who in turn, had lower amplitudes than children from the US.

Conclusions: Both Brazil and Cambodia are middle income countries and the US and Poland are high income countries according to World Bank. It is unknown whether the lower DPOAEs obtained from Brazilian and Cambodian children were related their access to access to health care or their exposure to other drug/environmental factors. Further studies are needed to examine the cause of such difference and to examine the need for race-based DPOAE norms.

Category: Diagnostic Audiology / Otology

Poster #: 124 **T35 Research Trainee Poster**

Feasibility and Reliability of Extended High-Frequency Bone Conduction Testing

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Emily Buss, PhD, UNC School of Medicine, Chapel Hill, NC

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Objectives: The air-bone gap is the primary differential diagnosis mechanism for type of hearing loss. Currently, bone conduction (BC) thresholds can only be obtained up to 4 kHz. Consequently, audiometric testing cannot reveal if hearing losses >4 kHz are sensorineural or conductive in origin. Furthermore, certain pathologies can result in a high-frequency or extended high-frequency (EHF) conductive hearing loss (CHL), such as partial ossicular discontinuity. The purpose of this study was to document feasibility and reliability of testing BC thresholds at EHFs using a novel bone transducer, the KLH96 Bone Transducer (Merz Medizintechnik GmbH). In this study, we investigated the effectiveness and reliability of masking at EHFs and estimated the dB HL of BC thresholds at EHFs based on a perceptual loudness matching paradigm.

Design: 29 participants, ages 15 to 27 years old, were selected based on suspected typical EHF hearing. Behavioral audiometric thresholds were obtained for air conduction (AC, 0.25-16 kHz) and masked BC (0.25-4 kHz) with standard clinical transducers. Otoscopy, tympanometry, and wideband tympanometry were performed to identify any middle-ear dysfunction that could be associated with CHL. Next, unmasked BC thresholds at octave frequencies from 2-16 kHz and the 11.2 kHz interoctave were obtained using the KLH96 transducer with a forehead placement. To obtain the effective masking level for each ear and frequency, pure tones were presented at 20 dB sensation level (SL) via the KLH96, and narrowband masking noise was presented via circumaural headphones and adjusted in level to determine the effective masking level. Lastly, as an alternative to acoustic calibration of dB HL 0 for BC, a perceptual loudness matching task was designed to estimate a dB HL value for BC in reference to the calibrated dB HL for the circumaural headphones. With their contralateral ear masked at the recorded effective level, participants matched the loudness of an air-conducted reference tone to a bone-conducted target tone, which was presented at 20 dB SL. Data were recorded in both ears, at octave frequencies from 2-16 kHz and the 11.2 kHz interoctave.

Results: Median AC thresholds across participants were audiometrically normal, with larger individual differences at than below 16 kHz. Better-ear AC thresholds were correlated with BC thresholds at EHFs. Additionally, between effective masking level trials, reliability was good and similar across both standard and EHF frequencies. More masking was needed as frequency increased, particularly at 16 kHz. Lastly, using the loudness matching perceptual data, thresholds in dB HL tended to be similar across ears and across modalities (AC and masked BC).

Conclusions: These data suggest that it is feasible within a laboratory setting to measure BC thresholds from 4-16 kHz with the KLH96 in young, normal hearing listeners. Additionally, EHF masking seems to work in similar ways to standard frequencies, and the reliability of masked BC thresholds appears to be good.

ELECTROPHYSIOLOGY

Category: Electrophysiology

Poster #: 125

Role of Cortical Auditory Evoked Potentials in Assessing Speech-in-Noise Abilities

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Objectives: The ability to process speech in noise is critical for children during language development. Background noise is especially challenging for young children as their immature brain requires a higher signal to noise ratio than adults. The vulnerability to noise is even more critical in infants with hearing loss as they struggle significantly more than their hearing counterparts in processing speech in noisy environments. Having an objective measure of the appropriate range of signal to noise ratios (SNRs) for which most words can be processed in infants and young children with hearing loss would likely lead to better outcomes as their listening environments could be modified whenever necessary. As a first step, this study was designed to examine if cortical auditory evoked potentials (CAEPs) can be used to accurately estimate speech in noise abilities in young adults.

Design: Speech in noise abilities were measured in a population of young, normally hearing adults, along with CAEPs in response to speech sounds delivered with varying SNRs. The Bamford-Kowal-Bench Speech in Noise (BKB-SIN) and Words in Noise (WIN) tests were administered in 20 adults aged 18-26 years. CAEPs were recorded following the presentation of /da/ in quiet and with SNRs ranging from +24 to -8 in 4-dB steps. The latencies and amplitudes of P1, N1, P2, and N2 were analyzed and correlated with the behavioral SNR responses, including the SNR-50%.

Results: All participants were screened and controlled for normal pure tone audiometry, tympanometry, acoustic reflexes, and distortion product otoacoustic emissions (DPOAEs). The study revealed that the latencies of each CAEP component significantly increased with decreasing SNRs, while their amplitudes significantly decreased. The magnitude of amplitude and latency changes under the increasing noise conditions were negatively correlated with the amplitude and latency values obtained in the quiet condition. CAEP components started to disappear when the SNR was close to 0 dB, and the number of absent responses grew exponentially with further decrease of the SNRs. Last, findings revealed that the most significant changes in CAEP latencies and amplitudes under the noise conditions started to occur at the same SNRs for which the behavioral speech in noise performances also started to decrease.

Conclusions: CAEP recordings in decreasing SNRs confirmed significant changes in the latencies and amplitudes of P1, N1, P2, and N2. Conditions with the highest levels of noise produced the longest latencies and lowest amplitudes but also the disappearance of some cortical components in many participants. The decrease in speech in noise performances occurred at the same SNRs for which most changes were seen at the CAEP level, suggesting that the CAEP changes induced by varying the levels of background noise may reflect behavioral speech in noise abilities, at least in normally hearing subjects.

Category: Electrophysiology

Poster #: 126

Evoked Potentials to Novel Minimal Pairs in Monolinguals and Bilinguals

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Subong Kim, PhD, Montclair State University, Bloomfield, NJ

Objectives: Bilingual individuals often find it more difficult to understand speech in acoustically degraded environments, especially when the auditory stimulus is in their less-dominant or second language, than monolinguals . Although such challenges can significantly affect audiology testing, treatment, and aural rehabilitation, research on differences in cortical speech processing between monolinguals and bilinguals remains scarce. Most existing studies have mainly used English minimal pairs as auditory stimuli in experimental setups. Instead, the present study used a bilingual Spanish/English minimal pair to reveal distinct cortical patterns of speech processing in noise among bilingual and monolingual speakers.

Design: The present study recruited 42 participants, including students at Montclair State University and members of the local community. The participants were separated into 3 groups, each comprising 14 members, based on language proficiency: English monolinguals, English/Spanish bilinguals, and English/Other-language bilinguals. All participants had normal-hearing thresholds, completed the LEAP-Q questionnaire to determine their level of proficiency in each of their languages, and were assessed for signal-to-noise ratio (SNR) loss scores using QuickSIN. Mismatch negativity (MMN) was recorded from 64 electrodes using the BioSemi ActiveTwo system in line with the international 10-20 layout in a single-walled, sound-treated booth while the participants viewed a muted movie with captions. Speech tokens of the English/Spanish minimal pairs "plan" and "ten" were presented bilaterally across eight conditions in a passive auditory oddball paradigm, with "plan" sharing meaning across both languages, unlike "ten."

Results: MMN and P3a were identified using difference waves calculated from ERPs elicited from the English/Spanish minimal pairs of "plan" and "ten." The amplitude and latency of MMN and P3a differed significantly depending on language order and whether the minimal pair was presented in quiet or noise. In addition, a third negative peak was observed when using "ten" as the speech token, and its amplitude was also affected by language order and the presence of noise. It should also be noted that bilingual participants showed a wider range of SNR loss on the QuickSIN than monolingual participants, despite all participants reporting proficiency in English.

Conclusions: Findings from auditory evoked potentials elicited by English/Spanish minimal pairs indicated significant effects of both SNR and the order of language presentation on speech processing. In particular, our findings that language order - whether the standard stimulus was in English and the deviant in Spanish, or vice versa - affects speech processing may explain why bilinguals find it more challenging to understand speech in noise.

Category: Electrophysiology

Poster #: 127

Categorization AERP Task and Informational Masking: Early vs. Late Responses

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Objectives: Behavioral research has demonstrated that speech noise disrupts performance more than non-speech noise, with two-talker speech being especially detrimental to the neural representation due to the cognitive demands of separating competing voices. While auditory event-related potential (AERP) studies confirm that speech babble impacts neural responses more than energetic noise, they have not shown significant differences based on levels of informational masking, such as varying the number of talkers. This may reflect the limited linguistic complexity of prior paradigms. The present study investigated whether a more cognitively challenging task requiring linguistically categorizing words would elicit a robust neural response, and to see if background speech babble of different numbers of talkers would differentially affect the responses. We hypothesized that the task would yield amplitude and latency differences in the neural response when in the presence of speech babble, with 2-talker babble, imposing the greatest informational masking, producing the largest effects on response morphology.

Design: 36 individuals (ages 18-40) with clinically normal audiometric thresholds and no history of auditory pathology participated in this study. Auditory event-related potentials were recorded in three background conditions: quiet, two-talker babble (2T, higher informational masking) and eight-talker babble (8T, lower informational masking). Participants linguistically categorized monosyllabic English words as either non-living or living entities (e.g. boy, dog, goose) and respond to every stimulus presentation on a response box. Stimuli were presented in an oddball paradigm, with non-living words occurring 80% of the time (frequent) and living words 20% of the time (infrequent). All stimuli were presented at +10 dB SNR in each background condition.Responses were recorded simultaneously from electrodes at Fz, Cz, and Pz. Standard auditory event-related potentials peaks were identified including early cortical responses (N1 and P2) and the later cognitive response (P300). N1 and P2 were measured at Cz in response to frequent stimuli, and P3 responses were measured at Cz and Pz in response to infrequent stimuli.

Results: The task produced robust neural responses in all listening conditions, including obligatory peaks (N1, P2) and later cognitive (P3) components. Speech babble visibly reduced amplitudes and prolonged latencies for these components. N1 and P2 responses were significantly larger and earlier in quiet than either noise condition ($p<.001$). N1 amplitudes were further reduced in two-talker babble compared to eight-talker babble ($p<.001$). P3 latency was significantly delayed in both noise conditions compared to quiet ($p<0.05$), but showed no difference between two-talker and eight-talker babble, indicating no effect of informational masking on this component. P3 amplitude and area remained similar across all conditions.

Conclusions: This study successfully elicited distinct neural responses using a linguistically complex categorization task, extending beyond the simpler discrimination required of previous paradigms. While our hypotheses that predicted informational masking effects on the P3 component were not supported, the early sensory components (N1, P2) revealed interesting and systematic informational masking effects within this linguistic categorization paradigm, suggesting that competing speech may have had more of an attentional or distracting effect in the current study.

Category: Electrophysiology

Poster #: 128

Neural Correlates of Listening Effort in Adults with Hearing Loss

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Objectives: Adults with sensorineural hearing loss (SNHL) often experience increased listening effort and fatigue, but the extent of these challenges varies across individuals, suggesting that factors beyond hearing thresholds contribute to effortful listening. This study examined the relationship between listening effort and electrophysiological indices of central auditory processing to elucidate mechanisms contributing to variability among adults with SNHL. Specifically, this study examined the relationship between behavioral measures of listening effort and auditory sensory gating in adults with hearing loss (HL) and with normal hearing (NH). This study hypothesized that the HL group would exhibit greater listening effort than NH peers. Additionally, HL would demonstrate altered auditory gating, reflecting reduced cortical inhibition. Finally, poorer gating efficiency would predict greater listening effort.

Design: A two-group, cross-sectional design compared twelve adults with bilateral SNHL to eleven adults with normal hearing (NH). Participants were recruited from the Dallas-Fort Worth area and met criteria of normal cognition, native English proficiency, and no neurological or developmental diagnoses. Participants completed behavioral measures of listening effort and electrophysiology measures of auditory sensory gating. First, listening effort was measured using a dual-task paradigm in quiet and noise, during which participants performed word recognition and semantic categorization concurrently. Reaction time differences indexed listening effort. Second, auditory sensory gating was assessed using electroencephalography with paired auditory stimuli to elicit cortical auditory evoked potentials (P1, N1, P2). Behavioral and electrophysiological data were analyzed with group comparisons and correlations.

Results: Noise yielded increased reaction times in both groups, indicating greater effort in the dual-task paradigm, though no group differences emerged. Electrophysiological results showed N1 and P2 gating in both groups, indicating preserved cortical inhibition in HL. Neither group demonstrated P1 gating; however, the HL group exhibited prolonged latencies and larger amplitudes in response to the first stimulus, suggesting increased cortical gain. P2 gating ratios predicted behavioral measures of listening effort only among HL, such that poorer gating (less suppression of stimulus 2) was associated with slower reaction times and greater dual-task costs.

Conclusions: Group differences in the P1 response may reflect impaired peripheral (bottom-up) processing accompanied by compensatory cortical mechanisms, such as increased cortical gain. The group-specific relationship between P2 gating and listening effort further suggests that adults with hearing loss rely more on cortical inhibitory control to manage auditory overload. Inefficient P2 gating, in turn, appears to exacerbate listening effort during challenging auditory tasks. Together, these findings highlight the interplay between bottom-up degradation and top-down inhibitory regulation in listening effort. These findings have significant clinical implications for hearing health care professionals managing patients who report disproportionate listening difficulties. Clinically, these findings emphasize the need to assess central auditory processes, particularly cortical inhibition, as potential biomarkers and intervention targets for improving neural efficiency in adults with hearing loss.

Category: Electrophysiology

Poster #: 129

Exploring Neural Correlates of Age-Related Hearing Difficulties with Resting EEG

Cynthia R. Hunter, PhD, University of Kansas, Lawrence, KS

Objectives: Hearing loss is among the largest modifiable risk factors for dementia and has been associated with age-related decline in working memory capacity. How hearing loss might impact brain function is not yet well understood. Indicators of age-related cognitive decline can be derived from resting-state electroencephalography (rEEG). However, it is not known whether these are associated with hearing loss. The goal of the current study was to explore the relation of hearing ability to known rEEG indicators of age-related cognitive decline.

Design: Correlations of pure-tone-average hearing loss, speech-in-noise ability, and self-reported hearing difficulty with oscillatory power in the alpha (8-13 Hz) and theta (4-7 Hz) bands as well as with individual alpha frequency were explored in a sample of middle-aged and older adults (N = 62; 44 women; mean age = 67.18, range: 43 - 85). Correlations of the hearing factors with working memory capacity were also explored. Analyses were disaggregated by sex to allow any potential sex differences to be observed.

Results: In the full sample, correlations of rEEG measures with hearing ability measures were small-to-moderate (range: -.10 to -.25), with the only significant relation being that greater pure-tone-average hearing loss was associated with lower oscillatory power in the alpha band. By comparison, correlations of working memory with the hearing ability measures were also small-to-moderate. Among women, moderate, significant associations of lower alpha power with greater PTA hearing loss and poorer speech-in-noise ability (range: -0.32 to -.33) were also comparable in magnitude to the correlations of these factors with working memory capacity.

Conclusions: Poorer hearing ability may be associated with reduced resting alpha power among cognitively healthy aging adults, particularly among women. As such, alpha power could be a biomarker of declining neurophysiological health associated with hearing loss. The small-to-moderate effect size of this relation was comparable in this sample to the known association of hearing loss with working memory capacity.

Category: Electrophysiology

Poster #: 130 **T35 Research Trainee Poster**

Attention and Stimulus Rate Effects on Cortical Auditory Evoked Potentials

Dilek Gas, BA, T35 Trainee-- AuD Student, Brooklyn, NY
Linda Hood, PhD, Professor, Vanderbilt University Medical Center, Nashville, TN

Objectives: The clinical application of cortical auditory evoked potentials (CAEPs) has benefits in diagnosis and assessing intervention outcomes. Clinical implementation demands time-efficient protocols that result in reliable, robust responses. This study examines stimulus rate and attention effects on the N1-P2 responses in young adults. The authors hypothesize that slower stimulus rates will result in larger amplitude responses while requiring fewer presentations. Furthermore, it is hypothesized that active listening will yield increased N1 amplitudes.

Design: Eleven females aged 22-29 years with normal hearing were selected for the study. A 2x3 design was implemented where 2 attention conditions (active, passive listening) and 3 stimulus presentation rates (0.271, 0.781, and 1.3/second) were presented in counterbalanced order. Participants were instructed to either count or ignore the number of stimuli while reading material of interest. A 94 ms /da/ syllable was presented at 75 dB SPL binaurally, with 160 responses obtained for each test condition across a time window of -100 to 500 ms. The presentation rate was jittered by 10% to reduce habituation effects. Preliminary data analysis included waveform correction using pre-stimulus baselines and averaged 160-sweep waveforms. Further statistical treatment used correlation analysis of the cumulative 20-sweep blocks to the 160-sweep averages. Absolute N1 and P2 peaks were manually identified and confirmed between the authors.

Results: The cumulative 160 sweep amplitude analysis indicated increasing response amplitudes with decreasing stimulus rate, and no observable differences between the active and passive listening tasks. Preliminary statistical analysis suggested a significant effect of stimulus presentation rate on absolute N1, P2, and peak-to-peak amplitudes. The peak latencies did not differ; however, for the active listening task, it was observed that the P2 response occurred earlier when using a 1.3/s presentation rate. Pearson Correlation Coefficients were used to compare the number of 20-sweep blocks, necessary to achieve a 0.95 correlation to the full 160-sweep average. For the active listening task, 80 sweeps were needed for the 0.271/s presentation rate, 100 sweeps for 0.781/s, and 120 sweeps for 1.3/s. For the passive listening task, 60 sweeps were needed for the 0.271/s presentation rate, 100 sweeps for 0.781/s, and 120 sweeps for 1.3/s. The results indicated that to achieve stable averages, an increased number of sweeps was required for faster presentation rates. When rates were compared, absolute amplitudes increased by an order of 2-to-3 times for the slowest rate (i.e., 0.271/s).

Conclusions: The current analysis supports the literature report of rate effects on CAEPs. While faster stimulus presentation rates may be desired in clinical implementation to maximize test efficiency, the data suggest that slower presentation rates may result in more robust responses while reliably maintaining comparable test time. Although notable differences were not observed between listening tasks in the preliminary data, analysis of smaller presentation blocks is planned in order to examine the possible effects of attention over time. Supported by NIH-NIDCD T35-DC008763

HEARING LOSS / REHABILITATION

Category: Hearing Loss / Rehab

Poster #: 131

Older Adult Awareness of Hearing Loss on Caregiving Experience

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Objectives: Hearing loss (HL) is prevalent among older adults, yet many do not recognize the impact of hearing loss on communication. This lack of awareness may hinder caregivers' ability to provide effective support as communication is often crucial for the caregiving process and experience. This study aims to investigate whether care recipients' awareness of HL is associated with caregiver burden and psychosocial wellbeing

Design: Using data from Round 13 (2023) of the linked National Health and Aging Trends Study (NHATS) and National Study on Caregiving (NSOC), a sample of 1,505 caregivers (Mean age 61.2 years SD:15 years; 66% Female) matched to 1,505 older adults (18.3% aged 75-79/ 22.3% aged 80-84, 68% Female; 54% White) was derived. HL awareness was defined via 3 levels 1) unrecognized HL (audiometric hearing loss, self-report no difficulty hearing), 2) recognized HL (audiometric hearing loss and self-report hearing difficulty/hearing aid use), and 3) no HL (audiometric results within normal limits). Caregiving outcomes include ADL/IADL-related care needs, and hours of care provided in the past month. We investigate caregiver experience via 1) perceived burden providing care (emotional, financial, physical), 2) perceived relationship attributes, 3) PHQ4 caregiver well-being, and 4) leisure or social activity restriction due to caregiving. We investigate differences by degree of hearing loss and by hearing aid use among those with hearing loss.

Results: Among the 1,505 caregivers, 722 (48%) assisted older adults with unrecognized HL, 511 (34%) assisted those with recognized and 291 (19%) assisted those with no HL. Relative to no HL, care recipients with hearing loss reported greater daily activity needs (ADL: 22% greater for unrecognized HL, $p<0.05$; 17% recognized HL, $p<0.05$) and suggests greater needs on IADL-related activities (IADL needs: 12.5% greater unrecognized HL, $p<0.09$; and 13.7% recognized HL, $p<0.07$). Results from models adjusted for multiple caregiver-care recipient characteristics suggest caregivers spent less time providing care for those with recognized HL and unrecognized HL 19% (95%CI:0.63-1.04) and 14% (95%CI:0.66-1.11) compared to those with no HL. The fewest hours of care were observed among individuals with mild, recognized hearing loss. The relationship between hearing loss and care hours was modest for mild hearing loss, but stronger for those with moderate hearing loss. For caregiver wellbeing, those caring for individuals with unrecognized hearing loss were significantly more likely to report depressive symptomatology, including little interest or pleasure in doing things (OR1.66; 95%:CI 1.10,2.51) or feeling down/depressed (OR1.70; 95%CI:1.12,2.58), compared to caregivers of those without hearing loss. No significant differences were observed in caregiving burden or relationship quality across recognition groups.

Conclusions: We expected hearing loss awareness to have meaningful impact on caregiver experience and wellbeing yet results overall suggest minimal influence. Recognizing communication is a fundamental and engrained component of the caregiving process, it begs the question of whether the limited measures we have available to study this question are too discrete to capture the dynamic nature of these interactions. Better quality data is needed, both in clinical and epidemiologic study to fully understand the role of hearing loss in the caregiving experience.

Category: Hearing Loss / Rehab

Poster #: 132 **Mentored Student Research Poster Award**

From Synapse Loss to Speech-in-Noise Deficits in Age-Related Hearing Loss

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Objectives: Age-related hearing difficulties, particularly in noisy environments, may include a role for cochlear synaptopathy-loss of ribbon synapses between inner hair cells and auditory nerve fibers-which can precede hair cell loss and threshold shifts. Despite extensive characterization of peripherally-based sequelae of such losses, far less is known about how these outcomes relate to perceptual deficits, singly and in combination. Here, we asked whether age-related cochlear synaptopathy is associated with measurable alterations in speech-in-noise detection without or with co-occurring outer hair cell dysfunction. We recorded involuntary behavioral reactions to sound, captured by facial videography, together with assessments of cochlear sensory and neural (dys)function and histopathology to begin to address this question.

Design: CBA/CaJ mice (M,F; N=50) entered the protocol at one of 5 age targets spanning youth (6 wks) to old age (110 wks). Facial micromovements were recorded via high-speed videography in head-stabilized, awake animals in response to frequency-adjusted, constant-level speech tokens presented in quiet and in graded background noise, providing an awake-behavioral index of suprathreshold auditory function. Immediately following this recording session, assessments of cochlear and auditory nerve function were performed under anesthesia, including distortion product otoacoustic emissions (DPOAEs) to evaluate outer hair cell function and auditory brainstem responses (ABRs) to assess function of auditory nerve and brainstem/midbrain pathways. Cochlear tissues were recovered for quantification of hair cells and afferent fiber synapses. Thus, we relate histological outcomes to the behavioral and electrophysiological measures obtained from the same animals.

Results: ABR and DPOAE thresholds and amplitudes were mature by 6 weeks and indistinguishable from those recorded for 16-week-old animals. In contrast, facial micromovement responses to speech were weak, particularly in noise, perhaps reflecting incomplete maturation of higher-level auditory pathways and/or immature multisensory/motor integration. By middle age (64 and 80 wks), slight-to-mild DPOAE and ABR wave I threshold elevations were observed, without outer hair cell (OHC) loss or significant reduction of DPOAE amplitudes. ABR wave I amplitudes were significantly reduced, but wave IV declines were proportionately smaller, suggesting compensation as signals travel centrally. Consistent with neural amplitude declines, significant afferent synapse loss (~20-30%) occurred across frequency. Facial micromovement responses remained generally robust, except at highest noise levels. By 110 weeks, DPOAE and ABR thresholds were elevated by 20-35 dB, suprathreshold amplitudes were significantly

diminished, OHC degeneration was widespread, and synapse losses were up to 60%, together reflecting significant and mixed sensory and neural involvement. Facial micromovement responses to speech were severely degraded, especially in noise, even when sensation level was increased to adjust for elevated thresholds.

Conclusions: These findings demonstrate that age-related cochlear synaptopathy is associated with measurable deficits in suprathreshold speech-in-noise detection, suggesting central mechanisms beyond peripheral dysfunction. Facial videography proved highly sensitive to age-related declines, complementing ABRs and DPOAEs, and underscoring that improved audibility alone can be insufficient to support normal function, particularly in noise. Using functional assays with translational value, this work provides insights toward clarifying peripheral and central contributions to age-related hearing decline.

Category: Hearing Loss / Rehab

Poster #: 133

Differences in Hearing Sensitivity and Health Beliefs Among English Learners

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Objectives: Hearing health disparities among English as a Second Language (ESL) students are not well understood, despite evidence that cultural, linguistic, and access-related factors can influence the prevention, detection, and management of hearing difficulties. Previous work at Eastern Illinois University found that middle and high school Spanish-speaking ESL students exhibited unexpectedly higher low-frequency thresholds (250-500 Hz) compared to their monolingual peers. Although this pattern contradicted the initial expectation of a high-frequency, noise-induced loss, it suggests unrecognized hearing differences that may contribute to communication and academic challenges. Building on these findings, this study aimed to (1) determine whether previously observed low-frequency threshold differences persist across a broader age range and locations, (2) examine cultural, linguistic, or environmental contributors to hearing-sensitivity variation, and (3) describe patterns of hearing-health awareness among ESL and monolingual students. It was hypothesized that ESL students would exhibit slightly elevated thresholds at low frequencies and that survey results would reveal distinct patterns in hearing health knowledge and attitudes reflecting differences in cultural perspectives and access to hearing-health information.

Design: A total of 142 children (69 Spanish-speaking ESL and 73 monolingual English-speaking students) participated from three Illinois school districts. Participants underwent tympanometry followed by pure-tone audiometric evaluation at standard frequencies (250-8000 Hz), conducted in a quiet classroom setting. Ambient sound pressure levels were measured beforehand to ensure testing validity. Children eight years and older also completed a 32-item survey assessing their knowledge, attitudes, and beliefs about noise exposure and hearing health, adapted from a validated survey.

Results: Across three school districts, ESL students showed slightly poorer hearing sensitivity than their monolingual peers. Differences were most evident at lower frequencies (250-500 Hz) and were consistent across all testing sites. On average, ESL students' thresholds were about 5–6 dB higher, while

overall hearing for both groups remained within normal clinical limits. Age was related to threshold, with older students showing slightly higher values; there were no differences by ear or school. Prevalence of elevated thresholds was less than 8% in both groups. Survey responses revealed limited awareness of hearing-health concepts in both groups, and neither knowledge nor attitudes explained the small threshold differences observed. Open-ended responses revealed that ESL students more frequently used emotional and experiential words (e.g., sad, pain, depression), whereas their monolingual peers tended to use descriptive or clinical terms about hearing function (e.g., hearing loss, deaf).

Conclusions: These findings replicate and extend previous results, revealing consistent low-frequency differences between ESL and monolingual English-speaking students. Whereas earlier work raised the possibility that noise exposure might contribute to hearing differences among ESL students, the consistent low-frequency pattern observed here and in prior data instead suggests that environmental or cultural factors may underlie these disparities. Furthermore, hearing-health knowledge and attitudes did not account for the threshold differences observed between groups, indicating that awareness alone is insufficient to explain variations in hearing sensitivity. These findings emphasize the need for school-based hearing conservation programs that are linguistically and culturally responsive to ensure equitable hearing-health awareness for diverse student populations.

Category: Hearing Loss / Rehab

Poster #: 134

Assessment of Frequency Tuning of SGNs in the Cochlear Apex

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Objectives: Human-like features of unmyelinated spiral ganglion neurons (SGNs) that aggregate into neural clusters have been observed in the Ly5.1 strain of mice. These clusters may share common excitatory inputs to enhance survival of de-afferented neurons that can no longer function alone, forming a "functional unit." The Ly5.1 strain is the only strain in which these clusters have been observed and may serve as a mechanism to study auditory processing in humans.

Design: This study investigates neural clusters in the apical spiral ganglion of ten adult wild type (WT) mice and ten adult Ly5.1 strain mice. Auditory brainstem response (ABR) measures are performed on each mouse for the purpose of measuring auditory thresholds. DPOAE measures and ABR masking tuning curves at 8 kHz from the left ear of each mouse are also obtained to assess hair cell function and frequency tuning of apical neuronal clusters at 8 kHz. Following these measures, the cochlea of each mouse is harvested for histopathological examination.

Results: It is anticipated that the frequency tuning in the cochlear apex of the mutant mice will be abnormally broad, compared to WT mice.

Conclusions: Due to the observed similarities of this neuronal clumping in mice and humans, findings of this study may indicate that affected humans and mice experience broadened tuning at low frequencies in the presence of neural clusters.

Category: Hearing Loss / Rehab

Poster #: 135

Auditory Communication Difficulties and Hearing Empowerment in Older Adults

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Objectives: Auditory communication difficulties (ACD), or the functional impacts of hearing loss, have historically been measured in clinical and research settings using the Hearing Handicap Inventory (HHI). Factors contributing to ACD include audiometric thresholds, speech in noise performance, personality, and hearing aid use, yet much of the variance observed in ACD remains unexplained. A recently developed and validated patient-reported outcome measure called the Empowerment Audiology Questionnaire (EmpAQ) assesses hearing-related empowerment. Higher levels of hearing-related empowerment are strongly associated with higher levels of general healthcare empowerment and lower levels of global disability. An association has also been found between higher hearing-related empowerment and lower reported activity limitation and social participation restriction, but the observed strength of this relationship is lower than expected. Because the EmpAQ is a relatively new measure, the relationship between hearing-related empowerment and other variables, including ACD and hearing aid use, has not yet been examined. This study poses three questions: 1) Does hearing-related empowerment correlate with ACD? 2) Does ACD differ in older adults with hearing loss depending on hearing aid use? 3) Does hearing-related empowerment differ in older adults with hearing loss depending on hearing aid use? By answering these questions, this work will determine whether hearing empowerment should be considered for inclusion in the test battery for hearing aid evaluation and validation.

Design: 21 older adults (age 65+) were recruited from Washington University Medicine's Adult Audiology clinics. Eligible participants received a comprehensive audiometric evaluation within the last year and were hearing aid users and non-users. Cochlear implant users were excluded from the study. Hearing loss severity ranged from normal hearing to severe hearing loss based on four frequency better ear pure tone average. Data collection is ongoing with a proposed sample size of 100 older adults.

Results: Preliminary results showed that hearing empowerment as measured by the EmpAQ and ACD as measured by the HHIE-S were not significantly correlated ($r=-0.018$, $p=.942$). No significant difference in ACD was observed between groups of hearing aid users and non-hearing aid users. However, a significant difference in hearing empowerment was observed between groups of hearing aid users and non-hearing aid users ($p=0.021$).

Conclusions: Our results suggest that the constructs of hearing empowerment and ACD are distinct from each other and that one may not necessarily predict the other. While hearing aid use did not predict significantly less ACD than non-use, hearing aid use did predict significantly more hearing empowerment

than non-use. Findings suggest hearing empowerment may be an important construct in validating device benefit and that the EmpAQ should be included in the test battery for hearing aid evaluation. Additional findings will be discussed.

Category: Hearing Loss / Rehab

Poster #: 136 **Mentored Student Research Poster Award**

Inferring Cochlear Microphonic and FFR Sources from Group Delay Estimates

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Objectives: Auditory signals can be characterized by their slow-varying envelope or fast-moving fine structure. Two evoked potentials that follow the fine structure of sound are the cochlear microphonic (CM) and the frequency following response (FFR). The generation sites of the human CM and FFR are likely within the auditory periphery and brainstem/cortex, respective; however, details about these generators remain poorly understood. Scientists theorize that the CM is generated from basal cochlear outer hair cells (OHC). The CM is widely interpreted as originating from OHC currents from the passive tail of the cochlear excitation pattern. Little is known about the place specificity of the human CM measured with an extracochlear electrode as stimulus frequency is changed. The FFR has historically been interpreted as originating from subcortical auditory neurons. There is a growing body of evidence that, in addition to subcortical generators, the FFR may include contributions from cortical and peripheral sources. Further, some studies suggest disentanglement of the CM within FFR responses can be challenging. Group delay is a measure that estimates the time delay of a system's response as a function of frequency. The latencies of the CM and FFR from group delay estimates can suggest potential generators based upon the established latencies of auditory structures. Further, any change in group delay indicates a change in the generator or in the contributions of two or more generators.

Design: The purpose of this study was to estimate the group delay of CM and FFR potentials recorded simultaneously in response to a 90 dB SPL frequency-swept tone (100 - 6000 Hz). Two-channel recordings were obtained from 25 young normal-hearing participants. We hypothesized that group delay for CM recordings would be short (0.5 - 2 ms) and increase with decreasing probe frequency, consistent with the idea that the population of OHCs contributing to the CM shifts along the tonotopic axis towards the cochlear apex. For the FFR, we hypothesized that group delays would exceed 5 ms, consistent with brainstem and cortical generators.

Results: Group delays for the CM progressively decreased from ~2.5 to 0.1 ms as frequency increased from 100 to 4000 Hz, suggesting that CM generation site depends upon probe frequency. CM response latencies were consistent with traveling wave delays. Due to poor signal-to-noise ratio, FFR group delays could only be estimated between ~250 to 1500 Hz. Within these frequencies, group delay values varied, spanning a range of ~0.4 - 7 ms among participants. Most participants had FFR latencies similar to CM latencies (<2ms) suggesting that peripheral generators dominated the FFR. A few participants had greater group delays (> 5ms) suggesting brainstem/midbrain generators.

Conclusions: CM group delay increases with decreasing probe frequency suggesting the CM exhibits a degree of place specificity. The variety of FFR group delays suggest that generation site may vary by participant and in many cases be dominated by peripheral sources.

Category: Hearing Loss / Rehab

Poster #: 137 **Mentored Student Research Poster Award**

Longitudinal Associations of Hearing, Music Engagement, and Cognition

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Objectives: Hearing loss (HL) affects nearly one in three U.S. adults over 70 and is a known risk factor for cognitive decline and dementia. Conversely, musical engagement-both active (e.g., playing instruments) and passive (e.g., listening)-has been associated with improved cognition and reduced dementia risk in older adults. Active engagement appears particularly protective, linked to enhanced executive function, memory, and attention through mechanisms like increased cognitive reserve and neuroplasticity. However, the relationship between HL, music engagement, and cognition remains poorly understood. Individuals with HL may have reduced engagement or overall appreciation of music, limiting potential cognitive benefits. Meanwhile, chronic noise exposure from music can itself contribute to HL, though professional musicians often demonstrate strong cognitive resilience despite being at higher risk. This study aims to elucidate the longitudinal associations of hearing, music engagement, and cognition using a latent growth curve model. Models estimated the extent to which baseline HL and hearing declines over time predicted changes in music engagement as well as cognitive function.

Design: Data were collected from a random sample of Canadian adults 45 years or older between 2011-2021 from three waves of the Canadian Longitudinal Study on Aging (CLSA) every 3 years (N=19,378; age mean=63.6 years, SD=10.3; 51.8% female). HL was assessed using pure tone averages (baseline mean=23 dB HL, SD=15.3). Music engagement was derived from passive and active engagement items. Cognitive function included both memory (Rey Auditory Verbal Learning Test [delayed recall]) and executive function (verbal fluency, mental alternation, and Stroop interference tasks). Latent growth curve modeling examined trajectories over time, adjusting for age, sex, ethnicity, education, income, and CLSA site.

Results: Worse baseline hearing was associated with reduced baseline music engagement (β=-0.031, SE= 0.009), but worsening HL was not associated with a change in music engagement over time. Similarly, worse baseline hearing was modestly associated with decreased baseline executive function (β=–0.134, SE=0.011) and memory (β=–0.183, SE=0.017). Additionally, worsening HL was associated with a faster decline in memory (β=–0.313, SE=0.084) over time, but not in executive function. Increased music engagement was associated with higher baseline (β=0.240, SE=0.065) and slower decline in executive function (β=0.145, SE=0.050) over time. In contrast, music engagement was not associated with memory at baseline or changes in memory over time.

Conclusions: Baseline HL was associated with reduced music engagement and worse cognition (executive function and memory). While worsening HL was linked to steeper memory declines, it was not linked to changes in music engagement over time, potentially because music engagement is dependent on factors beyond auditory ability, such as intrinsic motivation or behavioral resilience. In contrast, higher music engagement was associated with both improved executive function at baseline and a slower decline in executive function over time. These findings highlight music engagement as a potentially low-risk, accessible intervention to support cognitive health, even in the context of HL.

Category: Hearing Loss / Rehab

Poster #: 138

Personas and Journey Map of Music Enjoyment Across Hearing Loss

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Objectives: Music engagement supports quality of life by enhancing sociability, emotional well-being, and overall health. However, individuals with hearing loss (HL) often experience reduced music appreciation compared with their normal-hearing (NH) peers. Clinical management has traditionally emphasized improving audiometric thresholds and speech perception through hearing aids (HAs) and cochlear implants (CIs) yet has struggled to capture more functional outcomes such as music engagement.

Recently, persona development and journey,Äêmapping, adapted from user-experience methodologies, have been introduced to characterize the breadth of patient experiences. Although previously applied in HL, most work has centered on diagnosis, treatment, or rehabilitation rather than quality-of-life activities such as music. We aimed to characterize the diverse music engagement experiences of individuals with HL through persona development and journey-mapping.

Design: Forty-two individuals with and without sensorineural HL (SNHL) were recruited from academic otolaryngology and HL support groups to participate in 45-minute semi-structured Zoom interviews and surveys about their music engagement. Audio transcripts were coded abductively to identify key themes, with recruitment continuing until thematic saturation. Personas (archetypes representing individuals with similar experiences) and a journey map (visualization of canonical music engagement trajectory over time) were synthesized using grounded theory to reflect participants' lived experiences.

Results: Participants included 4 NH, 5 unaided HL, 19 aided HL (HA users), and 14 CI users; 6 of the non-CI HL participants had asymmetric SNHL (including single-sided deafness). Participants were grouped by enjoyment, yielding 7 enjoyer personas by hearing condition (NH, unaided/aided mild symmetric SNHL, aided moderate to severe symmetric SNHL, aided profound symmetric SNHL, post-lingually deafened CI user, congenitally deafened CI user, and aided asymmetric SNHL) and 1 non-enjoyer persona (severe-to-profound SNHL with HA and/or CI), as follows: Four NH individuals described broad engagement and exploration of new music. Nine individuals with mild SNHL described perceptual challenges that prompted optimizing listening environments, with mixed benefits from HAs, while 8 individuals with moderate to severe SNHL favored streaming nostalgic familiar music. Eight individuals with profound SNHL enjoyed music with HAs (N=2) due to residual low-frequency hearing or post-CI (N=6) through music-based aural rehabilitation. Still, some severe-to-profound SNHL individuals (N=6) reported limited engagement and enjoyment due to sound/pitch distortion. Three congenitally deafened CI users without prior NH experience retained enjoyment despite limited perception. Four individuals with asymmetric SNHL adapted by prioritizing listening with their better ear, though stereo perception remained difficult. The synthesized journey map illustrated worsening HL was associated with progressive narrowing of musical preferences, formats, and listening environments. Adaptations included prioritizing quiet listening environments, familiar music, and device features (e.g., streaming, music programs). Enjoyment persisted when perception permitted recognition and emotional connection with music; however, once distortion exceeded device compensation, engagement declined sharply, and music became unenjoyable.

Conclusions: Persona development and journey-mapping offer valuable frameworks for capturing heterogeneous experiences of music engagement among individuals with HL. Findings indicate a gradual constriction of engagement and enjoyment as HL worsens, partially offset by adaptive strategies. Future work includes quantitative validation of the personas and journey map to inform personalized rehabilitation and improve quality of life in this population.

Category: Hearing Loss / Rehab

Poster #: 139 **Mentored Student Research Poster Award**

Spatial Hearing Profiles in Normal, Acute Simulated, and Chronic Unilateral Hearing Loss

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Objectives: Spatial hearing relies on binaural integration of interaural time (ITD) and level (ILD) differences. Unilateral hearing loss (UHL) disrupts this integration, but adaptation may occur with chronic experience. The present study examined how spatial hearing profiles differ across normal-hearing (NH) listeners, individuals with acute simulated UHL (earplug), and participants with chronic UHL.

Design: Participants included three groups: NH controls, NH listeners with unilateral acute earplug-induced attenuation, and adults with chronic UHL. Tasks assessed ITD and ILD sensitivity, lateralization slopes, minimum audible angle (MAA), and localization accuracy. Psychometric functions were fit using the method of constant stimuli, providing threshold estimates for each cue condition. Slopes, bias, and overall goodness of fit were also examined to confirm reliable model performance.

Results: NH listeners showed steep psychometric slopes, low thresholds, and minimal bias, reflecting efficient use of binaural cues. Acute earplugging led to elevated thresholds, shallower slopes, and a consistent bias toward the unoccluded ear, indicating reduced access to binaural information. Participants with chronic UHL demonstrated greater variability but often preserved or partially recovered performance, especially for ILD and localization tasks. This pattern suggests long-term adaptation through monaural or ILD cues.

Conclusions: Acute disruption of binaural input immediately degrades spatial hearing, while long-term experience with asymmetric input promotes partial compensation. These findings suggest that spatial hearing plasticity supports functional adaptation in chronic UHL, though integration of temporal cues remains limited compared to normal hearing.

Category: Hearing Loss / Rehab

Poster #: 140

Social Connection as a Pathway between Hearing Intervention and Cognition

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On behalf of the ACHIEVE Collaborative Research Group, Johns Hopkins University, Baltimore, MD

Objectives: 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. This secondary analysis of the Aging and Cognition Health Evaluation in Elders (ACHIEVE) trial examined whether social connection functioned as a mechanistic pathway through which hearing intervention affected cognition among older adults.

Design: ACHIEVE (United States, 2018-2022) was a multicenter, parallel-group, unblinded 1:1 randomized controlled trial of 977 community-dwelling older adults 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). 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: 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: 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.

Category: Hearing Loss / Rehab

Poster #: 141

Associations Between Rural Residence and Auditory Outcomes in Veterans

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Objectives: A greater proportion of military Veterans live in rural areas than non-Veterans. In the general population, hearing loss is more prevalent among individuals living in rural areas than those in urban areas. This may be due to greater exposure to recreational noise compared to individuals living in urban areas. Whether these same patterns extend to Veterans remains unclear. The aim of the current study was to examine the association between rural residence and auditory outcomes, including hearing and tinnitus, among recently-separated Veterans.

Design: Participants were (n = 992) Veterans within 2.5 years of military service separation at time of enrollment in the Noise Outcomes in Servicemembers Epidemiology (NOISE) Study. Of these, 188 were identified as residing in rural areas and 804 resided in urban areas based on their rural-urban commuting area (RUCA) codes. Outcomes included hearing loss, grouped by frequency range (low .25-2kHz; high 3-8kHz; extended-high 9-16kHz) and defined as an average hearing threshold ≥ 20 dB HL; tinnitus presence (Tinnitus Screener), perceived hearing difficulties as defined by a score of > 16 on the Hearing Handicap Inventory for Adults (HHIA), and self-reported military and recreational noise exposure (Lifetime Exposure to Noise and Solvents Questionnaire [LENS-Q]). Associations between rural residence and outcome measures were estimated with multivariable logistic regression models. Odds ratios (OR) were estimated along with 95% confidence intervals (CI). Models were adjusted for potentially confounding demographic characteristics (age, sex, race/ethnicity, education).

Results: Compared to Veterans with an urban residence, Veterans with rural residence had greater odds of hearing loss in the low (OR=2.1, 95% CI=1.3, 3.3) and high (OR=2.3, 95% CI=1.5, 3.4) frequency ranges, though not in the extended-high frequency range (OR=1.3, 95% CI=0.9, 2.0). Furthermore, rural residence was associated with higher odds of tinnitus presence (OR=1.6, 95% CI=1.2, 2.3); however rural residence was not associated with higher odds of reporting hearing difficulties (OR=1.4, 95% CI=0.98, 1.9). Veterans with rural residence also had higher odds of moderate versus low recreational noise exposure (OR=1.8, 95% CI=1.2, 2.9) and high versus low recreational noise exposure (OR=2.7, 95% CI=1.8, 4.2). In contrast, there were no differences in military noise exposures between Veterans with urban and rural residence.

Conclusions: Veterans with rural residence were more likely to experience hearing loss and tinnitus than those with urban residence, even after controlling for demographic characteristics. Despite these associations, rural residence was not associated with greater perceived hearing difficulties. Elevated recreational noise exposure histories among Veterans with rural residence may contribute to these findings, underscoring the importance of targeted public health interventions to promote hearing protection and early identification in rural Veteran populations.

Category: Hearing Loss / Rehab

Poster #: 142

Hearing Loss Increases Hospitalizations among U.S. Adults with Heart Failure

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Objectives: Hearing loss is the most prevalent sensory disability in U.S. older adults and causes communication barriers in healthcare settings. Adults with hearing loss have greater risks of hospitalization, 30-day hospital readmissions, and longer lengths of stay when hospitalized. Heart failure is the leading cause of hospitalizations among U.S. older adults and successful disease management requires effective communication with healthcare providers. Upwards of 75% of adults aged 70 and older with heart failure also have hearing loss, yet limited research has investigated whether hearing loss is associated with hospitalizations among adults managing heart failure. The objectives of the current study were 1) to examine how hearing loss is associated with hospitalizations in adults with heart failure; 2) to assess the potential role of hearing aids in reducing hospitalizations; and 3) to determine whether the associations vary over the course of the illness and/or by major demographic groups.

Design: Nationally-representative prospective cohort data from the 1998-2020 Health and Retirement Study were used to examine adults who were diagnosed with heart failure (n=3,274). Hearing status was ascertained at each wave by patient-reported hearing and hearing-aid use (normal hearing, unaided hearing loss, aided hearing loss). Hospitalizations were assessed at each wave from participants' reported number of hospital admissions in the prior two years. Negative binomial mixed models examined numbers of hospitalizations over time by hearing status.

Results: Among study participants (mean age 71.46 years [±10.59]), approximately 63.84% reported normal hearing, 28.53% had unaided hearing loss, and 7.64% had aided hearing loss. Adults with unaided hearing loss had significantly more hospitalizations than adults with normal hearing (incidence-rate ratio [IRR]=1.14, 95% CI=1.07-1.22, P<.001). The association was partly attenuated after adjusting for the sociodemographic and health-related characteristics of adults with heart failure (IRR=1.07, 95% CI=1.00-1.14, P=.040). Adults with aided hearing loss had no significant difference in hospitalizations compared to adults with normal hearing. Among heart failure patients with hearing loss, those who were unaided had significantly more hospitalizations compared to those who wore hearing aids (IRR=1.26, 95% CI=1.06-1.49, P=.008). Associations were consistent over the course of the illness and did not vary across demographic groups.

Conclusions: Unaided hearing loss in heart failure patients increases hospitalizations while the use of hearing aids reduces hospitalization rates to levels similar to patients with normal hearing. Healthcare providers should consider routine hearing assessments in heart failure patients to identify those who may benefit from hearing aids to reduce their risk of potentially preventable hospitalizations.

Category: Hearing Loss / Rehab

Poster #: 143

Cognitive Abilities and Variability in Self-Reported Hearing Aid Outcomes

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Objectives: Hearing aid users frequently report difficulty communicating in complex listening environments, even when devices provide adequate audibility. Consequently, substantial variability persists in both speech recognition in noise and self-reported outcomes with hearing aids. Laboratory studies have shown that individual cognitive abilities are an additional significant source of variability in aided speech recognition in noise; however, the role of cognitive abilities in real-world aided listening experiences is not well-characterized. Understanding these relationships may provide insight into why listeners with similar audiometric thresholds report vastly different real-world benefits with their devices. Therefore, the objective of this study was to determine whether self-reported hearing aid outcomes are associated with individual cognitive abilities when hearing aids are fit according to current clinical best practices.

Design: We conducted a secondary analysis of self-reported hearing aid outcomes from a broader clinical trial designed to evaluate listener responses to signal processing in clinically fit hearing aids. Forty listeners with mild to severe hearing loss who received a standard-of-care hearing aid fitting from a university audiology clinic completed the trial. Hearing aids in this dataset were fit between 2016 and 2023 and represented five manufacturers across multiple technology levels. The experimental protocol included 1) a sentence recognition in noise task, 2) a cognitive battery assessing working memory (Abbreviated Reading Span Test), processing speed (Flanker), and executive function (Trails B), and 3) a validated self-report measure of hearing ability (12-item Speech, Spatial, and Qualities scale; SSQ-12). Respondents to the SSQ-12 choose ratings from 0 (maximum difficulty) to 10 (no difficulty), reflecting perceived speech understanding abilities, spatial hearing abilities, and sound quality with hearing aids in everyday listening situations. Additional objective measures included match-to-prescriptive targets and an acoustic envelope fidelity metric to characterize aided audibility and signal fidelity at user settings.

Results: SSQ-12 ranges [Speech (0.8-9.2), Spatial (0-10), and Qualities (2.5-9.5)] indicated high variability in outcomes. Linear mixed-model analyses per sub-scale indicated that SSQ-12 ratings were associated with individual cognitive abilities after accounting for age and degree of hearing loss. Higher cognitive ability was associated with higher SSQ-12 ratings; working memory ability significantly predicted the Speech subscale ratings, whereas executive function significantly predicted Spatial subscale ratings. There was no effect of individual cognitive abilities on the Quality subscale. Moreover, performance on the processing speed task was not a significant predictor of SSQ-12 ratings. Results will be interpreted in the context of listener factors including hearing aid experience, audibility (match to hearing aid prescription), and device-related factors such as acoustic coupling, technology levels, and signal fidelity.

Conclusions: Results suggest that individual differences in cognition may contribute to variability in real-world listening experiences with clinically-fit hearing aids (based on a self-report measure). Moreover, in this study, working memory was associated with self-reported speech understanding ability, while executive function was more relevant for spatial hearing ability, suggesting domain-specific cognitive

contributions to real-world hearing aid outcomes. Results add to findings from laboratory-based studies, highlighting that individual abilities beyond the audiogram account for hearing aid outcomes. [Work supported by NIH].

Category: Hearing Loss / Rehab

Poster #: 144

More Depression and Anxiety among Australian Adults with Hearing Loss

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Objectives: Hearing impairment is commonly associated with aging among adults, and age-related hearing loss is associated with various negative consequences related to physical and mental well-being. This cross-sectional study examines whether hearing loss is associated with poorer mental health among middle-aged and older adults in Australia

Design: This study used the Busselton Healthy Ageing Study, a multi-phase population study of baby boomers (i.e., age range 52 to 76 at the time of survey) collected from 2016 to 2022 (n=2131). We tested whether hearing impairment (self-reported assessment) is associated with clinically diagnosed depression (n=2119) and anxiety (n=2118). Multivariable logistic regression models were employed to examine the association between hearing impairment and depression and anxiety. We controlled for covariates, including age, sex, income, and education.

Results: Of 2131 adults, 507 (23.8%) self-reported hearing impairment. Of 2119 adults, 304 (14.3%) reported depression, while of 2118 adults, 69 (3.2%) reported anxiety. Those who have hearing impairment showed greater odds of depression (OR=1.68; 95% CI=1.24, 2.27; p<0.001), compared to those without hearing loss. Sex (p=0.004) and income (p<0.001) were also found to be associated with depression. Similarly, those who have hearing impairment showed greater odds of anxiety (OR=2.27; 95% CI=1.29, 3.99; p=0.005), compared to those without hearing loss. Income was also found to be significantly associated with anxiety (p=0.005).

Conclusions: In adults navigating nearing retirement life stages, self-reported hearing difficulty is associated with greater odds of depression and anxiety. Clinically, the findings support routine screening for mental health alongside hearing assessment, underscoring a holistic care that impacts mental health.

Category: Hearing Loss / Rehab

Poster #: 145

Extended High-Frequency Thresholds: Prevalence and Variability in Normal-Hearing Adults

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Objectives: Extended high frequencies (EHFs; >8 kHz) have been identified as early indicators of cochlear dysfunction, often before conventional hearing loss is observed. However, there is currently no consensus on how to define or interpret EHF "hearing loss" (i.e., elevated EHF thresholds), and few large-scale datasets of EHF thresholds exist for U.S. adults. We sought to characterize EHF thresholds in a large sample of U.S. adults with clinically normal hearing at conventional frequencies and to compare prevalence estimates across several definitions of EHF hearing loss.

Design: Over 600 participants were recruited from communities surrounding the University of Illinois Urbana-Champaign and Boys Town National Research Hospital. All participants self-reported normal hearing during recruitment and had air-conduction thresholds ≤20 dB HL at conventional frequencies (0.5-8 kHz). Puretone thresholds from 0.5-16 kHz were obtained using calibrated clinical audiometers. "No response" values were reported as 5 dB above audiometer output limits. Pure-tone averages were calculated for both conventional and EHF ranges. Several commonly used definitions of elevated EHF thresholds were evaluated as well as an empirically derived definition based on the current dataset. Analyses examined prevalence across definitions, as well as relationships with age and gender.

Results: Preliminary analyses indicated that the prevalence of elevated EHF thresholds varied substantially across definitions, ranging from 17-34%. Approximately one quarter of young adults (18-25 years) exhibited elevated thresholds (>20 dB HL) at one or more EHF frequencies, despite normal conventional thresholds. The prevalence increased with age (~54% in 26-35 years and ~88% in 36-60 years). Male adults tended to have poorer EHF thresholds than female adults.

Conclusions: Elevated EHF thresholds appear relatively common even among young adults with normal conventional audiograms. The choice of criterion for EHF "loss" substantially influences prevalence estimates, underscoring the need for standardized definitions and normative reference data. Ongoing data collection will refine these estimates and contribute to establishing reference standards for EHF sensitivity.

Category: Hearing Loss / Rehab

Poster #: 146

Hearing Loss Annual Progression: Findings from the NHATS

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Objectives: Hearing loss is highly prevalent among older adults and research suggests a population-level association with dementia and other negative health outcomes (i.e., increased risk of falls, hospitalization, social isolation). Despite the recent attention, few studies have provided epidemiologic models to characterize the annual progression of hearing thresholds among older adults. We aimed to assess the annual progression in hearing threshold by pure-tone audiometric testing in a cohort study nationally-representative of Medicare beneficiaries aged 65 and older in the US.

Design: We utilized data from National Health Aging Trends Study (NHATS) (rounds 2021-2023), a cohort study representative of community dwelling Medicare beneficiaries aged 65 and older. At each round, participants' hearing thresholds were obtained using portable audiometers, and a 4-frequency (0.5/1/2/4 kHz) pure-tone average (PTA) for the better hearing ear was calculated in dB HL. Covariates include age at baseline, sex, race, education, and household income. We used weighted adjusted generalized estimating equations to assess the association between risk factors and the progression of hearing thresholds. Our sample included 4,828 community-dwelling participants with at least two visits including hearing thresholds in the period of interest. Participants with missing covariates and with extreme changes in BPTA were excluded from our analyses (n=532), leaving a final analytic sample with complete data of 4,296 individuals.

Results: At baseline, mean age of the participants was 77.8 years, 55.9% were females, 65.7% White, 19.9% Black and 11.2% Hispanic, 62.1% had some college education or more, and 58.1% were in the highest level of household income. Longitudinally, weighted unadjusted annual change in BPTA, over age group, followed a non-linear trajectory, with a pick in the group 85-89 years old. On average, individuals were followed for 2 years, and BPTA increased on average 0.93 dB HL for each additional year of age (β=0.93, 95% CI 0.86;0.99). At baseline, female participants had statistically significant lower BPTA values compared to males (β=-4.82, 95% CI -5.7; -3.9). Compared to White participants, individuals identifying as Black (β=-4.60, 95% CI -5.6;-3.5) and Hispanic (β=-2.18, 95% CI -3.7;-0.7) had statistically significant lower BPTA. Regarding educational attainment, participants with some college education and those with a college degree or higher had statistically significant lower BPTA compared to those with less than a high school (β=-2.76, 95% CI -4.2;-1.3 and β=-4.48, 95% CI -6.0;-3.0, respectively). Finally, compared to those in the lowest level of household income, those with the highest had a statistically significant lower BPTA (β=-2.26, 95% CI -3.6;-0.9).

Conclusions: While seemingly basic, better understanding the annual progression of hearing loss thresholds may contribute to public health, clinical, and policy decision making including informing early detection screening programs, Medicare benefits, clinical visit schedules, and public health prevention strategies as well as high risk target populations (e.g., socioeconomically marginalized populations). Our non-linear findings suggest more importance should be placed on hearing across the lifespan as opposed to focusing solely on older adults. Further, these data lay the groundwork for analyses using repeated hearing measures to better understand associations between hearing loss and negative health outcomes (e.g., dementia, social isolation).

Category: Hearing Loss / Rehab

Poster #: 147

Links Between Hearing Loss, Social Engagement, and Cognitive Function in Adult Cochlear Implant Users

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Objectives: Hearing loss (HL) is one of the most prevalent chronic conditions in older adults and a leading modifiable risk factor for cognitive decline. Proposed mechanisms linking HL to cognitive decline include increased listening effort, reduced cognitive reserve, and decreased social engagement. For adults with moderate-to-profound HL, cochlear implants (CIs) rapidly restore auditory access and are associated with improved cognitive function. However, the mechanisms linking auditory function to cognitive outcomes and the role of social engagement remain unclear. This study examined how auditory function and social engagement relate to cognitive performance pre-CI and at 1-month post-CI activation. We hypothesized that both auditory function and social engagement would be positively associated with cognitive function. We further predicted that auditory function would demonstrate a stronger association, and that rapid restoration of audibility post-CI would reveal early changes in these relationships.

Design: Twenty-four post-lingually deaf adult CI users (aged 43–87 years; mean = 69) were tested pre-CI and at 1-month post-activation ("post-CI"). Auditory function was assessed using 4-frequency pure-tone averages (PTAs) for the better ear, spectral resolution (spectral-temporally modulated ripple test, SMRT), and best-aided speech recognition performance (AzBio sentences, CNC words) in the everyday listening configuration. Social engagement was assessed using self-report questionnaires of social support (Lubben Social Network Scale), social isolation (PROMIS - Social Isolation), and social self-efficacy (PROMIS - Self-efficacy for Managing Social Interactions). Finally, cognitive function was assessed using behavioral measures of short-term and working memory (reading span, forward/backward digit span), nonverbal reasoning (Raven's Progressive Matrices), and inhibitory control (Stroop). Correlations were computed between auditory and cognitive variables, and between social and cognitive variables at both time points.

Results: Pre-CI auditory performance - specifically, PTAs, AzBio sentences, and SMRT - was moderately to strongly and positively related to short-term and working memory (r's = .42–.72, p's ≤ .05). At the 1-month post-CI time point, AzBio sentences and SMRT remained significantly related to working memory, nonverbal reasoning, and inhibitory control (r's = .47–.61, p's ≤ .04), but PTAs were not related. CNC words showed no association with cognition at either time point. Pre-CI social engagement - specifically, social self-efficacy - was positively related to working memory, inhibitory control, and nonverbal reasoning (r's = .43–.51, p's ≤ .05). Post-CI, social engagement - social isolation and social self-efficacy - was more strongly related to working memory and nonverbal reasoning (r's = .56–.69, p's ≤ .05). Social support was only weakly related to cognitive measures.

Conclusions: Auditory function and social engagement were both related to cognitive function at pre-CI and 1-month post-CI, with auditory function showing a relatively stronger association, consistent with our hypotheses. However, the relative strength shifted from pre- to post-CI: auditory-cognition links weakened, while social-cognition links strengthened. This pattern may reflect reduced listening effort and cognitive load as audibility improves, consistent with proposed auditory-focused mechanisms. In contrast, stronger social-cognition links align with the proposed social engagement pathway. Optimizing auditory performance and supporting social engagement may both be critical for long-term cognitive health in adult CI users. Ongoing follow-up at 3 and 6 months and mediation analyses in a larger sample will clarify these evolving relationships.

HEARING TECHNOLOGY / AMPLIFICATION

Category: Hearing Technology / Amplification

Poster #: 148

Binaural Cue Captured by Behind-the-Ear Hearing Devices Under Reverberation

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Objectives: Behind-the-ear (BTE) hearing devices, including hearing aids and cochlear implants, share similar hardware and signal-processing features such as noise reduction and beamforming, primarily designed for speech enhancement. When fitted bilaterally, these devices are not optimized for spatial hearing. This study systematically quantifies how device hardware and signal processing, combined with reverberation, affect access to binaural cues in bilateral BTE device users.

Design: Simulated reverberant environments were reproduced over a loudspeaker array. A ~1-second sentence was played from virtual sources spaced ~5° apart across 0-90° azimuths under three acoustic conditions: anechoic, low, and high reverberation. Signals were recorded using BTE hearing aids with closed-dome fittings on a KEMAR manikin configured for mild hearing loss (30-35 dB HL). Three hearing aid programs were tested: (1) omnidirectional microphone, (2) directional microphone (beamforming/StereoZoom), and (3) omnidirectional with noise reduction. Reference recordings were made using KEMAR's in-the-ear (ITE) microphones. Recordings were postprocessed using a 32-channel gammatone filter bank between 80–8000 Hz before binaural cue extraction.

Results: For each azimuthal position, interaural level difference (ILD) were computed and averaged across 1500-8000 Hz and interaural time difference (ITD) across 80-1000 Hz. A linear mixed effects model assessed the influence of reverberation, microphone directivity, microphone position, and noise reduction was fitted to each binaural cue. Microphone position (BTE vs. ITE) had the strongest effect on both ILD and ITD, followed by reverberation. ILD was also altered significantly by microphone directionality. Noise reduction had no significant impact.

Conclusions: BTE microphone placement attenuates ILD and ITD, especially under reverberant conditions. ITE microphones are critical for preserving binaural cues at usable levels in complex acoustic environments.

Category: Hearing Technology / Amplification

Poster #: 149

Real-World Aided Loudness and Hearing Aid Outcomes

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Objectives: Achieving appropriate loudness perception is one component of successful hearing aid fitting . The purpose of the present study was to examine the relationship between aided loudness perception in the real world, as measured by the Cambridge Aided Loudness Profile (CALP) questionnaire, and self-reported hearing aid outcomes, as assessed by the Abbreviated Profile of Hearing Aid Benefit (APHAB) and the Device-Oriented Subjective Outcome (DOSO) scale. We hypothesized that hearing aid users whose aided loudness perception more closely resembled that of normal-hearing listeners would demonstrate better hearing aid outcomes.

Design: The participants were 35 experienced hearing aid users (11 females; age range = 44–88 years, M = 71.0, SD = 9.8). All participants had bilateral mild-to-severe sensorineural hearing loss and were fitted with Starkey Edge AI 24 Receiver-in-Canal devices programmed using the eSTAT 2.0 fitting formula. Following a minimum of one week of device use, participants completed three questionnaires. The CALP questionnaire assesses the perceived loudness and appropriateness of everyday sounds at soft, average, and loud levels. Participants also completed two outcome measures: (1) the APHAB, which includes subscales for Ease of Communication, Reverberation, Background Noise, and Aversiveness, with scores ranging from 1% to 99%; and (2) the DOSO, which comprises subscales for Speech Cues, Listening Effort, Pleasantness, Quietness, Convenience, and Use, with scores ranging from 1 to 5 for Use and from 1 to 7 for the other subscales. In addition, CALP data were also obtained from 16 adults with normal hearing (5 females; age< 35 years).

Results: Mean CALP loudness ratings for soft, average, and loud sounds from the individuals with normal hearing (NH) served as normative reference values in a three-dimensional loudness space (x=soft, y=average, and z=loud). Each of the 35 hearing-aid users was plotted within this space based on their CALP ratings, and Euclidean distances from the normative mean were computed. Smaller distances reflected loudness perceptions more closely aligned with those with normal hearing. Participants were ranked according to their Euclidean distances, and the top and bottom tertiles (n = 12 per group) were selected to form two comparison groups: NH-similar (closer to normal-hearing loudness perception) and NH-different (more divergent loudness perception). Relative to the NH-different group, the NH-similar group demonstrated significantly better scores on aided APHAB Global (mean difference=10.4%), aided APHAB Reverberation(mean difference=13.1%), DOSO Speech Cues (mean difference=0.9), and DOSO Listening Effort (mean difference=0.9), but lower scores on DOSO Use (mean difference=0.6).

Conclusions: Overall, loudness perception aligned with normal-hearing profiles was associated with better subjective outcomes, especially in speech-related domains. This finding suggests that real-world loudness perception plays a meaningful role in shaping hearing aid outcomes. Ensuring that loudness perception is appropriately adjusted during hearing aid fitting may enhance user satisfaction and communication success in everyday environments.

Category: Hearing Technology / Amplification

Poster #: 150

Social Determinants of Health in Relation to OTC Hearing Aids

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Objectives: Hearing aid outcomes are thought to be influenced by factors that have been termed social determinants of health. These social determinants of health include personal demographic factors such as race, age, gender and educational attainment as well as societal and environmental factors such as access to healthcare, social support and physical environment. The goal of the current study is to examine the relationship between social determinants of health and hearing aid outcomes in a pilot randomized-control trial of OTC hearing aids.

Design: 26 English-speaking adults between the age of 50 and 84 years participated in a 30-day trial of Bose SoundControl self-fitting OTC hearing aids. Participants who owned a smartphone device, had a mild to moderate hearing loss, and passed a cognitive screening were included. Following hearing testing and cognitive screening, participants completed the Hearing Belief Questionnaire (HBQ), the Abbreviated Profile of Hearing Aid Benefit (unaided), and Hearing Handicap Inventory for Adults/Elderly (HHIA/E). The participants were then randomly assigned to treatment or waitlist-control (delayed intervention) groups and were provided hearing aids. Following the 30-day trial, participants completed the aided questionnaires as well as the Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences (PRAPARE). The PRAPARE is a standardized patient risk assessment tool that has 21 questions about personal characteristics, family/home life, money/resources, and social/emotional health. Items include questions about race, ethnicity, farm worker status, veteran status, language, family size, housing stability, address, level of education, employment status, insurance, total combined income, food, material, and healthcare insecurity, transportation access, social support system, and stress. All hearing aid outcomes were assessed on an iPad provided to the patient whereas the PRAPARE was completed on paper. HBQ was scored separately across its six domains (perceived susceptibility, perceived severity, perceived self-efficacy, cues to action, perceived barriers, and perceived benefits. The total SDOH score was computed from items 1,2,3,4,7,8,10,11,12, and 14 of PRAPARE. Separate linear mixed models were analyzed using participant as the random effects variable and individual domains of the HBQ as outcome variables. The predictor variables included total score on the PRAPARE items, age, gender, group, and condition.

Results: Total SDOH score as computed in this preliminary analysis was significantly predictive of the Cues to Action subscale but not severity, self-efficacy, barriers, benefits, or susceptibility subscales of the

HBQ. Furthermore, HHI score was not predicted by the SDOH score. Additional details of the SDOH will be presented.

Conclusions: Preliminary findings indicate that SDOH are significantly related to at least one aspect of hearing health related beliefs, which can be useful in design and implementation of public campaigns to improve awareness related to hearing healthcare. Additional clinical implications for our findings will be discussed.

Category: Hearing Technology / Amplification

Poster #: 151

Barriers, Facilitators, and Motivators in Hearing Care: A Multi-Stakeholder Perspective

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Objectives: Hearing loss is highly prevalent among older adults experiencing cognitive impairment. Untreated hearing loss has been independently associated with increased risk of cognitive decline and neuropsychiatric symptoms like depression, anxiety, and agitation. Hearing care is a vital yet often overlooked factor in enhancing communication and psychosocial well-being among older adults with cognitive impairment and their care partners. This study aims to explore barriers, facilitators, and motivators related to hearing loss and hearing care among topic experts and end-users to inform how hearing care can be more responsive to users' needs.

Design: We conducted thirty semi-structured interviews among ten end-user participants, ten care partners, and ten topic experts in fields ranging from audiology and dementia care to program implementation and hearing technology. End-users were recruited from the Johns Hopkins Memory and Alzheimer's Treatment Center. We used a heterogeneous purposive sampling to recruit participants from diverse race/ethnicities, education, and income levels. Qualitative content analysis was utilized to interpret data and identify common themes that influence end-users' access to hearing care.

Results: Among end-users and care partners, 30% self-identified as African American, 45% as male, and 40% reported less than a college degree. Among end-users, the median better ear pure tone average (500, 1k, 2k, 4k Hz) was 35 dB HL (IQR 30.3, 40.6) and 40% are not currently using hearing aids. Among care partners, the median better ear pure tone average (500, 1k, 2k, 4k Hz) was 28.1 dB HL (IQR 26.6, 35) and 60% are not currently using hearing aids. End-users and care partners identified barriers to accessing hearing care, including the stigma associated with hearing loss, the cost of hearing aids, the lack of availability of hearing care, and the participants' denial of hearing difficulties. Suggested facilitators for improving access to hearing care include more affordable hearing aids and incorporating hearing

screenings into routine medical care. The participants' desire to improve communication and care partner support motivate accessing hearing care. Experts emphasize the importance of education on hearing and dementia, the role of care partners, minimizing burden, and reliance on practical, affordable technology.

Conclusions: Holistic dementia education and care should emphasize the importance of hearing health. Hearing health interventions must be responsive to end-users' perspectives when planning hearing care interventions for individuals with cognitive in order to strengthen access and improve outcomes.

Category: Hearing Technology / Amplification

Poster #: 152

Validation of Real-Ear-To-Coupler Prediction from Wideband Acoustic Immittance

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Objectives: Individualized prescription and fitting of hearing aids relies on measurement of wideband real-ear-to-coupler differences (wRECDs), which can be challenging for children with hearing loss. The objective of this research is to validate prediction of wRECD using tympanometry and wideband acoustic immittance (WAI) with machine learning. Our previous research has shown that 226 Hz tympanometry and WAI can accurately predict measured wRECD in infants and children. Previous modelling approaches used to predict the wRECD based on WAI are computationally intensive and not feasible for clinical implementation. This is a first attempt to apply machine learning as it has potential benefits for clinical prediction and implementation.

Design: 115 children ages 6 months-12 years with intact tympanic membranes received wRECD, tympanometry and WAI measures in each ear. Individual wRECD measurements were analyzed to evaluate the ability of age-based average RECDs to predict individual responses across frequencies from 250 Hz to 12.5 kHz. Four regression models were tested: Multiple Linear Regression, Ridge Regression, Random Forest, and Gradient Boosting. Models were trained using an 80/20 train–test split with multi-output regression to predict RECD at all frequencies simultaneously. Performance metrics included root mean square error (RMSE), mean absolute error (MAE), and the coefficient of determination (R^2).

Results: Ridge Regression demonstrated the best performance (RMSE = 4.41 dB, MAE ≈ 2.0 dB, R^2 = 0.11), followed by Linear Regression (R^2 = 0.10), Random Forest (R^2 = 0.09), and Gradient Boosting (R^2 = 0.02). Overall, the models indicated that while age-based averages capture broad trends, individual ear characteristics contribute significantly to acoustic variability.

Conclusions: Machine learning models provided reasonable approximation of individual wRECD values (given the RMSE of ~4 dB of measured wRECD based on WAI). Further refinement of modelling

approaches for implementation of a clinical tool to predict wRECD based on tympanometry or immittance measures will be discussed.

Category: Hearing Technology / Amplification

Poster #: 153

Effect of Environment on Speech Recognition with Advanced Noise Reduction

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Objectives: Hearing aid users struggle to understand speech in noisy environments, particularly with competing speech. Advanced noise management methods such as beamforming may limit benefits in such environments due to the distortion of spatial cues or attenuation of off-axis speech signals. New approaches to noise management, involving Deep Neural Networks (DNNs) may be more effective at improving the signal-to-noise ratio (SNR), regardless of speech and noise location. However, the efficacy of DNN-based noise reduction in the presence of competing speech remains unclear. To make clinical recommendations for the appropriate use of advanced noise management features, we need to determine the conditions under which these features will be effective. In this study, we investigated how DNN-based noise reduction and beamforming affect speech recognition in different spatial conditions and noise environments.

Design: Listeners with symmetric mild to moderately-severe sensorineural hearing loss repeated low-context sentences mixed with two types of background noise (two-talker masker or diffuse restaurant noise) at 0 dB SNR. Target sentences were presented from the front (0°) or right (+90°) in azimuth. Two-talker masker was spatially separated (+90° or 0°) or co-located with the target. Diffuse restaurant noise was presented symmetrically across an 8-speaker array around the listener. Listeners always faced the front speaker. A commercially available BTE-RIC was individually matched to prescriptive targets using real-ear measures. Four hearing aid programs were tested that varied by the combination of microphone and noise reduction settings: 1) omnidirectional + DNN-OFF, 2) beamformer + DNN-OFF, 3) omnidirectional + DNN-ON, 4) beamformer + DNN-ON. Unaided speech recognition across conditions served as a reference. A well-established metric of signal distortion using HASQI was applied to verify the acoustic effects of hearing aid conditions for a representative audiogram.

Results: Results from eleven listeners show that amplification improved speech recognition (re: unaided) particularly when the target and masker were spatially separated. Repeated measures ANOVA models for the two-talker masker (spatially separated) and diffuse noise showed a significant interaction between target location and microphone setting. As expected, the beamformer improved speech recognition over the omnidirectional setting for the target at 0° but decreased speech recognition for the target at +90°. In the two-talker masker condition, there was no effect of DNN settings on speech recognition; whereas, in the diffuse noise condition, DNN-ON resulted in significantly better speech recognition over DNN-OFF, regardless of target location. The improvement in speech recognition was greater when DNN-ON was combined with the beamformer. There was no effect of microphone or DNN setting in the co-located conditions. Signal distortion measures partly explained behavioral results.

Conclusions: Results from this study indicate that DNN-based noise reduction is effective in realistic listening conditions such as diffuse restaurant noise and can help mitigate distortion from the beamformer for off-axis targets. The beamformer was more effective than DNN-based noise reduction in a two-talker masker condition, for on-axis targets. However, unlike the beamformer, DNN-based noise reduction does not decrease speech recognition for off-axis targets. In summary, benefits from advanced noise management features may depend on the listening environment.

Category: Hearing Technology / Amplification

Poster #: 154

Hearing Aid Technology Levels and Feature Activation on Pediatric Outcomes

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Objectives: There have been several studies that have investigated the impact of hearing aid technology levels on functional outcomes for adults. While pediatric hearing aids also come in different technology levels, we know little about the potential impact of hearing aid technology level on pediatric outcome measures. Currently, clinicians are tasked with guiding families on hearing aid device selections, while they themselves do not have research to support technology-level choices.The aim of this study is to provide more insight into hearing aid technology levels for children with hearing loss, including what features are activated in pediatric hearing aid fittings, and the impact of technology levels and features on audibility and hearing aid fitting quality. This will be achieved by completing a retrospective review of the data from pediatric hearing aid fittings obtained in the longitudinal Outcomes of Children with Hearing Loss Consortium (OCHLCON) studies. We hypothesize that the technology level will not impact aided audibility, proximity to prescriptive target for pediatric hearing aid fittings, or language outcomes.

Design: This retrospective review included analysis of data previously collected for the OCHLCON studies. The study sample included a total of 29 hearing aid fittings from 29 participants. The participants in this study were between the ages of 3 - 6 years old at the time of data collection with mild to severe hearing loss fitted with bilateral behind-the-ear (BTE) hearing aids. Technology levels were based on the manufacturers' classifications of the model of each hearing aid. Audibility was measured as unaided and aided Speech Intelligibility Index (SII) values, and root-mean-squared-error (RMSE) deviations from prescriptive targets were used to assess fitting quality. Verbal working memory was assessed with the Nonword Repetition subtest of the Children's Test of Phonological Processing (CTOPP), and language was measured with the Clinical Evaluation of Language Fundamental Comprehending Sentences Score (CELF).

Results: There were 12 children fitted with entry level technology hearing aids, 13 children fitted with mid-level technology, and 4 children were fitted with high-level technology. There were no differences between technology level group and unaided hearing levels [(F(26,2)=0.51, p=0.68]. Aided audibility [F(20,2)=0.66, p=0.53] and RMSe [F(22,2)=0.75, p=0.48] did not differ across technology level. CTOPP

Nonword Repetition [F(13,2)=0.45, p=0.72] and CELF Comprehending Sentences Score [F(16,2)=1.23, p=0.33] also did not differ across hearing aid technology level.

Conclusions: Hearing aid technology level did not influence the level of aided audibility or proximity of the hearing aid fitting to prescriptive targets. There were no differences in verbal working memory or language abilities for children who use hearing aids based on technology level. These results suggest that adequate aided audibility and hearing aid fitting quality can be obtained with any level of hearing aid technology for children.

Category: Hearing Technology / Amplification

Poster #: 155

Altitude Effects on Hearing Aid Output: Developing Altitude-Specific Correction Factors

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Objectives: The purpose of this study was to examine the effects of altitude on hearing aid output across frequencies, motivated by the rising number of hearing aid users and their increasing exposure to high-altitude environments through travel.

Design: Computational simulations were conducted to evaluate changes in sound pressure level (SPL) across four altitudes [sea level (0 m), 2,743 m, 4,572 m, and 10,668 m] with the input sound level fixed at 60 dB SPL. The study included three phases: (1) SPL changes were calculated at each altitude while incorporating the outer ear transfer function and atmospheric absorption, assuming an open-closed tube of 2.5 cm in length and 7 mm in diameter; (2) SPL changes were recalculated while controlling for temperature to simulate stable indoor conditions; and (3) based on the SPLs obtained in phases (1) and (2), altitude-specific correction factors were derived. Phase (1) reflected realistic atmospheric temperature variations with altitude, whereas Phase (2) assumed stable controlled indoor temperatures.

Results: Both output SPL and resonant frequencies decreased with increasing altitude. When temperature was held constant, the decline in resonant frequency disappeared, although SPL still decreased. In Phase (1), correction factors ranged from approximately 0.2 to 9.6 dB from 250 to 8000 Hz, with the greatest adjustments observed between 2000 and 4000 Hz. In Phase (2), correction factors ranged from 1.2 to 5 dB and showed no frequency-specific trends.

Conclusions: These findings suggest that hearing aids should incorporate altitude-dependent correction factors, while accounting for temperature effects to ensure consistent output performance under varying environmental conditions.

Category: Hearing Technology / Amplification

Poster #: 156

Predictors of Objectively-measured Hearing Aid Hours of Use in ACHIEVE

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Objectives: Understanding factors that influence hearing aid usage is critical for optimizing hearing intervention outcomes and identifying patients who may benefit from additional support. The Aging & Cognitive Health Evaluation in Elders Study (ACHIEVE; clinicaltrials.gov NCT03243422) was a randomized control trial of hearing intervention vs. a health education control on 3-year cognitive trajectories (n=977) at four sites in the United States. The group randomized to hearing intervention received a comprehensive, patient-centered hearing intervention with prescription hearing aids (Phonak Audeo BR), additional assistive technology, counseling, and self-management support. Through the datalogging capabilities of the hearing aids, hours of use and environmental classifications were captured across the three years. This investigation aimed to identify key predictors of daily hours of hearing aid hours of use among hearing aid users in the ACHIEVE Study.

Design: We conducted an exploratory secondary analysis using data from 328 ACHIEVE participants (mean [SD] age: 75.92 [3.89], 52.1% female, 7.6% Black, 91.5% White) who received the Phonak Audeo BR devices and had daily hours of hearing aid use documented through Data Lake. Over a hundred potential predictors of daily hours of hearing aid hours of use were tested, including measures of objective and subjective hearing ability, physical health, mental health, cognitive function, social networks, and Data Lake derived hearing aid usage patterns. Missing data was addressed using multiple imputation by chained equations. A machine learning model identified predictors explaining the greatest variance in daily hearing aid use. Linear regression models estimated associations between selected predictors and daily hours of use.

Results: The final model explained 32.4% of the variance in daily hours of hearing aid hours of use and identified four significant predictors. Self-reported hours of hearing aid use immediately post-fitting was the strongest predictor of daily hearing aid use during the 3-year study (B=0.45, 95% CI: 0.31-0.59); suggesting that past behavior predicts future behavior. Pure tone average in the better hearing ear showed a positive association (B=0.18, 95% CI: 0.12-0.24), indicating individuals with worse hearing used devices for more hours per day. Experiencing a fall in the past 12 months was negatively associated with use (B=-1.80, 95% CI: -2.79, -0.82), potentially reflecting underlying physical function or general health status. Use of hearing aid phone connectivity features had a strong positive association (B=2.71, 95% CI: 1.77-3.64).

Conclusions: This analysis identified modifiable and non-modifiable factors associated with daily hearing aid hours of use following comprehensive intervention. Teaching patients to utilize device connectivity features, particularly phone integration, may represent a viable strategy to increase daily use, though

whether this relationship is causal or reflects underlying technology comfort remains unclear. The association between falls and reduced use highlights the importance of considering overall health status when delivering hearing care. The modest proportion of variance explained by the final model suggests numerous unmeasured factors may influence hearing aid use patterns. Future research into factors associated with daily hearing aid hours of use may help inform personalized intervention approaches and identify patients requiring additional support to maximize hearing aid benefit.

Category: Hearing Technology / Amplification

Poster #: 157

Hearing Aid Adoption Among US Older Adults Aged 70+

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Objectives: Hearing loss is highly prevalent and associated with negative health outcomes. However, hearing aid adoption remains relatively low. Characterizing hearing aid adoption trends is important for clinical and policy decisions to improve hearing care equity. Here, we use nationally representative data to characterize yearly change in hearing aid adoption among older Americans by key demographic, socioeconomic, and hearing variables. We hypothesize that socioeconomic status and demographic characteristics will drive hearing aid adoption trends, regardless of hearing loss severity.

Design: The National Health Aging and Trends Study (NHATS) is a nationally-representative, longitudinal, panel study of U.S. community-dwelling Medicare beneficiaries that began in 2011 and is regularly replenished to remain representative. Pure-tone audiometry was added in 2021. The relatively recent inclusion of audiometry limited the window of study so that no participant was more than 6 years removed from a hearing assessment. Participants aged 70 and older who were included in the 2015, 2021, 2022, and 2023 waves were identified. Mild hearing loss was defined as having a 4-frequency (0.5/1/2/4 kHz) PTA for the better ear between 25 and 40 dB HL, moderate to severe if scores were 40 dB or greater. Hearing loss severity in 2015 was imputed from later hearing assessments under the assumption that it remained consistent within a category (e.g., Mild/Moderate) over time. We modeled the proportion of individuals who self-report using hearing aids, stratified by key demographic characteristics (gender, race, income, hearing loss severity). Our sample resulted in 6,030 individuals in 2015, 3,084 in 2021, 4,794 in 2022 and 6,542 in 2023. Weighted population estimates were obtained from NHATS survey weights.

Results: Fluctuations in the proportion of adults aged 70 years or older using hearing aids were negligible on a yearly basis, but rose from 16.3% in 2015 to 19.5% in 2023. In the period 2021-2023, there was a +8.6% percentage increase in hearing aids use; Black Americans who owned and used hearing aids experienced the largest percentage change (+35%), followed by low-income individuals (+24%). Proportion of use was more rapid in participants with moderate or severe hearing loss, reaching 54.5% (95% CIs 50.9%-57.9%) in 2023, vs. 12.6% (95% CIs 10.3%-14.8%) in individuals with mild hearing loss in the same period. In the subsample of those with moderate to severe, Black Americans and low-income individuals experienced still the largest changes, with +19.3% and +46.2% respectively.

Conclusions: The largest relative increase in hearing aid use was observed among individuals with moderate to severe hearing loss, suggesting, at a certain point, degree of hearing loss may trump certain socioeconomic factors. Notably, Black and low-income Americans observed large relative increases in adoption. While caution is warranted given that relative percent differences can be large when the start point is low, the findings contrast with previous work. A combination of expanding Medicaid coverage and the introduction and publicity surrounding Over-the-Counter hearing aids may play a role in observation. Confirmation and more in-depth policy analyses are needed to better understand this stark contrast to previous findings.

Category: Hearing Technology / Amplification

Poster #: 158 **T35 Research Trainee Poster**

Pre-Decisional Distortion Bias Between OTC vs Prescription Hearing Aids

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Objectives: Millions of older adults in the United States live with hearing loss which significantly impacts their communication, social interaction, and quality of life. However, despite continuing efforts to improve accessibility, recent data continues to demonstrate low hearing aid adoption rates (~40-50%). One potential remaining barrier may be limited accessibility to information important for making informed decisions. This study explored the possibility that pre-decisional distortion biases affect consumer choices between OTC and prescription hearing aids. In stages, people were presented attribute information about OTC and prescription hearing aids. In line with work in psychology showing the potential for information distortion in consumer choices, we hypothesized that when early information, such as cost, strongly favored one hearing aid option over another, it would bias participants' evaluations of other subsequently presented attribute information and perhaps their ultimate choice.

Design: A total of 350 adults were recruited via an online survey platform (Prolific) and asked to imagine having mild-to-moderate hearing loss. Participants evaluated two unlabeled devices (Hearing Aid 1 vs. Hearing Aid 2), following presentation of six attributes describing the characteristics of OTC and prescription hearing aids. The wording of the six attributes was balanced so that the 3 attributes (strongly or weakly) favored OTC, and three favored prescription hearing aids. Attributes were presented sequentially, with two strongly favoring ("steer") attributes (cost, warranty) in positions 1 and 4 and weakly favoring, relatively balanced attributes (professional assistance, device setup, follow-up, buying process) in positions 2, 3, 5, and 6. The order of steer and weakly favoring attributes was counterbalanced across participants. After each attribute, participants rated which hearing aid option it favored on a 1-9 scale and their current overall preference. This study was preregistered.

Results: By design, the steer presented at Stage 1 produced a strong initial preference, but the key question was whether this early influence shaped evaluations of the information that followed in Stages 2-3. At these early attribute positions, we found a significant main effect of steer order: participants exposed to cost first favored the lower-cost device (consistent with OTC) more strongly, whereas those

exposed to warranty first favored the longer-warranty device (consistent with Prescription); but there was no sustained influence of the initial steer in the later stages. Steer order also did not significantly affect final device choice. A small effect of attribute order also emerged. Overall, results confirmed early-stage susceptibility to distortion from the Stage 1 steer, which dissipated after counter-steer information was presented in Stage 4.

Conclusions: Consistent with pre-decisional distortion bias, early exposure to strongly favoring information in the decision-making process biased subsequent evaluations of more balanced attributes. However, that distortion diminished when all attributes were presented, including the attribute strongly favoring the opposite choice. In other words, order effects did not persist through later stages or influence final device choice. This suggests that while early information can momentarily bias subsequent evaluations, overall balanced presentation mitigated sustained distortion. Clinically, these findings highlight that presenting hearing aid information in a balanced manner can limit bias and promote patient-centered decision-making.

PEDIATRIC AUDIOLOGY / OTOLOGY

Category: Pediatric Audiology / Otology

Poster #: 159

A Sponsored Hearing Loss Genetic Testing Program Reduces Testing Barriers

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Objectives: Over 60% of congenital sensorineural hearing loss (SNHL) cases are due to genetic causes, yet few eligible patients undergo genetic testing. A genetic diagnosis can provide insights into the likelihood of a syndromic condition, prognosis of disease progression, inheritance risks, and potential eligibility for gene therapy trials. However, barriers to testing include insurance reimbursement, patient costs, provider education gaps, availability of genetic services, and logistical challenges. We hypothesized that removing some of the key barriers to genetic testing for hearing loss will increase genetic testing utilization and facilitate earlier and more accurate diagnosis.

Design: A no-charge genetic testing and counseling program for SNHL was initiated in June 2024. Testing was performed by targeted panel sequencing of 274 hearing loss associated genes by a CLIA-certified laboratory. Individuals<40 years of age in the U.S. with at least one of the following are eligible: 1) bilateral or unilateral SNHL of mild, moderate, moderately severe, severe, or profound degree, 2) auditory neuropathy. Demographic and genetic findings are reported.

Results: From June 2024 to August 2025, 1,303 patients received genetic testing and 522 received genetic counseling. Over 40% of referrals came from otolaryngologists/audiologists. The overall genetic diagnostic rate was 33% while children<2 years of age had a 42% diagnostic rate. The diagnostic rate varied with hearing loss onset from 41% with congenital, 28% with prelingual, 24% postlingual, and 16% adult. The diagnostic rate was similar across all severities of hearing loss tested. Genetic diagnoses

varied across age of onset, ancestry/ethnicity, and severity of hearing loss. The most common non-syndromic diagnoses were associated with GJB2 and STRC. A syndrome was not suspected in 70% of patients with potentially syndromic diagnoses. Updated data will be presented.

Conclusions: Implementation of a sponsored genetic testing and counseling program for SNHL resulted in rapid uptake by otolaryngologists/audiologists and yielded a meaningful diagnostic rate. Accurate genetic diagnosis informs patient care through the identification of syndromic conditions prior to symptom onset, prognostication for hearing loss progression, and identification of potential gene therapy trial participants. Audiologist's role related to genetic testing may involve referral of patients for genetic testing, counseling of patients on potential benefits and limitations of genetic testing, guiding patients through decision-making on intervention choices and potential need for change depending on the genetic form of hearing loss.

Category: Pediatric Audiology / Otology

Poster #: 160

Impact of Pressure Equalization Tubes on Audiometric Thresholds in Children

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Objectives: This project is part of the Finding Appropriate Solutions to Treat Reduced Audibility in Kids (FASTRAK) study, which is a multi-site collaboration designed to develop validate clinical tools to support the identification and intervention of children with hearing loss. Using FASTRAK audiometry that accounts for ear canal acoustics and self-generated noise during threshold measurements, we are expanding our research to include children with pressure equalizing (PE) tubes. The main objective of the study was to compare traditional audiometric protocols to FASTRAK audiometry in children with PE tubes, which uses a microphone to measure ear-canal acoustics and self-generated noise. Obtaining accurate audiometric thresholds in children can be challenging, as rapidly changing ear canal characteristics (e.g., volume) and self-generated noise can introduce variability into measurements. PE tubes are a common intervention for otitis media, but the associated change in ear canal volume can affect audiometric thresholds, specifically based upon the transducer used. FASTRAK audiometry is a novel approach to audiological evaluation, which aims to provide a better understanding of how differences in ear-canal acoustics affect audiometric thresholds using ear-canal level calibration. We sought to determine the effects of PE tube intervention on audiometric thresholds. We hypothesized that thresholds below 1000 Hz will be elevated on the traditional audiogram compared to the FASTRAK audiogram, because larger ear-canal volumes result in increased impedance and a lower sound pressure level, primarily in that frequency region.

Design: We collected data from children between 2 and 12 years of age who had at least one patent PE tube, testing a total of 40 ears. The audiometric testing protocol included otoscopy, wideband tympanometry, real ear to coupler difference (RECD), an experimental audiogram, and a clinical

audiogram. Wideband tympanometry was used to confirm the presence of a functioning PE tube as well as to characterize wideband absorbance. The experimental audiogram was administered via computer-based software that monitored ear-canal noise levels and ear canal acoustics. Audiometric thresholds were measured at 0.25, 0.5, 1, 2, 4 kHz for each ear for both the clinical and experimental audiograms.

Results: Data collection is still underway but will be completed before the conference. Preliminary results from 7 children indicate that thresholds at 250 Hz and 500 Hz are routinely outside the normal range in ears with PE tubes. With FASTRAK audiometry, all thresholds in ears with PE tubes appear elevated likely due to higher impedance that occurs with increased ear canal volume.

Conclusions: The data demonstrates the effects of PE tubes on audiometric thresholds and ear-canal acoustics, specifically below 1.5 kHz. The goal of FASTRAK audiometry is to provide an alternative clinical tool to yield more specificity related to differences in ear-canal volume when testing populations that deviate from average values.

Category: Pediatric Audiology / Otology

Poster #: 161

Early Interventionists' Educational Pathways to Serving Deaf/Hard-of-Hearing Children

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Objectives: Early intervention (EI) providers play a vital role in supporting young children who are deaf/hard-of-hearing (DHH). However, limited specialized training is associated with a lack of confidence in providing care for DHH children which can result in subpar care leading to children missing out on the critical advantage in development EI offers. We aimed to explore early interventionists' professional development pathways and preparation for working with young children who are DHH via structured interviews. Our research questions were: (R1) Among early intervention providers who serve DHH children, what areas of education and training do they identify as insufficient or missing as well as skills they wish they had developed earlier in their careers? (R2) What educational experiences and training opportunities do EI providers report as having the greatest impact on their confidence and specialization for serving DHH children? (R3) What recurring themes emerge from EI providers' interviews that can inform future directions in EI professional education and preparation for working with children who are DHH?

Design: We purposively sampled EI providers practicing in the US via email. Twenty-five individuals participated in this cross-sectional, structured interview study. All participants practiced EI for a minimum of two years and had at least one child who is DHH age 0-3 years on their caseload in the last 60 days. On average, the participants had 12 years of experience working in EI and over 10 DHH children on their caseload. For this study, participating EI providers first completed an online demographic survey followed by a structured interview via Zoom.

Results: We are currently in the process of conducting reflexive thematic data analysis to identify recurring themes regarding the areas of education and training EI providers report they are lacking, the

experiences that impact provider confidence and specialization, and recommendations for future EI preparation. These results will highlight individual and systemic factors that influence EI provider preparation to serve DHH children and guide suggestions for strengthening the recommended professional development pathway for EI. We predict that the EI providers' direct experiences will yield insight into what experiences, classes, or trainings were most meaningful in their preparation to work with children who are DHH.

Conclusions: This study underscores the importance of subjective experiences of EI professionals who work with young children who are DHH. The qualitative analysis of these experiences can yield a better understanding of the practioners' current education statuses and potential needs for additional training. We also hope our findings reveal gaps that exist in the EI providers' educations, along with barriers they face when seeking to obtain more guidance on how to serve children who are DHH. These experiences and barriers can ideally be used as a tangible starting point for change to the recommended EI educational pathway and required training. Such improvement to the educational foundations of EI will eventually lead to prepared providers with increased understanding and ability to provide care for infants and toddlers who are DHH, ultimately resulting in higher quality of care for DHH children.

Category: Pediatric Audiology / Otology

Poster #: 162 **Mentored Student Research Poster Award**

Semantic Memory Structure in Children with Hearing Loss

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Objectives: This study has two objectives. First, we seek to elucidate the neurocognitive mechanisms that subserve semantic memory structure in children with typical hearing (CTH) and children who are hard of hearing (CHH), considering both fine-grained and broad structure. Additionally, we aim to compare both groups to identify the similarities and differences in their semantic memory organization. For CTH, we hypothesize that their semantic memory will be systematically organized and modulated by semantic feature similarity. In contrast, our central hypothesis for CHH is that reduced auditory access shapes the structure and content of semantic memory differently from CTH. Specifically, their semantic structure may be coarsely organized or otherwise less systematically organized.

Design: We used a picture-word match/mismatch paradigm, in which participants heard a word while viewing an image. The degree of featural similarity between the spoken word and preceding picture (e.g., dog) varied across four conditions: match (e.g., dog), a featurally similar word within the same category (e.g., cat; near violation), a less featurally similar word within the same category (e.g., turtle; far violation), and an unrelated word from a different category (between-category violation). Each trial began with a gray screen for either 500ms or 1500ms, followed by a fixation cross (500ms). A picture was then shown for 1500ms and remained onscreen while an auditory word was presented. To examine the semantic structure of match, near, far, and between violation conditions, we measured the amplitude of the N400 and theta-band activity in response to an auditory word presented after a pictorial context. We tested school-aged children (18 CHH, 21 CTH) between the ages of 6 to 14 years (mean age = 10.1).

We matched CHH and CTH on age and gender. All participants were monolingual English speakers with no additional disabilities according to parent report. To qualify for participation, CHH had to have four-frequency (500, 1000, 2000, 4000 Hz) better-ear pure-tone average thresholds (BEPTA) in the mild to severe range (20-75 dB HL). A certified pediatric audiologist measured air-conduction thresholds at each visit. Participants' mean BEPTA was 46.31 dB HL (SD = 12.37, range = 20-71.25).

Results: CTH demonstrated a graded neural sensitivity to semantic similarity, in that their N400 amplitudes and theta-band activity showed significant (or marginally significant) differences between the match and far violation conditions, the near violation and between-category violation conditions, and the match and between-category violation conditions. In contrast, there were no significant differences across conditions in either N400 amplitudes or time-frequency analyses for the CHH.

Conclusions: Findings from the current study suggest that CTH form category-based semantic organization and they are starting to develop a fine-grained semantic network in childhood. In contrast, CHH exhibited a less systematically organized pattern in their semantic memory structure, indicating that semantic memory may develop differently in this group. These findings highlight the role that auditory experience plays in shaping the development of semantic memory structure. The findings also underscore the clinical importance of targeted auditory and language interventions, particularly interventions that facilitate the development of systematic semantic memory structures.

Category: Pediatric Audiology / Otology

Poster #: 163 **Mentored Student Research Poster Award**

Relative Importance of Vowels and Consonants for Children's Sentence Recognition

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Objectives: Previous literature in adults supports the idea that consonants are more important for lexical access and word learning, while vowels support recognition of syntax and prosody. Additionally, studies suggest a vowel advantage for sentence recognition in adults, likely reflecting mature use of suprasegmental cues best conveyed by vowel acoustics. It is unknown if this advantage also applies to children who are still in the process of acquiring linguistic skills. Our study aims to see if there is a difference in how consonants and vowels are used for sentence recognition in school-age children. We expect that younger children will rely more equally on vowels and consonants for sentence recognition, while older children and adults will be more reliant on vowels than consonants.

Design: Participants to date include thirteen adults (18-35 years) and six children (4-13 years), all native English speakers with normal hearing in both ears. Stimuli include three lists of pediatric AzBio sentences (20 sentences/list). For all sentences, forced alignment was used to estimate boundaries between vowel and consonant segments. Using these boundaries, segments corresponding to phoneme categories were replaced with silence to create two conditions: vowel only and consonant only. A third condition includes unaltered (full) sentences. Target stimuli are presented at 70 dB SPL in addition to a speech-shaped noise masker. Using an ascending signal-to-noise ratio (SNR) method, SNR is increased in

5 dB steps until either the sentence is repeated correctly or the maximum SNR is reached. Correctly repeated words are scored at each SNR. For each condition, a psychometric function is fit to the results in order to estimate the SNR corresponding to 50% correct performance, function slope, and upper asymptote.

Results: To date, the full sentence condition has yielded the lowest (most difficult) SNR(50) threshold estimates, followed by the vowel only, then the consonant only conditions. Steep psychometric function slopes have been observed for all listeners in the full sentence condition. Overall, function slope is shallower for the consonant only condition compared to the vowel only condition, with greater differences in slope between phoneme categories for older children and adults.

Conclusions: Trends in the current dataset indicate potential developmental changes in how young school-age children use vowel and consonant cues for sentence recognition. Specifically, these results suggest the vowel advantage for sentence recognition seen in adult listeners may develop during school age. Future work will examine the potential role of phonological awareness and vocabulary development on children's use of vowel and consonant phonemes for sentence recognition.

Category: Pediatric Audiology / Otology

Poster #: 164 **Mentored Student Research Poster Award**

Early Impact of Extended High-Frequency Loss on Pediatric Spatial Hearing

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Objectives: Extended high-frequency (EHF; >8 kHz) hearing contributes to real-world speech-in-noise perception, yet it is excluded from standard clinical pediatric protocols. Many children who pass conventional audiograms still report everyday listening difficulties in complex acoustic environments. This study examined how age and EHF hearing status relate to subjective listening performance and spatial speech-in-noise processing in children and youth.

Design: A total of 78 participants aged 8-17 years (mean = 12.1 ± 2.8 years) with clinically normal standard audiograms completed EHF audiometry, the Speech, Spatial and Qualities of Hearing Scale (SSQ-12), and a sound-field Digits-in-Noise (sfDIN) test under co-located (0°) and spatially separated (±90°) conditions, using female target speech presented against a four-talker babble masker (two male, two female talkers). Participants were classified as NEHF (normal EHF hearing; 67.9%) or EHFHL (>20 dB HL at any frequency 10–16 kHz; 26.9%).

Results: Children with EHFHL showed significantly elevated standard-frequency thresholds and poorer SSQ scores, particularly on the Speech-in-Speech (SiS) subscale. Pure-tone average in the EHF range (PTA-EHF) significantly predicted SSQ scores, while age showed a weak positive effect, suggesting partial developmental influence. For sfDIN performance, age strongly predicted speech reception thresholds (SRTs) in both co-located and spatially separated conditions; older age was associated with better SRTs, with no significant group differences. As expected, co-located speech and noise resulted in poorer SRTs than spatial separation, reflecting reduced voice-segregation ability due to greater perceptual similarity between target and masker. PTA-EHF showed a weak, significant association only with SRTs measured with spatial separation, suggesting that high-frequency spectral information supports effective use of spatial cues for masking release.

Conclusions: Overall, EHFHL was associated with increased self-reported real-world listening difficulty but did not strongly affect spatial speech-in-noise performance, which was primarily driven by age-related maturation. It is possible that the sfDIN paradigm did not introduce sufficient informational masking to unmask subtle spatial processing differences, potentially contributing to the dissociation between subjective report and behavioral outcomes. The lack of sfDIN group effects may also reflect the relatively mild and limited range of EHF loss in this cohort, which may have reduced the ability to detect measurable spatial performance differences.

Category: Pediatric Audiology / Otology

Poster #: 165

Tracking Auditory Learning in ARIA Training Using Logistic Knowledge Tracing

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Objectives: In this project, we applied Logistic Knowledge Tracing (LKT) to model participants' performance during Auditory Rehabilitation for Interaural Asymmetry (ARIA). The goal was to predict individual performance trajectories and capture characteristics of auditory perceptual learning in children with dichotic listening deficits. We hypothesized that children with different dichotic deficit profiles, Amblyaudia (AMB) and Dichotic Dysaudia (DD), would exhibit distinct learning patterns during ARIA, reflecting differences in neural plasticity and rehabilitation rate, and that LKT would help reveal these patterns dynamically across training sessions.

Design: Twenty children (ages 7-14 years, M = 10.35, SD = 2.62) diagnosed with dichotic listening deficits participated in this study. Participants were identified based on standardized behavioral dichotic listening assessments administered at the Auditory Processing Laboratory at the University of Memphis. Each child completed the Randomized Dichotic Digits Test (RDDT), the Dichotic Words Test (DWT), and, when necessary, the Competing Words subtest (CW) from the SCAN battery. Classification was determined by comparing ear-specific scores and interaural asymmetry to age-appropriate low cut-off values. Children showing consistent deficit patterns across both tests were classified as AMB or DD; in cases of inconclusive results, the CW subtest served as a tiebreaker. Ten participants met criteria for each group.All children completed four weekly ARIA sessions, each consisting of two 20-minute blocks of

dichotic listening training with adaptive interaural intensity adjustments designed to promote use of the non-dominant ear. Across the training protocol, each participant completed approximately 690 dichotic trials involving single-syllable words, digits, and spondaic stimuli. The LKT model estimated the probability of a correct response as a function of baseline ability, cumulative practice, and the recency-weighted influence of prior outcomes. Model parameters were optimized through stepwise selection using the Akaike Information Criterion (AIC), and generalizability was evaluated with leave-one-out cross-validation.

Results: Separate LKT models were developed to examine auditory learning across multiple analytical levels. Group-level omnibus models characterized the overall learning trajectory during ARIA, while subgroup models compared AMB and DD learning patterns to assess rate and stability of improvement. Trial-level and ear-specific models tracked performance for each ear separately, revealing how dominant and non-dominant ears contributed to overall progress. Individualized models were also constructed to monitor ear-specific change and interaural asymmetry across trials within each session, enabling visualization of adaptive learning. Together, these hierarchical models captured auditory learning at both the group and individual levels, providing a dynamic framework for characterizing ear-specific performance and interaural balance.

Conclusions: By quantifying the trial-by-trial probability of correct responses, LKT offers a data-driven framework for tracking auditory learning throughout ARIA training. This approach enables fine-grained monitoring of ear-specific performance and interaural asymmetry, supports individualized adjustment of training parameters, and enhances both theoretical understanding of auditory plasticity and clinical precision in auditory rehabilitation.

Category: Pediatric Audiology / Otology

Poster #: 166

Exploring the Link Between Dichotic Listening and Speech Production

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Objectives: This study investigated speech production errors in children with dichotic listening deficits. It was hypothesized that children with dichotic listening deficits would exhibit speech production errors that would vary based on the pattern and severity of their dichotic deficit.

Design: School-aged children between the ages of 6 and 15 years were recruited following dichotic listening testing at their schools and through word of mouth. All participants in this study were assessed for dichotic listening prior to speech production measures. Dichotic listening was tested using the Dichotic Words Test (DWT), Randomized Dichotic Digits Test (RDDT), and the Competing Words subtest of the SCAN-3 (CWT). Speech production was assessed using the Goldman-Fristoe Test of Articulation-3 (GFTA-3), consonant-vowel-consonant (CVC) nonsense words and dichotic words. The GFTA-3 was scored using age-matched normative data. For the nonsense and dichotic words, the total number of speech sound errors and the Percent Consonants Correct (PCC) were calculated for each listening condition: right ear, left ear, and binaural. All participants in this study exhibited a dichotic listening

deficit. 23 participants completed the GFTA-3, 22 participants completed the dichotic words task, and 20 participants completed the nonsense words task. Two groups were formed based on GFTA-3 scores: Group 0 included children who scored at least one standard deviation below the mean range. Group 1 included those with age-appropriate performance. Statical analyses conducted in R used Pearson's correlation and simple linear regression to compare PCC scores across the nonsense and dichotic words tasks for all participants and within each group. Trends were assessed across measures using descriptive statistics.

Results: The GFTA-3, a picture naming task which does not rely on auditory processing, revealed that 48% of participants scored at least one standard deviation below the mean range. Among these, 91% exhibited the Dichotic Dysaudia pattern, characterized by weak dichotic performance in both ears. Performance on the nonsense and dichotic words tasks did not show trends based on group, but all participants showed speech sound errors on these tasks. Moderate, statistically significant correlations were observed between the right and left ear conditions of dichotic words and the binaural condition of the nonsense words task across all participants. In individual groups, a moderate, significant relationship was observed between the right ear on the dichotic words task and the left ear and binaural condition of the nonsense words task in Group 0, children who performed one standard deviation or more below mean range on the GFTA-3. No significant relationships were found between dichotic deficit severity and GFTA-3 severity across all subjects.

Conclusions: Children with dichotic listening deficits exhibited speech sound errors in their speech production, but the rate varied by method of stimulation. Participants showed more speech sound errors on tasks using auditory stimuli to elicit a response compared to the picture naming task, suggesting that these children may have sufficient motor representations for speech but experience perceptual challenges that interfere with accurate speech production. These preliminary findings suggest that assessing articulation with auditory stimuli may provide important information about the role of speech perception in speech production, especially in children with known auditory processing difficulties.

Category: Pediatric Audiology / Otology

Poster #: 167

Sound Beginnings: Dichotic Listening Deficits and Phonological Processing in Children

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Objectives: Dichotic listening tasks evaluate binaural integration and separation-fundamental processes of central auditory processing. Previous studies have connected dichotic listening performance to phonological awareness, but the link between the severity of deficits and specific phonological processing areas remains unclear in larger clinical samples. This research investigates whether the severity of dichotic listening deficits is related to performance in particular domains of phonological processing among school-aged children. The goal is to see if children with more severe dichotic listening issues differ in phonological awareness, phonological memory, or rapid naming skills compared to those with milder problems. It is hypothesized that the severity of dichotic listening deficits will be linked to differences in phonological processing performance.

Design: This correlational study explores the link between the severity of dichotic listening deficits and phonological-processing skills in school-aged children. Pilot analyses involved 21 children (ages 7.5-14.2 years) with confirmed dichotic listening deficits. Data from 42 participants have been collected and are in the process of being analyzed. Children were recruited through clinical referrals and community outreach; all had normal hearing and no neurological or developmental disorders. Dichotic listening performance was assessed using the Randomized Dichotic Digits, Dichotic Words, and SCAN-3 Competing Words tests to generate a severity score. Phonological processing was measured with the Comprehensive Test of Phonological Processing-2 (CTOPP-2), which includes measures of phonological awareness, phonological memory, and rapid naming. Pearson correlation and hierarchical regression analyses will be used to determine whether the severity of dichotic listening deficits predicts phonological processing performance.

Results: Analysis of the pilot sample (n = 21) revealed moderate negative trends between dichotic listening deficit severity and both phonological awareness and rapid naming. Data collection is complete for 42 participants, and full analyses are in progress. Correlation and hierarchical regression analyses will explore the relationships between dichotic listening severity and each phonological processing domain. These analyses will assess the strength and direction of the associations between dichotic listening performance and phonological processing skills.

Conclusions: The pilot data suggest that children with more severe dichotic listening deficits tend to have weaker phonological awareness and slower rapid naming. These findings support a link between binaural processing and phonological skills that are fundamental to language and literacy development. This relationship highlights the importance of assessing auditory processing when identifying and managing children with listening or reading difficulties.

Category: Pediatric Audiology / Otology

Poster #: 168

Speech Recognition and Spatial Hearing in Individuals with Down Syndrome

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Objectives: Perceptual segregation of speech from background talkers matures throughout childhood, with notable variability in both typically developing (TD) children and in individuals with developmental disabilities such as Down syndrome (DS). The sources of this variability remain poorly understood and likely reflect interactions between auditory function and non-auditory processes such as executive functioning. We investigated speech recognition in children and adults with DS and TD controls, for target speech and speech interferers, either spatially co-located or separated (the difference in

performance between the conditions being spatial release from masking, SRM). We also investigated how executive functioning is associated with individual variability in these measures.

Design: Children and adults with DS and TD controls were tested in two separate experiments. Experiment 1 included TD children (ages 5 to 17 years; n=65) and TD adults (ages 18 to 24 years; n=50). Experiment 2 included children with DS (ages 10-17; n=06), adults with DS (ages 21-25; n=08), and age-matched TD controls. Data collection is in progress. Individuals with DS had hearing sensitivity ranging from normal hearing to severe hearing loss, and were tested with hearing aids when applicable. For both experiments, participants were tested using a closed-set, four-alternative forced-choice task to estimate speech reception thresholds (SRTs). Target stimuli were spondaic words, and interfering sentences were two-talker "babble" from the Harvard IEEE corpus. Target stimuli were presented at 0° in quiet, and with interferers co-located (0°), or spatially separated (90-deg to the right or left). Executive functioning, including attention, working memory, cognitive flexibility, and inhibition, was assessed in individuals with DS and TD children using the forward and backward digit span, dimensional change card sort, and flanker inhibitory control and attention tests, respectively.

Results: Experiment 1 revealed significant associations between age and SRTs for all conditions tested, and between age and SRM, indicating significant maturation in spatial hearing in TD individuals. Furthermore, significant associations were found between SRTs in separated conditions with both the digit span forward and the digit span backward in TD individuals, and the relationship between working memory and SRM was moderated by the location of the interferers. Preliminary visual observation of the data of experiment 2 indicated a trend of higher SRTs and lower SRM in both the children and adults with DS compared to age-matched TD controls. Moreover, executive functioning of both children and adults with DS may be associated with SRTs and SRM.

Conclusions: Experiment 1 provides insight into age effects, indicating maturation of spatial hearing and associations with executive functioning. Experiment 2 indicates that children and adults with DS showed poorer speech recognition and limited benefits from spatial separation as compared to TD controls. Moreover, cognitive processes may contribute to individual variability in speech recognition abilities among individuals with DS, providing insights into the communication abilities of individuals with DS with or without hearing loss. [This work was supported by NIH-NIDCD R01DC019511 to R.Y. Litovsky, S. L. Hartley, A. Alexander, and in part by a core grant to the Waisman Center (NIH-NICHD P50HD105353)]

Category: Pediatric Audiology / Otology

Poster #: 169

Voice Emotion Perception Development In Preschoolers With Hearing Loss

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Objectives: The ability to perceive voice emotion is important for the development of social-emotional, cognitive and communication skills, and has been linked to quality of life. In children with typical hearing (TH), voice emotion perception is a skill that emerges early in development and develops throughout childhood. While it is well documented that older children who are deaf / hard of hearing (DHH) may have difficulties perceiving voice emotion, the development of voice emotion perception in this

population is not well described. To address this gap, this study evaluated voice emotion discrimination and identification in 3- to 5-year-old DHH and TH children. It was expected that the task and the presented voice emotion would impact performance for all children, with higher discrimination than identification scores. Discrimination performance was expected to be independent of age but dependent on hearing status. In contrast, identification performance was expected to be age and hearing status dependent. Additionally, it was hypothesized that language and cognitive skills would be associated with identification but not discrimination performance.

Design: Sixteen children with TH and 38 with bilateral hearing loss were recruited: 14 children with cochlear implants (CI) and 24 with hearing aids (HA). Children were roughly equally distributed across age groups: 19 three-year-olds, 17 four-year-olds, and 18 five-year-olds. Children with additional diagnosed disabilities associated with impaired emotion perception (such as Autism Spectrum Disorder) were excluded. Children completed 4 tasks: a go/no-go task to measure discrimination of happy/sad/angry/scared from neutral voice emotion; a 4-alternative forced choice task to measure happy/sad/angry/scared voice emotion identification; a standardized language assessment (CELF-P3), and a standardized nonverbal cognitive assessment (PTONI).

Results: As expected, the results showed that performance was dependent on the task, with significantly higher performance on the discrimination than the identification task. On the discrimination task, all participating children successfully learned the task and performed above chance levels. However, younger children and those with CI demonstrated poorer performance compared to older children and those without CI. Conversely, older children and those with HA and TH performed at or near ceiling levels. On the identification task, 50% of children exhibited very low accuracy and few children reached ceiling performance. While identification significantly improved with age it did not differ between children with CI, HA and TH. Performance on each task was associated with the voice emotion used, language and nonverbal cognitive skills.

Conclusions: The results of this research indicate that like TH children, voice emotion perception in DHH children develops throughout the preschool years and appears influenced by the type of auditory signal the child receives (HA/acoustic vs. CI). The results have high clinical relevance as they can be used to guide the development of clinical assessments and protocols for DHH preschoolers.

Category: Pediatric Audiology / Otology

Poster #: 170 **T35 Research Trainee Poster**

Children's Talker Identification Ability: Effects of Talker Similarity and Language

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Objectives: Talker identification (talker ID) refers to a listener's ability to differentiate between individuals based on their voice. Talker similarity and talker language may influence talker ID in children. For example, children show reduced accuracy in distinguishing talkers when their voices have similar acoustic profiles. Additionally, language familiarity (e.g., hearing speech from a talker speaking in the listener's native language) has shown to enhance the cognitive processing of speech and talker-specific information. Few studies have examined the interaction between talker similarity and talker language, and no known published work has manipulated both variables within the same paradigm to assess their combined effect on children's talker ID ability. Additionally, few studies have directly compared talker ID abilities between children with typical hearing (TH) and children who are deaf or hard-of-hearing (DHH), leaving a gap in understanding how auditory access influences this skill. This study examines how talker similarity and talker language jointly influence talker ID ability in TH children and DHH children after incidental learning.

Design: Participants included 38 native English-speaking children (6-13 years; m=10.2; SD=2.07). TH participants passed a hearing screening at 15 dB HL from 250 - 8000 Hz. DHH participants were divided into two groups: hearing aid users and cochlear implant users. Participants completed a talker ID task that yields accuracy (%) and decision-making time (ms) in four conditions (English different talkers, English similar talkers, Mandarin different talkers, Mandarin similar talkers).

Results: Preliminary analyses were completed for the TH group (n=29) using Linear Mixed Effects Models (LME) controlling for age in RStudio. The first LME was used to examine predictors of accuracy. Significant main fixed effects of talker similarity (estimate = 6.96, $p < 0.001$), talker language (estimate = -20.78, $p < 0.001$), and age (estimate = 3.57, $p < 0.001$) were found, as well as a significant interaction between talker similarity and talker language (estimate = 11.27, $p < 0.001$). The second LME was used to examine predictors of decision-making time. Significant main fixed effects of talker similarity (estimate = -384.54, $p < 0.001$), talker language (estimate = -244.96, $p < 0.005$), and age (estimate = -163.26, $p < 0.005$) were found. The interaction between talker language and talker similarity was also significant (estimate = 346.39, $p < 0.005$). Data collection for DHH participants is ongoing. Preliminary data from this group suggests considerable variability in performance.

Conclusions: Talker ID accuracy was significantly better in the different conditions and English conditions. The significant interaction between talker similarity and talker language on accuracy suggests that talker ID is more difficult in unfamiliar languages, especially when the talkers are similar. Findings on decision-making time suggest that a greater difference in talkers and older participant age are associated with faster decision-making. The significant interaction between talker similarity and talker language on decision-making time indicates the influence of similarity depends on whether the talkers spoke in English or Mandarin. Clinically, better talker ID abilities may support children's speech and language development, particularly in noisy settings and understanding social-pragmatic cues across different speakers.

SPEECH PERCEPTION

Category: Speech Perception

Poster #: 171 **Mentored Student Research Poster Award**

Relationship Between MEMR Strength and Neural Encoding of Degraded Speech

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Objectives: Normal audiograms do not necessarily indicate intact auditory function, as many individuals with clinically normal thresholds experience difficulty understanding speech in adverse listening conditions. Cochlear synaptopathy, the loss of synaptic connections between inner hair cells and auditory nerve terminals, has been proposed as a mechanism underlying these subclinical deficits. However, human studies have yet to establish a consistent link between synaptopathy and impaired speech perception, leaving the neural basis of subclinical auditory deficits unresolved. The middle ear muscle reflex (MEMR) has emerged as a promising noninvasive marker of peripheral neural integrity that may reflect noise-induced synaptopathy and help explain individual differences in auditory processing. Building on this rationale, the present study investigated whether MEMR strength predicts the fidelity of subcortical and cortical encoding of degraded speech in adults with clinically normal hearing.

Design: Thirty adults (ages 20–61) with normal audiograms (thresholds ≤ 20 dB HL) participated. Participants completed a battery of tests including the Noise Exposure Structured Interview (NESI), extended high-frequency (EHF) audiometry, MEMRs, frequency-following responses (FFRs), and mismatch negativity (MMN). NESI quantified recreational, occupational, and firearm noise exposure history. EHF thresholds were measured from 10–16 kHz to assess subclinical basal cochlear damage. Ipsilateral and contralateral wideband MEMRs were recorded at tympanometric peak pressure using the Interacoustics Titan system interfaced with MATLAB and the Interacoustics Research Platform. The probe stimulus consisted of five 105-dB ppeSPL clicks interleaved with four elicitor noise bursts (100–4000 Hz) presented at 75, 90, and 105 dB SPL. MEMR magnitude was defined as the maximum change in absorbance across 14 frequency bands (250–1516 Hz), and level-dependent growth functions were derived across elicitor levels. Neural responses indexing subcortical and cortical encoding of speech were obtained using FFRs and MMNs. Speech degradation was applied by convolving a sustained vowel (/u/) with room impulse responses representing mild (RT60 ≈ 0.7 s), medium (RT60 ≈ 0.8 s), and severe (RT60 ≈ 0.9 s) reverberation. FFRs were recorded to the vowel /u/ under dry and reverberant conditions, and MMNs were elicited by reverberant or dry deviants presented against a dry standard.

Results: Preliminary analyses indicate that individuals with greater noise exposure exhibit reduced MEMR magnitude and shallower level-dependent growth functions, consistent with noise-induced cochlear synaptopathy. EHF thresholds were not significantly correlated with MEMR strength or growth, indicating that MEMR variability is independent of basal cochlear damage. Ongoing analyses are examining whether MEMR magnitude and growth predict subcortical and cortical encoding of degraded speech. Reductions in neural speech encoding are expected to be most pronounced under more challenging listening conditions, with weaker MEMRs associated with lower FFR amplitudes and reduced MMN responses, suggesting compromised subcortical phase locking and cortical discrimination of speech.

Conclusions: These findings support MEMR as a noninvasive marker of noise-induced synaptopathy that is independent of basal cochlear damage. Our results will clarify whether impaired peripheral neural

function due to synaptopathy cascades to higher auditory structures, thereby compromising subcortical and cortical encoding of speech features.

Category: Speech Perception

Poster #: 172 **Mentored Student Research Poster Award**

Neural Correlates of Time-Compressed Discourse Comprehension Across Age Groups

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Objectives: Real-world communication requires the integration of higher-order, complex cognitive-linguistic processes. These neural mechanisms are not fully recruited by the simple word- and sentence-repetition tasks that are commonly used in the audiology clinic. Assessing discourse comprehension, rather, provides a more ecologically valid approach to quantifying communication abilities in everyday life. This study examined the neural correlates of discourse comprehension among younger and older adults with normal to near-normal hearing acuity. To simulate challenging real-world communication conditions, listeners answered corresponding comprehension questions in response to time-compressed discourse narratives. We hypothesized that: (1) advanced age would negatively impact behavioral accuracy and response time following the comprehension questions, (2) cognitive measures of processing speed and working memory would predict discourse-comprehension performance, and (3) older adults would show alternative cortical recruitment relative to younger adults, reflecting some form of age-related compensatory processes.

Design: Behavioral and neuroimaging measures assessed discourse comprehension in 41 normal-hearing participants (20 younger adults 19-27 years, 21 older adults 55+ years). Participants listened to ten short-story passages taken from the Discourse Comprehension Test (DCT) that were time-compressed to increase the acoustic and cognitive challenge. Listeners were instructed to answer a total of 50 yes-or-no comprehension questions of varying difficulty. Comprehension questions fell into four categories based on the information contained in the preceding narrative: main idea stated (MIS), detail stated (DS), main idea implied (MII), and detail implied (DI). Behavioral measures of task accuracy and response time were collected. Functional near-infrared spectroscopy (fNIRS) was used to measure cortical activity in auditory and frontal regions-of-interest during the comprehension task. Cognition was assessed using subtests from the Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV) to measure working memory capacity and temporal processing speed.

Results: Behavioral comprehension performance indicated the detail-implied questions (DI) produced the lowest accuracy and longest response times across groups. Multilevel-modeling results revealed significant interactions between age group and implied-question types (MII and DI), indicating that younger adults had better performance for these inference-based questions. Cognitively, temporal processing speed predicted response time as participants with greater (better) processing speed measures yielded significantly shorter (faster) response times. Neuroimaging results showed age-related differences in cortical recruitment across question types. Younger adults demonstrated greater

differences in neural activity between conditions that varied in difficulty, reflecting efficient resource allocation. Comparatively, older adults showed minimal differences in neural activity between question types. These patterns align with an interpretation of compensatory, yet capacity-limited, neural recruitment in older adults.

Conclusions: Time-compressed discourse places high inferential and temporal-processing demands that reveal significant interactions between age, cognition, and neural recruitment. The combination of behavioral comprehension measures, cognitive processing, and neural activity shows age-related compensatory mechanisms for comprehending time-compressed discourse. The capacity-limited neural activation in conjunction with poorer behavioral performance highlights an age-related reduction in processing efficiency in response to elevated task demands. Our results emphasize the importance of discourse-level, ecologically-valid assessments that incorporate cognitive and neural measures to better characterize everyday communication challenges in aging populations.

Category: Speech Perception

Poster #: 173

The Role of Extended High Frequencies in the BKB Test

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Objectives: Extended high-frequency (EHF; 8 - 20 kHz) hearing has an established association with speech-in-noise (SIN) performance. Notably, this relationship has been found in stimuli that do not contain EHF spectral information, resulting in questions regarding the underlying mechanisms driving this phenomenon. In the present study, we seek to further evaluate the relationship between SIN performance and EHFs using a recently recorded corpus that includes spectral information up to 20kHz. We have used spatial configurations that test the role of EHFs and monaural and binaural effects for SIN performance.

Design: Audiometric (250 - 16 kHz) and speech-in-noise data were collected on normal-hearing participants (PTA ≤ 25 dB HL) at the University of South Florida. Speech-in-noise performance was evaluated using the BKB-SIN speech corpus both under HDA200 headphones (diotically) and in the free field. Free field presentations were either in a separated (target at 0o; masker at 180o) or a co-located configuration (target and masker at 0o). Maskers were the combination of three narratives spoken by three female talkers, and the target was a separate female talker. Each target sentence contained either 3 or 4 target words that were scored individually. Speech stimuli were presented either with the full spectrum (up to 20 kHz) or partial spectrum (low-pass filtered at 6 kHz). Participants were therefore tested on 6 total conditions (each spatial configuration with either partial or full spectrum). We used a method of constant stimulus, with a fixed presentation level for the target sentences at 60 dBA, and descending signal-to-noise ratios (SNRs). In each run, the SNRs were decreased by 3 dB consecutively for 8 target sentences, then repeated, for a total of 16 sentences per run. The SNR decreased from +12 dB to -

9 dB for the headphones and co-located, free-field conditions, and from +3 dB to -18 dB for the separated, free-field condition. Each participant was tested on three runs per condition, for a total of 48 sentences in each condition (6 per SNR). Data were fitted using an ogive function to determine threshold.

Results: Psychometric curves were generated for each condition showing the effect on speech recognition accuracy as a function of SNR. On average, listeners performed best in the spatially separated conditions, with roughly 7-dB spatial release from masking at 50% accuracy on the psychometric curve. The co-located, free-field condition and diotic headphone condition did not yield different psychometric curves on average, and the partial and full spectrum presentations were not different across spatial configurations. At the individual level, there were some differences for spectral and spatial presentations which will be further discussed in this presentation.

Conclusions: The results of the current study indicate that the presence of a full spectrum in a spatially separated speech-in-noise task does not necessarily yield better speech-in-noise performance in young, normal- hearing listeners on average, suggesting that listeners are not advantaged by high frequency cues for this task. However, individual differences in EHF thresholds may account for some variance in the results.

Category: Speech Perception

Poster #: 174 **Mentored Student Research Poster Award**

Regional Brain Atrophy Explains Aging Effects in Speech-in-Noise Recognition

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Objectives: Most neural evidence on age-related speech-in-noise (SiN) performance has relied on correlational approaches to characterize how age relates to SiN ability. These methods identify associations but cannot determine whether, or to what extent, brain structures mediate age effects on SiN. Moreover, it remains unclear how such mediation manifests when hearing sensitivity is clinically normal. The present study applies a brain-wide, region-level mediation framework to examine the neural pathways through which regional brain atrophy mediates age effects on SiN performance. We

hypothesize that mediation will involve regions implicated in cognitive control (e.g., anterior cingulate, prefrontal cortex), sensorimotor integration (e.g., superior parietal gyrus), and auditory processing (e.g., superior temporal gyri), and that effects will persist, though attenuated, in the normal-hearing subgroup.

Design: We studied 208 adults who participated in the Aging Brain Cohort Study at the University of South Carolina (ABC@USC), aged 20 to 80 years (Mean = 49.52, SD = 19.6). Participants completed the NIH Words-in-Noise (WIN) test and underwent high-resolution magnetic resonance imaging scanning. Regional volumetric measures were extracted based on the Johns Hopkins University atlas, and mediation was tested using a novel MATLAB-based analysis approach, the graphical Brain Association Tool (gBAT), which enables systematic, brain-wide exploration of brain–behavior associations. A secondary analysis was conducted in a subgroup of 150 participants with normal hearing sensitivity (pure-tone average ≤ 20 dB HL) to examine the neural pathways mediating the effects of age on WIN recognition when hearing sensitivity is normal.

Results: Behavioral analyses confirmed a robust association between age and speech-in-noise perception. Across the full cohort, each additional decade of life was associated with an approximately 1.3 dB SNR increase in WIN thresholds, after adjusting for gender and education. Notably, this relationship persisted among participants with clinically normal hearing ($\beta = 0.07$, $p < .001$). Whole-brain mediation analyses revealed that regional gray matter atrophy mediated the age-WIN association within a distributed fronto-parieto-subcortical network encompassing 26 cortical and subcortical regions. Mediating regions included bilateral superior and middle frontal gyri, precentral and postcentral gyri, angular gyri, dorsal anterior cingulate cortex, superior parietal lobules, left supramarginal gyrus, bilateral precuneus, left middle occipital gyrus, left posterior cingulate cortex, right caudate nucleus, left globus pallidus, and left thalamus. In the normal-hearing subgroup, mediation effects in the middle frontal gyri, posterior cingulate cortex, subcortical regions, and occipital lobe were no longer significant.

Conclusions: These findings underscore that neural mechanisms, rather than hearing sensitivity alone, account for a substantial portion of the variance in word-in-noise perception. The mediation results extend prior correlational work by demonstrating that age-related atrophy in specific cortical and subcortical regions statistically explains the age-WIN link. Notably, the mediating regions identified here overlap with, but are not identical to, those reported previously. Together, these areas form an interconnected network of sensory, cognitive, and motor subsystems that support speech recognition under adverse listening conditions. Overall, the results elucidate the neural pathways through which aging influences SiN perception and provide a mechanistic framework for developing interventions to preserve communication and cognitive function in older adults.

Category: Speech Perception

Poster #: 175

Emotion Identification in Single and Concurrent Talkers

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Objectives: Recognition of emotional prosody and auditory stream segregation are two complex auditory processes that rely on similar underlying acoustic cues. For example, fundamental frequency and pitch contour provide information on the emotional content of a message and also serves as a means of tracking a voice across time and separating it from background talkers. Populations with poor access to these underlying acoustic cues, such as cochlear implant recipients, experience difficulty recognizing emotional prosody and segregating speech from background talkers. Other populations with top-down processing deficits, such as a history of stroke, may experience difficulty in one perceptual domain, but not in the other. As a preliminary step towards exploring these effects in special populations, the current study investigated emotion identification of younger adults with normal hearing listening to natural and noise-band vocoded stimuli in a task that requires stream segregation of concurrent talkers. The purpose of this study is to evaluate how degraded bottom-up input influences stream segregation and recognition of emotional prosody on single- and concurrent-talker emotion recognition tasks.

Design: Normal hearing adults identified the emotion in single- and concurrent -talker stimuli. Nonspeech utterances were recorded from a single male talker conveying one of four emotions (happy, sad, angry, or surprised). Original recordings were processed to change the perceived vocal tract length (VTL) to facilitate stream segregation in concurrent-talker stimuli. Unprocessed and VTL processed stimuli were also noise-band vocoded with 8 to 16 channels to stimulate cochlear implant processing. Participants identified emotion from a closed set of responses for single-talker stimuli, and for stimuli consisting of two emotional utterances played concurrently (participants responded with both emotions). A subset of participants also completed a talker identification task on the single-talker stimuli to determine the extent to which VTL processing yielded distinct voices in natural and noise-band vocoded conditions.

Results: Results indicate higher emotion identification accuracy in single-talker compared to concurrent-talker conditions. Single-talker emotion identification accuracy declined for vocoded speech (8 and 16 channels), relative to natural speech. Changes in VTL produced minimal changes in single-talker emotion identification for natural speech. However, VTL processing resulted in poorer performance when these stimuli, were vocoded (relative to vocoded stimuli without a VTL shift). In concurrent-talker stimuli, VTL shifts facilitated segregation of natural speech, leading to better emotion identification of two talkers. However, when concurrent-talker stimuli were vocoded, the VTL shifts did not produce a similar improvement in performance. A subset of participants completed a talker identification task to evaluate the extent to which VTL shifts produced salient differences between talkers in natural speech and vocoded conditions.

Conclusions: The ability to identify concurrent emotions relies heavily on access to temporal fine structure cues, which are also beneficial for stream segregation. Results indicate that spectral features associated with VTL can facilitate stream segregation in natural speech, but provide less benefit when speech is noise-band vocoded. Overall, degraded auditory input associated with vocoding impaired both emotion identification and stream segregation. An interaction between VTL processing and vocoding may disrupt identification of emotional prosody of two concurrent talkers.

Category: Speech Perception

Poster #: 176

Predictors of QuickSIN Variability Across WHO Hearing Impairment Grades

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Objectives: Variability in speech in noise performance is often observed for individuals with similar hearing thresholds. The factors contributing to this variability may not be the same across the different World Health Organization (WHO) grades of hearing impairment (no, slight, and moderate impairment). The purpose of this study was to determine if factors obtained during a basic audiologic evaluation (age, four-frequency PTA (4PTA), and word recognition in quiet) can account for the variability in individuals' SNR loss on the Quick Speech-in-Noise Test (QuickSIN). The magnitude of variability and the relative influence of these factors were assessed across and within three of the five WHO grades of hearing impairment, and we hypothesized that both would differ by impairment grade.

Design: A retrospective chart review was conducted for adult patients evaluated at a university audiology clinic since 2020. Data was collected for 86 patients. Participants were included if they had normal hearing or symmetrical sensorineural hearing loss with a 4PTA that fell within one of the three WHO impairment grades being evaluated and completed the QuickSIN and word recognition in quiet as part of their audiologic evaluation. Multiple linear regressions were performed within each impairment grade to assess the contribution of 4PTA, word recognition in quiet, and age on QuickSIN SNR loss. Additionally, a Brown-Forsythe test was used to test for equal variances across the different grades of impairment.

Results: Findings revealed that 44% of the variability in QuickSIN performance could be accounted for by age, 4PTA, and word recognition in quiet ($p<0.001$). As hypothesized, the amount of variability differed significantly across the three grades ($p< .05$). For participants with no hearing impairment, 4PTA, word recognition in quiet, and age only explained 21% of the total variance ($p = 0.01$). Within this grade, word recognition in quiet was the only significant predictor ($p = 0.02$), accounting for 11% of the variance. For those with slight impairment, the model only approached statistical significance, explaining 31% of the total variance ($p = 0.06$); age was the only significant predictor ($p = 0.03$), contributing 21% of the variance. In the moderate impairment grade, these three factors explained 51% of the variability in QuickSIN scores ($p = 0.15$). However, neither the overall model nor any of the individual factors were significant, likely due to the currently small sample size (n=11). Data collection is ongoing for this group. Notably, 4PTA was consistently a weak predictor, explaining less than 4% of the variability within each grade.

Conclusions: Results showed that the magnitude of variability and the relative influence of age and basic audiologic factors (4PTA and word recognition in quiet) on QuickSIN performance differed across WHO grades of impairment. This indicates that these factors only account for part of the variability in individuals' speech understanding in noise, highlighting the importance of clinically performing speech in noise tests.

Category: Speech Perception

Poster #: 177

Working Memory and Recognition of Different Types of Degraded Speech

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Objectives: Comprehending degraded speech relies on the interaction between bottom-up auditory processing and top-down cognitive engagement. Among cognitive factors, working memory is most consistently linked to speech recognition in adverse listening conditions, particularly speech-in-noise. However, its role in recognizing other forms of degraded speech, such as reverberant and time-compressed speech, remains unclear. The existing literature also shows inconsistent findings regarding whether working memory functions similarly in young adults with normal hearing and older adults with age-related hearing loss. The present study examined the combined effects of age and hearing on the relationship between working memory and recognition of degraded speech, specifically speech in four-talker babble, reverberant speech, and time-compressed speech. Guided by the Ease of Language Understanding (ELU) model, we hypothesized that working memory compensates for compromised hearing, predicting stronger correlations between working memory and speech recognition in older adults with hearing loss.

Design: Two participant groups were included: young adults with normal hearing (YNH; n = 10; age 21–28 years) and older adults with hearing impairment (OHI; n = 28; age 61–87 years). Working memory was assessed using four tasks: Reading Span, Word Repetition Span, Nonword Repetition Span, and List Sorting. These tasks varied in modality (auditory, visual, or combined) and cognitive load. Speech recognition in degraded conditions was measured using a "one-up-one-down" adaptive procedure to estimate the 50% speech recognition threshold (SRT_{50}). Each condition included three runs of 20 sentences (60 total), drawn from the Hearing-in-Noise Test (HINT). The SRT_{50} was calculated as the average performance on the third run.

Results: As anticipated, the YNH group significantly outperformed the OHI group across all three speech-recognition tasks. In contrast, group differences in working memory emerged only on the Reading Span Test, where the YNH group demonstrated significantly better performance; no significant differences were observed on the other working memory measures. Furthermore, Reading Span was the only working memory task significantly associated with Speech-in-Babble and Time-Compressed Speech recognition, and this effect was observed solely in the OHI group.

Conclusions: This study provides further evidence that the combined effects of age and hearing loss negatively impact the recognition of various forms of degraded speech, including speech masked by babble containing both energetic and informational masking components, as well as speech temporally distorted through reverberation or time compression. In contrast, the combined effects of age and hearing loss on working memory performance were evident only in the Reading Span Test, where younger adults with normal hearing outperformed older adults with hearing impairment. This finding suggests that age-related declines in working memory are most pronounced in linguistically demanding tasks, regardless of the modality in which they are presented (i.e., auditory or visual). Additionally,

Reading Span performance was significantly associated with recognition of Speech-in-Babble and Time-Compressed Speech, consistent with prior findings identifying Reading Span as the most robust cognitive predictor of speech-in-noise recognition. These results underscore the critical role of cognitive factors in speech perception, highlighting the importance of incorporating both auditory and cognitive considerations into clinical assessment and rehabilitation.

Category: Speech Perception

Poster #: 178

Listener Position Influences Energetic and Informational Masking in Virtual Environment

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Objectives: Speech recognition in a realistic multitalker environment is affected by the position of the listener relative to competing talkers and may depend on the degree of informational masking that nearby talkers produce. As listeners move through a virtual environment, the intensity of individual masker voices change, which influences which masker voice dominates the mixture. To the extent that the dominant masking voice in a mixture produces informational masking, we would expect that listener position may influence the degree of informational masking that a listener experiences. A virtual acoustic environment was designed to test this hypothesis in younger and older adults with varying degrees of hearing sensitivity.

Design: Thirty adult participants were aged 19-79 years and represented a range of hearing sensitivities (four-frequency pure-tone averages between ears ranged from -3.1 to 46 dB HL). Participants repeated sentences in three simulated positions in a virtual acoustic environment with six competing talkers. Four of the competing talkers were fixed type (male and female narratives), while the other two varied across conditions, ranging from purely energetic (speech envelope modulated noise) to highly informational (narratives spoken by the same talker as the target sentences). The intensity of target sentences (BKB corpus) adapted based on word recognition scoring to estimate the psychometric function in each position for each masker type.

Results: Results indicated that the most advantageous listening position was the one that afforded listeners with the most robust spatial cues for separating the target from maskers. Contrary to our expectations, the most difficult masker condition was not the same voice as the target, but rather a different voice that matched the sex of the target. This result suggests other factors beyond target-masker similarity contributed to the informational masking effects observed in these data. A significant interaction between position and masker type was observed, such that the position with the most robust spatial cues showed the smallest effects of masker type (i.e., less informational masking). Hearing sensitivity of the listener was significantly associated with speech recognition thresholds and also interacted with listener position, indicating that the effect of hearing sensitivity can be mediated to some extent by proper positioning. Listener age did not significantly predict performance, beyond what could be attributed to the changes in hearing sensitivity associated with age.

Conclusions: Significant effects of informational masking were observed in a virtual acoustic environment with six competing talkers. The degree of spatial separation between target and maskers could be manipulated successfully by changing the listener's position in the space. These changes in listener position influenced the degree of informational masking, and the effect of peripheral hearing loss on speech recognition. These results suggest that rehabilitative strategies to optimize a listener's position in a noisy environment can yield improvements in speech recognition in noise. Implications of these results for clinical counseling and rehabilitative audiology will be discussed.

Category: Speech Perception

Poster #: 179

Reverberant Speech Perception in Older Adults: Cortical Encoding and Behavioral Measures

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Objectives: Older individuals often encounter greater challenges communicating effectively in everyday situations with background noise and reverberation compared to younger listeners. Previous research has indicated that some listeners experience perceptual difficulties beyond the severity indicated by their audiograms. Our primary objective is to identify the factors that contribute to these perceptual problems. This specific study aimed to investigate the influence of hearing loss and cognitive processing on the ability of an older individual to perceive reverberant speech. We assessed the effects of varying increasing levels of reverberation using three distinct measures: cortical auditory evoked potentials, working memory and inhibitory control aspects of executive function, and syllable discrimination and sentence intelligibility. Our hypothesis was that an increase in reverberation would lead to diminished cortical encoding. Consequently, individuals with impaired cortical encoding may encounter greater difficulties comprehending speech in higher reverberation levels. Furthermore, we hypothesized that the combination of measures assessing neural encoding and cognition would enhance our understanding of the speech perception outcomes obtained in the study.

Design: Two age- and sex-matched groups of older adults (≥50 years) were assessed, one with normal hearing (n=11, thresholds ≤25 dB HL ≤4 kHz) and the other with mild-to-moderate hearing loss (n=12). The effect of reverberation on cortical encoding in each group was determined in three reverberation levels, including an anechoic condition. Participants also completed a syllable discrimination task that included confidence ratings and an open set sentence perception task. Working memory was assessed using the Reading Span Task. Participants completed these tasks over two to three visits, with task order randomized.

Results: Preliminary analyses showed that increasing reverberation negatively impacts speech perception and alters the amplitude and timing of peaks in evoked responses. Differential effects of reverberation across the two group will also be included. Speech intelligibility results showed that

increased reverberation resulted in poorer speech reception scores - the largest variability in scores was observed in the highest level of reverberation and the group with hearing losses exhibited the greatest variability. No differences were observed between the groups in terms of their working memory scores. These results will be compared to results from young normally hearing adults from a previous study completed in our lab.

Conclusions: Estimates of the effect of hearing loss on older individuals' physiology and behavior in reverberation is important for both assessment and management of difficulties in complex listening environments. These data demonstrate that hearing loss degrades neural encoding and impacts speech understanding. Listener factors that might impact speech perception in reverberation were included that assess speech perception outcomes. The outcomes of this study will help design clinically applicable models to assess individual susceptibility to environmental interference.

Category: Speech Perception

Poster #: 180

Acoustic and Contextual Effects on Listening Effort in Older Adults

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Objectives: The present study investigated how acoustic modifications-specifically slower speech rate and increased target word intensity-together with lexical contextual expectancy influence speech perception, speech processing, and listening effort in younger and older adults. We hypothesized that speech perception performance, neural responses (e.g., N400 and late positivity), and listening effort would differ across speech conditions. Specifically, accuracy would be higher, response times faster, and listening effort lower in the Slow and Enhanced conditions compared to the Original condition. Secondly, high-expectancy words were expected to yield better behavioral and neural outcomes than low-expectancy words, with stronger N400 and late positivity responses reflecting more efficient processing. Third, older adults were predicted to show greater benefit from the Slow and Enhanced conditions than younger adults, demonstrating higher perceptual accuracy and reduced effort. Finally, older adults were expected to rely more heavily on semantic expectancy cues than younger adults, showing larger differences in performance and neural activation between high- and low-expectancy words.

Design: Thirteen younger adults and nineteen older adults participated. Most older participants had mild to moderate high-frequency hearing loss. Participants listened to conversational speech under three conditions: original, slow (50% time expansion), and intensity-enhanced (6 dB target word gain), presented in restaurant noise at 0 dB signal-to-noise ratio. Target words were either high or low in semantic expectancy. Speech perception was assessed by button-press accuracy and response time, listening effort was measured through a dual-task paradigm and subjective workload ratings, and neural processing was measured using event-related potentials focusing on N400 and late positivity components.

Results: Linear mixed-effects models revealed significant effects of speech condition and lexical expectancy on speech perception and listening effort. Intensity-enhanced speech improved accuracy and response times compared to both the original and slow speech conditions, even for low-expectancy words. In contrast, the slow condition produced the lowest accuracy and longest response times across expectancy levels. Participants reported greater perceived effort for the slow condition than for the enhanced condition. Neural results showed stronger N400 and late positivity responses during the enhanced condition, indicating more efficient processing. Larger and earlier negativities were observed for low-expectancy words, whereas high-expectancy words in the slow condition elicited weaker and delayed responses. Overall, intensity enhancement facilitated behavioral and neural processing of speech in noise more effectively than temporal slowing, suggesting that acoustic emphasis on key words can improve intelligibility and reduce cognitive effort during speech perception.

Conclusions: In summary, the findings indicate that slower speech does not reliably facilitate speech perception and may even increase listening effort in older adults. By contrast, emphasizing critical words through enhanced intensity provides a more effective strategy, particularly when contextual information is limited. These results highlight the importance of lexical emphasis over global rate adjustments in communication with older listeners. Clinically, this suggests that communication partner training and counseling should encourage clear prosody and targeted word emphasis to support comprehension in noise. Such strategies can enhance everyday conversational success and serve as practical tools in auditory rehabilitation and aging communication research.

VESTIBULAR

Category: Vestibular

Poster #: 181

Beyond Audition: Cognitive Function and Fall-Related Outcomes as Mediators of Balance Dysfunction in Adults with Age-Related Hearing Loss

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Objectives: Age-Related Hearing Loss (ARHL) is a well-established, independent risk factor for falls, yet the precise mechanisms underlying this relationship remain inadequately characterized. Given the co-location of the auditory and vestibular end organs in the inner ear, the Modified Clinical Test of Sensory Interaction on Balance (mCTSIB) composite is a highly relevant and sensitive outcome for investigating balance ability in a population with hearing loss. While hearing aids (HAs) effectively restore auditory input, their long-term impact on functional balance is poorly understood. A critical, unresolved question is whether prolonged HA use independently influences balance, or if its apparent effect is mediated by other central factors. Therefore, this study examined whether long-term HA use directly predicts objective balance performance, as measured by the mCTSIB, or if its effects are mediated by cognitive function and psychological measures of fall-related concern.

Design: In a cross-sectional study, 43 adults with ARHL (mean age 68.3 ± 7.6 years) were classified as non-users (n=16), short-term (n=11), or long-term HA users (n=16). Functional balance was assessed with the Bertec Portable Functional Walkway, using the Modified Clinical Test of Sensory Interaction on Balance (mCTSIB) composite score as the primary outcome (Normal/Abnormal). Assessments included pure-tone audiometry, Montreal Cognitive Assessment (MoCA), and fall-related measures: updated perceived control over falling (UPCOF) and falls efficacy scale-international (FES-I).

Results: A preliminary Chi-Square test of independence revealed no significant differences in cognitive impairment rates across groups ($p > .05$). However, subsequent binary logistic regression showed that cognitive function was the only significant predictor of balance ability (OR=0.519, p=0.030), with higher cognitive scores linked to lower odds of abnormal mCTSIB performance, after controlling for the demographics. The model demonstrated acceptable fit (Nagelkerke R2=0.460) and correctly classified 83.7% of cases.

Conclusions: This study demonstrates that the functional balance of adults with ARHL is strongly determined by global cognitive function, not by the duration of hearing aid use. While hearing aids are crucial for auditory rehabilitation, our findings indicate they do not independently influence balance performance, as measured by the sensitive, vestibular-targeted mCTSIB. The critical finding is that even sub-clinical variations in cognitive scores within the normal range are a powerful predictor of balance ability, underscoring the central role of cognitive processing in sensory integration and postural control.

Category: Vestibular

Poster #: 182 **T35 Research Trainee Poster**

Vestibular and Cognitive Influences on Caloric-Induced Alpha Suppression

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Objectives: Suppression of cortical alpha oscillations during caloric stimulation has been observed in previous investigations. However, it is well known that alpha is also strongly influenced by cognitive factors. This study aimed to clarify the contributions of vestibular stimulation and cognitive demand to alpha suppression observed during caloric stimulation. The first objective attempted to evaluate vestibular and cognitive contributions to alpha suppression by comparing real caloric stimulations, with and without a cognitive task, and a sham caloric stimulation without tasking. We predicted that real caloric stimulation without tasking would suppress alpha more than sham, reflecting vestibular input, and that caloric stimulation with tasking would produce greater alpha suppression than caloric stimulation without tasking, reflecting additional cognitive demand.Additionally, resting state alpha

offers a stable index of baseline cortical excitability. It is unknown whether the degree of suppression observed during caloric stimulation is influenced by this baseline cortical excitability. The second objective was to examine whether individual differences in resting alpha power, a marker of baseline cortical excitability, can predict vestibular responsiveness, as measured by peak slow phase velocity (pSPV). We hypothesized there would be no relationship between these factors since the caloric test is clinically considered a test of end organ and brainstem reactivity.

Design: Twenty healthy adults (18-39 years; mean = 25.1 years; 15 female) participated in a single session with EEG and ENG recordings. Participants had no history of otologic symptoms, hearing loss, neurological concerns, or previous balance concerns.The session included three counterbalanced experimental conditions including a sham caloric without a cognitive task, and two real calorics, one with and one without a cognitive task. Sham caloric was defined by a caloric irrigation delivered at body temperature. The cognitive task was counting out loud. EEG was recorded using a 64-channel cap, and pSPV was derived from ENG during a 90-second post-irrigation window. EEG data were downsampled to 200 Hz, bandpass filtered, and re-referenced to linked mastoids. Resting-state alpha power was analyzed to assess its relationship with pSPV.

Results: For the first objective, our results supported that caloric stimulation without tasking was not significantly different than a sham caloric without tasking. Alpha suppression only significantly reduced when a mental task was introduced.For the second objective, analyses revealed that higher baseline cortical arousal, indexed by resting state alpha power, was associated with smaller caloric responses (lower pSPV).

Conclusions: These findings suggest top-down cognitive demand primarily contributes to alpha suppression during caloric stimulation. Greater alpha suppression during tasking indicates that cognitive engagement modulates cortical activity beyond vestibular input alone. Additionally, the inverse relationship between resting state alpha and pSPV demonstrates that individuals with higher resting state alpha power is associated with reduced peripheral vestibular responses, suggesting that baseline cortical excitability may modulate vestibular responsiveness.Together, these results highlight a dynamic interaction between cortical state and vestibular responses, suggesting that cortical arousal may influence brainstem-mediated vestibular reflexes. To our knowledge this finding has not been reported and highlights the fact that clinical interpretation of caloric responses may need to consider cortical resting state.

Category: Vestibular

Poster #: 183 **T35 Research Trainee Poster**

Audiometric and Vestibular Outcomes in Individuals with Enlarged Vestibular Aqueduct

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Objectives: Enlarged Vestibular Aqueduct (EVA) is a common inner ear malformation associated with pediatric hearing loss, yet its audiometric and vestibular presentation is highly variable. This study aims to characterize the impact of EVA on auditory, immittance, and vestibular outcomes within a single cohort and to identify sources of phenotypic variability. We hypothesize that ears with EVA will show significantly different auditory, immittance, and vestibular outcomes compared to age-matched controls, with some measures serving as sensitive diagnostic indicators. A second aim is to examine whether the presence of additional inner ear anomalies, vestibular aqueduct (VA) size, and age account for variability. We hypothesize that presence of additional inner ear anomalies, VA size, and age will account for variability in the above measures.

Design: Thirty-five participants were enrolled: 17 participants with EVA (33 ears; 6 males; mean age=20.4), and 18 healthy controls (36 ears; 12 males; mean age=23.7). Auditory outcomes included pure-tone thresholds for participants with EVA (pure tone average [PTA] at .5, 1, 2, 4 kHz) and a hearing screening at 20 dB for controls. Immittance measures included 226 Hz tympanometry, wideband tympanometry (WBT), and acoustic reflex thresholds (ART). Vestibular measures included gaze with/without fixation, vibration-induced nystagmus test (VINT), video head impulse test (vHIT), cervical vestibular evoked myogenic potentials (cVEMPs), and ocular VEMPs (oVEMPs). VEMPs were recorded via air conduction (AC; .25–2 kHz, insert earphones) and bone conduction (BC; .25–1 kHz, mini-shaker). All participants underwent magnetic resonance imaging (MRI) for VA measurement and assessment of other inner ear anomalies.

Results: All control participants passed the hearing screening and all ears with EVA had hearing loss of varying severities and types. Tympanometry and WBT were predominantly normal in control ears and were variable in ears with EVA. ARTs were present in most of the control ears, whereas only one ear with EVA showed both ipsilateral and contralateral responses. Notably, 16 ears with EVA exhibited ipsilateral ARTs at 2 kHz only. Nystagmus was present on VINT in two controls and four participants with EVA. All controls had normal vHIT, while four participants with EVA demonstrated vestibular dysfunction. For cVEMP, corrected amplitudes (CAs) decreased as frequency increased across all participants. While not significant, ears with EVA demonstrated larger CAs for AC and smaller CAs for BC compared to controls. For oVEMP, the largest oVEMP amplitudes were present at 500 and 1000 Hz with AC and oVEMP amplitudes decreased as frequency increased for BC across all participants. Furthermore, ears with EVA demonstrated larger oVEMP amplitudes for AC and smaller oVEMP amplitudes for BC compared to controls. For sources of variability, VA size was not significantly correlated with PTA ($p > .05$).

Conclusions: EVA is associated with hearing loss and distinctive noninvasive physiological patterns, including atypical WBT, ART, vestibular abnormalities on vHIT in a subset, and modality- and frequency-specific VEMP differences. VA size alone did not account for variability, genetic outcomes and further analyses are ongoing. These findings support the clinical utility of combined immittance, ART, and vestibular metrics to aid early identification and management of EVA.