American Auditory Society Scientific and Technology Meeting
March 3-5, 2016

PODIUM PRESENTATIONS: Thursday, March 3, 2016

PODIUM SESSION I: HEARING AIDS IN ADULTS AND CHILDREN

Podium Paper I.A.

Hearing Aids: User-Adjustment of Output and Spectrum

Arthur Boothroyd, PhD; Carol Mackersie, PhD, San Diego State University, San Diego, CA

This study was carried out in preparation for research into the efficacy of, and candidacy for, user-fitting and readjustment of hearing-aids. Self-fitting software was developed to provide adjustment of high-frequency boost, low-frequency cut, and overall level. A sample of participants with mild-to-moderate hearing loss made these adjustments while listening to prerecorded speech. Word-in-sentence recognition was then measured using the listener's adjustment (Aided 1). The process was repeated (Aided 2). Finally, word-recognition was measured at a normal conversational level without spectral adjustment (Unaided). Mean adjustment time was two minutes for Aided 1 and one minute for Aided 2. Mean word recognition rose from 46% unaided to 88% for Aided 1 and 91% for Aided 2. An interesting finding was that listeners consistently opted for increased level and increased high frequency boost after the first word-recognition test. This finding, though not conclusive, suggests that self-testing, as part of a self-fitting process, can increase the importance of intelligibility (relative to quality) in determining a listener's adjustment criteria. The data support the conclusion that effective self-fitting of amplification is feasible but the effects of hearing-aid experience, starting conditions, the inclusion of self-testing, and user characteristics have yet to be determined.

Podium Paper I.B.

Effectiveness of Premium and Basic Hearing Aid Technologies

Yu-Hsiang Wu, PhD; Elizabeth Stangl, AuD, The University Of Iowa, Iowa City, IA

Although directional microphones (DM) and noise reduction (NR) algorithms are important hearing aid technologies designed to improve listening experience in noise, the evidence of their effectiveness in the real world is limited. Furthermore, it is unknown if more advanced DM/NR currently only available on high-cost, premium hearing aids would provide more benefit than DM/NR of low-cost, basic hearing aids. The purpose of this study was to determine and compare the effectiveness of DM/NR technologies of premium and basic hearing aids. The study used a repeated-measure design with four conditions, which consisted of factorial combinations of hearing aid model (premium and basic) and DM/NR status (on and off). To measure real-world outcomes, standardized questionnaires were used. The participants also used smartphones that delivered surveys several times per day to report their real-time experience with hearing aids (i.e., the ecological momentary assessment; EMA). In total, fifty-one adults completed 8,592 EMA surveys. The results of the questionnaires and EMA indicated that the participants reported better outcomes in the DM/NR-on than -off conditions, supporting the effectiveness of DM/NR. The EMA results further suggested that premium and basic DM/NR had a differential effect on outcomes. The implication of these outcome measures will be discussed.

Podium Paper I.C.

Hearing Aid Gain Preferences in Noisy Rooms

Peggy Nelson, PhD; Dianne Vantasell, PhD; Melanie Gregan, PhD; Trevor Perry, University Of Minnesota, Minneapolis, MN

Noisy restaurants are challenging environments for hearing-aid users and are the source of dissatisfaction for many. Self-adjustment technology can provide custom amplification parameters to accommodate listener preferences in noise. Previous results (Nelson et al, AAS 2015) indicated that as signal-to-noise ratio (SNR) decreases, some listeners reduce hearing aid gain, with significant variability across listeners. Data will be presented from 30 listeners aged 52 - 79 years with mild to moderate hearing loss who self-adjusted amplification parameters in simulated restaurant environments. Participants listened using an iPod Touch running a real-time simulation of a multichannel compression hearing aid, with gain/compression parameters adjustable via a simple user interface (EarMachine). Listeners adjusted amplification parameters while listening to running speech at signal levels of 65 dBC and SNRs of +25 to -10 dB. Listeners' self-adjusted gain in quiet was near that prescribed by NAL-NL2, with slightly higher gain in low-frequency regions and slightly lower gain in high frequencies. On average, listeners selected 9 dB lower gain in the lowest SNR condition. Individual differences from NAL targets were not related to hearing loss or age. Intelligibility testing confirmed that although listeners reduced gain in difficult conditions, reductions seldom interfered with speech understanding. Acknowledgements: NIDCD R01 DC01309301, EarMachine.

Podium Paper I.D.

Impact of Simulated Microphone Directionality on Monitoring Complex Auditory Scenes

Julie Cohen, AuD; Laguinn Sherlock, AuD; Douglas Brungart, PhD, Walter Reed National Military Medical Center, Bethesda, MD

Anecdotal results often suggest that listeners receive less benefit from directional microphone technology in real world listening environments than they do in controlled laboratory experiments. One explanation for this might be that laboratory experiments tend to focus on selective attention tasks, where a listener is asked to focus attention on a single talker at a known location, whereas real-world environments often require listeners to perform divided attention tasks where they attend to a target talker while scanning the auditory scene for important events. This study will assess how directional microphone configurations impact auditory awareness in a task that requires listeners to detect and localize changes in a complex scene, including: 1) addition of a talker; 2) removal of a talker, 3) change in talker identity (e.g., gender), and 4) change in topic of sentences spoken by a talker. Directional hearing will be simulated for normal hearing listeners by adjusting the gain of each source in response to changes in the orientation of their head. Results will be discussed in terms of the impact of directionality on speed and accuracy of change detection in each condition and in terms of the patterns of exploratory head movements that occur in each condition.

Podium Paper I.E.

Application of CROS in Children with Severe Unilateral Hearing Loss

Meghan Wisneski, AuD; Erin Christianson, PhD; Julie Kinsman, AuD; Susan Norton, PhD, Seattle Children's Hospital, Seattle, WA
The purpose of this study was to determine if children with single-sided deafness (SSD) show improved performance on speech perception tasks in noise while using modern contralateral routing of signal (CROS) systems compared to the unaided condition. We hypothesized that CROS-aided speech perception performance would be better than the unaided condition. Thirty-seven children with SSD and normal or near-normal hearing thresholds in the better hearing ear were included in our cohort. Speech perception testing in noise was carried out in a sound-treated booth such that the target signal was directed 90 degrees towards the poorer hearing ear and masking noise was directed 90 degrees towards the better hearing ear (S90ssd/N90nh), relative to 0 degrees azimuth. The results showed that CROS-aided speech perception scores in noise were significantly better than the unaided in noise condition. Modern CROS hearing systems are an appropriate treatment method for children with SSD. This option is a non-surgical approach and should be considered a first step in treatment for SSD. We recommend regular performance evaluations for children who use a CROS system and that this testing is completed in an S90ssd/N90nh, relative to 0 degrees azimuth, configuration.

Podium Paper I.F.

Sentence Recognition in Noise and Reverberation for Children with Hearing Aids

Ryan McCreery, PhD; Benjamin Kirby, PhD; Meredith Spratford, AuD; Marc Brennan, PhD, Boys Town National Research Hospital, Omaha, NE
Elizabeth Walker, PhD, University Of Iowa
Children with hearing loss must listen and understand speech in classrooms and other acoustic environments with noise and reverberation. Significant individual variability in performance across children may be related to differences in auditory experience and cognition. To date, few studies have examined the factors that support listening in noise and reverberation for children who wear hearing aids. The current study included 48 children who wore hearing aids and 48 age-matched peers with normal hearing. We examined how factors related to amplification and cognitive abilities influenced individual differences in sentence recognition in noise and reverberation. We predicted that children with higher aided audibility and more consistent hearing aid use would have better speech recognition in noise and reverberation than peers with poorer audibility or less consistent hearing aid use. Children with strong working memory abilities were also expected to have better speech recognition in noise and reverberation due to an enhanced ability to maintain phonological representations of degraded stimuli during recognition. We found that regardless of hearing status, children with stronger working memory abilities had better speech recognition than peers with poorer abilities. Children with hearing aids who had higher aided audibility also had better speech recognition in noise and reverberation.

PODIUM SESSION II: PHYSIOLOGICAL MEASURES OF THE AUDITORY SYSTEM

Podium Paper II.A.

High Frequency Transient-Evoked Otoacoustic Emission Measurements in Young Adults

Douglas Keefe, PhD; Denis Fitzpatrick, PhD; Marcin Wrobkewski, AuD, Boys Town National Research Hospital, Omaha, NE
Patrick Feeney, PhD; Daniel Putterman, AuD, VA Portland Health Care System, National Center For Rehabilitative Auditory Research, Portland, OR
Angela Garinis, PhD, Oregon Health & Science University, Portland, OR
Lisa Hunter, PhD, Cincinnati Children's Hospital Medical Center, Cincinnati, OH
Transient-evoked otoacoustic emission (TEOAE) responses to clicks and chirps were measured in a low-frequency (LF) band (0.7-8 kHz) and high-frequency (HF) band (7.1-14.7 kHz) in young adults with normal hearing. In each band: (1) a click stimulus was designed to have a flat incident pressure level with minimal temporal dispersion, and (2) six chirp stimuli had an instantaneous frequency that either increased or decreased linearly with time at one of three sweep rates (317, 188, or 53 Hz/ms). TEOAEs were acquired for each stimulus type to compare bandwidth, sweep-rate and level effects. Significant TEOAEs were detected in time and frequency domains based on the signal-to-noise ratio and the coherence synchrony modulus. Click TEOAEs were analyzed in terms of group delay and group spread across frequency, and instantaneous frequency and instantaneous bandwidth across time. Chirp TEOAEs were transformed into equivalent click TEOAEs and analyzed in a manner similar to click TEOAE analyses. These LF and HF stimuli with varying phase characteristics generate TEOAEs sensitive to cochlear function and spatial-temporal suppression. Baseline normative data will be useful in research to improve longitudinal monitoring programs that use HF TEOAEs to predict changes in hearing due to ototoxicity. Supported by NIH R01 DC010202.

Podium Paper II.B.

The Functional Roles of Hair Cells and Spiral Ganglion Neurons in Complex Listening Situations

Mark Parker, PhD, Tufts University School Of Medicine, Boston, MA
Efoe Nyatepee-coo, AuD; Gifty Easow; Richard Hoben, AuD, St Elizabeths Medical Center
The overall aim of this research is to describe the functional roles played by hair cells and spiral ganglion neurons in audition. Several recent lines of research have highlighted the critical functional role of the spiral ganglion in complex listening situations, such as speech recognition in the presence of background noise. This study extends this work to determine whether the outer hair cells also play a role in speech processing during complex listening situations. To test this, normal and hearing impaired subjects (N=25) were subjected to speech recognition testing in quite (NU-6) and in the presence of competing background noise (Quick SIN), and then outer hair cell function (DPOAE amplitude) and spiral ganglion (ABR wave I amplitude) function was measured. Statistical differences between normal and impaired groups was measured by students t-test and ANOVA, and a linear mixed regression model was used to identify correlations between patient age, pure tone average, NU-6 scores, DPAOE amplitudes, and wave I amplitudes. The preliminary results indicate that poorer Quick SIN scores (<5 SNR loss; p=0.00), but not NU-6 scores (p=0.23), are associated with both reduced DPOAE amplitudes (mean 4KHz DPOAE=>-7. 7 +/- 2.2 s.e.m.) and reduced wave I amplitudes (mean peak-trough > 0.12 V+/- 0.05 s.e.m.). Furthermore, there is a stronger correlation between speech recognition in noise and hair cell and spiral ganglion function as the patient ages. These preliminary results suggest that both outer hair cells and the spiral ganglion play a functional role in speech discrimination in the presence of background noise, but not in quiet.

Podium Paper II.C.

Physiological Measures of Hearing After Exposure to Infant Sleep Machines

Andrew Dimitrijevic, PhD; Lisa Hunter, PhD; Michael Smith; David Moore, PhD, Cincinnati Children's Hospital Medical Center, Communication Sciences Research Center, Cincinnati, OH

Infant sleep machines (ISMs) are devices that generate noise, intended to help babies sleep. A recent study showed that ISMs can deliver sounds at levels well above recommended occupational health and hospital nursery standards indicating that some parents might be exposing their children at sound levels capable of causing damage. This study sought to determine whether ISM exposure is related to hearing impairment. We quantified ISM use in children through the use of a parent-based questionnaire. Additionally, sound level measurements of the ISM were performed. In both non-ISM exposed and ISM exposed children, we measured otoacoustic emissions (OAEs), auditory brainstem responses (ABR), auditory steady state responses (ASSRs), and cortical responses to spectral and temporal 'change' responses. Preliminary data from 10 control and 7 ISM exposed children did not show significant differences between the two groups. No differences in OAE thresholds or amplitudes were observed. However, all electrophysiological measures showed reduced, mean, suprathreshold evoked response amplitude in the ISM group, particularly in the youngest of the ISM exposed children. These preliminary findings suggest that ISM exposure does not affect outer hair cell hearing thresholds but may affect suprathreshold hearing. The findings suggest that these children may experience difficulties in noisy environments such as a busy classroom. More data are needed to determine whether more subtle, significant differences are present.

Podium Paper II.D.

Relationship between 20Hz Auditory Steady-State and Transient Auditory Evoked Potentials

Ozcan Ozdamar, PhD; Fred Holt, PhD; Jorge Bohorquez, PhD, University Of Miami, Coral Gables, FL

When the auditory system is stimulated with brief sounds presented at 20Hz, an enhanced amplitude double peaked auditory steady-state response (ASSR) is observed. Spectral analysis shows a large component at 20Hz with a smaller contribution at 40Hz. Although 20Hz ASSR activity has been known to be modulated by attention and different levels of arousal and implicated in several psychiatric disorders, its true nature and relationship to 40Hz ASSRs and transient auditory evoked responses (AEPs) are not known. In this study possible generation mechanisms of the 20Hz ASSRs are studied using synthetically generated responses derived from transient AEPs obtained by deconvolution of recordings at around the same frequency. Simulation studies using peak removals show that waveform interactions of the brainstem, middle and early late response components (V, Na, Pa, Nb and P1) appear to be responsible for such waveform characteristics and account for the observed amplitude increase at this frequency. The first large positive peak of the 20Hz ASSR was mostly generated by V and P1 while Pa was responsible for the second smaller peak. The negative peaks were mostly due to Na and Nb, respectively. Magnitude and phase spectral analysis of the acquired and synthetic waveforms closely matched the results.

Podium Paper II.E.

Neural Correlates of the Binaural Masking Level Difference in Humans
Christopher Clinard, PhD; Sarah Hodgson, James Madison University, Harrisonburg, VA
Processing related to binaural masking level differences (BMLDs) has been confirmed in the auditory brainstem of non-human mammals, but attempts to find neural correlates of BMLD have been largely unsuccessful when studying responses from the human auditory brainstem. BMLDs at 500 Hz were obtained from 14 young, normal-hearing adults (ages 21- 26). Behavioral and physiological testing was performed in three binaural stimulus conditions: SoNo, S-No, and SoN. Both approaches estimated detection thresholds using a traditional bracketing approach across a range of stimulus signal-to-noise ratios. Physiological BMLDs used the frequency-following response (FFR), a scalp-recorded auditory evoked potential dependent on sustained phase-locked neural activity. FFR BMLDs were significantly smaller (poorer) than behavioral BMLDs and did not reflect a physiological release from masking, on average. FFR amplitude was systematically affected by stimulus phase condition and signal-to-noise ratio. FFR amplitude differences between phase conditions (e.g., SoNo amplitude S-No amplitude) were significantly predictive of behavioral S-No BMLDs ($R^2 > 0.8$); individuals with larger amplitude reductions had larger (better) behavioral MLDs and individuals with smaller amplitude reductions had smaller (poorer) behavioral MLDs. These data indicate a role for sustained phase-locked neural activity in BMLDs of humans.

Podium Paper II.F.

The ABR of Bottlenose Dolphins: Noiseburst Risetime and Level
Robert Burkard, PhD, University At Buffalo, Buffalo, NY
James Finneran, PhD, US Navy Marine Mammal Program, San Diego, CA
Jason Mulsow, PhD; Dorian Houser, PhD, National Marine Mammal Foundation, San Diego, CA
Phillips et al. (2001) investigated the effects of noiseburst risetime and level on auditory nearfield responses of chinchillas. When plotted across stimulus SPL, response amplitude was substantially reduced, and response latency was substantially increased, with increasing noiseburst risetime. The effects of risetime on response latency and amplitude largely disappeared when plotted across noiseburst onset slope (in Pa/s). In this study we obtained ABRs in 5 bottlenose dolphins, using suction-cup electrodes placed just behind the blowhole (non-inverting), near the right external auditory meatus (non-inverting), and near the base of the dorsal fin (common). Noisebursts were digitally filtered to flatten the spectrum from 10-160 kHz. Noiseburst risetimes varied from 31.24 s to 4 ms; noiseburst level ranged from 95-145 dB SPL (re: 1 Pa). Dolphins were trained to submerge underwater, and remain in place until ABR collection (1024 sweeps, 20-Hz rate; 100-3000 Hz passband) was completed. When plotted across stimulus SPL, there was an increase in latency and a decrease in amplitude with increasing risetime (and decreasing level). When plotted across onset slope (in Pa/s), the effect of risetime was substantially reduced for peak latency and amplitude for risetimes greater than 0.125 ms.

PODIUM SESSION III: AUDIOLOGY / OTOLOGY AND HEARING TESTING TECHNOLOGY

Podium Paper III.A.

Dynamics of the eVOR Elicited by a Vestibular Prosthesis

James Phillips; *Leo Ling; Christopher Phillips; Kaibao Nie; Jay Rubinstein,* University Of Washington, Seattle, WA

Introduction: Electrical stimulation from a chronically implanted vestibular prosthesis could potentially restore lost vestibular function. In order to provide optimal benefit, the relationship between stimulation pulse amplitude, or stimulation pulse rate, and slow phase eye velocity of electrically elicited VOR (eVOR) must be established. We examined the relationship between these variables in rhesus monkeys and human patients implanted with a vestibular prosthesis. Methods: Subjects who were implanted with a vestibular prosthesis underwent biphasic pulse electrical stimulation that had 1) constant frequency and pulse amplitude, 2) sinusoidally modulated pulse frequency, or 3) sinusoidally modulated pulse amplitude. The slow phase eye velocities that were elicited were compared across stimulation type, and across modulation frequencies. Results: Human subjects and monkeys produced qualitatively similar results. Increasing slow phase eye velocities increased with increasing stimulation pulse frequency or current amplitude. However, comparable constant current and frequency stimulation produced higher slow phase velocities than the same currents and pulse rates during modulated stimulation. Furthermore, high and low modulation frequencies produced less velocity modulation than intermediate modulation frequencies (e.g., 5 Hz). Conclusion: The dynamics of the response to eVOR is complex, and does not match the response dynamics of the normal VOR.

Podium Paper III.B.

Type 1 Diabetes and Hidden Hearing Loss

Christopher Spankovich, PhD, University Of Mississippi Medical Center, Jackson, MS
Colleen Le Prell, PhD; Edward Lobarinas, PhD, University Of Texas At Dallas, Richardson, TX
Linda Hood, PhD, Vanderbilt University, Nashville, TN

The purpose of this study was to examine the relationship between noise exposure background (NEB) and evidence of "hidden hearing loss" in young adults with type-1 diabetes compared to age-sex-matched controls. Forty (20 type-1 diabetes) "normal hearing" (i.e., thresholds 25 dB HL 250 to 8000 Hz) young adults (18-28 years) with variable noise exposure were recruited. TEOAEs, DPOAEs, and ABRs were compared between groups and as related to measures of noise exposure, including the NEB (Stamper & Johnson, 2013), Adolescent Habits and Hearing Protection Use Questionnaire (Olsen & Erlandsson, 2004), and reported temporary changes in hearing. ANOVA and linear regression were performed. No statistically significant differences between groups for noise, OAEs, and ABR outcomes (Waves I and V amplitude/latency) were indicated. In addition, there was no statistically significant relationship of reported noise exposure and auditory function measures. Males and females did show statistically significant differences in OAE and ABR outcomes, but not for reported noise exposure. We were unable to identify a relationship between reported noise exposure and sensitive auditory function outcomes in "normal hearing" young adults with and without type-1 diabetes. Study design and interpersonal variability of noise effects will be discussed as related to hidden hearing loss.

Podium Paper III.C.

Intraoperative Assessment of Air-Bone Gap Closure During Ossiculoplasty

Krzysztof Morawski, MD; Kazimierz Niemczyk, MD; Robert Bartoszewicz, MD, Department Of Otolaryngology, Medical University Of Warsaw, Warsaw, Poland
Erdem Yavuz, PhD; Rafael Delgado, PhD, Intelligent Hearing Systems, Miami, FL
Objective: To assess intraoperative air-bone gap closure (I-ABG-Closure) during ossiculoplasty using round window electrocochleography (RW-ECochG). Methodes and Measures: Forty patients with history of cholesteatoma undergoing second stage ossicular reconstruction surgery were included to this study. During the second look procedure, a needle electrode for RW-ECochG was placed at the RW niche via posterior tympanotomy. Prosthesis placement efficacy was evaluated by intraoperatively measured RW-ECochG. I-ABG-Closure was evaluated in two options. Firstly, as a difference between pre- and postossiculoplasty auditory thresholds for click and tone-bursts, defined as the last intensity for which RW-ECochG-N1 peak was present. Secondly, as an automatic estimation of pre- and postossiculoplasty RW-ECochG-N1 latency changes. Results: Six months postoperative ABG-Closure ranged between 10 to 45 dB and significantly correlated with I-ABG-Closure ($r>0.5$; $p<0.05$). Adjustments in prosthesis configuration and placement resulted in measurable changes in I-ABG-Closure evaluated as a RW-ECochG thresholds and latency shortening. The authors present the minisoftware for automatic I-ABG-Closure estimation. Conclusions: RW-ECochG was found to be a very effective tool for evaluation of I-ABG-Closure showing good correlation with postoperative hearing status in cases of second stage ossiculoplasty. Automatic evaluation of RW-ECochG latency shortening to predict I-ABG-Closure was found to be fast, objective and precise.

Podium Paper III.D.

Wideband Acoustic Immitance: Instrument, Ethnicity, and Gender Specific Normative Data

Navid Shahnaz, PhD; Sukaina Jaffer; Ainsley Ma, University Of British Columbia, Vancouver
This study investigated wideband acoustic immittance (WAI) values in a normal hearing young adult population based on gender, ethnicity, and instrument used. Test-retest reliability was also measured across all systems. Eighty normal hearing young adults (40 Caucasian and 40 Chinese aged between 18-34) were recruited to undergo WAI testing with two hand-held devices (Otostat Mimosa Acoustics and Titan Interacoustics) and two non-portable devices (Reflwin Interacoustics and Mimosa Acoustics HearID). The differences between power absorbance (PA) at ambient and peak pressure, frequency averaged PA (between 0.38 - 2 kHz) as a function of air pressure (wideband tympanometry-WBT in Titan), phase angle, and resonant frequency in these groups and instruments were investigated. Body mass index (BMI) and equivalent ear canal volume was measured to investigate the source of these differences. Mean PA varied across frequencies between devices, ethnicities and genders. Instrument specific data did improve the ability to distinguish between normal and twenty-eight ears with surgically confirmed Otosclerosis using receiver operating characteristics (ROC) curve analysis. It is advised that future research investigating the clinical utility of WAI in middle ear dysfunction incorporate gender, ethnicity, and various instrument specific norms to determine whether these factors improve sensitivity and specificity in identifying various middle-ear pathologies.

Podium Paper III.E.

Forward-Pressure Level Calibration Improves Accuracy and Reliability of Pure-Tone Audiometry

Judi A. Lapsley Miller, PhD, Mimosa Acoustics, Champaign, IL
Sarah R. Robinson, MS; Jont B. Allen, PhD, University Of Illinois At Urbana-Champaign, Urbana, IL
Charlotte M. Reed, PhD; Zachary D. Perez, Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA

Clinical pure-tone audiometry is conducted using headphones or earphones with a coupler (average ear) calibration. Deviations in individual-ear acoustics from average affect test validity, and variations in probe insertion or headphone placement affect test-retest reliability. Using a standard otoacoustic emissions probe, containing a microphone and loudspeaker, an in-the-ear calibration may be performed for each insertion. However, if the stimulus level is set according to the probe microphone pressure, acoustic standing waves in the ear canal cause stimulus level errors at the eardrum as large as 20 dB above 4 kHz, depending on probe depth. Forward pressure level (FPL) calibration removes these errors, and reduces variations due to probe angle. We compare standard audiometry using a modern clinical audiometer to a FPL-calibrated prototype audiometer. The test procedure was similar to those commonly used in hearing-conservation programs, using pulsed-tone test frequencies at 0.5, 1, 2, 3, 4, 6, and 8 kHz, and an automated modified Hughson-Westlake audiometric procedure. Results indicate that reliability is better with FPL calibration and that the improvement is clinically meaningful, potentially allowing hearing-conservation programs to have more confidence in determining significant threshold shifts at 6 and 8 kHz - key frequencies for early detection of noise-induced hearing loss.

Podium Paper III.F.

Development of a Mobile Audiometric Headset with High Passive Attenuation

Odile Clavier, PhD; James Norris, PhD; Jed Wilbur, MS; Sandra Graveson, Creare LLC, Hanover, NH

Meeting the increasing demand for hearing healthcare will require technologies that enable quality screening in non-traditional settings. Mobile technologies offer much promise in terms of reach, however, they cannot ensure a quiet environment to accurately measure thresholds. We present on the engineering development of a headset specifically designed for audiometric applications, with earmuffs that provide high passive sound attenuation. Although significant attenuation can be obtained with deeply-set insert earphones, circumaural earmuffs are easier to use and provide reliable noise attenuation, even with un-trained users. Designing high attenuation earcups requires trade-offs between volume, mass, ear cushion compression, comfort, and ergonomics. To enable mobile testing, the audiometer electronics were designed to fit entirely within the earcups and communicate with mobile devices over Bluetooth. The added electronics added another challenge to attenuation. Ultimately, Real Ear Attenuation At Threshold (REAT) measurements shows this design can achieve an average of 30 to 40 dB of attenuation at all frequencies tested between 250 Hz and 8000 Hz, using the ANSI S12.6-2008, Method A on 20 human subjects. Such high attenuation will allow quality hearing screening in settings not specifically designed for audiometry, such as schools, industrial sites, and point-of-care locations.

PODIUM PRESENTATIONS: Saturday, March 5, 2016

PODIUM SESSION IV: COCHLEAR IMPLANTS

Podium Paper IV.A.

Cochlear Implantation in Cases of Single-Sided Deafness

Margaret Dillon, AuD; Emily Buss, PhD; Meredith Anderson, AuD; Kevin Brown, MD; Harold Pillsbury, MD, University Of North Carolina At Chapel Hill, Chapel Hill, NC
English King, AuD; Ellen Deres, AuD, UNC Health Care

Single-sided deafness (SSD), where the patient has one poor ear and one normal hearing ear, results in reduced speech perception abilities in noise, localization abilities, and quality of life as compared to normal hearers. Current SSD treatment options route the signal from the affected side to the normal hearing ear. The ability to use binaural cues for improved speech perception in noise and localization has been variable with these technologies. It is of interest whether cochlear implantation of the affected ear would benefit recipients on such tasks due to stimulation of the auditory pathway on the affected side. The objective of this study was to assess subjective benefit, localization, and speech perception abilities in spatially separated noise of cochlear implant recipients with SSD. Subjects completed the test battery preoperatively, and one, three and six months postoperatively. Three listening conditions were assessed: unaided, bone-conduction device, and cochlear implant. Subjects experienced an improvement with their cochlear implant on measures of localization and speech perception, which was in line with their subjective report. Cochlear implantation in cases of SSD may provide improved speech perception in noise, localization, and subjective benefit as compared to an unaided listening condition or with currently approved treatment options.

Podium Paper IV.B.

Physiological Responses to Acoustic Stimulation in Cochlear Implant Users

Paul Abbas, PhD; Viral Tejani, AuD; Carolyn Brown, PhD; Rachel Scheperle, PhD, University Of Iowa, Iowa City, IA

We use neural telemetry system of the Nucleus cochlear implant and acoustic stimulation to measure cochlear microphonic (CM) and neural responses (neurophonic and compound action potential) from an intracochlear electrode in Hybrid CI users. Our goal is to better understand the pathophysiology behind the loss of acoustic hearing experienced by a subset of Hybrid CI users as well as gaining a better understand how acoustic and electrical signals interact. We have recorded responses to broadband clicks and 500-Hz tonebursts in over 40 individuals with high frequency hearing loss to date. The majority of individuals show a clear growth of both CM and neural response measures and physiological thresholds correlate with behavioral thresholds. In a subset of our subject pool, however, showed clear growth of CM but no neural response, suggesting a pathology of hearing loss related to synaptic or neural dysfunction as opposed to damage to the hair cells. We also made repeated measures over the first year post implant. Most subjects showed no change in threshold but a small group experienced a delayed loss of their acoustic hearing, both behaviorally and in both CM and neural responses, suggesting a presynaptic etiology of hearing loss in these cases.

Podium Paper IV.C.

Low-Frequency Conductive Component Following Cochlear Implantation with Med-El Internal Device

Jessi Middaugh, AuD; Carrie Slough, AuD; Timothy Hullar, MD; Angie Garinis, PhD; Brittany Wilson, Oregon Health & Science University, Portland, OR

Loss of residual sensory hearing following cochlear implantation is common due to inner-ear trauma associated with surgical placement of the electrode array. Recent evidence has shown that patients develop a post-surgical conductive component in their low-frequency residual hearing that did not exist prior to implantation. The present study is a retrospective and prospective examination of patients who received the Med-EL Concert or Synchrony internal device which has an electrode array marketed to preserve cochlear structure and residual hearing following implantation. Clinical audiometric data including, tympanometry, air and bone conduction thresholds will be discussed for pre- and post-implant evaluation. Preliminary results from three patients suggest that when hearing is preserved in the apical region of the cochlea after surgery, a low-frequency air-bone gap ranging between 20 dB HL and 50 dB HL is evident, suggesting conductive pathology.. These findings indicate that anatomical changes or trauma during implant surgery may produce a low-frequency conductive component. Pre- and post-implantation evaluations should include bone conduction threshold testing to monitor for such changes. Identifying the source of this loss would be useful for modifying current surgical techniques or device development for preserving residual hearing post-implantation.

Podium Paper IV.D.

Evaluation of Fine Structure Coding Strategies in Cochlear Implants

Douglas Sladen, PhD; Ann Peterson, MA, Mayo Clinic, Rochester, MN
Chang Liu, PhD, University of Texas at Austin, Austin, TX

Older implanted adults have more difficulty with speech in noise recognition than younger implanted adults. Temporal processing deficits have been suggested as a possible underlying reason for age-related differences. It is possible that temporal fine structure in speech coding strategies offer older implanted adults additional benefits, though this hypothesis remains untested. This study compared the performance of older and younger implanted adults to explore how patients make use of fine structure cues compared to traditional envelope coding strategies. To date, fifteen adult cochlear implant listeners have participated in a crossover experiment. Participants were asked to use high definition continuous interleaved sampling (HDCIS) and fine structure processing (FS4/FS4-p); each for a three month period. After each three-month interval, a test battery comprised of temporal modulation detection thresholds (TMDT), consonant recognition (CR), and speech in noise recognition was completed. At study completion, participants were asked to indicate their preferred coding strategy. Preliminary results demonstrate equivalent outcomes in TMDTs and CR scores for all ages when using HDCIS and FS4/FS4-p, though speech recognition in noise testing shows an advantage for fine structure processing. No age-related performance differences were found. These results have clinical implications on selection of appropriate sound coding strategies.

Podium Paper IV.E.

Spectral Modulation Detection in the Non-Implanted Ear Predicts Bimodal Benefit

Rene Gifford, PhD; Linsey Sunderhaus, AuD; Adrian Taylor, AuD; Tim Davis, AuD; Jourdan Holder; Susan Reynolds, Vanderbilt University, Nashville, TN

Tony Spahr, PhD, Advanced Bionics, Valencia, CA
Michael Dorman, PhD, Arizona State University, Tempe, AZ
Most cochlear implant (CI) candidates have acoustic hearing in one or both ears. Studies have shown that acoustic hearing provides significant benefit when paired with a CI in a bimodal listening configuration. The degree of bimodal benefit, however, varies across ears and is generally not correlated with audiometric threshold, etiology, age, or preoperative speech recognition. At present, there is no clinical measure providing predictive utility for selecting an ear to be implanted - a critical consideration when bilateral implantation may be restricted. The quick spectral modulation detection (QSMD) task is a modified version of a validated psychophysical procedure assessing spectral resolution. We have replicated a previous study1 examining the utility of the acoustic QSMD task (rate = 1 cyc/oct) as a predictor of bimodal benefit. In a group of 50 postlingually deafened adult CI users, we found a significant correlation between QSMD and bimodal benefit for AzBio sentence recognition in noise at +5 dB. We did not observe a correlation between audiometric thresholds and bimodal benefit, though there was a trend for those with lower (i.e. better) thresholds to derive bimodal benefit. The acoustic QSMD task can provide information regarding the predictive utility of a given ear to add bimodal benefit. 1 Zhang T, Spahr AJ, Dorman MF, Saoji A. (2013). The relationship between auditory function of non-implanted ears and bimodal benefit. Ear Hear. 34(2):133-41.

Podium Paper IV.F.

Binaural Pitch Fusion with Bilateral Cochlear Implants

Lina Reiss, PhD; Curtis Hartling, AuD; Jennifer Fowler, AuD, Oregon Health & Science University, Portland, OR
Recent studies show that adults who use hearing aids or bimodal cochlear implants (CIs) experience abnormally broad binaural pitch fusion, such that sounds differing by as much as 3-4 octaves in pitch are fused across ears; normal-hearing listeners only fuse tones differing by less than 0.01-0.03 octaves. The goal of this study was to determine whether adult bilateral CI users also experience broad binaural pitch fusion. Stimuli were pulse trains delivered to individual electrodes. Fusion ranges were measured using simultaneous, dichotic presentation of reference and comparison stimuli in opposite ears, and varying the comparison stimulus to find the range that fused with the reference stimulus. Bilateral CI listeners had binaural pitch fusion ranges varying from 0-11 mm (average 4.9 - 3.3 mm), equivalent to 0-18.7 Cochlear electrodes or 0.5-5 Med-EL electrodes or 1.2 octaves in the frequency domain. No correlations were observed between fusion ranges and within-ear electrode discrimination abilities, indicating that broad fusion is more likely due to central auditory processing differences in how information is combined binaurally, rather than peripheral factors such as poor electrode discrimination. This broad fusion and the associated binaural averaging of spectral information may explain the variability of binaural benefits in bilateral CI users.

Podium Paper IV.G.

Enhancing Streaming and Improving Intelligibility in Cochlear Implant Simulation

Frederic Apoux, PhD; Brittney Carter; Eric Healy, PhD, The Ohio State University Wexner Medical Center, Columbus, OH
Thus far most attempts to improve speech intelligibility in noise for cochlear implant (CI) users have consisted of trying to suppress the background noise. The current approach

differs fundamentally from these attempts, as the goal is to improve intelligibility in noise while preserving the richness of the acoustic environment. To achieve this goal, we have developed two techniques that enhance existing and/or introduce new segregation cues. The first technique, referred to as dual-carrier processing, consists of transmitting the target speech and background on separate carriers. The second technique involves distinct envelope filter cutoffs for each signal. Both techniques were evaluated in CI simulation. The results of this evaluation showed that each technique can improve speech intelligibility in noise compared to traditional CI simulation by up to 50% points. Combining the two techniques improved intelligibility by up to 60% points. In comparison, normal-hearing (NH) listeners' performance on unprocessed speech in noise was 70% points above that of traditional CI simulation, a mere 10% points above the performance achieved using our techniques. In other words, the combined improvement reported here suggests the possibility for CI users to nearly match the performance of NH listeners in noise while preserving the background.

Podium Paper IV.H.

Effectiveness of an Automatic Directional Microphone for Cochlear Implant Recipients

Smita Agrawal, PhD, Advanced Bionics, LLC, Valencia, CA

Most cochlear implant (CI) recipients face dynamic and challenging listening situations every day. Directional microphones (DM) have been shown to effectively improve face-to-face speech understanding in noise. Automatic DM activation in noise would allow listeners to use and benefit from such technology more easily. The autoUltraZoom feature available on Advanced Bionics Naida CI Q90 sound processors uses an automatic scene classifier to analyze the listening environment and independently activate an omnidirectional microphone (T-Mic2, processor mic or 50/50) in quiet and a DM (UltraZoom) in noise. The objective of the present study was (1) to examine whether autoUltraZoom selects the correct microphone mode in quiet and in noise and (2) to evaluate its effect on speech understanding in quiet and in noise as compared to its manual counterparts (T-Mic2 and UltraZoom). Speech understanding was evaluated in 20 Advanced Bionics CI recipients with AzBio sentences presented from 0 in quiet and in Phonak Cantina Noise from ±90 and 180. Following mic modes were evaluated randomly and compared: T-Mic2, UltraZoom and autoUltraZoom. ClearVoice (medium) was active in all programs. Results will be presented at the meeting.

PODIUM SESSION V: PSYCHOACOUSTICS, SPEECH PERCEPTION AND LISTENING EFFORT

Podium Paper V.A.

Influence of Musical Training on Spectral Ripple Perception

Evelyn Davies-Venn, PhD, University Of Minnesota, Minneapolis, MN

Musicians often endure countless hours of training to hone their craft. Such training induces neural plasticity and enhances cognitive skills. Recent studies show that musical training also enhances peripheral auditory processing abilities such as sensitivity to temporal fine structure and narrowband frequency resolution. This study evaluated

whether musician enhancement in frequency resolution can be generalized to broadband spectral resolution. Spectral rippled noise shares similar complex spectra as speech, but it is void of context and linguistic cues, which are strongly influenced by enhanced cognitive skills and may confound speech perception results. It also predicts speech scores in quiet and noise for listeners with normal hearing and hearing loss. Thus, rippled-noise might be sensitive to peripheral mechanisms that underlie enhanced speech perception in musicians. This study evaluated broadband spectral resolution in musicians and non-musicians with normal hearing. We tested the hypothesis that musicians have enhanced broadband spectral resolution abilities. Spectral modulation transfer functions were measured to determine whether musicians had lower spectral modulation detection thresholds compared to age-matched non-musicians. Results to date show slight musician enhancement in spectral processing, but this effect is modulated by the intensity of musical training. The clinical implications of these findings for auditory-rehabilitation will be discussed.

Podium Paper V.B.

Reduced Masking Release Revealed in Glide Detection for Hearing-Impaired Listeners

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Evelyn Davies-venn, PhD; Peggy Nelson, PhD, University Of Minnesota, Minneapolis, MN
Adam Svec, PhD, Starkey Hearing Technologies, Eden Prairie, MN

Detection of frequency change is important for formant detection and for understanding complex signals such as speech. The temporal envelope of noise can interfere with speech understanding and lead to reversed masking release in hearing-impaired (HI) listeners. This study demonstrates such interference on detection of frequency change for pure tones. Frequency change detection thresholds were measured using 60-ms upward-sweeping pure tone glides with initial frequencies of 1250 and 2500 Hz. Glides were presented in quiet, steady noise and gated noise to normal-hearing (NH) and HI listeners compensated for audibility. Results showed that NH listeners experienced improvement in glide detection thresholds for gated over steady noise, indicating masking release. Their glide thresholds in either noise positively correlated with glide thresholds in quiet, suggesting an effect of frequency selectivity on glide detection in both types of noise. In contrast, HI listeners demonstrated no or reversed masking release for their glide thresholds. Their glide thresholds in gated noise positively correlated with pure tone thresholds instead of glide thresholds in quiet, suggesting other mechanisms (e.g. envelope confusion) rather than frequency selectivity explaining the no/reversed masking release. Results have implications for understanding masking release for hearing loss and amplification outcomes in fluctuating noise.

Podium Paper V.C.

Non-Native English Speakers' Spectral Integration of English Speech

Lauren Calandruccio, PhD, Case Western Reserve University, Cleveland, OH
Emily Buss, PhD, University Of North Carolina, Chapel Hill, NC

Compared to their native speaking peers, non-native speakers of English often have greater difficulty recognizing English speech in noise. This is true even for highly proficient sequential bilingual speakers who have near perfect English perception in quiet. It is possible that their poor performance is due, in part, to an inability to integrate sparse

spectral information when the speech of interest is masked by competing noise. To determine spectral-integration abilities of non-native English speakers 20 sequential Mandarin (native language)/English (second language) bilinguals and 10 monolingual English listeners were recruited. The first two listening conditions estimated the bandwidth associated with 20% correct for English speech filtered into a band centered on either 500 or 2500 Hz. These listener specific bandwidths were then used to estimate listeners' English speech recognition for three conditions: low frequency band alone, high frequency band alone, and low plus high frequency band together. Non-native speakers of English needed a wider bandwidth to perform similarly to native speakers of English in both the low and high band conditions. However, natives and non-natives were equally efficient at combining spectral information across two (low and high) English speech bands.

Podium Paper V.D.

Prevalence and Verification of Communication Deficits in Blast-Exposed Service Members

Lee Ann Horvat, MS, AuD; Lina Kubli, PhD; Lynn Bielski, PhD; Douglas Brungart, PhD; Jacqueline Jackson, AuD; Melissa Kokx-Ryan, AuD; General Lee, BS, BA; Olga Stakhovskaya, AuD, PhD; Kenneth Grant, PhD, Walter Reed National Military Medical Center, Bethesda, MD
Hector Galloza, MS, Independent Contractor for Creare, LLC

There is both anecdotal and objective evidence to suggest that active-duty service members who have been exposed to high-explosive blasts may experience significant problems understanding speech in noisy and complex listening environments that far exceed what would be predicted based on their audiogram alone. As a result, there are serious gaps in our current capability to effectively characterize the functional auditory deficits reported by Service Members or through yearly monitoring of hearing thresholds. Recently, rapid screening tools consisting of short surveys and brief listening tests have proven useful in identifying individual Service Members who have difficulty understanding speech even though they have normal hearing thresholds. Preliminary data will be reported from a multi-site study on 1) the prevalence of self-perceived difficulties understanding speech in noisy environments by Service Members with normal to near-normal hearing, 2) the relationship between self-perceived speech communication deficits, exposure to high-intensity blasts, and performance on functional measures of speech and binaural hearing, and 3) central auditory processing (primarily related to temporal and binaural cues) and cognitive-communication processing skills (primarily related to memory, attention, and speed of processing) in normal-hearing, blast-exposed listeners with demonstrated functional communication deficits.

Podium Paper V.E.

Modality Effects on Sensory and Cognitive Resources in Multitask Listening

Lynn Bielski, PhD; Ken Grant, PhD, Walter Reed National Military Medical Center, Bethesda, MD

Everyday listening situations are complex, and require listeners to allocate sensory and cognitive resources between the desired signal(s) and events in the background. Numerous studies have shown that in these complex environments, listeners often use visual cues to supplement audition, and there is broad consensus that auditory-visual (AV) speech perception provides substantial benefits over auditory-alone (AO) speech perception.

These benefits include faster, more accurate, better recollection, and subjectively less perceptual effort for speech inputs. Given the many advantages of AV over AO speech perception, one might predict that the ability to monitor changes in the background while communicating with a speaker in the foreground would be significantly better in the AV mode. To test this assumption, a divided attention test with AV or AO topic-related sentences as the primary task and the detection of silent gaps in a background noise as the secondary task. Performance on the topic identification task was evaluated at equal performance levels and equal SNR. Performance on the gap detection task was evaluated for three different gap durations. Results will be discussed in terms of the allocation of sensory and cognitive resources, perceptual effort and potential rehabilitative strategies for those with hearing loss and/or cognitive impairment.

Podium Paper V.F.

Changes in Alpha Power and Pupil Dilation During Sentences Degraded by Noise and Channel Vocoding

Catherine McMahon, PhD; Isabelle Boisvert, PhD; Peter Delissa, PhD; Louise Granger; Ronny Ibrahim, PhD; Chi Lo; Macquarie University, North Ryde

Listening effort is influenced by both the clarity of the auditory signal as well as the cognitive resources available, and it is recognised that assessment of this in a clinical setting might increase the sensitivity of speech perception tests. This, in turn could facilitate targeted rehabilitation or better comparison of signal processing strategies. Changes in pupil dilation and alpha power (8-13Hz) have been shown to be associated with speech perception tasks which vary in intelligibility. However, the relationship between these objective measures and changes in signal-to-noise ratio or performance (word or sentence recognition) is not simple. Further, it is not clear whether these objective measures behave in the same way for the same change in signal degradation or whether they reflect different processes which are independently associated with cognitive load. Therefore, in this study, we simultaneously measured changes in pupil dilation and alpha power (electroencephalography) in 18 young adults with normal hearing using 16- and 6-channel noise vocoded sentences at signal-to-noise ratios between +7 and -7dB. We demonstrate the relationships between the objective correlates, sentence recognition performance and signal-to-noise ratio and show differences in the behaviour of alpha power and pupil dilation with signal degradation.

Podium Paper V.G.

Concurrent Processing of Spoken Language and Visual Stimuli in Preschool Children

Tina M. Grieco-Calub, PhD; Kristi M. Ward, Northwestern University, Evanston, IL

Children are often expected to simultaneously process auditory and visual stimuli. The purpose of this study was to determine how spoken language processing is influenced by visual stimuli varying in complexity and redundancy with the speech stimulus. Two groups of three-year-old typically-developing children performed a word recognition task while listening to auditory-only speech or while concurrently viewing a (a) flashing light; (b) static image of a female; (c) female producing target speech; or (d) female producing non-target speech. Groups were assigned to a quiet environment or an environment containing speech maskers at 0 dB signal-to-noise ratio. An eye-tracking paradigm quantified the accuracy and speed of spoken language processing. Results revealed faster and more accurate language processing during auditory-only trials than during trials with visual

stimuli in the quiet and speech masker environments. This suggests that concurrent visual stimuli interfere with language processing in preschool-aged children. Additionally, children exposed to the speech masker were slower, but equally accurate, at processing language than children in quiet for all conditions except trials containing the female producing target speech. This suggests that redundant visual speech preserves the speed of language processing in children in noisy environments. Implications for preschool classrooms will be discussed.

Podium Paper V.H.

Listening Effort Measured Across Different Cochlear Implant Profiles

Ann Perreau, PhD; Diana Irwin, Augustana College, Rock Island, IL
Bailey Tatge; Yu-hsiang Wu, PhD, University Of Iowa, Iowa City, IA

Several studies have examined listening effort in individuals with hearing loss to determine the extent of impairment. Regarding cochlear implants (CIs), results have found that listening effort is improved using bilateral CIs compared to unilateral CIs. However, few studies have investigated listening effort and the short electrode CI. The purpose of this study was to compare listening effort across four CI groups, and to a normal hearing control group. The participants completed a dual-task paradigm with a primary task identifying sentences in noise and a secondary task measuring reaction time on a Stroop test. Performance was assessed at different signal-to-noise ratios (SNR), ranging in 2-dB steps from 0 to +10 dB, which was individually selected based on the individual's SNR-50, or SNR required to correctly repeat 50% of the sentences. The participants also completed subjective questionnaires and a reading span test. Results revealed a significant decrease in listening effort for listeners with normal hearing compared to bilateral and unilateral CI groups. Interestingly, there was no significant difference in listening effort between individuals with normal hearing and a short electrode CI. Finally, results found that age and reading span were significantly correlated with listening effort.

PODIUM SESSION VI: TINNITUS, HEARING HEALTH AND EPIDEMIOLOGY

Podium Paper VI.A.

The Healthcare Cost of Tinnitus Management in the UK

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David Stockdale, British Tinntius Association
Don Mcferran, Colchester Hospital University NHS Foundation Trust
Peter Brazier, Optimity Advisors
Tony Kay, Aintree University Hospital NHS Foundation Trust
Christopher Dowrick, University of Liverpool

As health services come under increasing economic pressures to deploy resources more effectively there is a need to demonstrate the value of tinnitus therapies, and how value may be continuously enhanced. The objective of this project was to quantify the economic value of tinnitus therapies provided by the NHS differentiating between the common therapies currently available. Treatment pathways, costs, and health outcomes were determined from the tinnitus literature, national statistics, a patient survey, and expert opinion. These were used to create an economic model. We calculated cost of treatment per patient, average health outcome per patient (QALYs gained), and cost-effectiveness (cost

per QALY gained). The average cost of treatment per patient per year was estimated to be GB£717, equating to an NHS healthcare bill of GB£2.7billion per year. Across all pathways, tinnitus therapy costs £10,600 per QALY gained. Sensitivity analyses had little effect on the estimate. NHS provisions for tinnitus are therefore cost-effective against the National Institute for Health and Clinical Excellence cost-effective threshold, and spending on other comparable conditions. Most therapies help, but education alone offers very small QALY gains. The most effective therapies in the model were delivered within audiology.

Podium Paper VI.B.

Can we Develop a 'Silver Bullet' for Tinnitus' Nanotheranostic Perspective

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Avril Holt, PhD, Department Of Anatomy & Cell Biology, Wayne State University School Of Medicine, Detroit, MI
Magnus Bergqvist, PhD; James Castracane, PhD, SUNY Polytechnic Institute, Colleges of Nanoscale Science & Engineering, Albany, NY

With over 50 million individuals affected by tinnitus and with approximately 3 million disabled by this condition, new approaches are urgently needed for diagnosis and treatment. Herein, we describe a theranostic nanoparticle-based platform to localize and treat tinnitus by attenuating hyperactive neural activity in affected brain regions. The multi-functionality of the nanoparticles (NPs) is the driving force underlying this approach, since: 1) their exterior surface can be decorated with multiple ligands which allows for targeting specific receptors in the brain responsible for tinnitus-related hyperactivity and for crossing the blood-brain-barrier (BBB), 2) contrast agent can be encapsulated within the NPs allowing for spatial localization of tinnitus-related areas in the brain using MRI, and 3) the central core can be charged with a pharmacological agent, whereby a payload of drugs can be delivered to a specific brain region where the receptors reside to attenuate and/or eliminate the tinnitus-related hyperactivity. Initial ex vivo and in vivo experiments indicate that capsid-based NPs are able to bind to Hep/G2 cells in vitro and in vivo and are able to cross the BBB. Current studies underway seek to optimize NP concentrations, load therapeutics/imaging agents, and explore over expressed receptor targets for delivery to specific brain regions.

Podium Paper VI.C.

A Novel Intervention to Promote Help Seeking for Hearing Loss

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Claus Nielsen, PhD; Ariane Laplante-Levesque, PhD, Eriksholm Research Centre, Snekkersten

Our research has shown that the constructs of the Transtheoretical Model (Prochaska & DiClemente 1983) and the Health Belief Model (Rosenstock 1966) can be applied to understanding hearing health behaviors. The combination of perceiving fewer benefits and more barriers, having lower self-efficacy, and encountering fewer cues to action is associated with lower likelihood of seeking help for hearing difficulties. We therefore developed a counseling-based intervention targeting these attitudes that limit behavior change with the goal of changing these attitudes and thus increasing help-seeking behavior. The intervention is designed for use by primary care physicians or community health workers and thus does not require audiological knowledge. It is brief (<10 minutes) and

aims to change the individual's intrinsic/autonomous motivation to seek help. Data from up to 100 individuals surveyed twice over a 6-month period will be presented, half of whom received the intervention and half of whom did not. Baseline and follow-up data will be presented along with outcomes regarding help-seeking and hearing aid uptake.

Podium Paper VI.D.

Addressing Hearing Health Care Disparities in a Rural Hispanic Community

Nicole Marrone, PhD; Daisey Sanchez; Adriana Sanchez; Stephanie Adamovich, PhD, Speech, Language, And Hearing Sciences, University Of Arizona, Tucson, AZ
Maia Ingram; Jill De Zapien, BA; Scott Carvajal, Mel And Enid Zuckerman College Of Public Health, University Of Arizona, Tucson, AZ
Rosie Piper, Mariposa Health Clinic, Nogalez, AZ

U.S.-Mexico border communities face numerous challenges to accessing health care services limiting preventive care for hearing health and leading to under-diagnosed hearing loss. We developed and tested a Community Health Worker (Promotora) program on hearing health and wellness, Oyendo Bien, to address hearing health disparities seen within a rural community. Here we report on initial analyses of the pilot program. The Promotoras lead two 5-week pilot intervention programs that focus on hearing health education within the context of a supportive group environment. Promotoras recruited persons with hearing loss and their communication partners to participate. Enrollment interviews were conducted one week prior to the program. The program sessions were observed for treatment fidelity. Outcomes were evaluated two weeks after program completion and longitudinally using a mixed-methods approach. The pilot program was both feasible and well received. Persons with hearing loss and communication partners significantly improved in enjoyment of life, self-efficacy to manage hearing loss, and family communication. Preliminary analyses suggest sustained benefits over time. The engagement of community health workers in addressing hearing health in communities that suffer disparities can be an effective way to tailor intervention strategies to community characteristics and increase cultural relevance. [Research supported by NIH/NIDCD.]

Podium Paper VI.E.

Risk Factors for Hearing Loss among Children Aged 0-17 Years

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Christa L. Themann, MA, Hearing Loss Prevention Team, National Institute For Occupational Safety And Health (niosh), Cdc, Cincinnati, OH

Objective: Describe hearing impairment (HI) and risk factors for children. Methods: The 2014 National Health Interview Survey-Child Supplement (NHIS-CS) is the first large-scale, nationally-representative survey on hearing of U.S. children (n=13,380). Parents/caregivers were interviewed by Census Bureau staff and reported HI ('a little trouble', 'moderate trouble', 'a lot of trouble', or 'deaf'). Information was collected on early childhood development, hearing screening, specialist referrals, communication difficulties, 3+ ear infections-past year, ear tubes ever inserted, loud noise exposure, use of hearing protection and hearing aids. Logistic regression models were statistically-adjusted for covariates using national sampling weights. Results: HI was reported for 1.4 million, 1.94%

(males, 2.12%; females, 1.75%). Prevalence was lowest, 1.17%, ages 0-5; increased to 2.49%, ages 6-11, and 2.14%, ages 12-17. Percent with HI referred to hearing specialists (past five years) was 83.26%, 65.30%, and 78.66% for ages 0-5, 6-11, and 12-17, respectively. For 'moderate-to-worse' HI children (0.4 million, 0.56%), 32.1% were currently using hearing aids. In multivariable logistic models, risk factors were: age >6 years, 3+ ear infections-past year, ear tubes ever inserted, and early developmental delay. Conclusion: The 2014 NHIS-CS provides nationally-representative hearing health information for U.S. children.

Podium Paper VI.F.

Dizziness and Falls in Older Adults: Iceland AGES-RS Longitudinal Study

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Hannes Petersen; Palmi Jonsson, University of Iceland, Reykjavik, Iceland
Charles Della Santina, Johns Hopkins University
Gudny Eiriksdottir; Vilmundur Gudnason, Icelandic Heart Association, Kopavogur, Iceland
Diana Fisher, National Eye Institute, NIH

Background: Older adults have high risk of falls resulting in serious morbidity and mortality. Objective: Identify risk factors of falling for preventive interventions. Methods: Falls and associated risk factors were analyzed using data from the Age, Gene/Environment Susceptibility-Reykjavik Study (AGES-RS), a population-based, longitudinal cohort of 5,764 adults, aged 66-96 years in 2002-2006; 3,411 survivors were re-interviewed/examined five years later in AGES-RS II. Results: Among 3,411 returning adults, aged 72+ years, falling (past 12 months) prevalence in AGES-RS I was 17.6% (15.0%, males; 19.5%, females), and five years later in AGES-RS II was 23.0% (21.2%, males; 24.2%, females). Falling (past 12 months) was associated with: dizziness (odds ratio, OR=1.8; 95% confidence interval, CI=1.5-2.3); hospitalization (past five years) (OR=1.4; CI=1.1-1.8); frequent doctor visits (past 12 months) (1.5; CI=1.2-1.9); recent hip pain (OR=1.4; CI=1.1-1.8). Among AGES-RS participants who reported falling in past 12 months, 65.9% fell again within five years. Falling prevalence (past five years) in AGES-RS II was 51.1% (48.0%, males; 53.0%, females). Among participants who fell (past five years), 41.4% reported one or more associated dizziness symptoms: spinning/floating sensation, 17.0%; light-headedness, 7.0%; presyncope, 10.9%; oscillopsia, 2.5%; unsteadiness, 28.3%. Conclusion: Dizziness contributes substantially to falling risk among older adults.

Podium Paper VI.G.

Hyperacusis: Prevalence and Risk Factors in the US Adult Population

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Howard Hoffman, MA; Katalin Losonczy, MA, NIDCD

For the first time in 2014, the US National Health Interview Survey asked respondents about hyperacusis: "Some people are bothered by everyday sounds or noises that don't bother most people. Do everyday sounds, such as from a hair dryer, vacuum cleaner, lawnmower, or siren, seem too loud or annoying to you" Responses were weighted to ensure nationally representative estimates of prevalence and risk factors: 14.1 million civilian, non-institutionalized US adults (5.9% of adults) have "hyperacusis" by this definition. While most consider this to be no problem or a small problem, about 4.3 million US adults (1.8% of adults) consider it a moderate problem or worse. Univariate predictors

of “hyperacusis” included self-reported hearing impairment (especially difficulties communicating in noise), female sex, older age, higher education level, tinnitus (especially tinnitus severity), current hearing aid use, occupational noise exposure, severe emotional problems, and severe headaches or migraine. In multivariate models, all of these except for hearing aid use were significant risk factors for “hyperacusis” and/or “moderate or worse problem.” However, the age effect was reversed: after accounting for hearing impairment and other variables, adults aged 40 or more were less likely to have a moderate or worse problem than younger adults.

Podium Paper VI.H.

Acoustic Reflex Prevalence in the United States

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Acoustic reflexes are invoked as a protective mechanism by some damage-risk criteria (DRC). However, acoustic reflexes are not always observed among people without auditory dysfunction, and should not be included in DRC unless there is 95 % certainty that 95 % of the population have acoustic reflexes. We present the prevalence of acoustic reflexes among people 12 years and older (N > 11,400), using data from the National Health and Nutrition Examination Survey (NHANES). The NHANES can be used to produce prevalence estimates generalizable to the non-institutionalized US population. Ipsilateral reflexes were screened at two elicitor frequencies and detected using Frequentist methods and via Kalman filtering of the reflex trace. Reflexes are pervasive only among those with hearing thresholds better than 15 dB HL at all frequencies, and fall below the criterion certainty with poorer sensitivity even at lower frequencies. Age and tympanometric variables are also related to reflex detection. Reflex prevalence is generally high among young people with adequate hearing sensitivity for unrestricted military duty, but the prevalence is not uniform among audiometric configurations within this hearing profile.