

1. This document is created for accessibility and is intended to be a supplemental resource. If you would like to print a hard copy of this document, please follow the general instructions below to print multiple slides on a single page or in black and white.
2. This handout is for reference only. Non-essential images have been removed for your convenience. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.
3. Copyright: Images used in this course are used in compliance with copyright laws and where required, permission has been secured to use the images in this course. All use of these images outside of this course may be in violation of copyright laws and is strictly prohibited.
4. Social Workers: For additional information regarding standards and indicators for cultural competence, please review the NASW resource: Standards and Indicators for Cultural Competence in Social Work Practice
5. Need Help? Select the “Help” option in the member dashboard to access FAQs or contact us.

How to print Handouts

On a Mac

- Open PDF in Preview
- Click File
- Click Print
- Click dropdown menu on the right “preview”
- Click layout
- Choose # of pages per sheet from dropdown menu
- Checkmark Black & White if wanted.

On a PC

- Open PDF
- Click Print
- Choose # of pages per sheet from dropdown menu
- Choose Black and White from “Color” dropdown

No part of the materials available through the continued.com site may be copied, photocopied, reproduced, translated or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent of continued.com, LLC. Any other reproduction in any form without such written permission is prohibited. All materials contained on this site are protected by United States copyright law and may not be reproduced, distributed, transmitted, displayed, published or broadcast without the prior written permission of continued.com, LLC. Users must not access or use for any commercial purposes any part of the site or any services or materials available through the site.





Clinically-Relevant Hearing Aid Research, in partnership with Vanderbilt University

Erin M. Picou, AuD, PhD

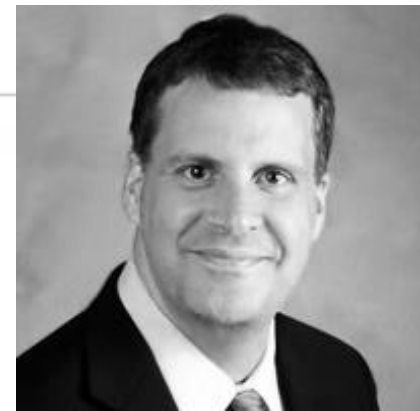
Todd A. Ricketts, PhD



Erin Margaret Picou

AuD, PhD CCC-A

Erin Picou is an associate professor in the Department of Hearing and Speech Sciences at Vanderbilt University Medical Center. She currently directs the Hearing and Affect Perception Interest (HAPI) laboratory, which is funded through a variety of industry and federal sources. Her research interests are related to hearing aid technologies for adults and children, with specific focuses on speech recognition, listening effort, and emotion perception. Erin is currently serving as the Editor in Chief of the *American Journal of Audiology* and as a section editor of *Ear and Hearing*. In addition to her research activities, Erin is involved with teaching and mentoring clinical and research doctoral students



Todd Ricketts, PhD

Professor and Vice Chair of Graduate Studies, Thomas L. and Jane Wilkerson Yount Endowed Chair in Hearing & Speech Sciences, Vanderbilt University Medical Center. Todd has published more than 100 articles and book chapters and provided over 300 presentations both nationally and internationally. His current research focus is on individualizing hearing aid technologies and cost-effective services and he is funded through a variety of industry and federal sources. He is an ASHA Fellow and currently serves as the vice-chair of American National Standards Institute (ANSI) S3 (Bioacoustics) committee. In addition to his research and service, Todd teaches and mentors students at Vanderbilt.

Disclosures

- **Presenter Disclosure:** Todd Ricketts: Financial: Todd Ricketts is employed by Vanderbilt University. He has received research funding on a topic that may be discussed in this course from Resound, Signia, Starkey, Sonova, Oticon, Widex, Persona Medical, Frye Electronics, the Department of Veterans Affairs Rehabilitation Research & Development Service (VA RR&D), the National Institute of Disabilities and Rehabilitative Research (NIDRR), the Patient-Centered Outcomes Research Institute (PCORI) and the National Institute on Deafness and Other Communication Disorders (NIDCD). Non-financial: Todd Ricketts has no relevant non-financial relationships to disclose. Erin Picou: Financial: Erin Picou is employed by Vanderbilt University. She has received research funding on a topic that might be discussed in this course from: WSAudiology, Starkey, Oticon, Widex, ASHFoundation, and Sonova. Non-financial: Erin Picou is a Section Editor for Ear and Hearing and the American Journal of Audiology.
 - AudiologyOnline has made a donation to Vanderbilt University's student educational program in appreciation of the presenters donating their time to the Vanderbilt Audiology Journal Club on AudiologyOnline.
- **Content Disclosure:** This learning event does not focus exclusively on any specific product or service.
- **Sponsor Disclosure:** This course is presented by Vanderbilt University in partnership with AudiologyOnline.

Limitations/Risks

- The applicability and accuracy of the course content may vary by the clinical, geographical, and cultural context; you should evaluate the course accordingly.
- As healthcare is rapidly evolving, new findings may change the validity of the information presented in this course. Providers should always consult the latest research and guidelines from professional associations.
- The interventions discussed in this course may be limited in generalizability, requiring practitioners to consider specific individual and population factors.
- The course may not cover all possible risk factors, diagnostic methods, or treatment options, and complex cases may require additional considerations.
- Healthcare providers should apply cultural competence and sensitivity to ensure effective and respectful care based on their patients' diverse needs.
- Providers should always evaluate the limitations of diagnostic and screening tools, considering their potential for false results as well as any ethical implications.
- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

Learning Outcomes

After this course, participants will be able to:

- List new key journal articles on the topic of hearing aid benefits in the real world.
- Describe the purpose, methods and results of new key journal articles on realistic hearing aid benefits.
- Explain some clinical takeaway points from new key journal articles on hearing aids.

Today's Spotlight

- Clinically-relevant hearing aid research in adults
 - Bilateral beamforming
 - Real ear measurements
 - Feature selection with a questionnaire
 - Experienced emotion in everyday listening situations
 - Importance of nature sounds

Rallapalli, V., Freyman, R., & Souza, P. (2025)

Relationship Between Working Memory,
Compression, and Beamformers in Ideal Conditions

Ear and Hearing, 46(2), 523-536

What they (initially) asked...

- The purpose of this study was to determine whether the association between individual working memory ability and speech recognition in noise with different amplitude compression (WDRC) time-constants is affected by commonly present (hearing aid based) SNR changes (omnidirectional microphone versus beamformer - speech front, noise behind).

A little background...

- Previous work has demonstrated that differences in speech recognition in adverse listening conditions resulting from differences in hearing aid WDRC time constants (i.e. compression release times) are associated with a persons working memory ability (Stone & Moore 2008; Davies-Venn & Souza 2014; Souza et al. 2015b, 2021).
- However, most of this work has excluded potential hearing aid related SNR improvements (e.g. beamforming processing with spatially separated speech in noise) and instead has used collocated speech in noise and omnidirectional hearing aid microphones.

What they asked... (in retrospect)

- Is the association between individual working memory ability and speech recognition in noise through various hearing aid processing correlated with the level of temporal distortions (as quantified by the HASQI)?
- The HASQI (Kates & Arehart 2014) compares the short-term time-frequency modulation of hearing aid processed noisy speech signals with a linearly amplified reference (while also modeling specific hearing loss effects).

A little (more) background... temporal distortions

- Hearing aids increase audibility, but the listening environment and some HA features may also affect the temporal envelope (as well as potentially other important cues for speech recognition). For example:
 1. fast-acting WDRC flattens the temporal envelope which can be detrimental to speech understanding in noise at positive SNRs.
 2. Noise in the environment can also act to smooth/flatten the temporal envelope, but this can be offset (at least partially) by beamforming.

Why it matters...

- Most modern hearing aids include microphone-based SNR improvement technologies (e.g. directional microphones/beamformers). Consequently, this study examines a previously explored topic while also including a hearing aid condition that is typical in clinical fittings (i.e. potentially improved generalizability of the results).

What they did...

- Participants: Older adults (21; 61-86 yo) with bilateral mild to moderately-severe sensorineural hearing loss fitted with commercially available BTE-RIC hearing aids fitted to NAL-NL2 targets (most double-dome).
- Speech Recognition: Low-context sentences (2 male, 2 female talkers) presented at 65 dBA in four-talker babble (0 to 10 dB SNR; 2 dB Steps) – co-located (0 degrees) and spatially separated (180 degrees).

What they did...

- Microphone mode was “Binaural Beam” or Omni and WDRC time-constants were Fast (70-120ms) or Slow (900-1400ms) release times (5-70/90ms attack).
- 24 Omni conditions (6 SNRs $\times$ 2 Spatial $\times$ 2 WDRC time-constants)
- 12 Beam conditions (6 SNRs $\times$ 1 Spatial (no collocated) $\times$ 2 WDRC time-constants).
- “Working Memory” assessed with the abbreviated reading span test.

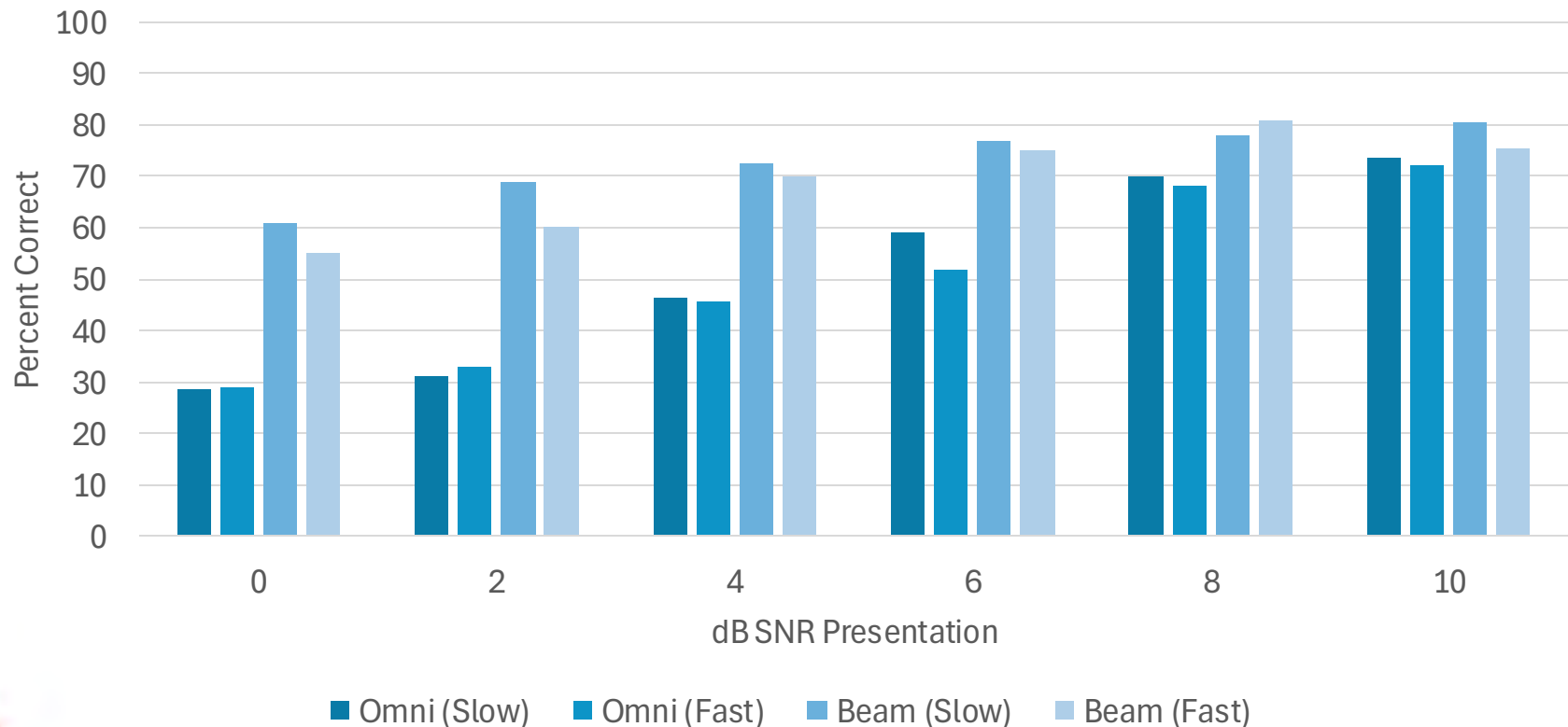
What they found (HASQI – signal distortion)...

- Good SNR < Bad SNR
- Beam < Omni
- Slow WDRC < Fast WDRC
- No significant interactions – except with LME model – expected interaction in that the SNR related distortion was smaller per dB for Beam than Omni.

What they found (speech rec - separated)...

Strong Beam main effect
No effect of compression speed (or interaction) – also true for collocated

Speech recognition (speech and noise separated)



What they found...

- Contrary to the author's hypothesis, spatially- separated speech recognition in noise for slow or fast time-constants did not depend on working memory in Beam or Omni conditions.
 - That is, there was no clear evidence that WDRC time constants significantly affected speech recognition
- Speech recognition increased at a faster rate for the same decrease in distortion for individuals with better working memory (27.43% versus 33.66%).
 - That is individuals with better working memory were more likely to benefit from reduced signal distortions than individuals with poorer working memory.

Why this is important...

- More evidence of clear positives for Beamforming in optimal lab conditions.
- More evidence that individuals with better working memory gain more benefits from reduction in signal distortion (i.e. beamforming benefit in noise), although on average both groups benefit (better and worse working memory).
- Evidence that signal distortion differences due to WDRC time constant differences in one commercial hearing aid may not be great enough to significantly affect speech recognition.
 - At least for conversational speech levels

What are the clinical implications...

- While there is more to learn regarding theoretical considerations around how amplitude compression interacts with working memory, these effects (particularly in comparison to those associated with Beamforming), may be small enough in current commercial products to affect clinical decision making.
- Importantly, this conclusion does not extend to other considerations around compression such as sound quality.
- Another example of how our patient with the less impairment (in this case cognitive working memory), may achieve the greatest benefits from technology.
 - Additional technologies may be needed for individual with low working memory for acceptable performance (i.e. remote microphones).

Saleh, H. K., Folkeard, P., Liao, S., & Scollie, S. (2024)

Development and Initial Evaluation of the Hearing
Aid Attribute and Feature Importance Evaluation
(HAFIE) Questionnaire

International Journal of Audiology, 63(9), 712-721

What they asked...

- What are patient attitudes/importance ratings for modern hearing aid features guided by previously identified concepts associated with hearing aid preference (Saleh et al. 2022).
- Examined through the development of a novel questionnaire called the Hearing Aid Attribute and Feature Importance Evaluation (HAFIE) aimed at improving hearing aid selection by identifying the hearing aid characteristics most important to the patient.

A little background...

- There are many current hearing aid benefit, performance, and satisfaction questionnaires (e.g. GHABP, Gatehouse 1999; SADL, Cox and Alexander 1999; COSI, Dillon, Jamest, and Ginis 1997; HAPQ, Gatehouse, Naylor, and Elberling 2006); IOI-HA, Cox and Alexander 2002; APHAB, Cox 1997; and the HASP; Jacobson et al. 2001.
- However, these were not generally developed as selection tools (other than the HASP).
- Modern HA features were not present at the time of development.

Why it matters...

- There are many modern HA features, some of which have effectiveness support in at least the lab.
- However, little if any evidence-based selection guidance.

What they did...

1. Initial construction based on a published concept map.
2. Focus groups and interviews with clinicians
3. Revision based on focus group input
4. Distribution of the revision - 218 respondents (18-93 yo with hearing difficulty, 84 HA users).
5. Analysis of the results from the online distribution (item evaluation, internal factor structure, internal consistency).
6. Additional revision based on this analysis

What they found...

- Final questionnaire - 28 items, 3 subscales (Advanced connectivity & streaming; Physical attributes & usability; Sound quality & intelligibility)
- Average inter-item correlation coefficients were found for the three subscales/factors (0.43, 0.40, and 0.48) which also had high internal consistency (Cronbach's alpha 0.90, 0.85, and 0.815).

Why this is important...

- This tool may help clinicians track features and inform patients of the available options and provide evidence to justify hearing aid suggestions.

What are the clinical implications...

- While further work is needed, this tool has the potential to be used as part of an evidenced based needs assessment for adult hearing aid candidates.
 - Most importantly, we need to assess whether use of this tool has the potential to improve hearing aid outcomes such as patient satisfaction, clinical efficiency, etc.

Almufarrij, I., Sindi, N., Pepler, A., & Munro, K. J.
(2024)

Is the Role of Probe-tube, Real-ear Measurements
Changing for Adults with Mild-to-moderate Hearing
Loss?

International Journal of Audiology, 1-5

What they asked...

- “This study compared the deviation from target before and after fine tuning using probe-tube real-ear measurements (REMs).”
- Or said in another way – Are “Initial Fits” (IFs) using manufacturer fitting software (also called “first fits”) more accurate than previously demonstrated (i.e. Assessed through probe microphone verification of prescriptive hearing aid gain targets.

A little background...

- Real Ear Measurements (REM) are typically recommended to verify prescriptive hearing aids gain/output targets.
- This has primarily and repeatedly been recommended historically for two separate reasons:
 - For a variety of reasons – hearing aid manufacturer's versions of specific amplification targets (i.e. NAL-NL1, NAL-NL2, DSL) did not result in accurate fits on average (most typically considerable underfit in the high frequencies).
 - Individual patient acoustics including hearing aid coupling and MLE vary across individuals (large individual variability).

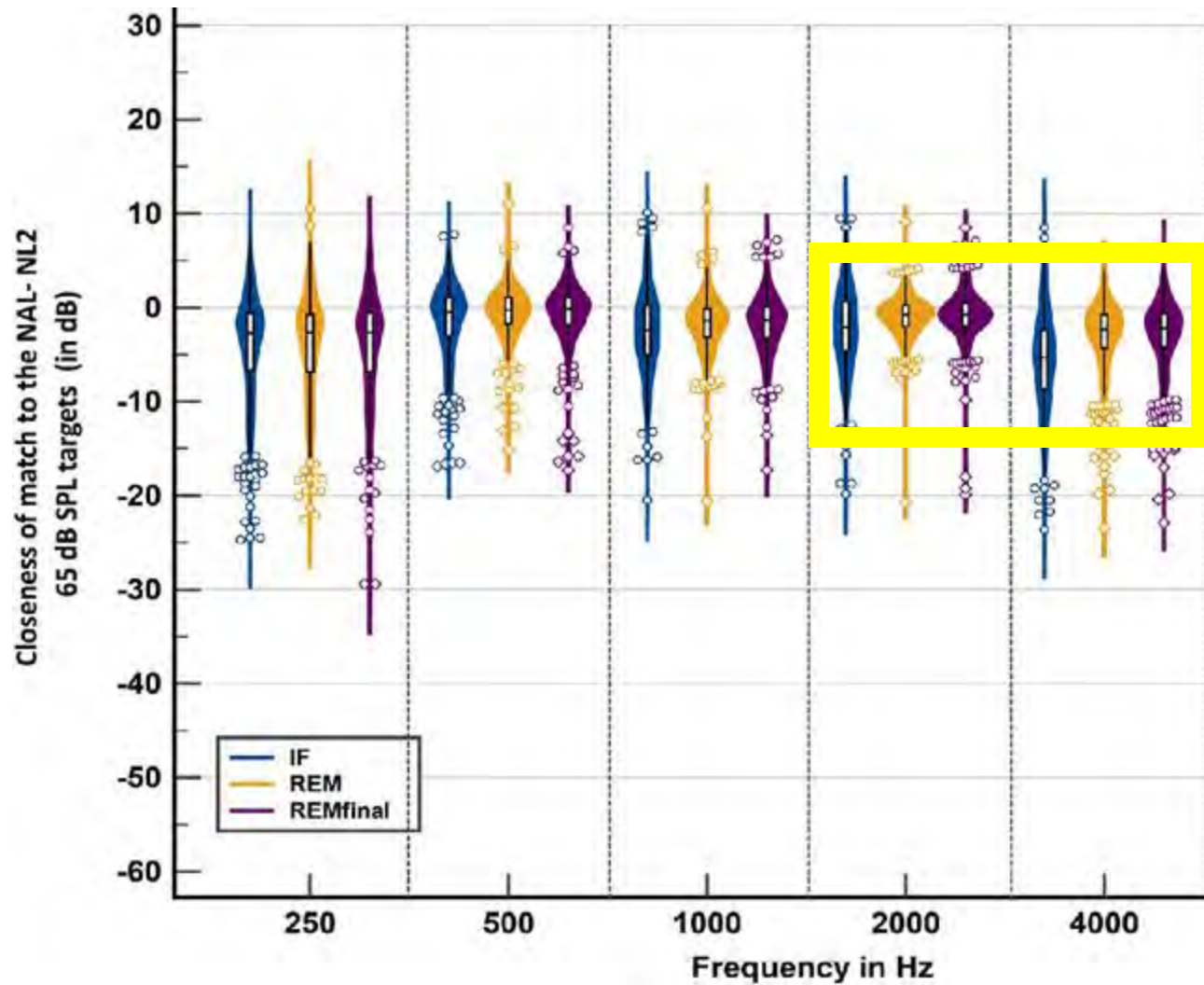
Why it matters...

- A more recent study (Almufarrij, Dillon, Adams, et al. 2023), found that, “unlike earlier studies, the manufacturer’s IF was very close to the prescription target with REM improving the match at 2 and 4 kHz by (only) 2–3 dB” – in one manufacturer.
- Potential that manufacturer IFs might be a better starting place than in the past.
- Potential that completing REM is less critical than previously?

What they did...

- Retrospective analysis of data from Royal Surrey NHS Foundation Trust (South England).
- 256 new adult hearing aid users (120 male, 136 female) fitted mostly in 2022.
- Examined fittings using Phonak branded instruments (variety of models, styles, couplings, etc.).
 - Targeting a different manufacturer than other recent studies showing more accurate IFs - Oticon
- Evaluated the RMS error of the deviation (recorded responses vs targets) then log transformed (normalize and reduce effects of outliers).

What they found...



Why this is important...

- At least a subset of manufacturer's IF values are now correct on the average!
 - Consistent with other recent studies - (e.g. Almufarrij, Dillon, Adams, et al. 2023; Folkeard, Bagatto, and Scollie 2020; Narayanan et al. 2024)
- Minimally, “being right on average” should reduce the time it takes to fit an individual.

Other findings and what these data do not show...

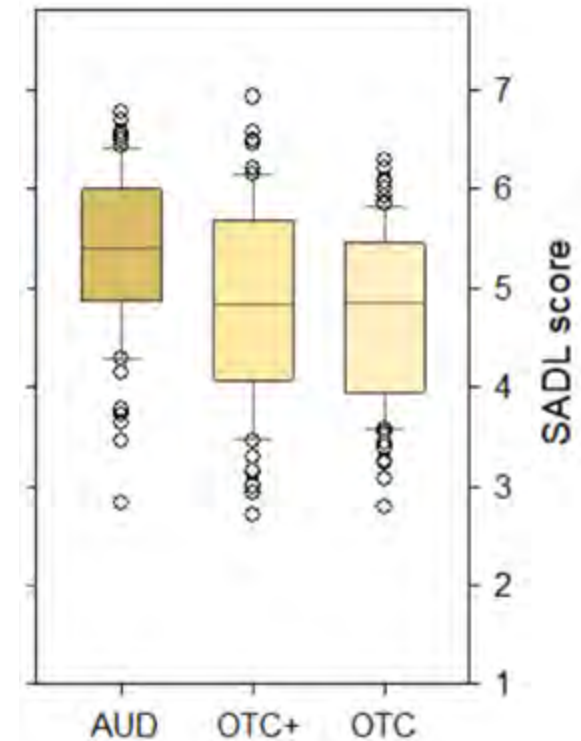
- Deviations for IF were significantly higher than deviations for REM and REMfinal
 - Expected given that REM fittings allow for clinician adjustment to targets considering individual acoustics/coupling.
- Deviations for open fits were significantly higher than closed fits
 - Expected given that REM fittings allow for clinician adjustment to individual acoustics and open fittings introduce individualized REUG differences.
- Does not really address the second main reason for completing REMs (Individual patient acoustics including hearing aid coupling and MLE vary across individuals).
 - Perhaps a jump in logic going from small affects of “fine-tuning” to perhaps ignore individual differences?

What are the clinical implications...

- Manufacturer IFs (for those studied) are now accurate on average and should get us to a great starting place (considerable clinical time saver).
- If REM is not possible, you are much more likely to be right for the average patient than in the past.
- Are all patients average? Do individual differences in coupling, MLE, acoustics matter (can be deviations > 10 dB – not “a few dB”)?
 - Perhaps less with mild/moderate HL, but how “wrong” is wrong? More follow-up work needed?

Potential implications for the results from a recent study

- Significant positive benefits from OTC and limited services HA delivery models; however, clinically significantly greater benefit/satisfaction from an AuD model.
- Additional benefit from individualized HA needs assessment (re: HAFIE)?
- Additional benefit from individualized REM over audiologists selected pre-fit?



(Wu, Y.H.; Stangl, E.; Branscome, K.; Oleson, J. & Ricketts, T.A. (2025). Impact of hearing aid service-delivery model and technology on patient outcomes: A Randomized Clinical Trial. JAMA Otolaryngology–Head & Neck Surgery. doi:10.1001/jamaoto.2025.1008)

Holman, J. A., & Naylor, G. (2025).

The influence of hearing loss and hearing aid
use on experienced emotion in everyday
listening situations

Clinical Rehabilitation, 02692155251326830.

What they asked...

- Are there differences between emotional states reported by people with and without hearing loss?
 - If so, do differences vary by listening situation?
- In what situations do hearing aids have effects (positive or negative)?

A little background...

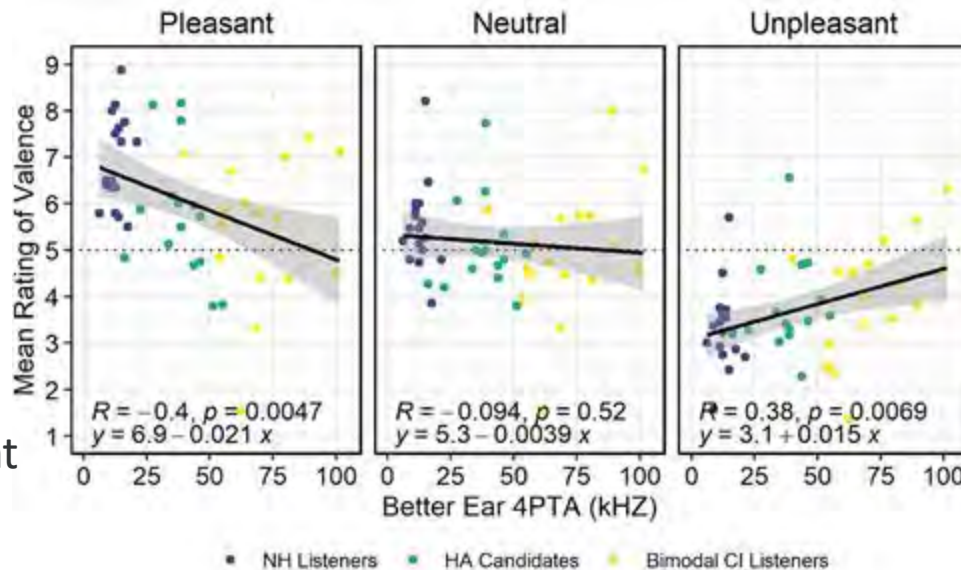
- Hearing loss can make communication difficult
- People with hearing loss can become disconnected emotionally and physically from those around them
- People with hearing loss have a reduced range of emotional responses (in the lab) than their peers with normal hearing



Pleasant



Unpleasant



Tawdrous, M. M., D'Onofrio, K. L., Gifford, R., & Picou, E. M. (2022). Emotional responses to non-speech sounds for hearing-aid and bimodal cochlear-implant listeners. *Trends in hearing*, 26, 23312165221083091.

Why it matters...

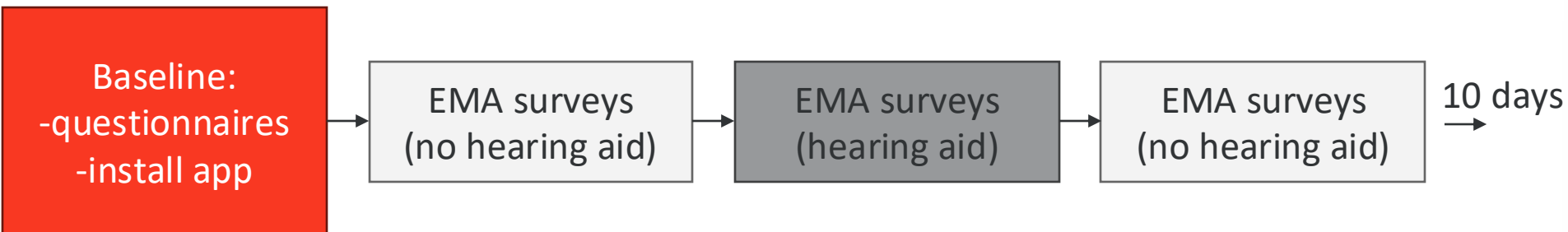
- Traditionally hearing aid signal processing and fitting methods have focused on speech communication in quiet and/or in noise
 - *Dillon 2012, Moore 2007, Ricketts, Bentler & Mueller 2019*
- Increasing interest in studying hearing aids for music and emotion perception
 - *Chasin & Hockley 2014, Picou et al. 2018*
- Little evidence about hearing loss or hearing aid use on emotions in specific listening situations
 - Particularly using real-time data

What they did...

- Participants
 - Experienced hearing aid users ($n = 26$; 69.2 years)
 - Adults with normal hearing ($n = 20$; 61.2 years)
- Procedures
 - Rated experienced emotions (valence, arousal, discrete) at random points
 - Hearing aid users did so with and without hearing aids

What they did...

- Ecological momentary assessment
 - 6 surveys per day for ~10 study days
 - Situation type
 - Conversation purpose
 - Background noise
 - Location
 - Valence
 - Arousal

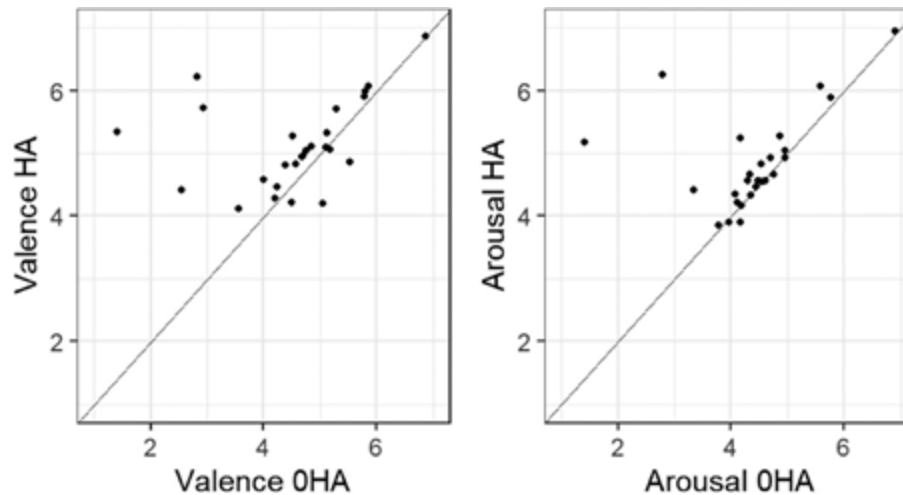


What they found...

- Common listening situations (% of surveys)
 - One-on-one conversations (~38%)
 - Television (~35%)
 - Group conversation (~15%)
 - Radio / music (~10%)
 - Ambient (~1%)

What they found...

- Ratings of valence and arousal were higher WITH hearing aids than without hearing aids
- Ratings of valence similar aided to normal hearing
- Not situation dependent



Holman, J. A., & Naylor, G. (2025). The influence of hearing loss and hearing aid use on experienced emotion in everyday listening situations. *Clinical Rehabilitation*, 02692155251326830.

Why this is important...

- Unaided hearing loss associated with negative impact on emotion
 - Factors besides speech communication should be considered in the evaluation and management of hearing loss
- Hearing aids restored emotions experienced in everyday listening
 - Not seen in laboratory settings
 - Benefits of hearing aids might be greater than expected for emotional responses

What are the clinical implications...

- Without hearing aids, emotional responses are negatively affected – and patients might not realize it or mention it
- Hearing aids can help
- Hearing aid benefits might be different (better) than expected based on laboratory findings

Apoux, F., Laurent, S., Gallego, S., Lelic, D.,
Moore, B. C., & Lorenzi, C. (2025).

Effects of Hearing Loss and Hearing Aids on
the Perception of Natural Sounds and
Soundscapes:
A Survey of Hearing Care Professional
Opinions.

American Journal of Audiology, 1-15.

What they asked...

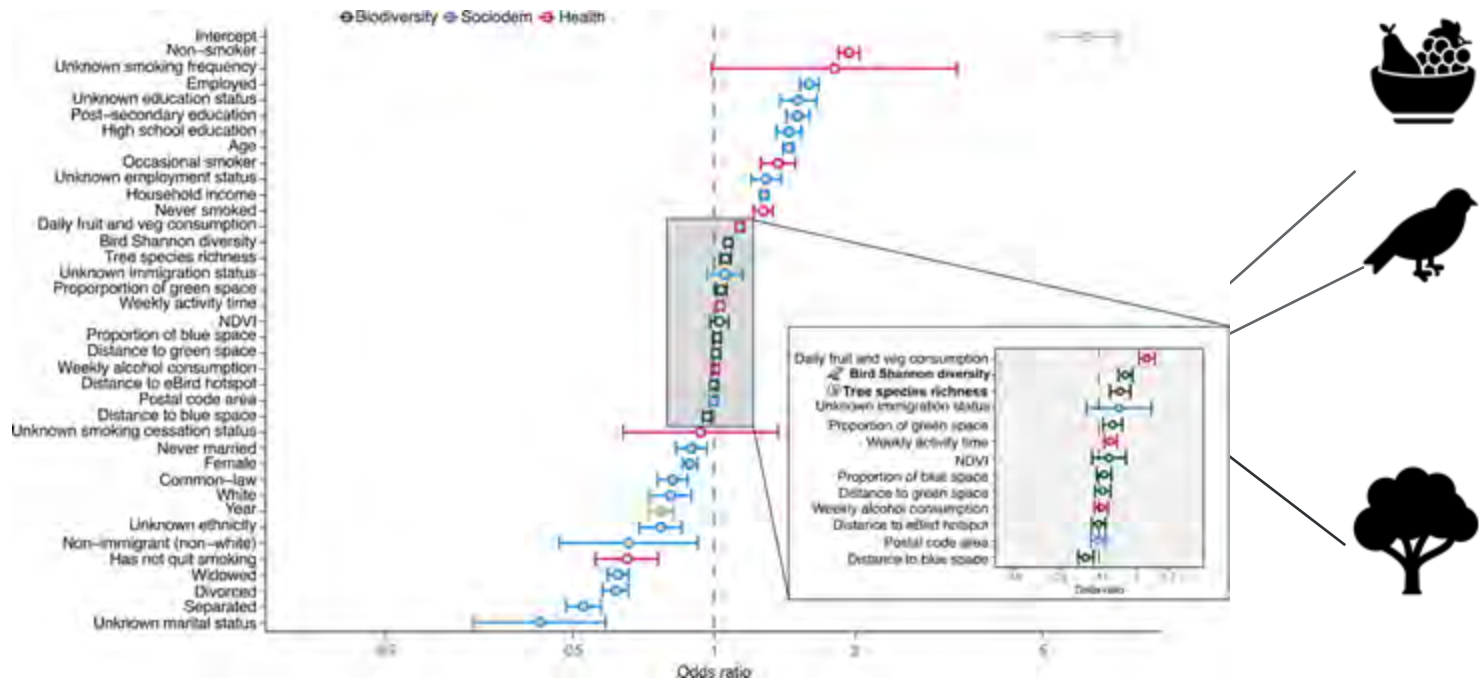
- How do hearing care professionals feel about the importance of "natural sounds" to their patients?

A little background...

- Traditionally hearing aid signal processing and fitting methods have focused on speech communication in quiet and/or in noise
 - *Dillon 2012, Moore 2007, Ricketts, Bentler & Mueller 2019*
- Increasing interest in studying hearing aids for music and emotion perception
 - *Chasin & Hockley 2014, Picou et al. 2018*
- Little attention to effects of hearing loss and hearing aids on the perception of natural environmental sounds
- Hearing natural sounds could be important because listening to natural sounds has been shown to increase general well-being and overall quality of life
 - *Buxton et al. 2021, Erfanian et al. 2019*

A little background...

- Bird and tree species diversity were significantly positively related to good self-reported mental health



Buxton, R. T., Hudgins, E. J., Lavigne, E., Villeneuve, P. J., Prince, S. A., Pearson, A. L., ... & Bennett, J. R. (2024). Mental health is positively associated with biodiversity in Canadian cities. *Communications Earth & Environment*, 5(1), 310. <https://www.nature.com/articles/s43247-024-01482-9>

A little background...

- "Natural sounds"
 - Biological sounds (bird songs, insect stridulations)
 - Action sounds
 - Nonhuman animals
 - Geophysical sounds (wind, rain, streams)
- "Natural soundscapes"
 - Complex combination of biophony and geophony
 - In habitats with little human activity
 - Forests, grasslands, nature reserves

A little background...

- People with mild-to-severe sensorineural hearing loss experience greater difficulties than people with normal hearing discriminating natural soundscapes
- *Apoux et al. 2023, Miller-Viacava et al. 2023, Thoret et al. 2020*
 - Habitat type (forest, meadow, grassland, chaparral)
 - Moment of the day (dawn, midday, dusk, night)
 - Season (fall, winter, spring, summer)

Why it matters...

- Unclear how hearing loss and hearing aids can affect perception of natural sounds, emotional responses to them, or their significance in daily lives
- Survey of hearing care professionals a good first step for understanding these factors, since professionals have extensive knowledge about reports from people with hearing loss

Why it matters...

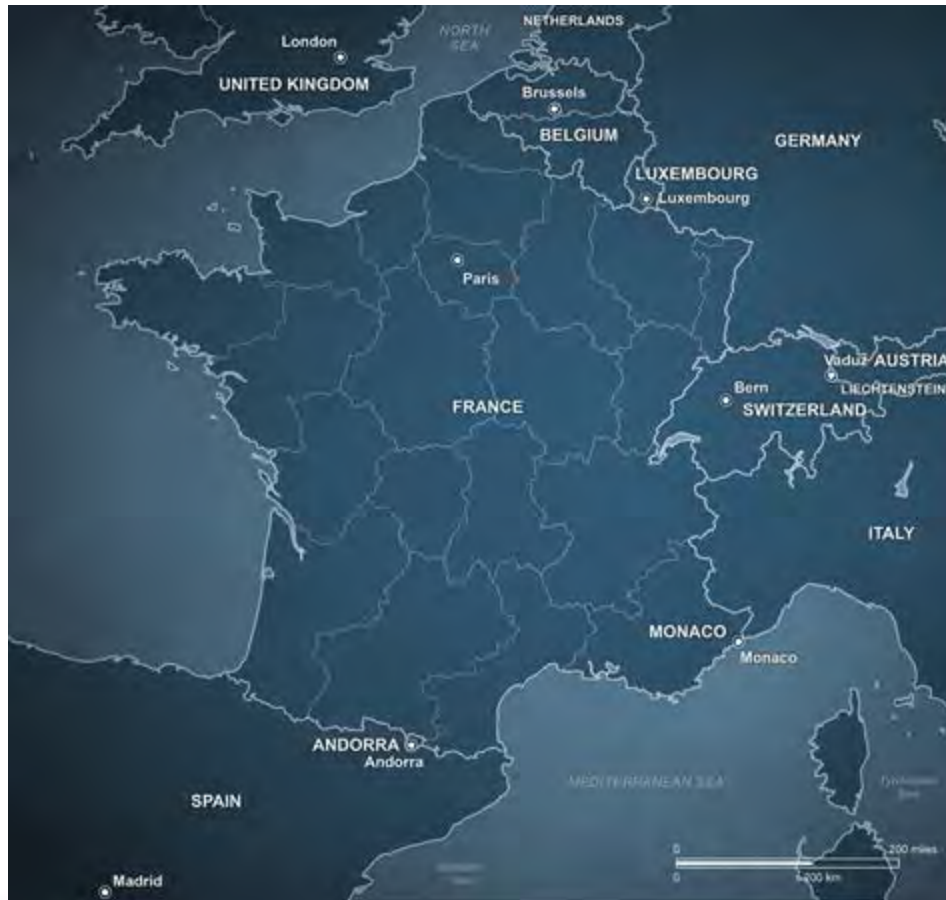
- Rural and suburban and urban environments differ in their complexity and composition
 - Biophony (sounds produced by animal vocalizations)
 - Geophony (geophysical sounds, wind, rain, streams)
 - Anthrophony (sounds produced by manmade objects, automobiles, electronics)



What they did...

- Evaluated hearing care professionals' perception of patients' listening situations and hearing demands
 - Patients' accuracy in perceiving natural sounds
 - Pleasantness and importance of hearing natural sounds
 - Before and after hearing aids
 - Reported satisfaction with hearing aids

What they did...



France has 5 main temperate climates:

- Oceanic
- Altered Oceanic
- Semi-Continental
- Mountain
- Mediterranean

What they did...

- Questionnaire (asked to consider either before or after hearing aid trial period)
 - Reporting
 - How many of your patients mention natural sounds?
 - Accuracy
 - Do your patients report that natural sounds are heard correctly?
 - Pleasantness
 - Do your patients report that natural sounds are pleasant?
 - Importance
 - Do your patients report that hearing natural sounds is important to them?

How would you answer?

- Reporting
 - § How many of your patients mention natural sounds?
 - *None, Some, About half, Most of them, All or almost all*
- Accuracy
 - § Do your patients report that natural sounds are heard correctly?
 - *Correctly, A little distorted, Very distorted, Rarely or never recognizable, My patients do not talk about this*
- Pleasantness
 - § Do your patients report that natural sounds are pleasant?
 - *Pleasant, Rather pleasant, Some pleasant and some unpleasant, Rather unpleasant, Unpleasant, My patients do not talk about it*
- Importance
 - § Do your patients report that hearing natural sounds is important to them?
 - *Not important at all, Not very important, Important, Very important,, Essential, My patients do not talk about it*

What they did...

- Hearing care professionals (n = 290)
 - Average 15 years of practice (0 – 56 years)
 - 95 departments and 5 climate regions
 - More in the eastern regions and areas in Oceanic climate
- Patients
 - 58% estimated to live not in rural areas
 - Younger population
 - More densely populated
 - Access to essential services
 - Under the influence of a major employment center

What they found...

- How often do patients with hearing loss report hearing natural sounds?
 - Before hearing aids >> 7%
 - After hearing aids >> 45%
- Reports about natural sounds increased dramatically after hearing aid provision

What they found...

- Do patients with hearing loss perceive natural sounds correctly?
 - Before hearing aids >> 42% of patients accurate
 - After hearing aids >> 91% of patients accurate
- Professionals believe most patients can recognize natural sounds well with hearing aids

What they found...

- Are natural sounds pleasant for patients with hearing loss?

>> More patients discuss pleasantness after hearing aid fitting and there is an increase in reports of pleasantness AND unpleasantness

Before hearing aid fitting



☐ Do not talk about it
☒ Pleasant
☒ Rather pleasant
☐ Some pleasant/some unpleasant
☐ Unpleasant

After hearing aid fitting

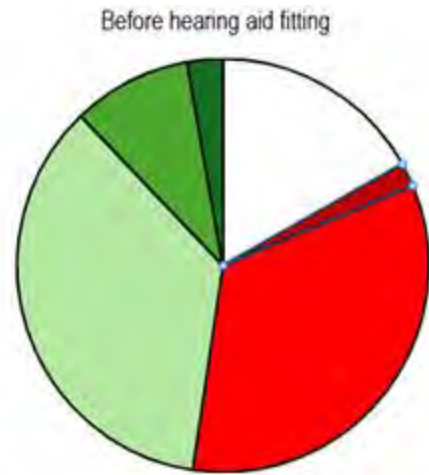


☐ Do not talk about it
☒ Pleasant
☒ Rather pleasant
☐ Some pleasant/some unpleasant
☒ Unpleasant

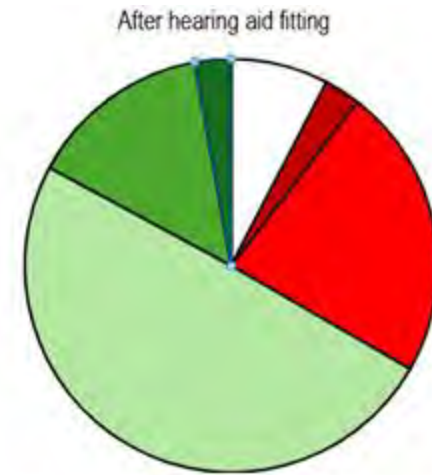
What they found...

- How important are natural sounds for patients with hearing loss?

>> Hearing aids reveal and enhance importance of natural sounds



□ Do not talk about it ■ Not important at all
■ Not very important □ Important
■ Very important ■ Essential



□ Do not talk about it ■ Not important at all
■ Not very important □ Important
■ Very important ■ Essential

What they found...

- Professionals whose patients live in rural areas were more likely to:
 - Report that their patients could recognize natural sounds
 - Report that hearing natural sounds is important to their patients
- >> somewhat expected because people living in rural areas are more likely to be exposed to natural sounds

What they found...

- Ratings of accuracy and importance largely independent of climate zone
 - Trend for water sounds to be more important in Oceanic climate
 - Trend for insect sounds to be more important in Mediterranean climate



Why this is important...

- Data suggests people are unlikely to be aware that they are missing natural sounds before a hearing aid fitting
 - Insidious onset of hearing loss
 - Lack of feedback from sources
 - Communication partners can repeat
 - Bird song simply disappears



Why this is important...

- Hearing aids can improve recognition of natural sounds and the recognition of the importance of natural sounds
- Implications for relationship between natural environments and well-being
 - Patients might be missing out on benefits
 - Hearing aids might help

What are the clinical implications...

- Green prescribing – consider the importance of the trial period and the soundscapes encountered during that time
- Gain settings – might be benefits of extended high frequency audibility (5-10 kHz) for natural sounds (yet to be investigated)
- Noise reduction – might consider reducing its strength for natural sounds (yet to be investigated)
- Counseling – especially for patients in rural environments
 - Patients might not notice natural sounds before fitting

Lelic, D., Picou, E.M., Shafiro, V., & Lorenzi,
C. (2025)

Sounds of nature and hearing loss:
A call to action

Ear and Hearing, 46(2), 298-304

What they asked...

- Do individuals with hearing loss gradually lose their “connection” to natural sounds in their daily routines, typically without realizing it?
- What role can hearing aids play in restoring some of these natural sounds and scenes for adults with hearing loss?

A little background...

- Apoux et al. (2025) reported hearing care professionals observe increased reports of natural sounds, including accuracy, importance and pleasantness, after a hearing aid trial
 - Limited to observer bias of hearing care professionals

A little background..

- Only a few studies on environmental sound perception in adults with hearing loss
 - Shafiro et al. (2022) - systematic review showing cochlear implant users have reduced environmental sound recognition
 - Tawdrous et al. (2022) - reduced emotional responses to non-speech sounds for hearing aid and cochlear implant users
 - Miller-Viacava et al. (2023) - hearing loss interferes with ability to discriminate soundscapes of natural scenes

Why it matters...

- Listening to natural sounds is important to many patients
 - e.g., *Apoux et al., 2025*
- Natural sounds are related to well-being
 - e.g., *Buxton et al., 2024; Erfanian et al., 2019*
- People spend less time communicating via speech than they do monitoring their environmental surroundings
 - e.g., *Keidser et al., 2020; Lorenzi et al., 2023*



What they did...

- Re-analysis of Lelic et al. (2025)
 - Client-Oriented Scale of Improvement (COSI) before fitting
 - Randomized first-time hearing aid users into:
 - Control group (n = 20)
 - Positive focus group (report positive listening experiences in their daily life via an app; n = 18)
 - Both groups periodically answered questionnaires about hearing aid satisfaction and benefit
 - Found significantly higher benefit and satisfaction scores for the positive focus than the control group as early as 2 weeks and throughout 6 months of study

What they did...

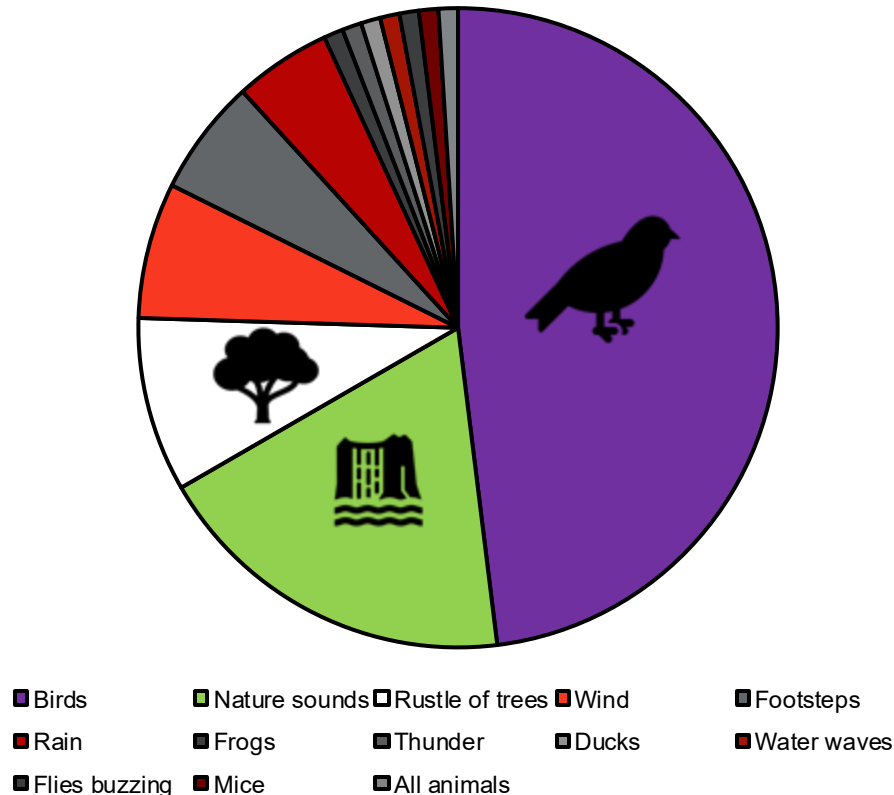
- Re-analysis of those data of the positive focus group
- Evaluation of listening situations important on the COSI before hearing aid fitting
- Examined the positive focus reports in the app

What they found...

- Prior to hearing aid fitting
 - 100% (18 of 18) of participants included a situation where listening to speech was important
 - 17 of 18 reported wanting to watch television at normal volume
 - 22% (4 of 18) participants reported wanting to hear nature (3rd most common listening situation)

What they found...

- After hearing aid fitting (via app)
 - 15 of 18 reported positive experiences related to natural sounds



What they found...

- *"Have noticed a much more nuanced soundscape in relation to the sounds of nature, like today, when it has started to rain"*
- *"Didn't think there was birdsong at this time of year, but there is... heard the wren yesterday + another one I didn't recognize."*
- *"I hear sounds that I admit I was previously cheated out of, such as in the evening when the birds go to rest at dusk, the chirping and chirping is so pleasant to sit and listen to. It is pure relaxation and quality of life."*

Why this is important...

- Difficulty with speech understanding is easy to conceptualize – instant feedback
- Consequences of missing natural sounds – attributable to other factors
- Evidence from these reports suggests benefits of hearing aids might be greater in the field than in the lab (context matters)

What are the clinical implications...

- Patients might arrive with unrecognized listening needs
- Understandable speech-focus initially
- Discuss other kinds of sounds post-fitting
- Encourage natural listening during the trial period
 - Rediscovery of natural sounds
 - Well-being benefits

Summary & Conclusions

- Unaided hearing loss associated with negative impact on emotion; hearing aids restored emotions experienced in everyday listening (Holman et al., 2025) **Q5**
- Without hearing aids, natural sounds might be ignored or difficult to recognize; with hearing aids, natural sounds are easily recognized by most patients – according to the survey of hearing care professionals (Apoux et al., 2025)
- Prior to hearing aid fitting, approximately 25% of participants reported wanting help hearing sounds of nature – 80% of them reported positive experiences with nature after the hearing aid fitting (Lelie et al., 2025) **Q4**

Summary & Conclusions

Q1

- Evidence of clear positives for Beamforming in optimal lab conditions; individuals with better working memory gain more bilateral beamformer benefits Rallapalli, Freyman & Souza (2025)

Q2

- Accuracy of the initial manufacturer's fit of NAL-NL targets when compared to real ear measures (REMs) in listeners with mild-to-moderate hearing loss is very good on average (Almufarrij et al., 2024)

Q3

- Hearing Aid Attribute and Feature Importance Evaluation (HAFIE) is a potentially useful questionnaire for improving hearing aid selection by identifying the hearing aid characteristics most important to the patient (Saleh et al., 2024)

Thank you! Questions?

todd.a.ricketts@vumc.org

erin.picou@vumc.org



Congratulations!

- You've completed the course and can move on to the exam!
- From your account:
 - Go to pending Courses
 - Choose take exam