

The Problem: Untreated Hearing Loss

- **15% of American Adults** have trouble hearing (Blackwell et al., 2014), but only **1 in 6** who could benefit have tried a hearing aid (NIDCD, 2024)
- Untreated hearing loss leads to **46% higher healthcare costs** (Reed et al., 2019) for the individual and has a **\$981 Billion economic impact** yearly (McDaid et al., 2021)

Factors Influencing Effective Treatment of Hearing loss

- **Accessibility:** Lack of access to quality audiological care for many communities, with only **1 audiologist per ~24,500 people** in the US (U.S. Bureau of Labor Statistics, 2023; United States Census Bureau, 2025)
- **Precision Audiology:** Multiple causes for SNHL, but current diagnostic testing cannot differentiate between subtypes, meaning **treatments are generalized** and are only successful to varying degrees

How APARC is Helping:

Leveraging **collaborations** between audiology, auditory neuroscience, and AI-driven data analytics to create a **community-engaged-research** lab to collect data from **diverse populations** (SES, racial, hearing-health) using a **mechanistically based protocol**. We are also providing hearing-health information, through vetted recommendations, handouts and the APARC website (Purdue University APARC) and outreach to under-resourced communities that would typically lack access to quality audiological resources.



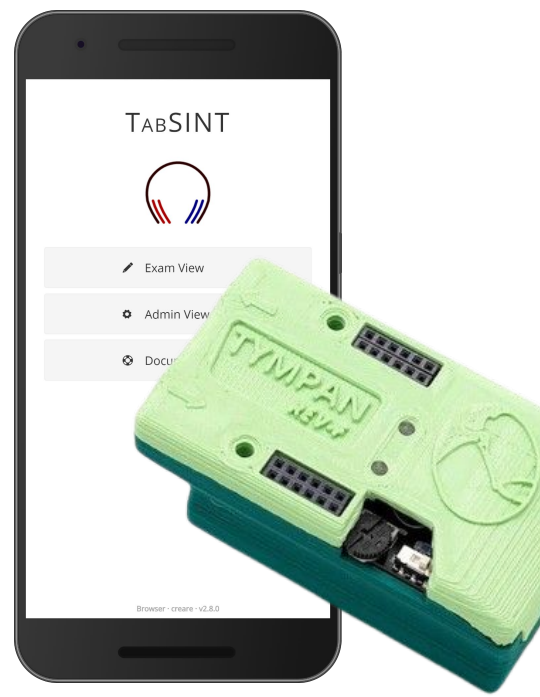
The APARC team has passed out over **900** pairs of reusable earplugs to community members



APARC's location was specifically chosen to facilitate community engagement, e.g. participating in the Indy Winter Farmers Market to provide education and resources to community members while recruiting for our research studies



Traditional Clinic/ APARC @ 16Tech
Audiometer: \$15,000
Titan Immittance Bridge: \$19,000
Sound Booth: \$85,000
Total: \$119,000.00

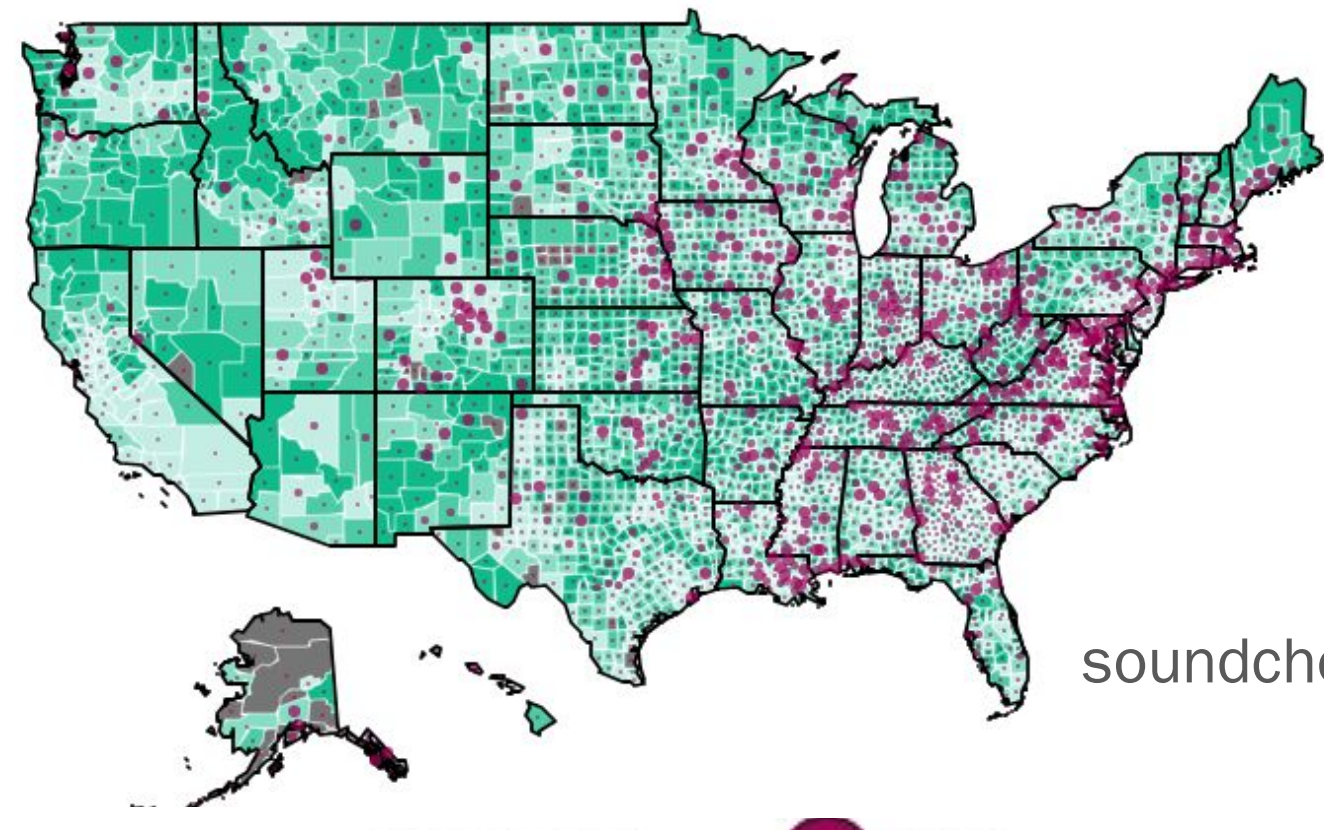


Tympan Open-Source Platform
Tympan: \$330
Tablet: \$1,000
Headphones: \$200
Total: \$1,530



Making Audiology More Accessible For All

- **Location:** 16 Tech Innovation District in Indianapolis
 - Lab opens directly out into the Artisan Marketplace (AMP), a unique food court designed to help minority restaurateurs from neighboring low-resource communities
 - “APARC is an innovative program that is improving patient outcome through technology. By locating in 16Tech, APARC joins a growing cluster of health-tech and med-tech companies that have access to resources that help them scale and the diverse communities they aim to serve.” -Emily Krueger, CEO of 16Tech
- **Community Outreach:** We provide free earplugs and hearing-health information at a wide range of community events, while working to recruit subjects from a variety of racial, SES, and hearing-health backgrounds
 - E.g. Boo Bash, Indy Winter Farmers Market, Indy Gay Market
- **Data and Info Sharing:** In just over 3 months we’ve provided 103 comprehensive hearing assessments to community members
 - Every subjects receives a copy of their results, which are explained to them and signed by a licensed audiologist
 - Recommendations and resources are provided (handouts and website: e.g. info on area clinics and hearing health)
- **Collaboration:** working with others who share our goal of making audiology more accessible
 - Ceare LLC (4-year NIH SBIR Grant): to validate the Tympan/TabSINT, an open-source platform that will allow comprehensive hearing evaluations to happen outside the booth (see Ceare OpenHearing webpage)
 - This open-source platform has the goal of democratizing access to quality hearing healthcare, significantly benefiting underserved communities (e.g. rural farming, nursing homes) where there is a higher prevalence of hearing loss and less access to quality audiological care
 - Dawn Flynn, MS, CCC-A: assisting with Indy-Car driver physicals with the goal of being able to provide testing trackside
 - We’ve helped collect audiograms and OAEs on 42 Indy-Car drivers this winter as part of mandatory driver physicals

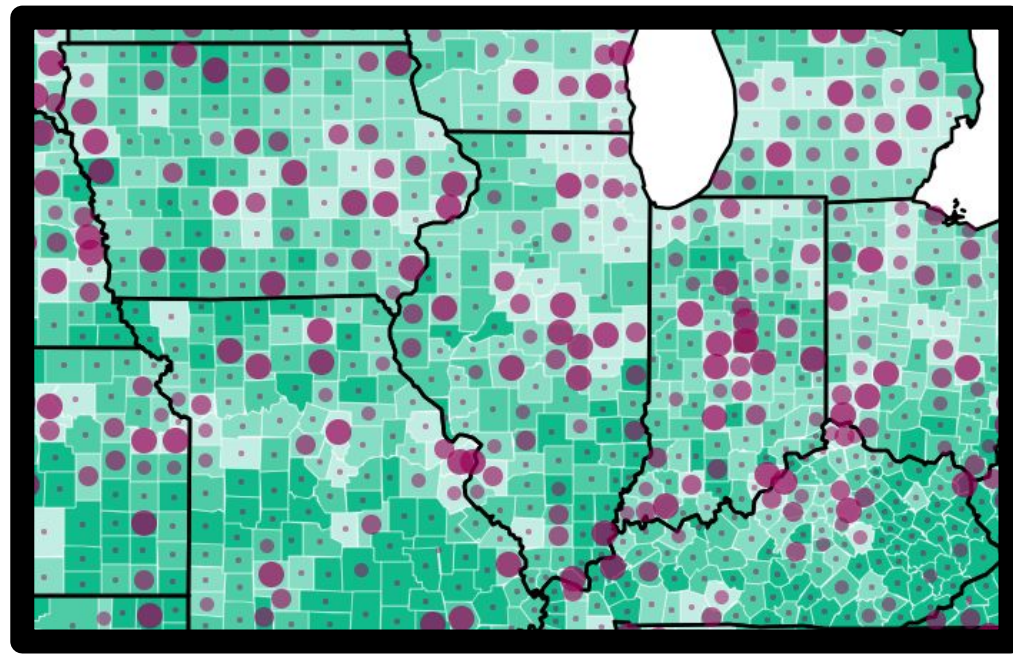


Audiologists per 10k population

- 06+
- 04-06
- 03-04
- <03

High - Low - Insufficient Data

soundcheckmap.org/map

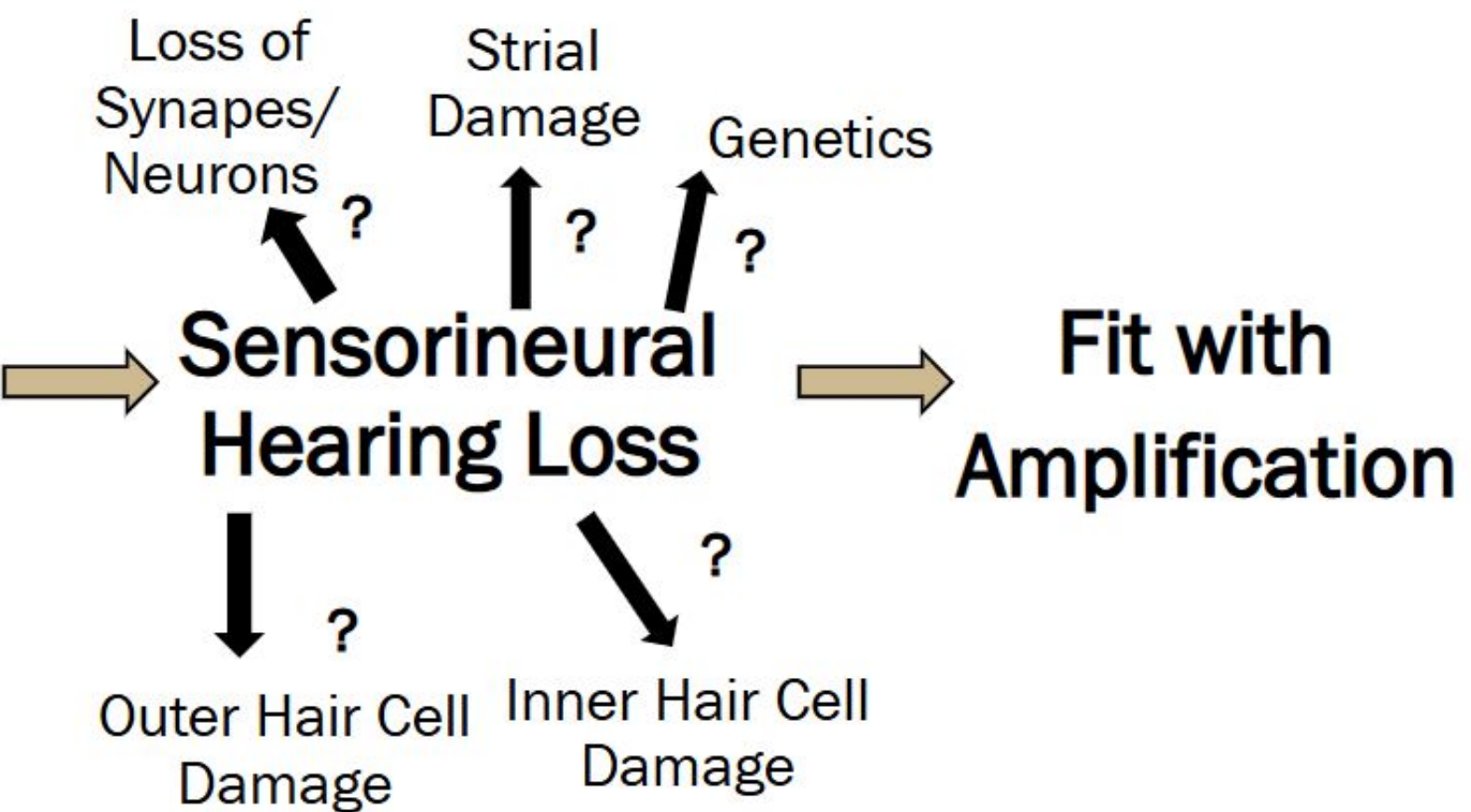


High - Low - Insufficient Data

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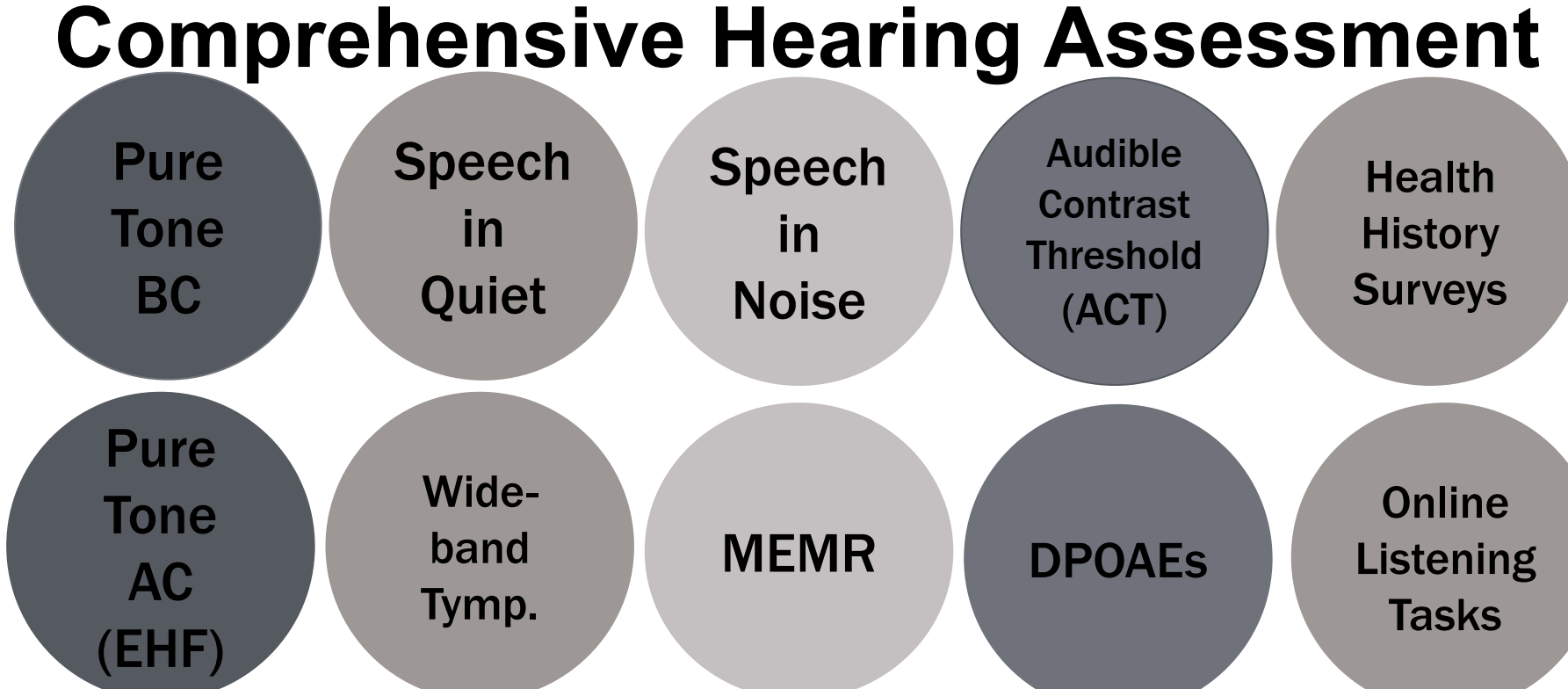
Patient 1: Can't hear the TV
Patient 2: Spouse noticing misunderstandings
Patient 3: Struggles in background noise
Patient 4: Not noticing any issues



Loss of Synapses/Neurons
Strial Damage
Genetics
Sensorineural Hearing Loss
Outer Hair Cell Damage
Inner Hair Cell Damage
Fit with Amplification

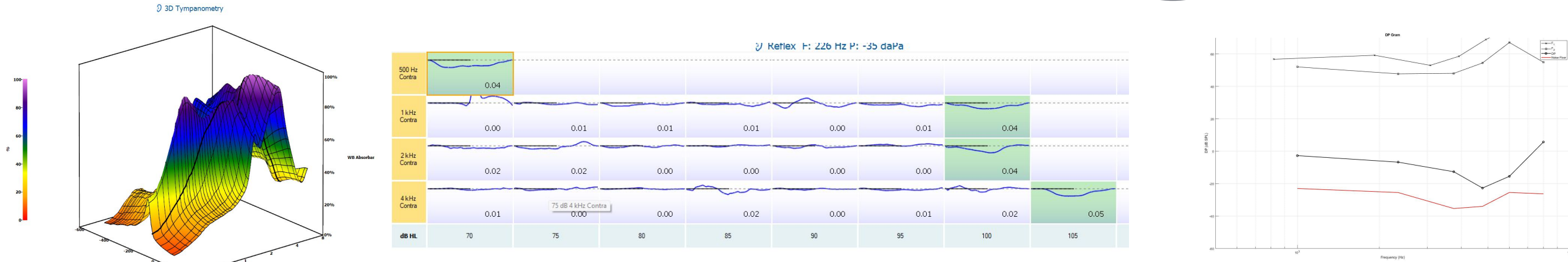
Making Audiology More Precise

- **Comprehensive Evaluation:** Every subject is run through a fully inclusive protocol of clinical tests using clinical equipment (~45min), and online surveys and listening tasks (~1hr)

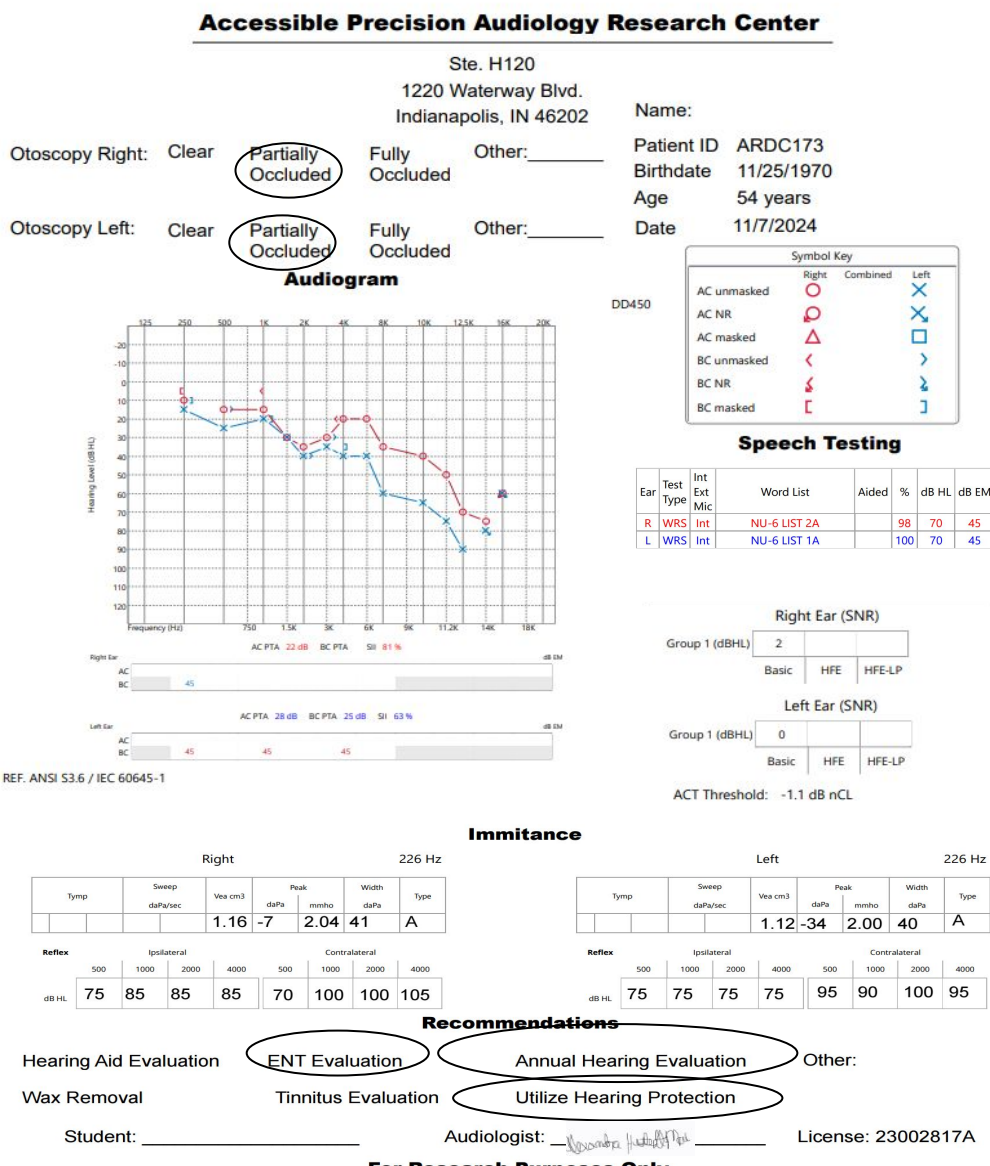


Comprehensive Hearing Assessment

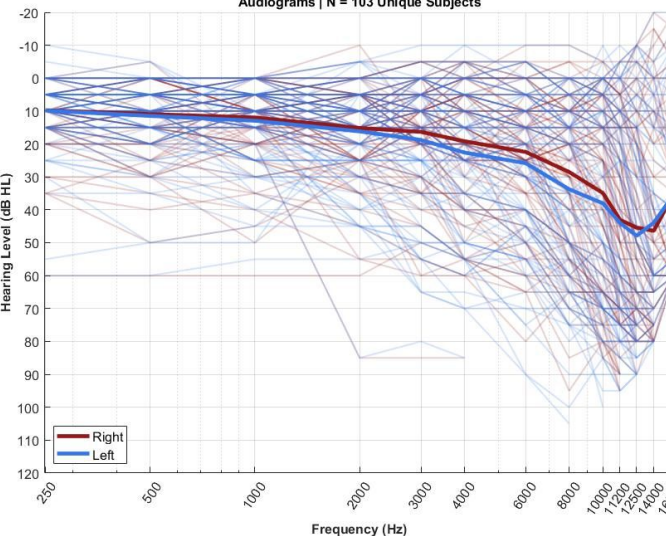
- Pure Tone BC
- Speech in Quiet
- Speech in Noise
- Audible Contrast Threshold (ACT)
- Health History Surveys
- Pure Tone AC (EHF)
- Wide-band Tymp.
- MEMR
- DPOAEs
- Online Listening Tasks



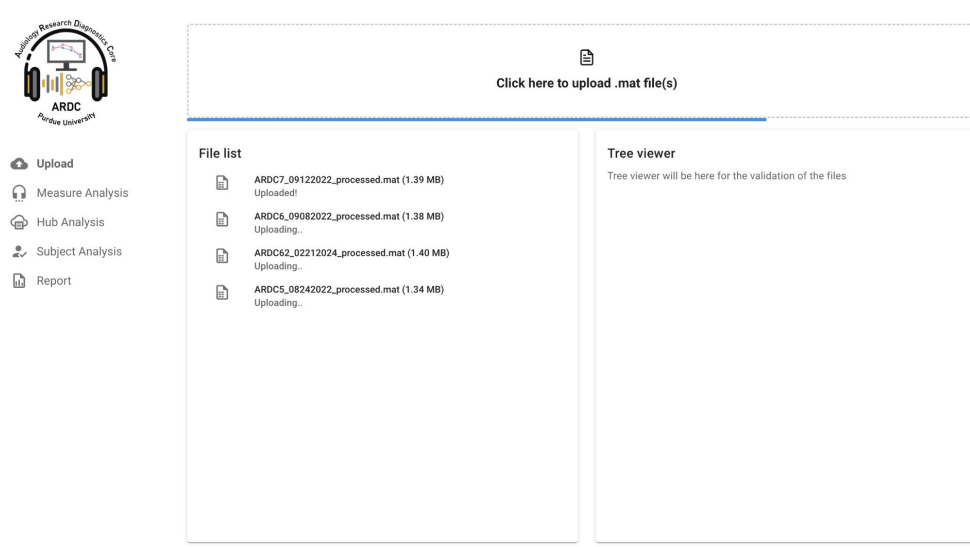
3D Audiogram, 2D Audiogram, Hearing Aid Fitting, Speech Testing



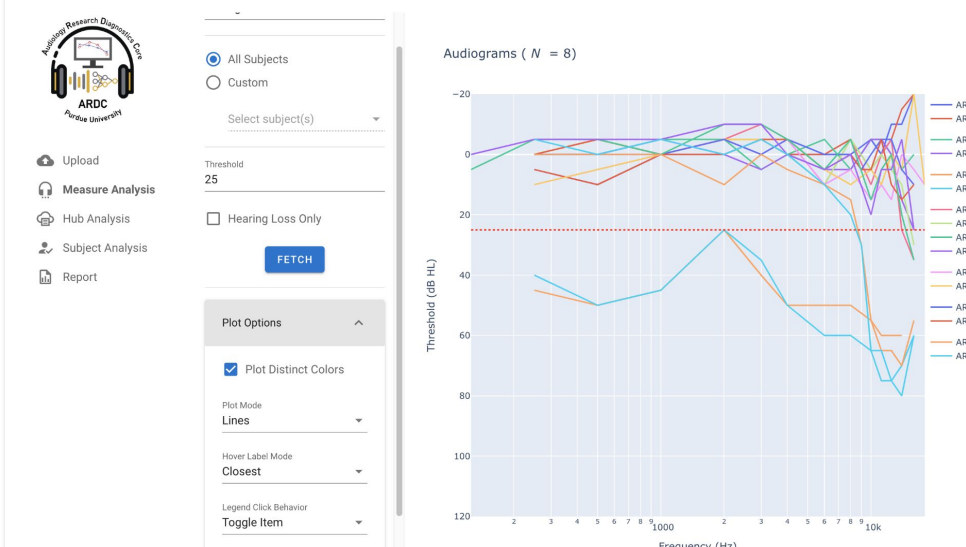
Accessible Precision Audiology Research Center



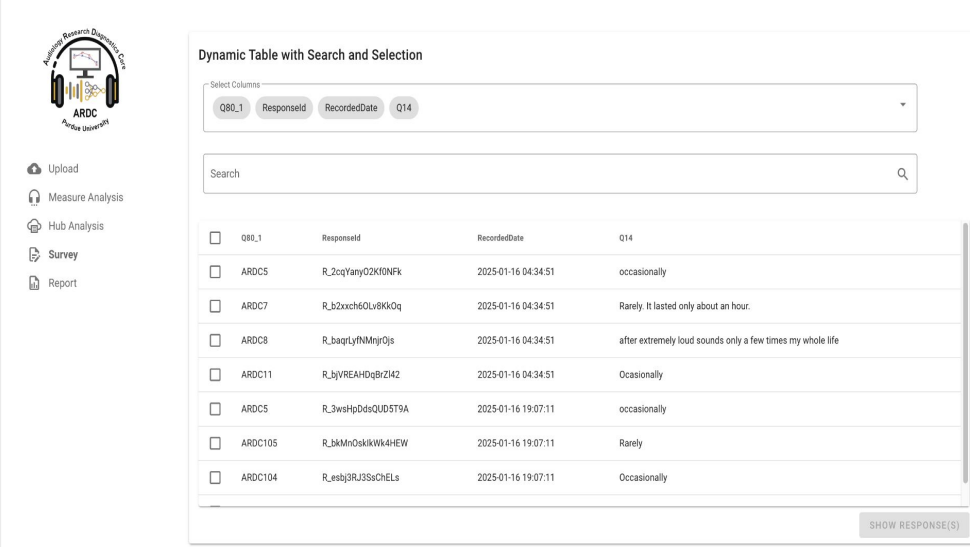
Accessibility: 16 Tech Innovation District



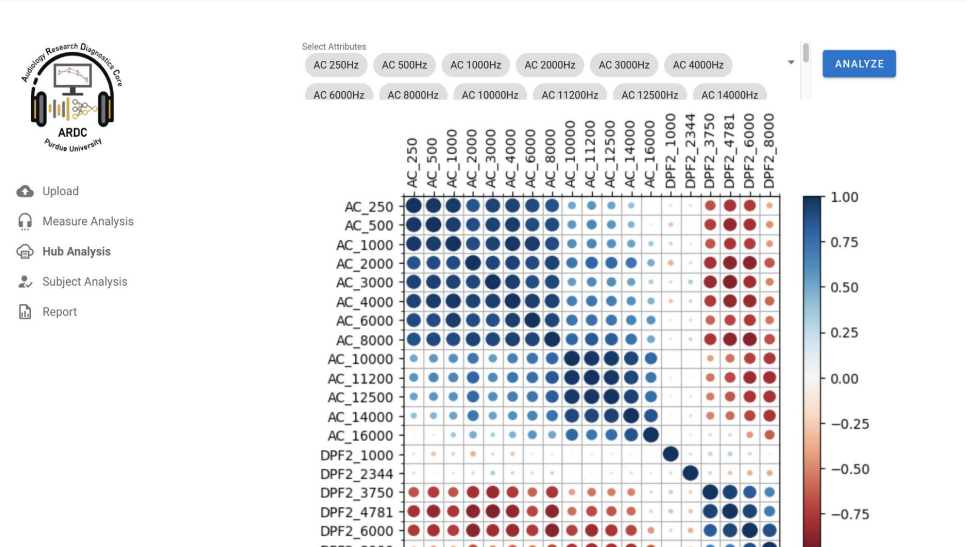
Comprehensive Hearing Assessment



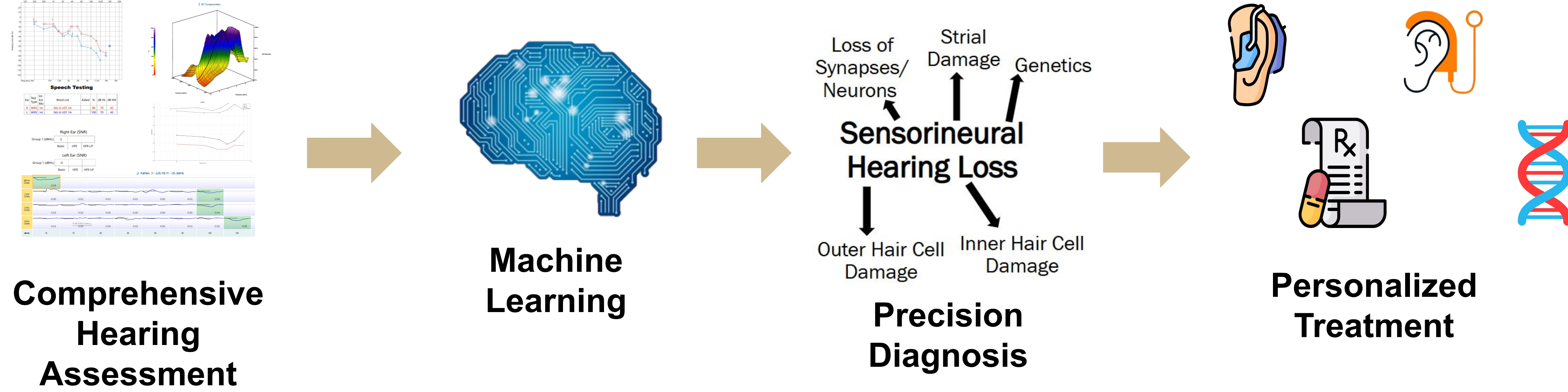
Comprehensive Hearing Assessment



Comprehensive Hearing Assessment



Comprehensive Hearing Assessment



Comprehensive Hearing Assessment → Machine Learning → Precision Diagnosis → Personalized Treatment

Loss of Synapses/Neurons
Strial Damage
Genetics
Sensorineural Hearing Loss
Outer Hair Cell Damage
Inner Hair Cell Damage

- ## Future Directions
- Continue and expand current efforts in community outreach, hearing research and education
 - Provide hearing screenings and hearing-health talks to area community centers, after school programs and adult day care facilities
 - Go out into rural communities with mobile and affordable equipment to provide access to quality hearing healthcare for those who would typically go without
 - Continue to develop and expand the cross-species auditory neuroscience data knowledge base to allow researchers across the globe to contribute, analyze, and view data

- ## References
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Acknowledgements

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