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Audibility-based Clinical Decision-Making and Parent Counseling in Pediatric Audiology

Caitlin Sapp, AuD, PhD, CCC-A



Caitlin Sapp, AuD, PhD

Caitlin Sapp is the head of Pediatric Audiology at UNC Medical Center in Chapel Hill, NC and the director of the Early Hearing Loss Lab at UNC. She completed her AuD training and her PhD at the University of Iowa. She has extensive experience in infant hearing assessment and case management and has collaborated with state EHDI departments on quality improvement efforts related to audiology services. Her research interests include examining the factors that improve language and social outcomes for children who are Deaf and Hard of Hearing, in particular malleable clinician factors like parent counseling.



Introduction

Pediatric Audiologist

Head of Pediatric Audiology at the
University of North Carolina at
Chapel Hill, UNC Medical Center

Director

Early Hearing Loss Lab at the
University of North Carolina at
Chapel Hill



Disclosures

- **Presenter Disclosure:** Financial: Caitlin Sapp received an honorarium for this presentation. They are an employee of UNC School of Medicine and Medical Center, a paid consultant for Akouoso and receive NIH/NIDCD sub-award research support. Non-financial: Caitlin Sapp is a member of the KIPA Implementation Science Board North America, a reviewer for *AJA*, *Ear and Hearing*, *JASA*, and a member of CI PATH.
- **Content Disclosure:** This learning content does not focus exclusively on any specific product or service.
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Our work and research centers primarily on children who use listening and spoken language.



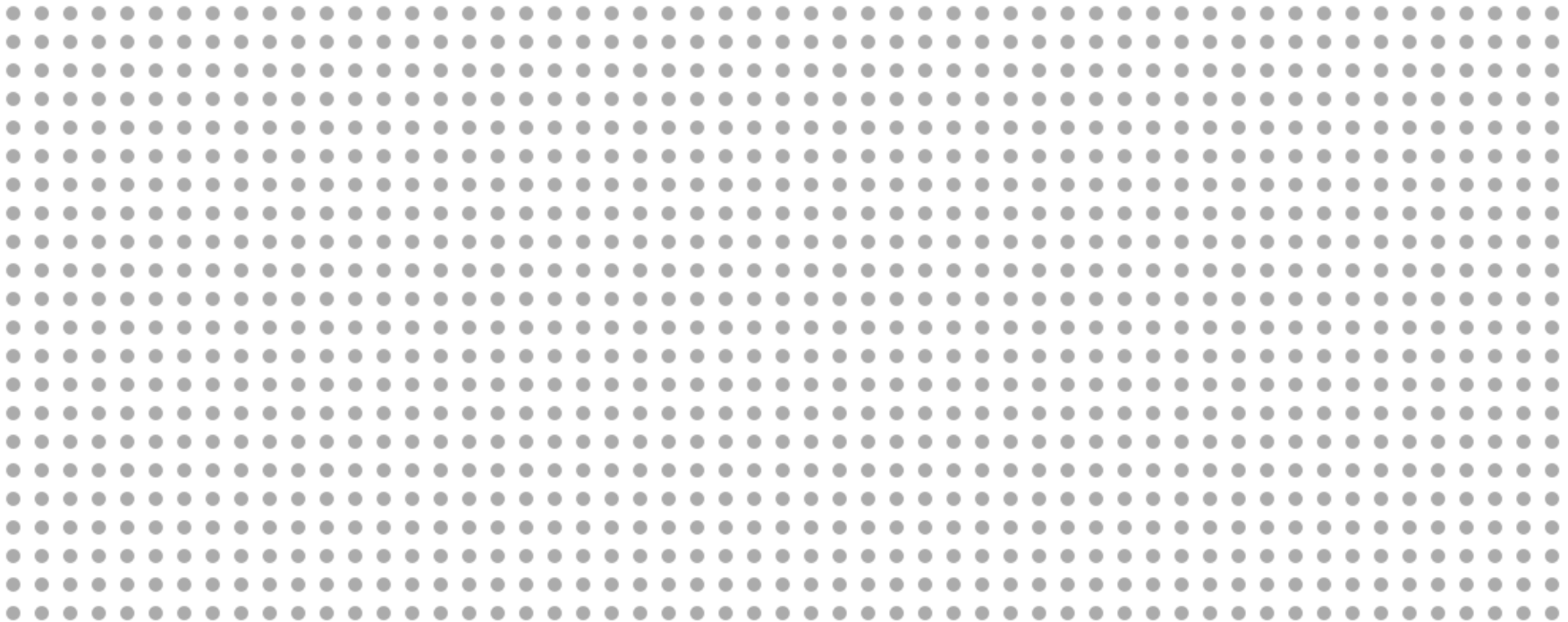
Learning Outcomes

After this course, participants will be able to:

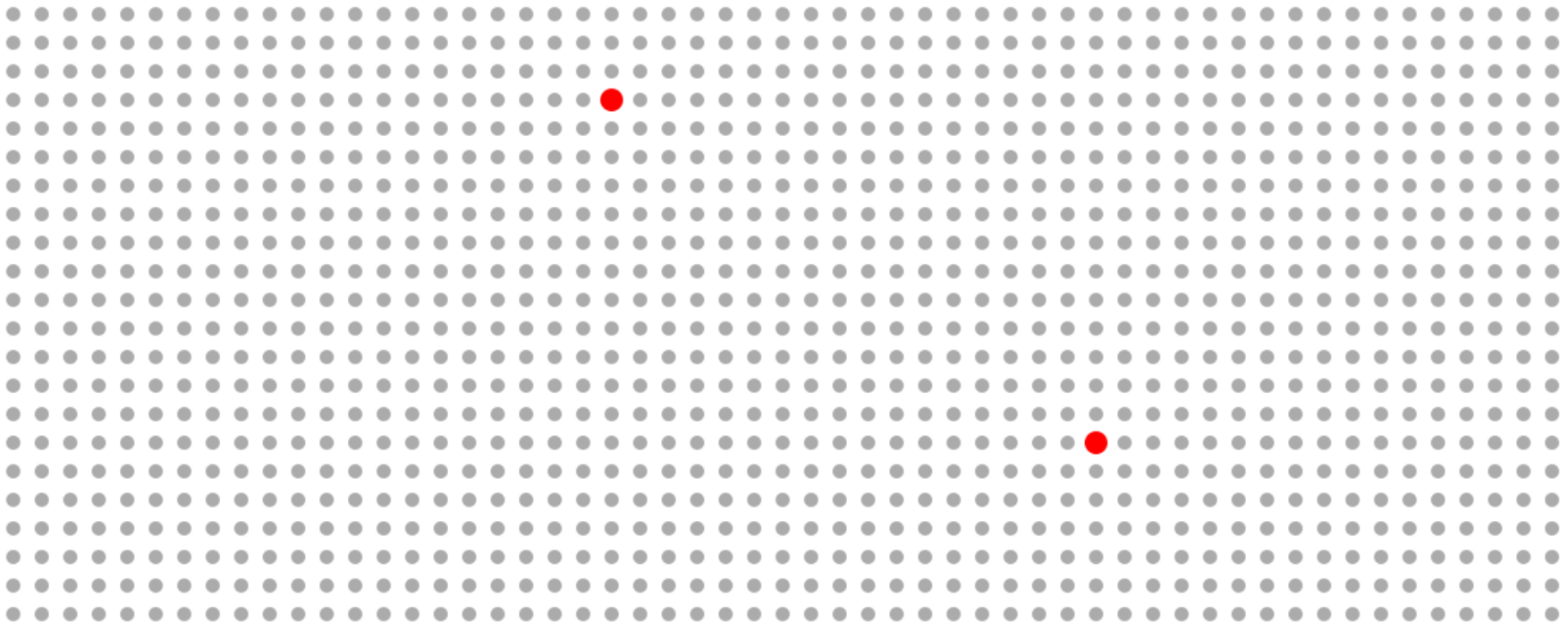
- Identify the gaps in current parent counseling approaches about early hearing loss from the literature.
- Contrast audibility-based counseling and degree-based counseling after diagnosis and during early audiological management.
- Identify the strengths of unaided and aided audibility measures in presenting diagnostic hearing test results and hearing technology recommendations.



In the United States, we perform more than 3.5 million newborn hearing screenings each year.



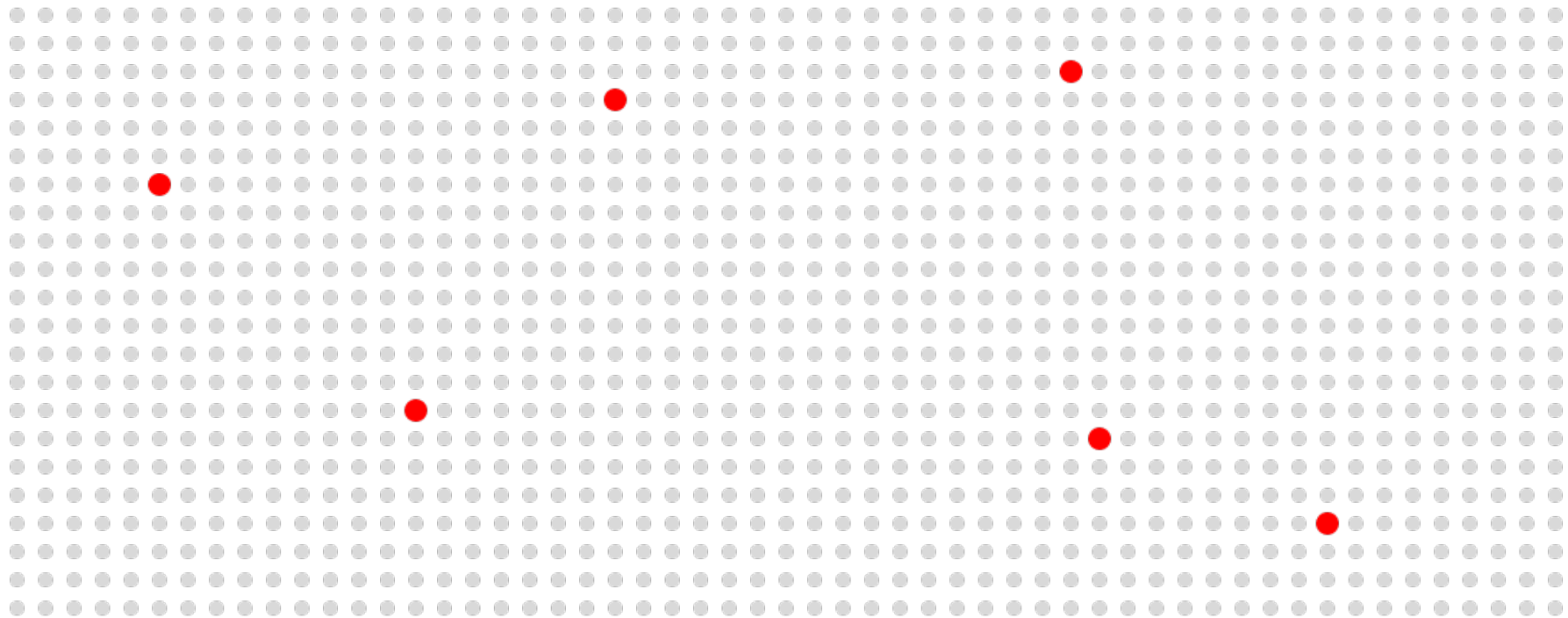
For every 1000 infants who receive a screen, we find about 2 who show permanent hearing loss.¹



¹CDC, 2024; 1.8/1000 births, collapsed across states and territories.



By the school-age years, this number goes up to about six children per 1,000.¹

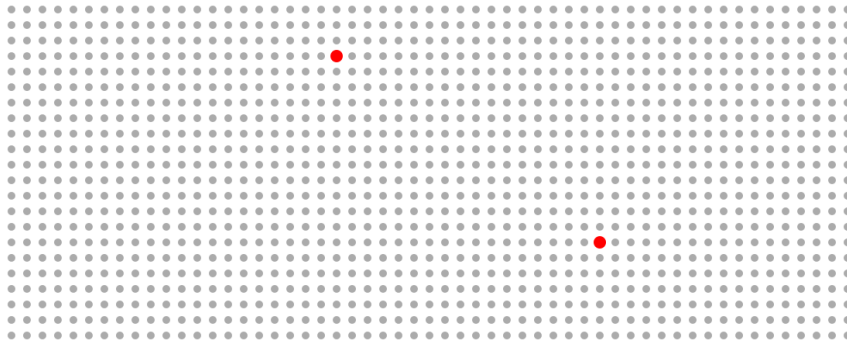


¹CDC, 2024; 1.8/1000 births, collapsed across states and territories.



The US Healthcare system spends more than \$23,000 on universal screenings to identify each child with congenital hearing loss.

To fully realize the benefit of this investment, early diagnosis *must* lead to early intervention.



This relies on parents taking action soon after diagnosis.



Why focus
on parent
counseling
to move
the needle
in early
hearing
loss?

We are in control of the words
we use.

Words are free!

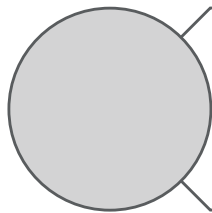


We face several fixed factors that impact how we foster success in families.

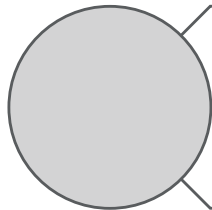
- Level of hearing loss
- Geographic distance
- Insurance coverage
- Family resources
- Provider networks



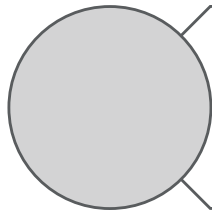
Our task becomes identifying the levers for success that are within our sphere of influence and optimizing for success.



The words we use with
families



The consistent use of
evidence-based practices

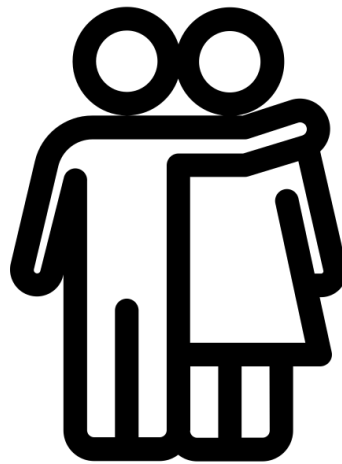
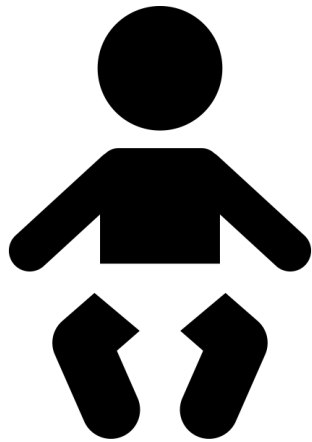


Identifying clinical markers
of urgency

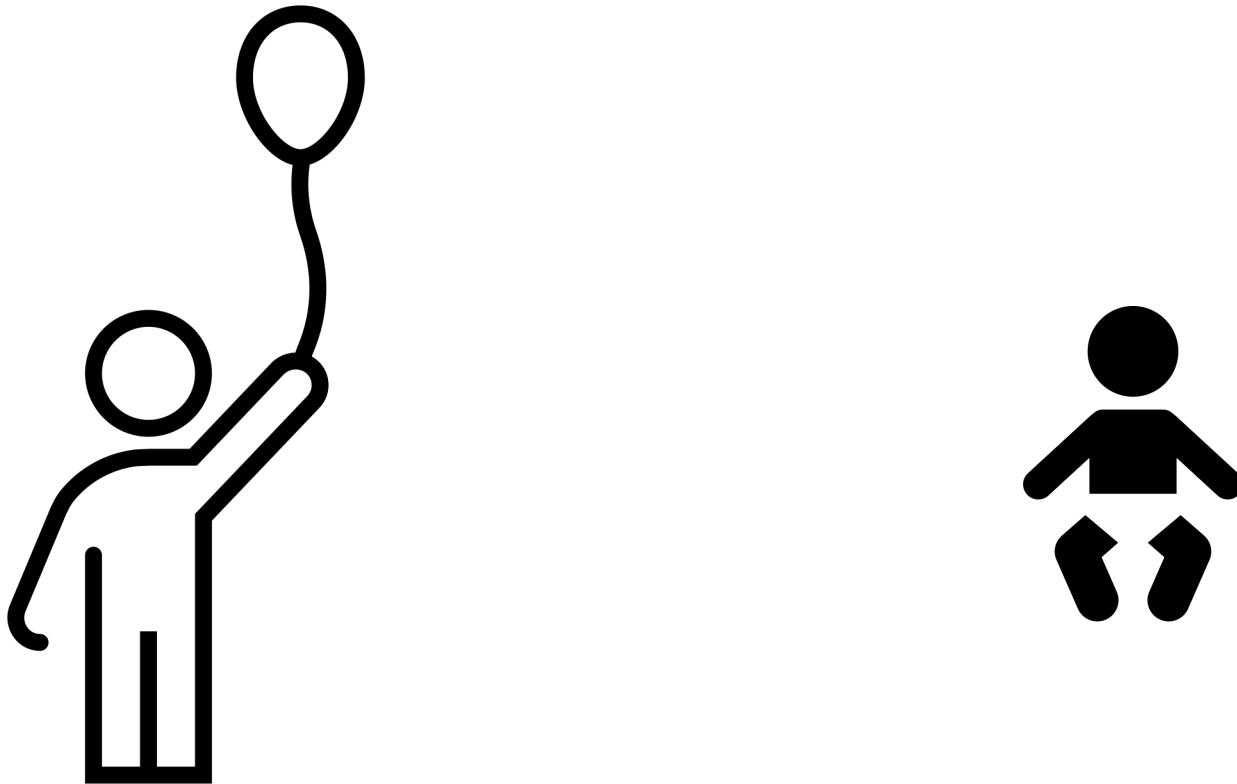
Gaps in Parent Counseling



Parents are healthcare agents for their children and are the primary recipients of pediatric audiology counseling.



Today, we have de-coupled the timing of diagnosis from the onset of concern by moving to universal newborn hearing screening.



ALERT!

Changing the way that we talk about hearing loss can create a lot of anxiety!

Locus of control

Evidentiary proof in
successful cases

Efficient at getting to the most
important bits!



Parents may not always take away the information they feel like they need.

- Information about unaided hearing
- Orientation about nitty gritty hearing aid use
- Specific information about wear time
- Need persist across levels of hearing loss
- Realistic expectations for progress with spoken language

Watermeyer et al., 2017 ; Gilbey, 2010; Muñoz et al., 2015; Johnston et al., 2008; Visram et al., 2020; Tattersall and Young, 2007; Fitzpatrick et al., 2008



Parent need information connecting our results to where they are in the process.

- Poor clarity between what is a hearing *screening* and what is a full *diagnostic* exam
- How a *diagnostic* test differs from previous screenings.

Gilbey, 2010; Elliott et al., 2022; Fitzpatrick et al., 2008; Tattersall and Young, 2007



Parents may struggle to understand the functional implications of hearing loss.

- Variable understanding of words like mild
- Reconciling behavioral responses in their home environments
- Any level of HL = Deaf!
- Technical Jargon inhibits learning

Donald and Kelly-Campbell, 2016; Watermeyer et al., 2017; Wolfe and Smith, 2015; Haggard & Primus, 1999; Aguila-Vinson, 2004; Clark, 1981



Parents lack clarity about the implications of HL and amplification (from Sapp et al., in review)

Parents must integrate an entirely new lexicon.

“I think they really had to break it down. It took us a couple of appointments. What is a moderate hearing loss? What are decibels? But, that first appointment is emotional and very overwhelming. What does this mean for us? How are we going to live, like, what are we going to do?” (9103)

Many struggled to differentiate *HL* from *deafness*.

“I immediately jumped to the conclusion that she was profoundly deaf because hearing loss to me, at the time, equaled she was deaf. It was black and white. Like, she can't hear my voice...she could never have heard my voice.” (9065)

Behavioral responses to sound make accepting the diagnosis difficult.

“She seemed to be responding to stuff. We were doing our own informal testing . I remember the night before the test, [husband] asked if I was nervous and I said, ‘Not really,’” (2497)

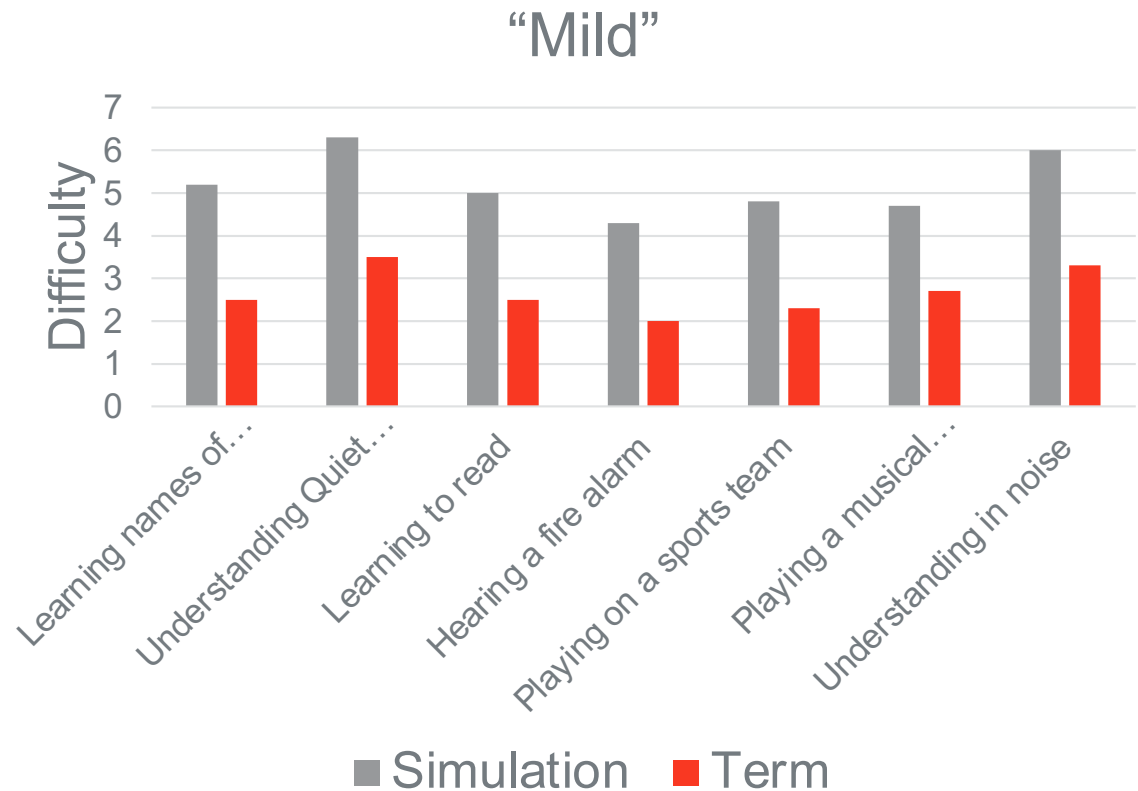


Parents may struggle to understand the functional implications of hearing loss.

- Variable understanding of words like mild
- Reconciling behavioral responses in their home environments
- Any level of HL = Deaf!
- Technical Jargon inhibits learning
- Motivational Interview techniques
- Role of audibility-based descriptors



Parents may misinterpret the impact of hearing loss if we focus on the degree of hearing loss alone.



Adapted from Haggard & Primus 1999 AJA



The audiologist must balance the need for information to act with the risk of *attentional narrowing*.

- Informational counseling
 - Level of hearing loss
 - Referrals for medical work up
 - Hearing aid consult/earmold impressions
 - Setting up next appointments

Attentional narrowing limits a family's ability to absorb and use new information for next steps.

Emotional reactions are not easily disentangled from informational counseling.



What is *Audibility*, and what
can it tell us that the
audiogram can't?



Audibility descriptions of hearing test results focus on how a hearing loss limits auditory access on a common scale.

Audibility is the proportion of speech sounds that are available to a listener.

-Measured using the Speech Intelligibility Index (SII)

Audibility also provides a straightforward mechanism to talk to families about candidacy and the benefits of full-time hearing aid use.

-Measured using the *Aided* Speech Intelligibility Index (aSII)



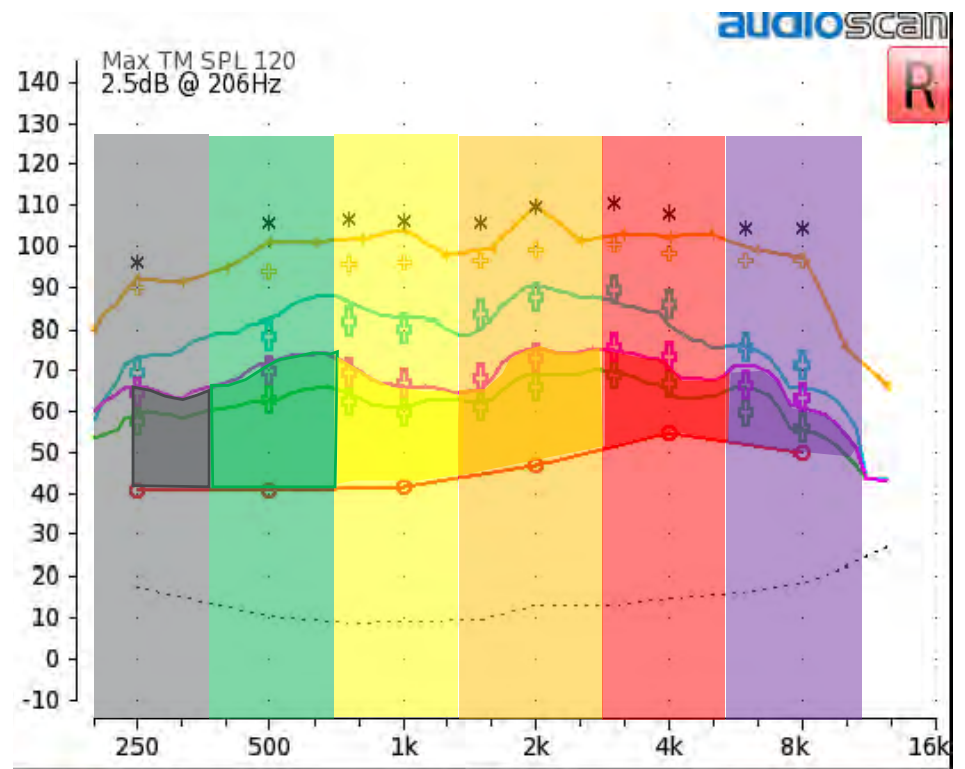
Calculating audibility using the SII requires that we know two components:

How much of a given frequency band falls above a patient's thresholds?

How important is that frequency band to understanding spoken language?



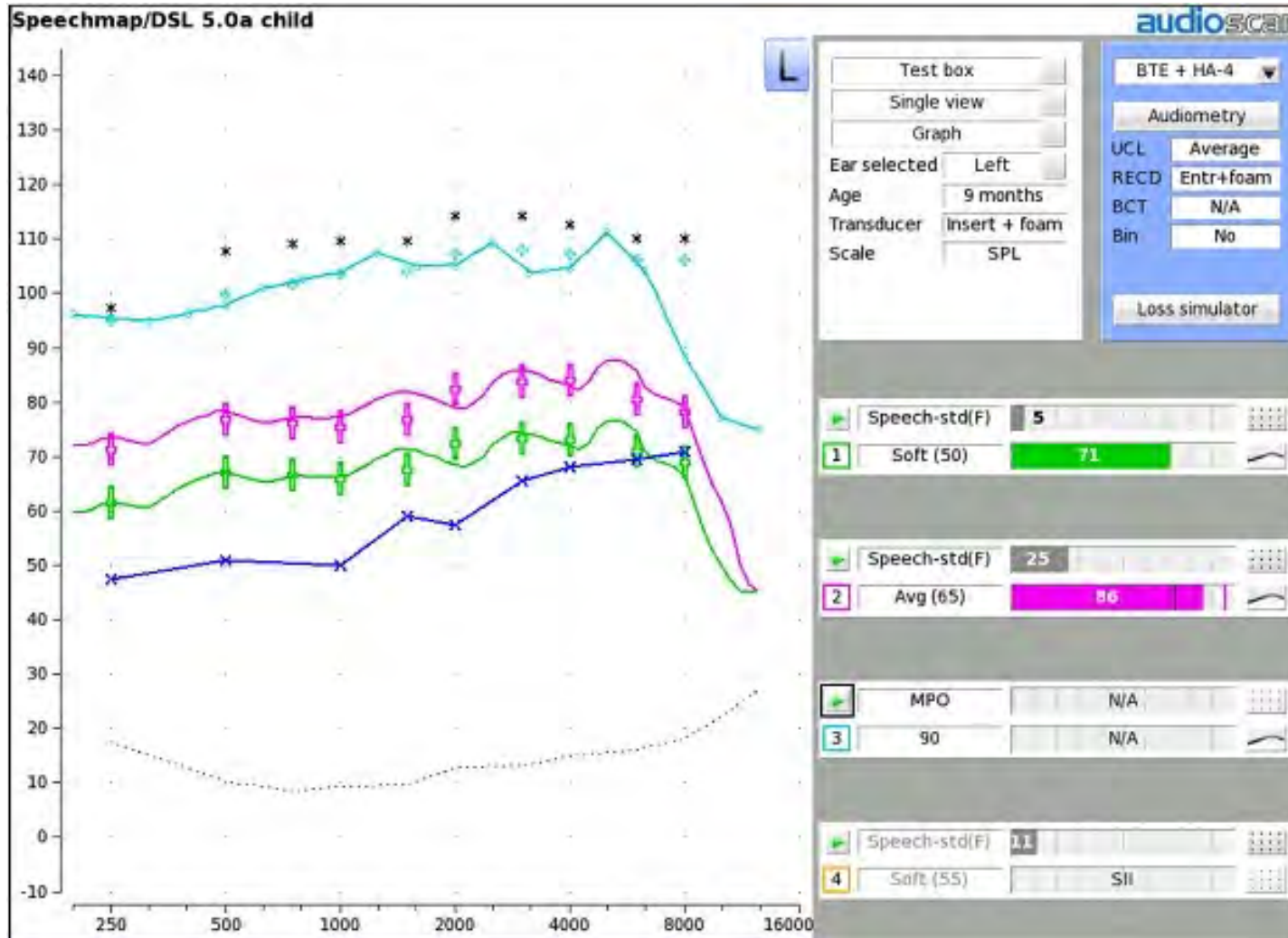
Calculating audibility with the SII



A child's specific-audibility values are influenced by several factors that can change over time.

- Level of hearing loss thresholds (fixed)
- Ear canal acoustics (fixed; can be optimized)
- Level of the speech stimulus (fixed)
- Configuration of hearing loss (fixed)
- Degree of benefit from hearing aids (e.g., closer fit to target; can be optimized)
- Device use rates have implications for long-term aided audibility benefit.





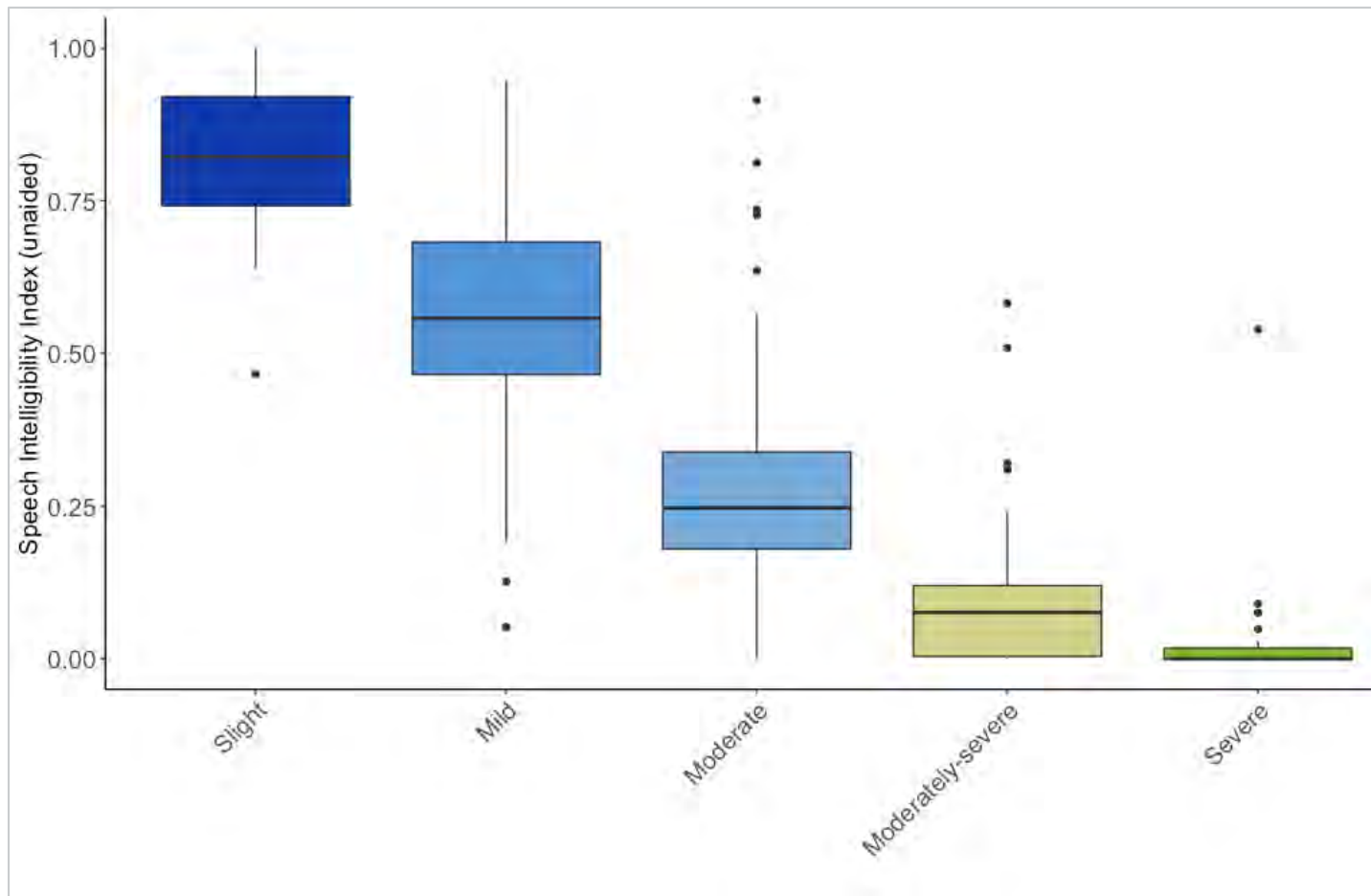
Audibility is already calculated for us during the hearing aid fitting process.

Unaided SII

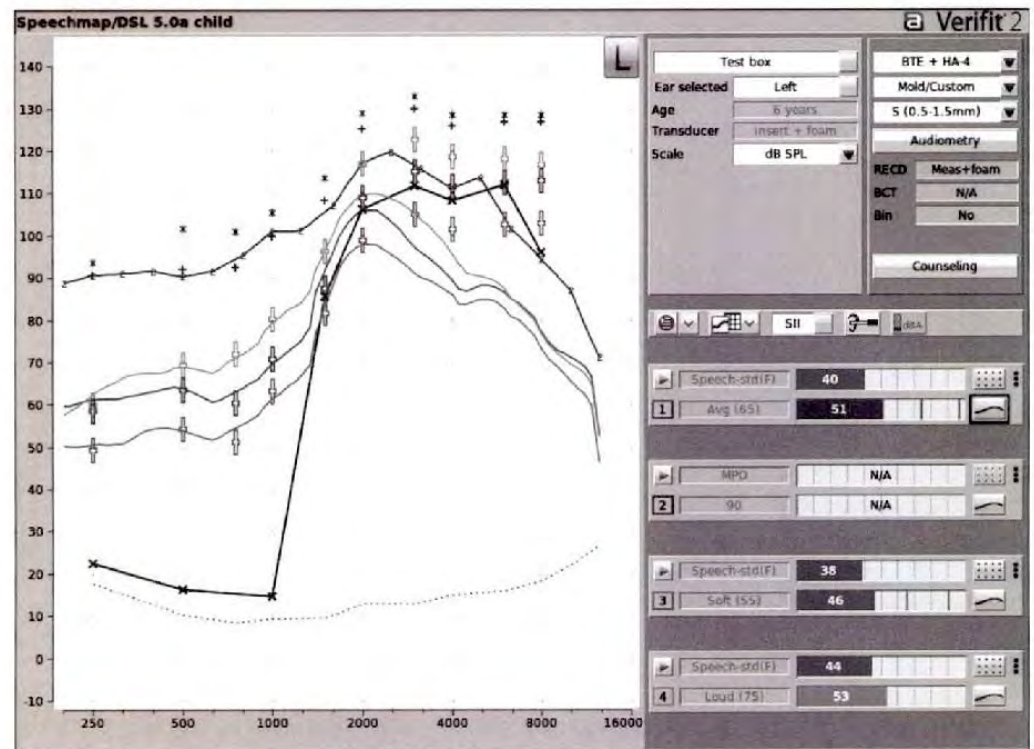
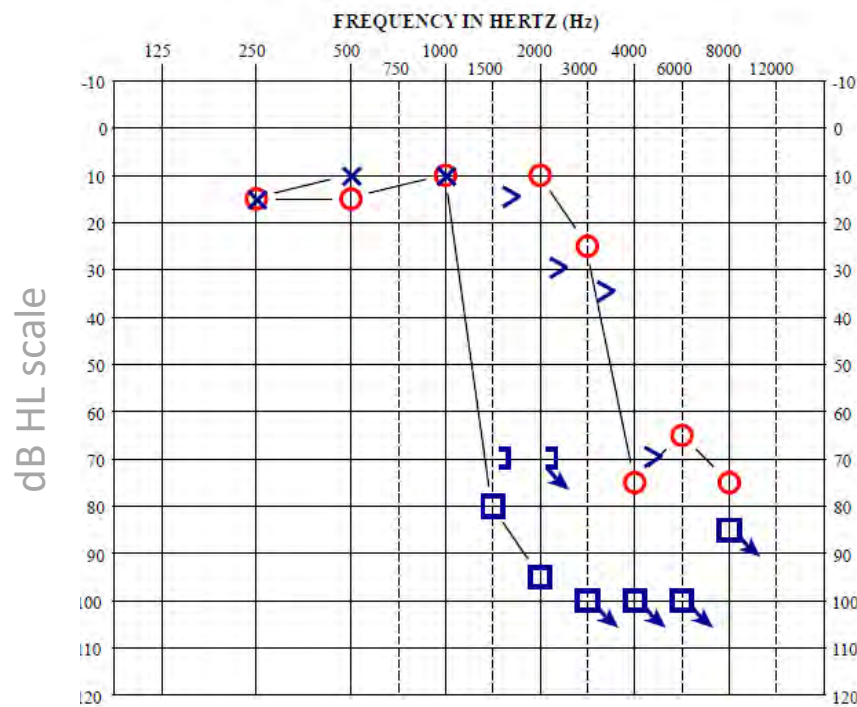
Aided SII

Does not represent extra work for practicing audiologists

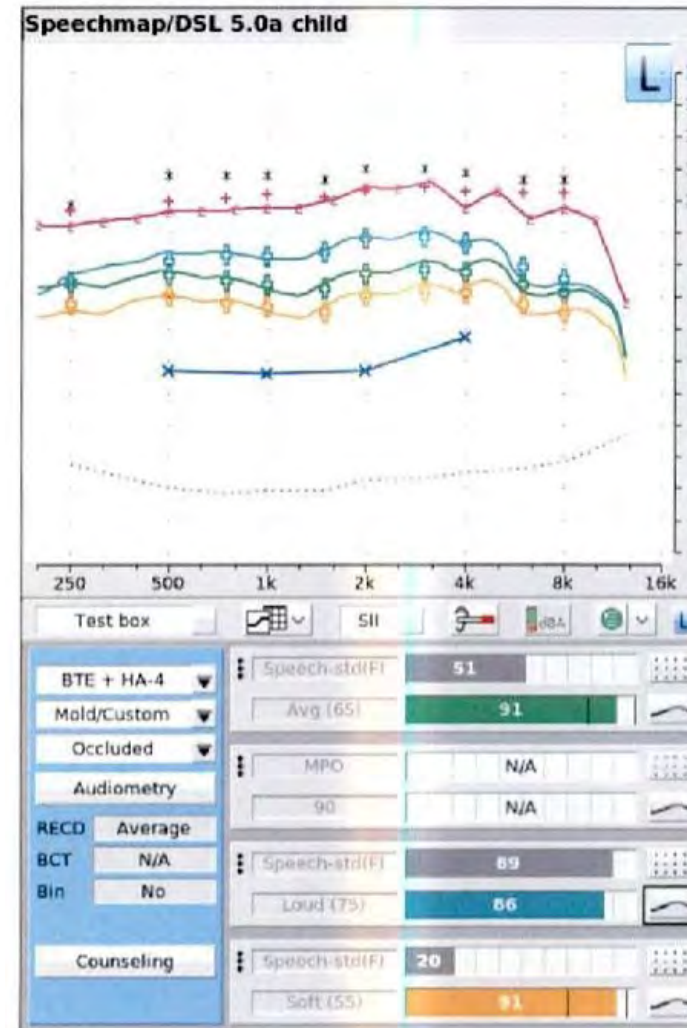
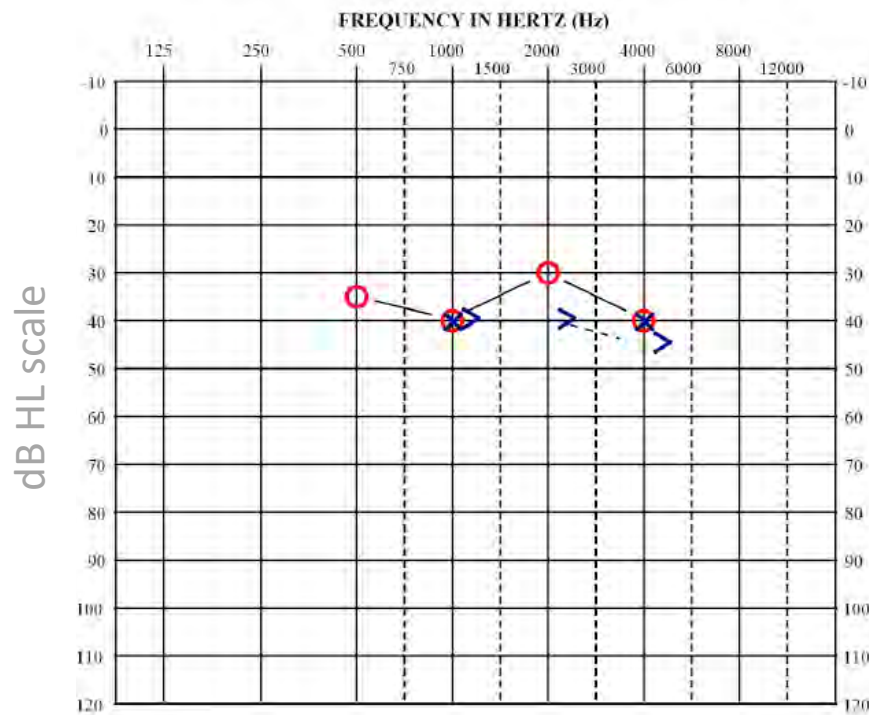
Two children with the same degree of hearing may have drastically different access to the sounds of spoken language.



Audibility Case One: 5-year-old female



Audibility Case Two: 18-month-old male



Counseling with Audibility Measures



Counseling with audibility

Hearing Evaluation

“This level of hearing loss reduces her access to average speech by around 45%”.

Hearing aid Fitting

“With her hearing aids on, she’s getting almost 90% of even soft speech!”

Hearing aid use

“During each hour she’s not wearing her devices, remember she’s coming in at that low % of access, just 55%.”



Counseling with audibility

The hearing aid fitting & follow up

Natural extension of the work an audiologist is already doing.

Scaffolds conversations (especially for motivating changes)



Measuring audibility over time

Our team is working to make audibility part of our electronic medical record to track this over time.

Allows the audiologist to track the influence of changing ear canal acoustics.



Mild hearing loss

Focus on *unaided* audibility and the decrease it has on auditory access.



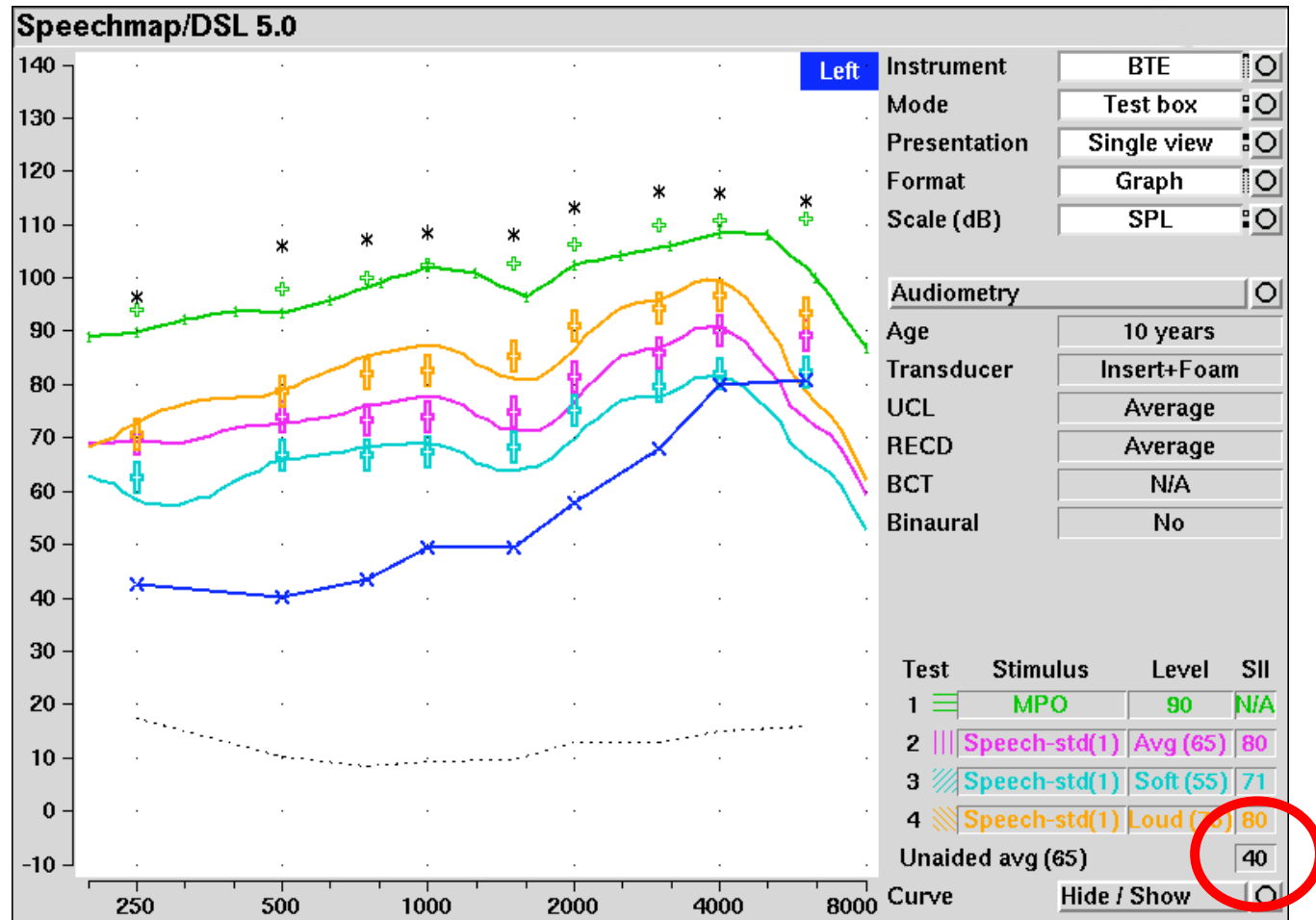
Profound hearing loss

Focus on *aided* audibility and the limitations of traditional amplification to boost access.



“We are measuring how much benefit the hearing aids provide for accessing the sounds of speech”

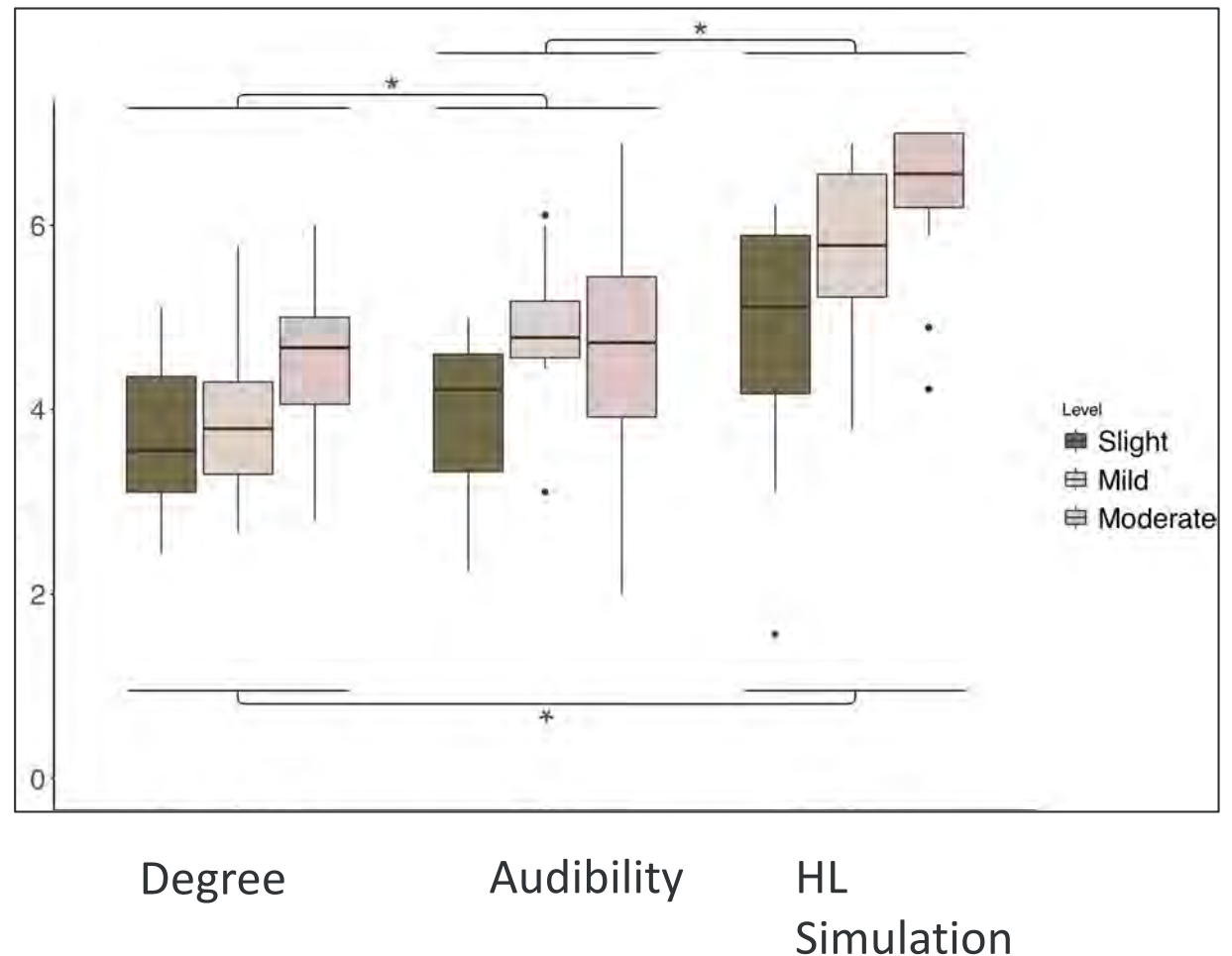
“This value shows us that even without hearing aids, she hears some sounds. This makes sense with what you told me about her hearing at home!”



Compared to degree of hearing loss, Audibility has been linked with greater parent concern about hearing loss.

Sapp et al., 2023

Level of parent concern (0-7)



Parent-reported benefits and drawbacks of using audibility (Sapp et al., in review)

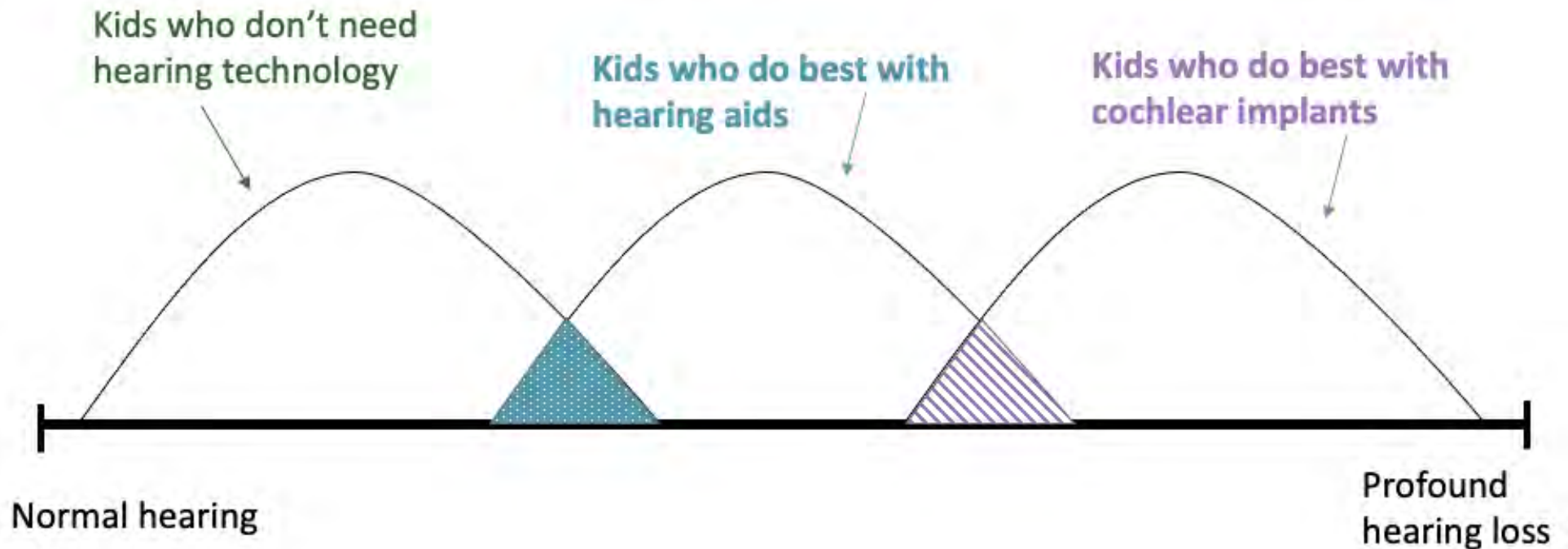
Potential Benefits	Potential Drawbacks
Understand the link between diagnosis and implications	Capacity for audibility-based measures to exclude children
Explain diagnosis to family and friends	May communicate a "failing" result for families
Clearer than words like mild and moderate	In cases of mild HL, may not seem very serious
Helpful to differentiate the benefit of amplification	
Complement degree-based and simulation	



Audibility-based Referral and Fitting Criteria



Aided audibility can help support decision making for technology transitions.



Counseling with audibility at UNC: Device recommendations

At UNC, we are moving toward letting measures of auditory access drive recommendations.

Unaided audibility <80%?

Full-time hearing aid use

Aided audibility <65%?

Recommend discussion with cochlear implant team



How much aided benefit is enough? Wiseman et al., 2023

Hearing Thresholds, Speech Recognition, and Audibility as Indicators for Modifying Intervention in Children with Hearing Aids

Ear and Hearing

- 182 pediatric hearing aid users & 78 children with typical hearing
- Examined outcomes through the lens of auditory factors: how restricted must aided audibility be before kids no longer display same benefit from hearing aids?
- Aided SII values <0.61 associated with risk for underperformance (or 61% access to average speech).



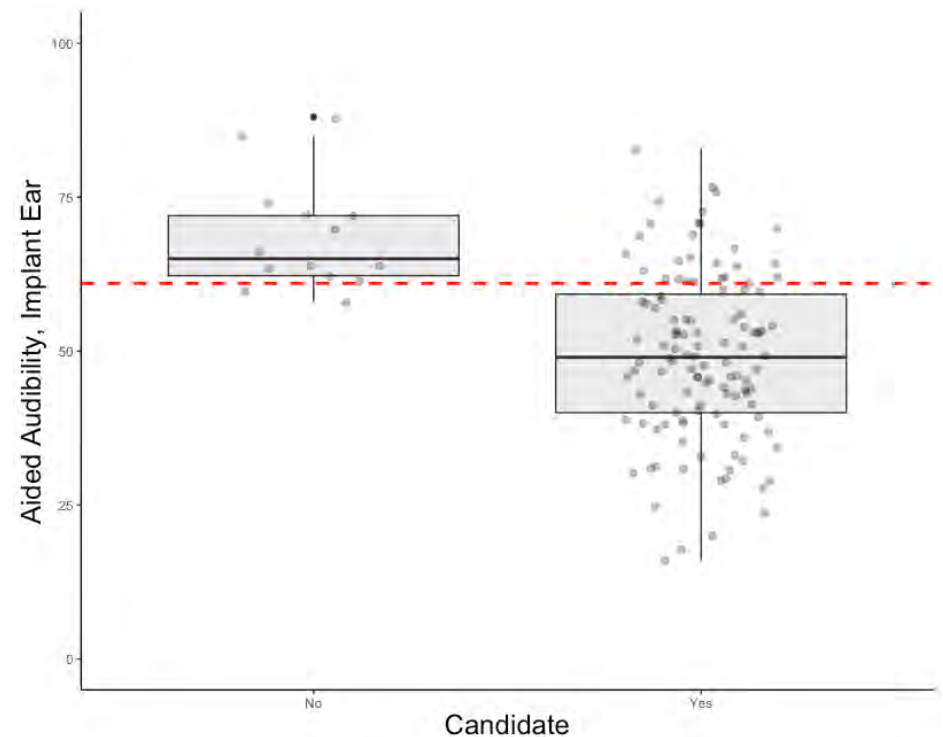
At UNC, we are now studying aided audibility values in kids referred for CI to validate and expand its use.

Study design:

Retrospective cohort
review

Study period: 2017-
2021

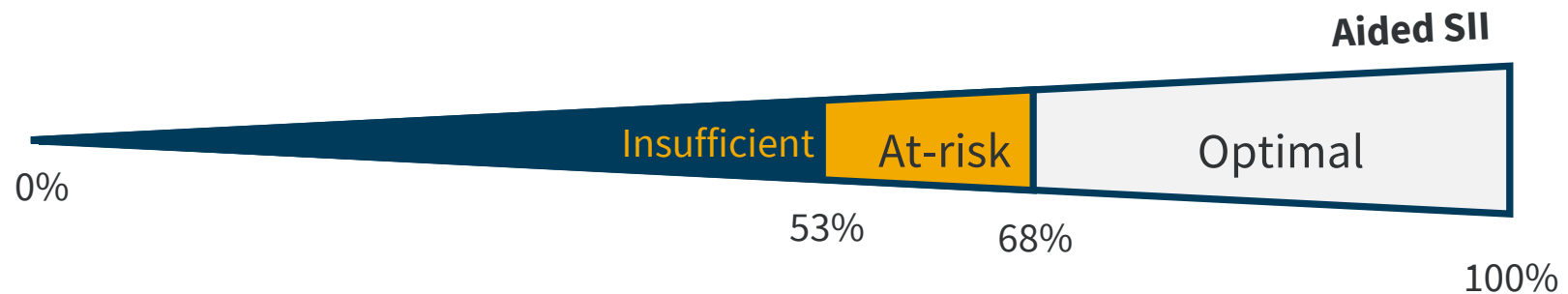
Subjects: Children (0-
18 years) referred for a
cochlear implant
evaluation at UNC



High sensitivity (~96%) applying the cutoff from Wiseman et al.
retrospectively on pediatric patients with known candidacy outcomes.



Aided audibility guidelines for CI referral (Wiseman et al., 2023)



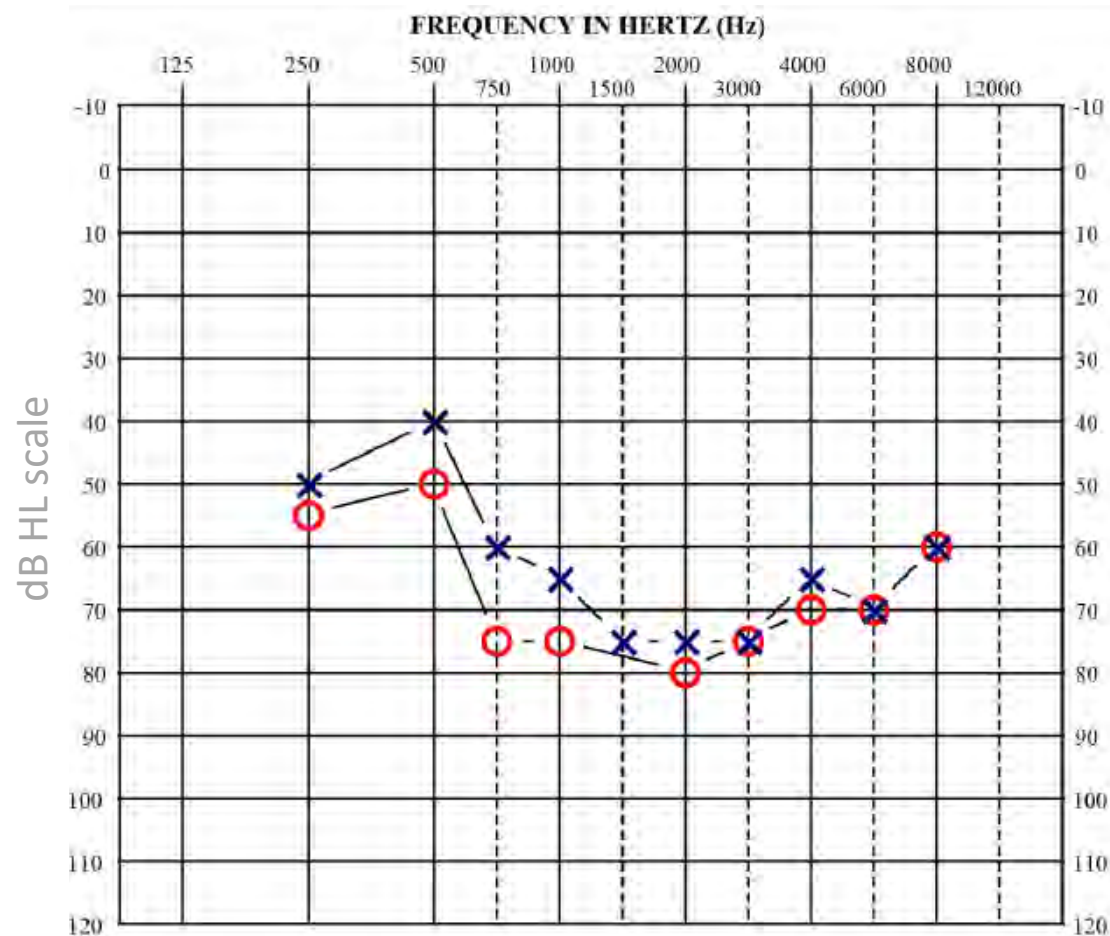
Aligns with other estimates:

Stiles et al. (2012) - 65%

Tomblin et al. (2020) - 71%

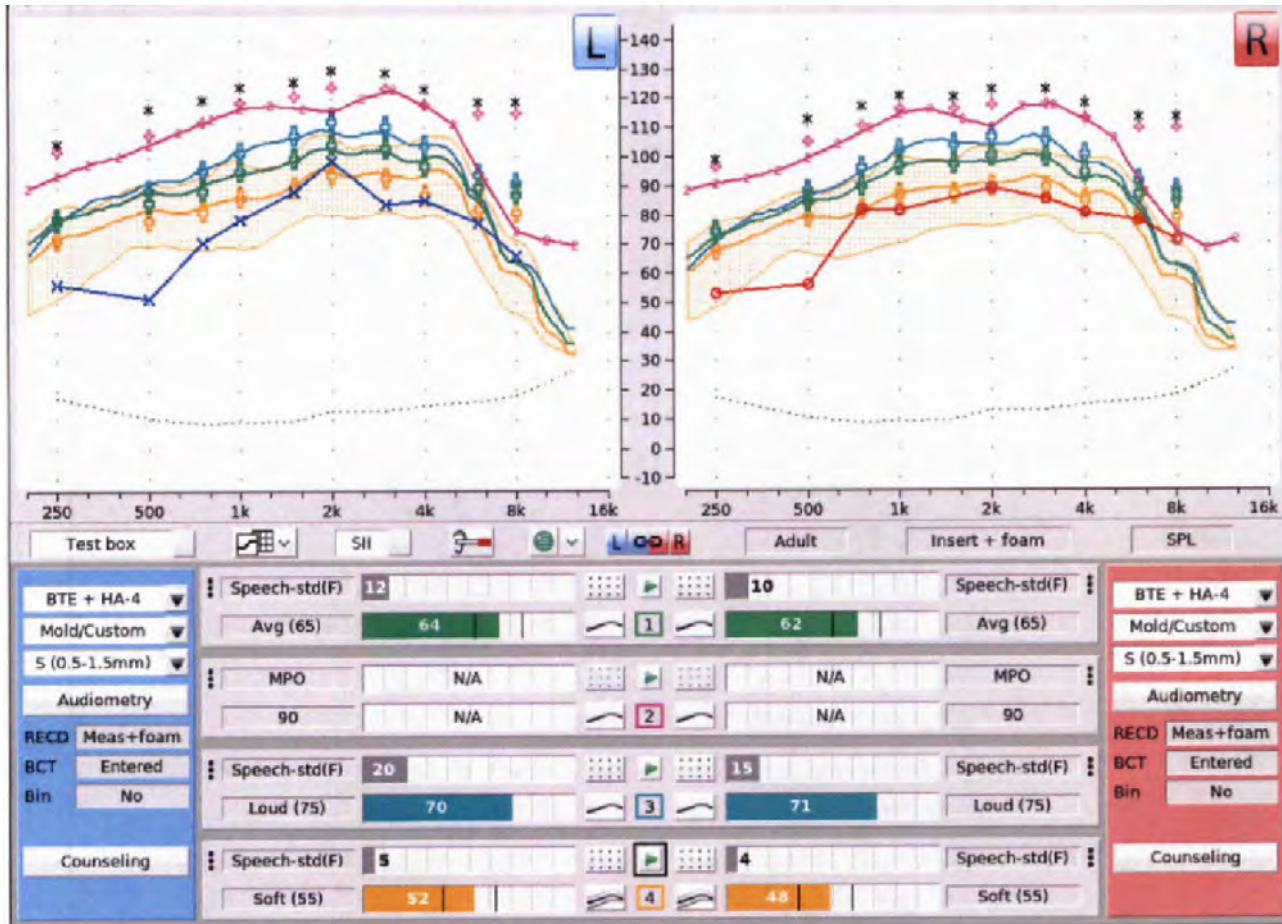


Audibility Case Three: 8-year-old female



Stable
Age-
appropriate
language
Long-term HA
user





Referred for pediatric cochlear implant evaluation based on PTA (72/68), and borderline aided SII values (62%/64%)

Ultimately, not a candidate based on excellent word recognition scores.

Supporting Auditory Experience with Audibility- based Framing



Effective Audibility



Auditory Experience.

Generating and measuring effective audibility is two-fold:

High-quality hearing evaluation

Up to date, serial threshold testing

Valid, age-appropriate test paradigm (e.g., ABR, VRA with inserts)

Apply appropriate correction factors when necessary

Cross-check with objective measures and vice versa

High-quality Hearing Aid fitting

Probe microphone verification

Child appropriate target selection

Low error in fitting (close match to target)

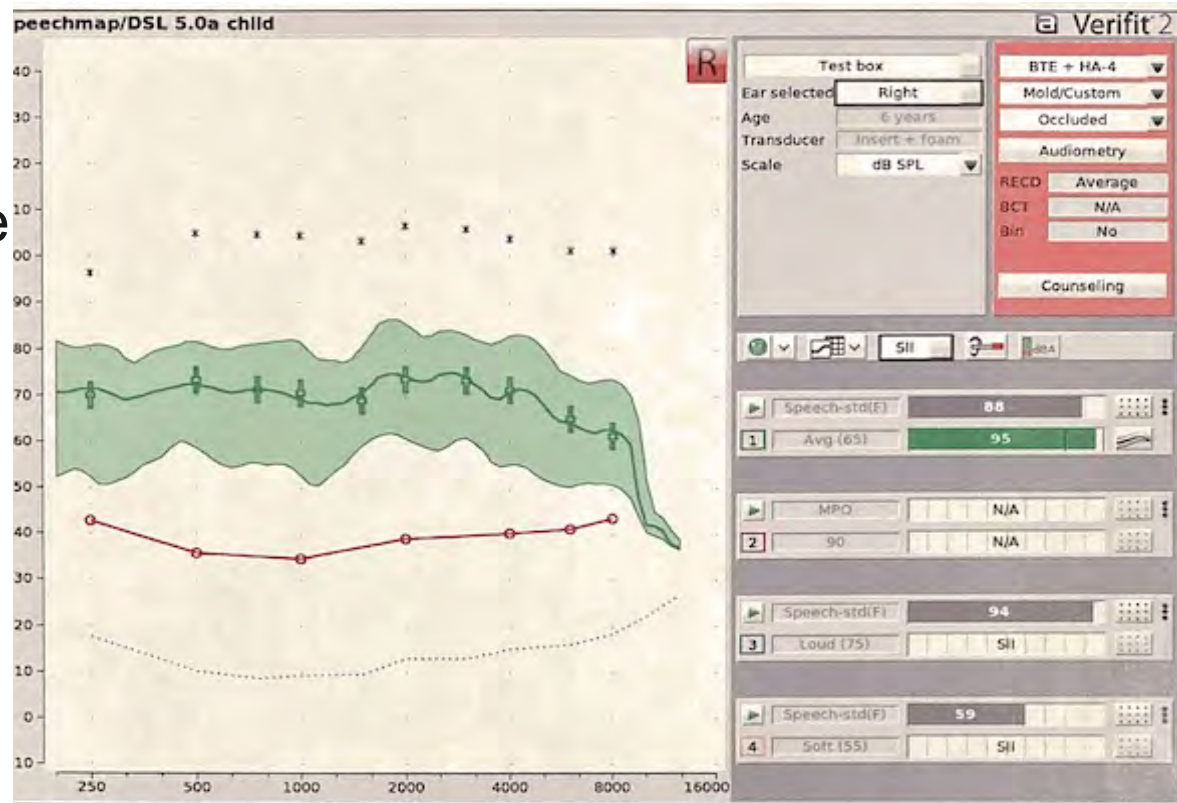
Up to date Real Ear to Coupler Difference (RECD)

Discuss full-time device use with families and engage them with tracking options.



Audibility Case Four: Auditory Neuropathy

This hearing aid is set for low gain, here verified to a flat mild hearing loss.



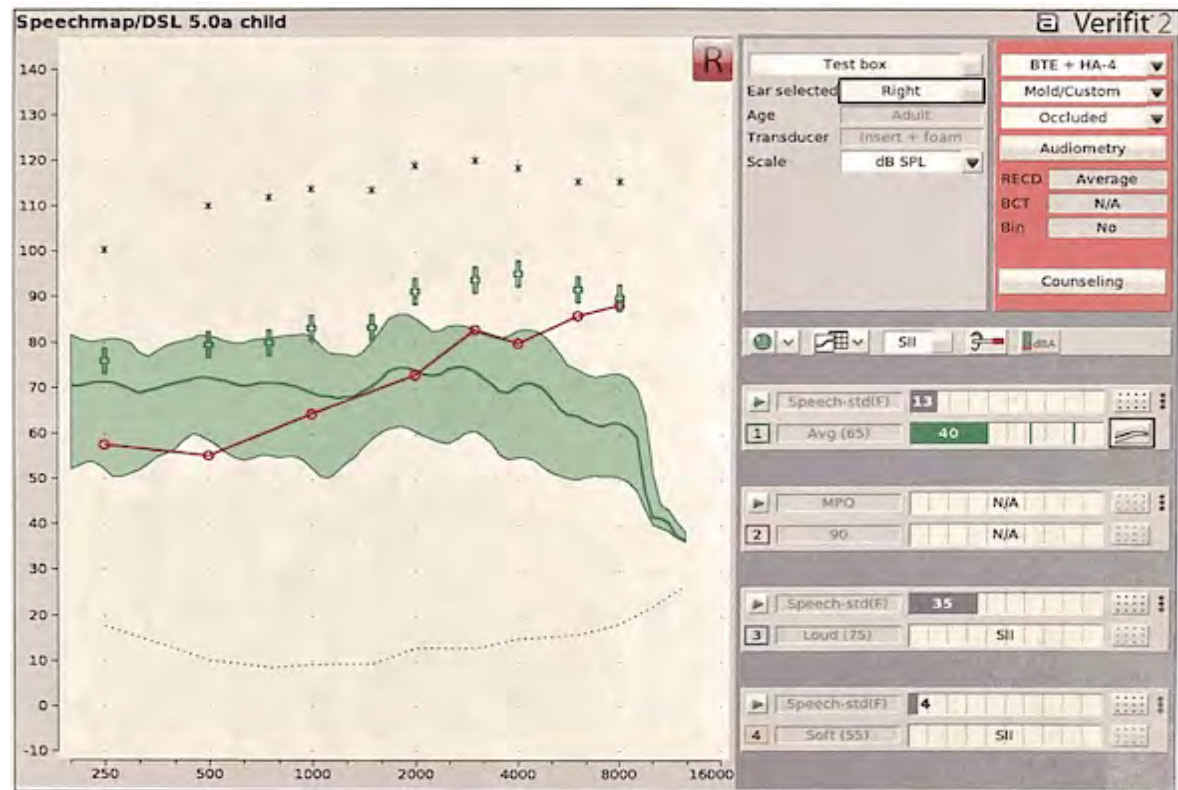
Hood, 1998; Walker et al., 2016



Audibility Case Four: Auditory Neuropathy

This verification shows the same low-gain hearing aid but using real-world thresholds.

The starting point matters!



Summary & Conclusions



Summary

There are opportunities to expand our counseling approaches in response to gaps!

Audibility-based framing is one tool to describe hearing loss and link the diagnosis with intervention steps.

Aided and unaided audibility may play different counseling roles based on the level of hearing loss.



Consider how early auditory experience frames the *Why?* in Pediatric Audiology.

Language is an experience-dependent phenomenon associated with being a human.

Tell me about how you pictured teaching your baby language.

Hearing loss takes what should be an effortless process and requires a TON OF EFFORT by parents to address.

Tell me about how you learned language as a child.



Thank you for attending!

Caitlin Sapp, AuD, PhD
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