

# When Mild Hearing Loss Is Not Mild: A New Tool for Calculating Unaided Audibility

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Disorders and the National Centre for Audiology

**with the KIPA Group (Steve Aiken, Dave Gordey, Eileen Rall,  
Leisha Eiten, Lisa Davidson, George Lindley, Michael Scott)**

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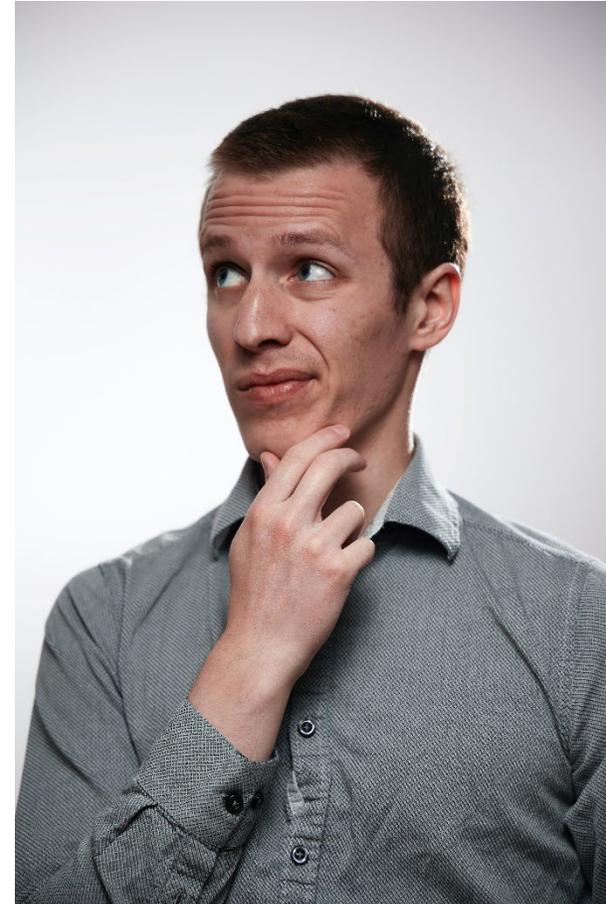
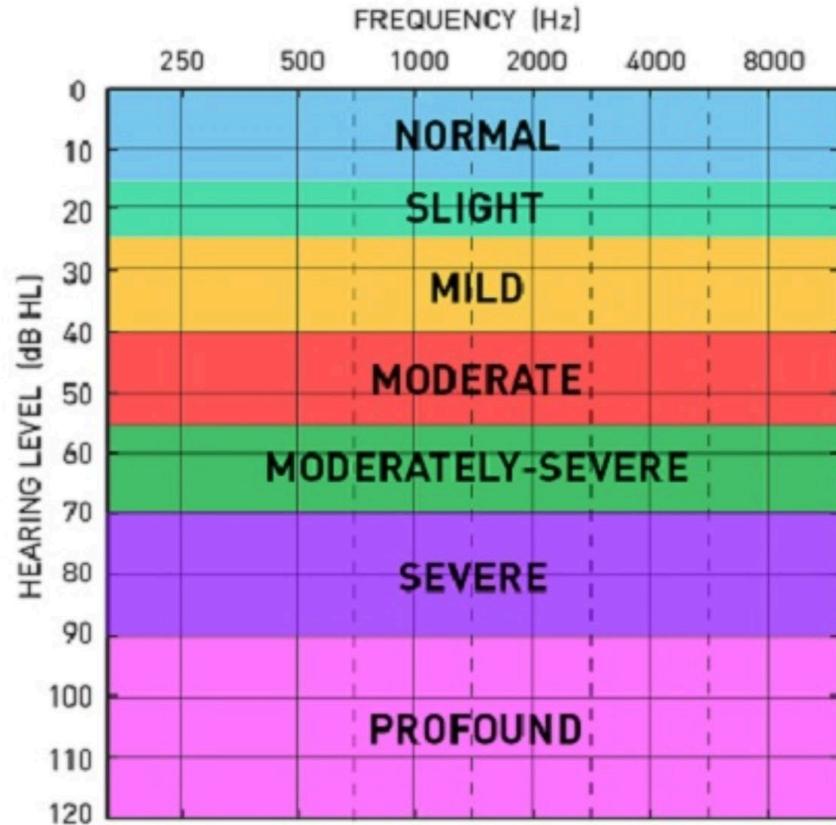


# Acknowledgements



- **MRIS, Early Researcher Award (ER-16-12-144) to Sheila Moodie**
- **The KIPA group ([kipagroup.org](http://kipagroup.org)); With support by Oticon**
- **OCHL Study Researchers & Group**
  - **Ryan McCreery**
  - **Elizabeth Walker**
- **Marlene Bagatto and Susan Scollie**
- **Nilram Jalilian**

# When is mild hearing loss not “mild”?



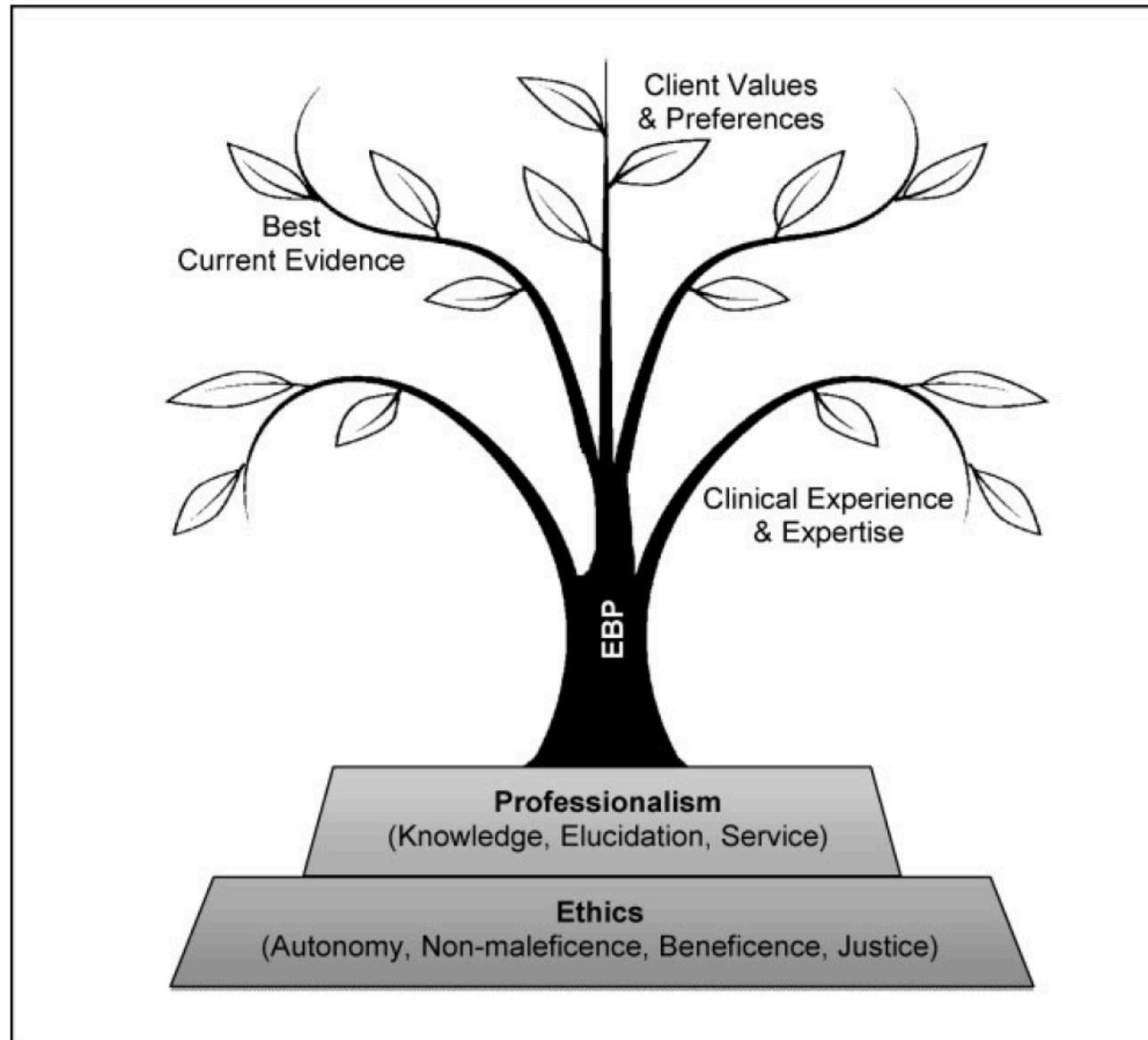
AJA

**Review Article**

# **Candidacy for Amplification in Children With Hearing Loss: A Review of Guidelines and Recommendations**

**Elizabeth M. Fitzpatrick,<sup>a,b</sup> Emilia Cologrosso,<sup>c</sup> and Lindsey Sikora<sup>a</sup>**

*American Journal of Audiology* • Vol. 28 • 1025–1045 • December 2019 •



**Figure 1** Evidence-based practice (EBP) in the context of ethical practice and professionalism.

# Ontario IHP

- **IHP Audiologists routinely seek support for the management of children with UHL and MBHL**

ADDENDUM 4: DECISION SUPPORT GUIDE FOR HEARING AID USE IN INFANTS & CHILDREN WITH MINIMAL/MILD BILATERAL HEARING LOSS<sup>1</sup>

Ontario Infant Hearing Program Amplification Protocol, 2019:  
[https://www.uwo.ca/nca/pdfs/clinical\\_protocols/IHP\\_Amplification%20Protocol\\_2019.01.pdf](https://www.uwo.ca/nca/pdfs/clinical_protocols/IHP_Amplification%20Protocol_2019.01.pdf)

# What we know:

- **Children with mild hearing loss are at risk for speech, language, social, emotional and/or educational difficulties including fatigue while learning;**
- **Not every child will experience difficulties**
- **Audibility is determined by:**
  - **Hearing threshold**
  - **Speech level, noise, distance**
  - **Context**
  - **Age**
  - **Device and device use**

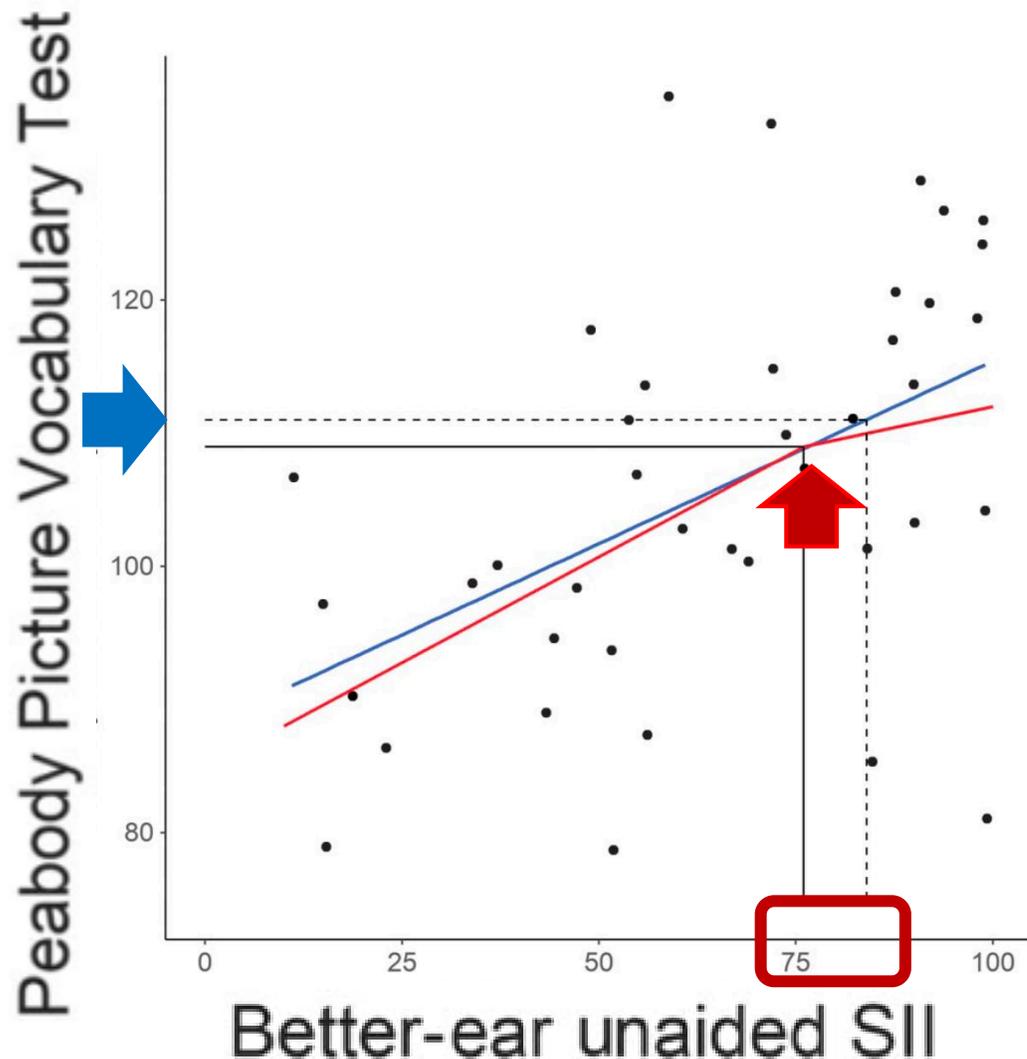


# **Audibility-based hearing aid fitting criteria for children with MBHL**

**McCreery et al. (2020).**

***Lang Speech Hear Services Schools, 51:55-67.***

# Relationship Between Language Measures & SII



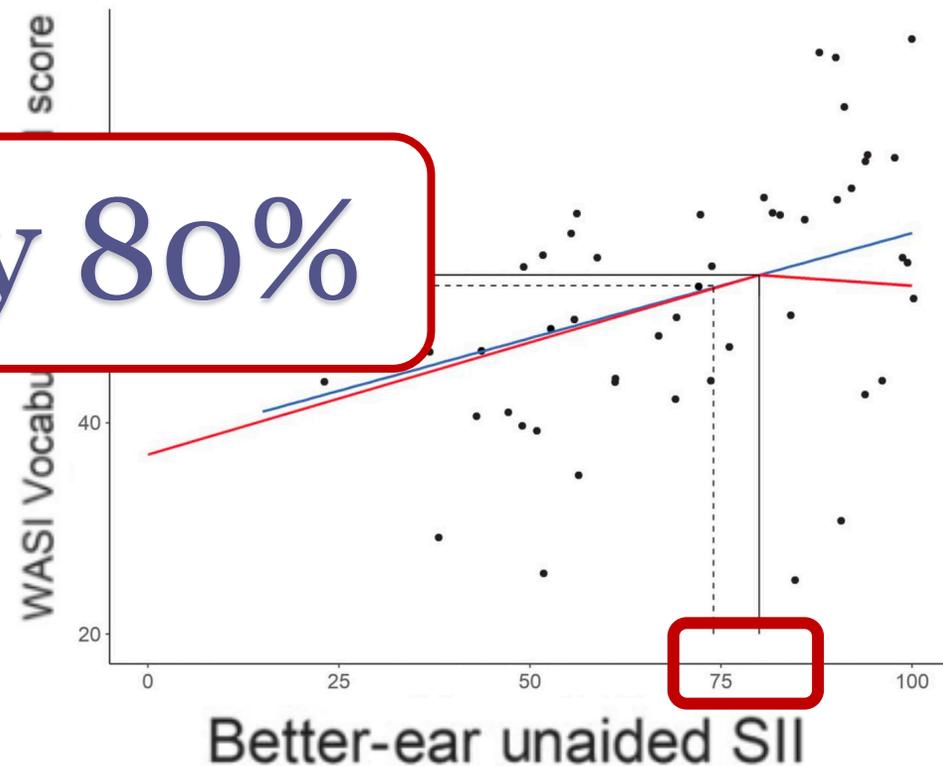
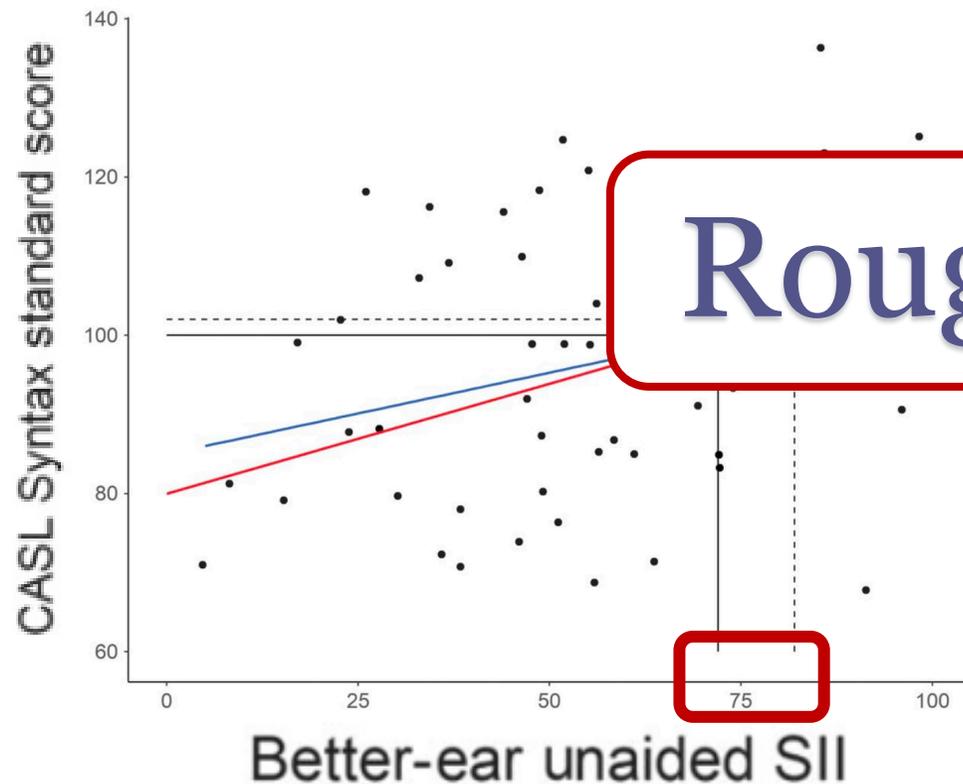
- **Subjects:**
  - 52 hearing loss; 52 normal hearing
  - 3–10 yrs old in both groups
- **Measures:**
  - language: vocabulary and syntax
  - hearing: unaided SII
- **Two methods:**
  - **using regression line (blue), what SII matches median performance for normal hearing [dashed]... ~80%**
  - **using piecewise regression (red), where does slope of line become more steep [solid]... ~75%**

McCreery et al. (2020). Audibility-Based Hearing Aid Fitting Criteria for Children With Mild Bilateral Hearing Loss. *Lang Speech Hear Services Schools*. 51:55-67.

# Unaided SII Value that Results in Good Scores

- **Syntax (Comprehensive Assessment of Language)**

- **Vocabulary (Wechsler Abbreviated Scales of Intelligence)**

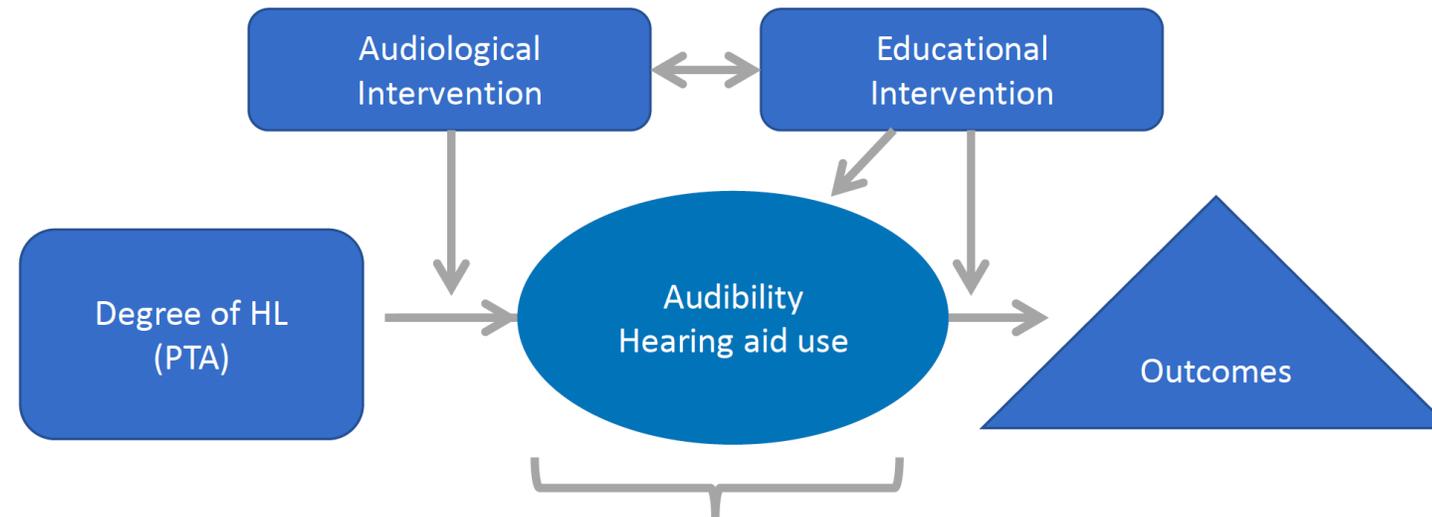


# Clinical Implications

- **Children with unaided SII of approximately  $< 80$  should be considered candidates for amplification**
- **Hearing aid candidacy is a complex decision process that includes many factors beyond levels of hearing or SII**
  - **Consider other factors**
- **Unaided SII provides an alternative to the dB HL or nHL audiogram in combination with other considerations**

# What we have learned from the OCHL researchers:

OCHL model: cumulative auditory experience



**Factors that influence relationship between PTA and outcomes.**

# Estimating the Unaided SII for Amplification Consideration



**Gold**: measure RECD and estimate SII on real-ear equipment (e.g., the Audioscan Verifit)

- when hearing aid recommendations are made, equipment may not be available



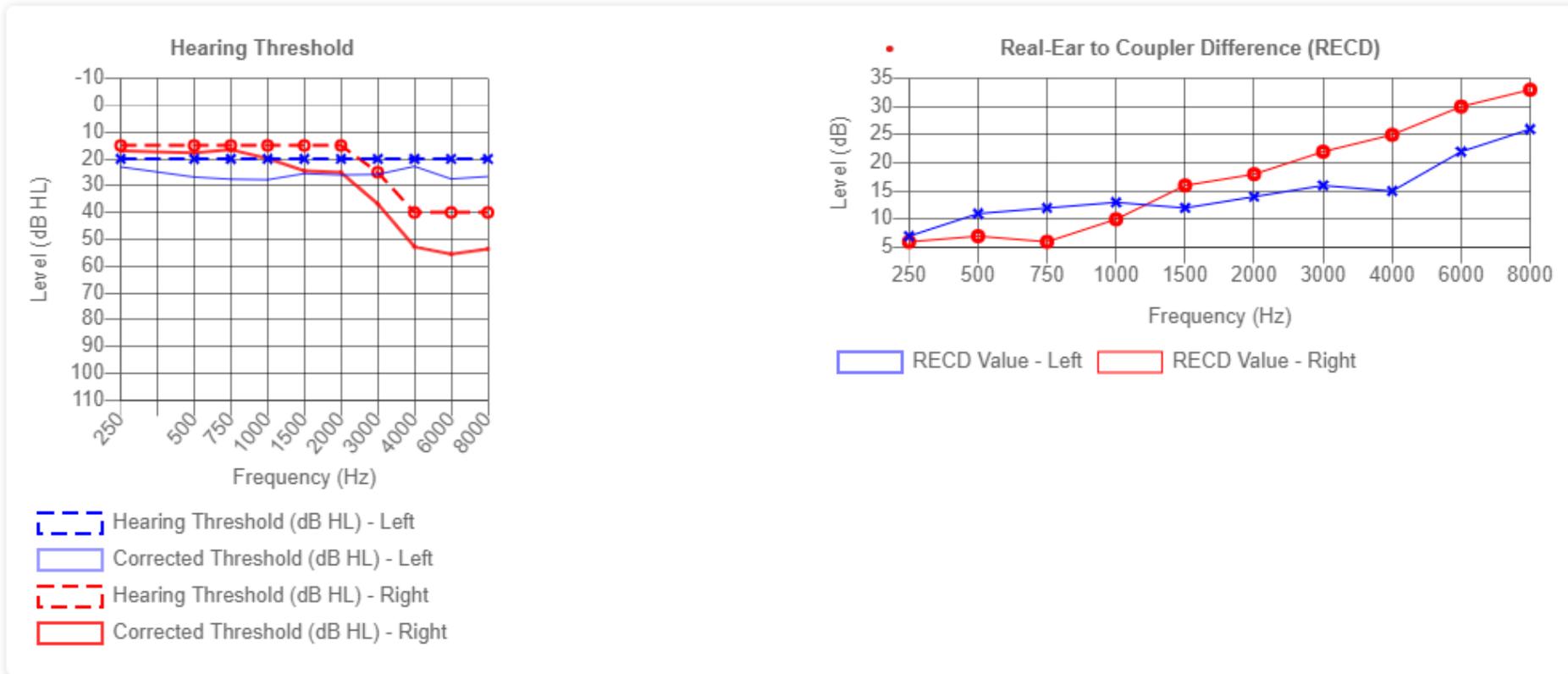
**Silver**: estimate the RECD based on age and use web-tool

- when real-ear equipment not available



**Bronze**: make recommendations based on HL audiogram alone

- Does not account for ear canal acoustics (HL to SPL)



# The KIPA SII Web Tool

<http://kipagroup.org/charts/>

- Estimates the SII using:
  - **measured thresholds**
  - **measured or age-corrected RECD**
- Top figures show:
  - **thresholds and RECD-corrected thresholds**
  - **RECD**
- Bottom figures show:
  - **SII estimates**
  - **speech vs thresholds in dB SPL**

The screenshot displays the KIPA SII Web Tool interface, which includes several key components:

- Top Charts:** Two line graphs at the top. The left graph, titled "Hearing Threshold", plots Level (dB HL) from -10 to 110 against Frequency (Hz) from 250 to 8000. It shows measured and corrected thresholds for both ears. The right graph, titled "Real-Ear to Coupler Difference (RECD)", plots Level (dB) from 0 to 30 against Frequency (Hz) from 250 to 8000, showing RECD values for the left and right ears.
- Input Fields:** Below the charts are "Audiogram Selector" and "RECD Selector" for both ears. The Audiogram Selector includes frequency buttons (250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000 Hz) and level buttons (30, 30, 30, 30, 30, 30, 30, 30, 30, 30). The RECD Selector includes frequency buttons and RECD level buttons (e.g., 7, 11, 12, 13, 12, 14, 16, 15, 22, 26 for 3 months; 1, 5, 6, 7, 9, 10, 12, 12, 14, 19 for 18 years).
- Calculation and Results:** A "Calculate" button is present. Below it, the results for the Right (R) and Left (L) ears are shown:
  - Right (R):** SSI - Average Speech (65dB SPL) is 59% (50-69%).
  - Left (L):** SSI - Average Speech (65dB SPL) is 75% (65-83%).
- Bottom Charts:** Two detailed graphs at the bottom show "Average Speech (65 dB SPL) right - SII: 0.59" and "Average Speech (65 dB SPL) left - SII: 0.75". These graphs plot Level (dB SPL) from 0 to 100 against Frequency (Hz) from 160 to 8000. They include shaded regions for LTASS (65 dB SPL) and Hearing Thresholds (Lower and Upper Range).

# MINIMAL/MILD BILATERAL HEARING LOSS



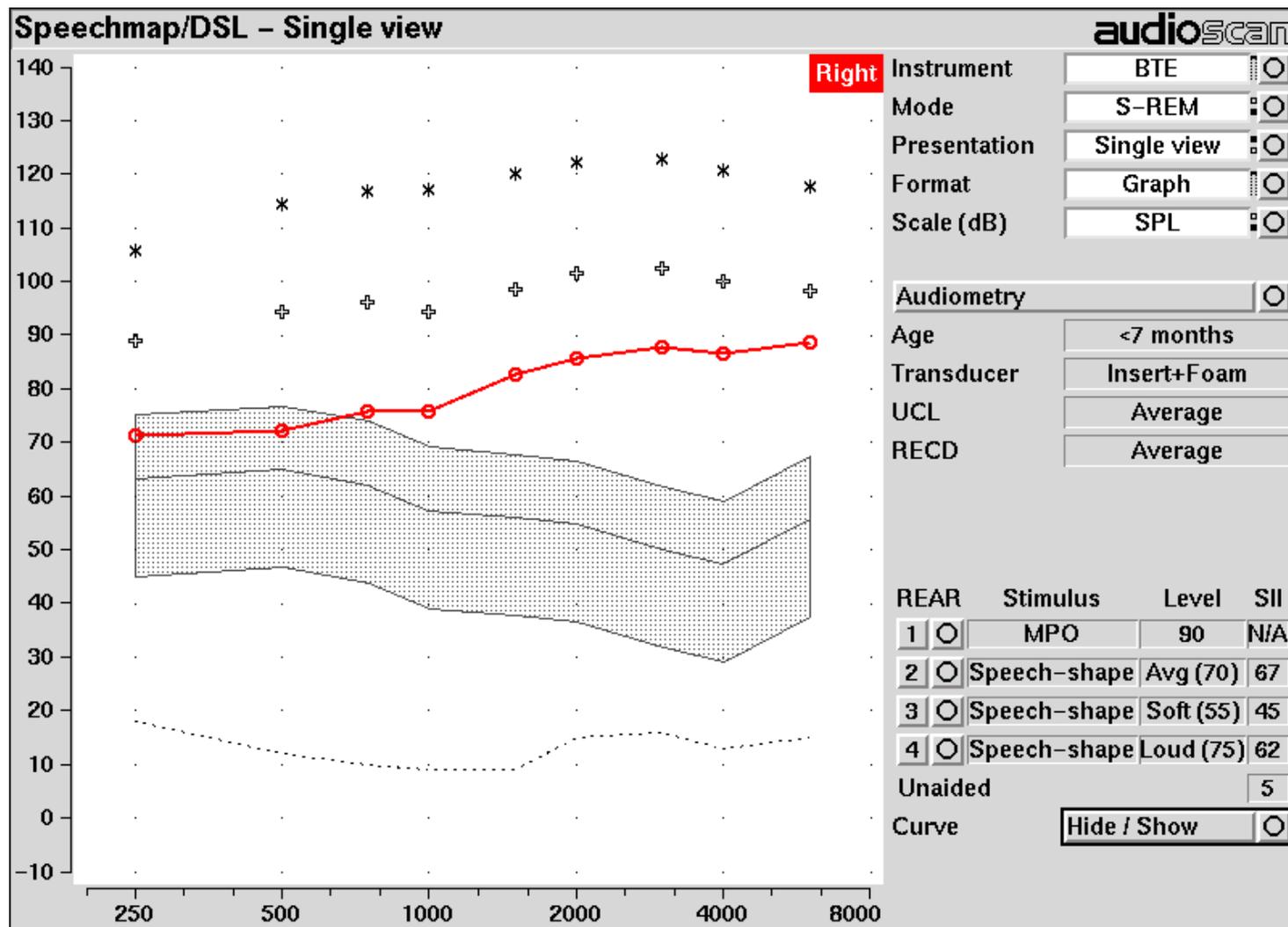
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[https://www.uwo.ca/nca/pdfs/clinical\\_protocols/IHP\\_Amplification%20Protocol\\_2019.01.pdf](https://www.uwo.ca/nca/pdfs/clinical_protocols/IHP_Amplification%20Protocol_2019.01.pdf)

# Some Case Examples

- 1. Meet Quinn;**
- 2. Defining accurate thresholds for children with mild hearing loss for the purposes of determining candidacy for intervention;**
- 3. Meet Colin;**
- 4. Parents are important candidacy partners**
- 5. Summary and Take-home messages**

dB SPL (TM)

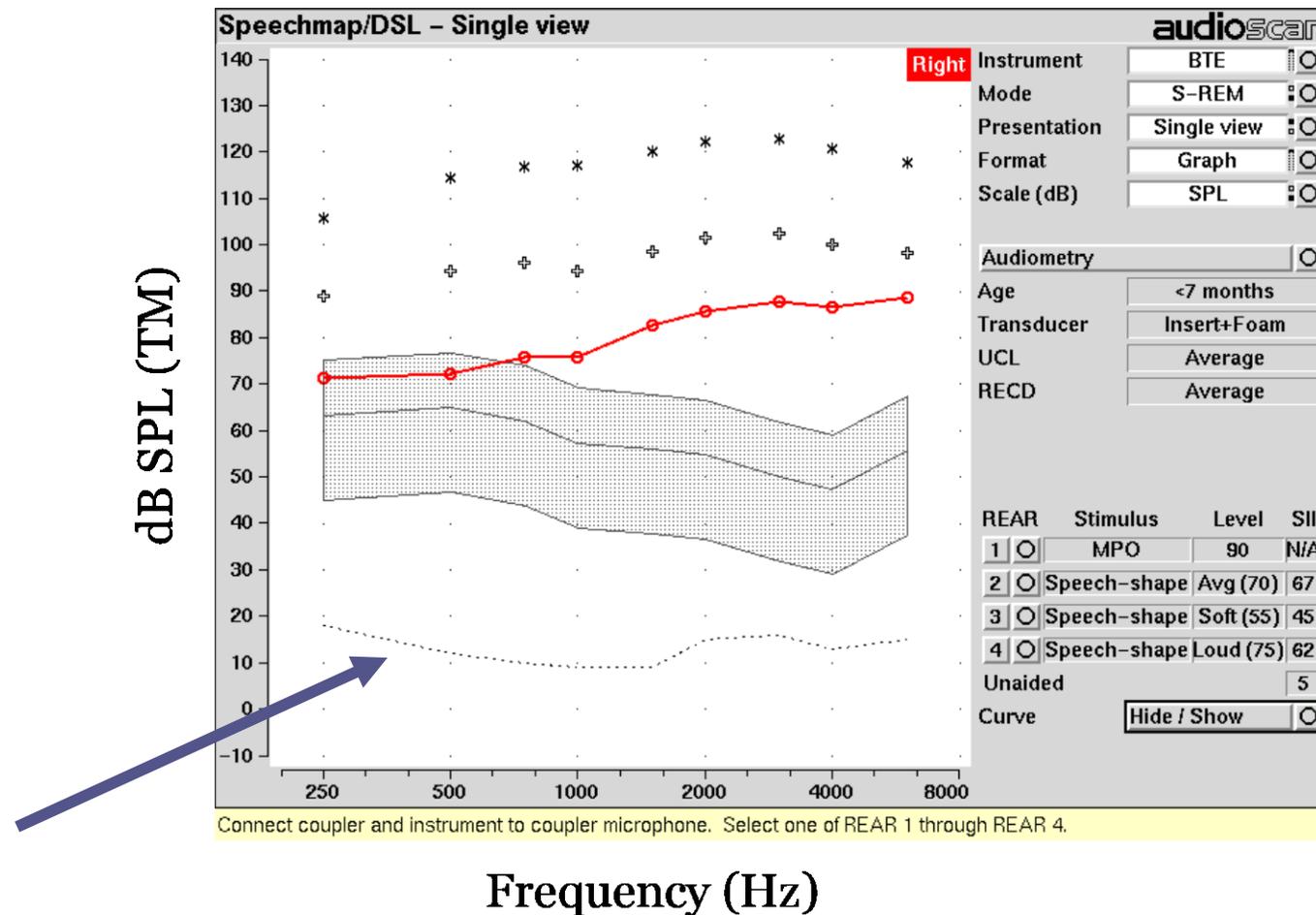


Connect coupler and instrument to coupler microphone. Select one of REAR 1 through REAR 4.

Frequency (Hz)

# Adjusted HL values

$$\text{dB SPL (TM)} - \text{MAP} = \text{adjusted HL (dB)}$$



# Take home message #1

- **There is nothing mild about mild hearing loss.**
- **You won't actually know if it's a mild hearing loss unless you measure the child's ear canal acoustics at the assessment appointment**
- **Use insert earphones whenever possible and measure the ear canal acoustics (RECD) for the individual at the assessment appointment.**

18 months



**QUINN**

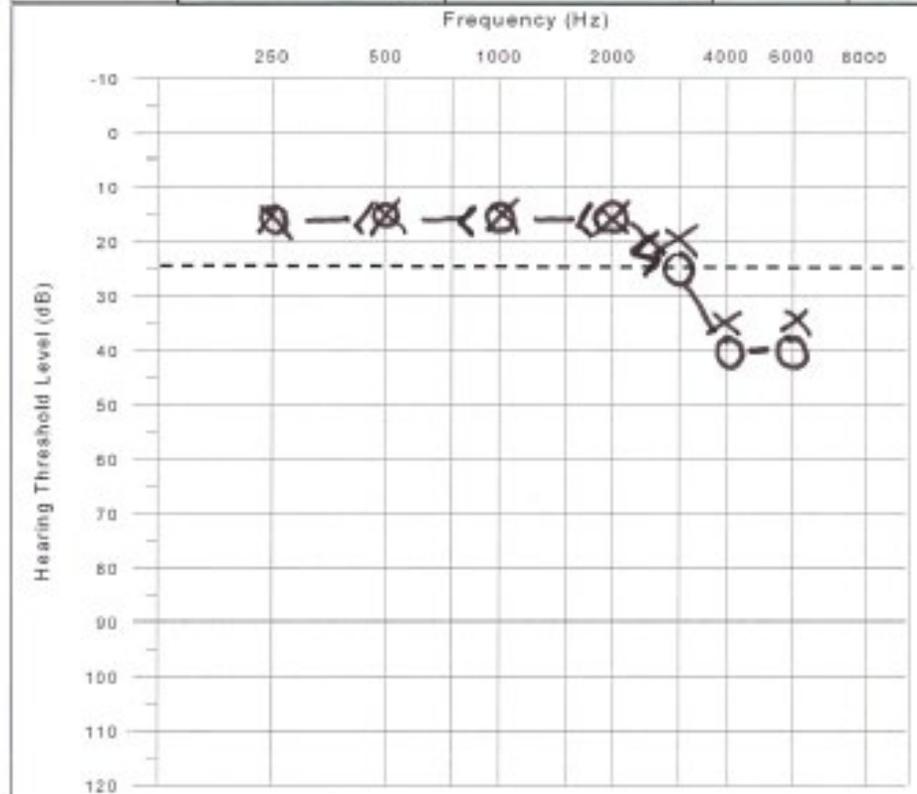
# Case Example 1

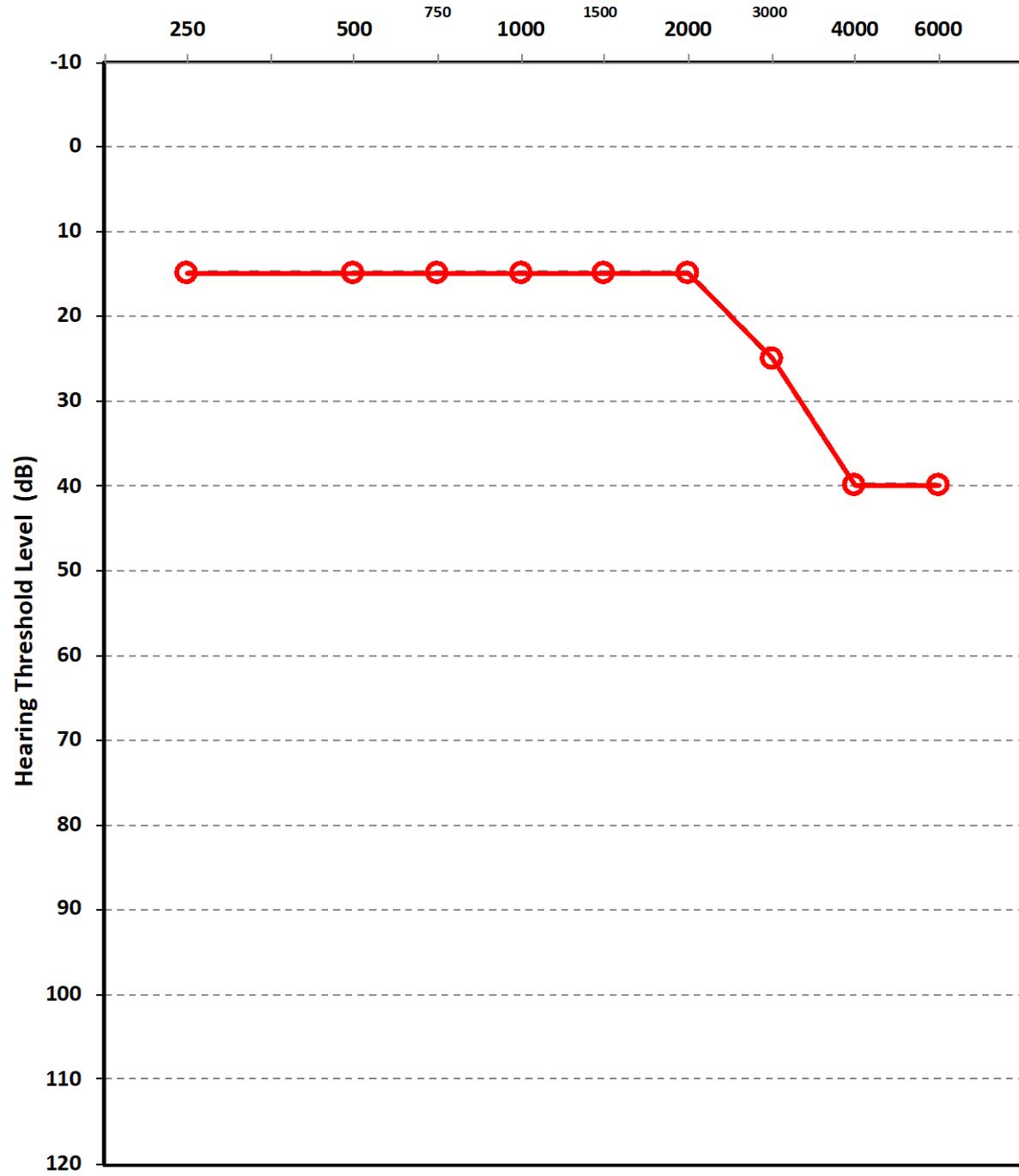
H.A. Leeper Speech and Hearing Clinic  
 Western University  
 Elborn College  
 London, Ontario, N6G 1H1  
 Tel: (519) 661-2021

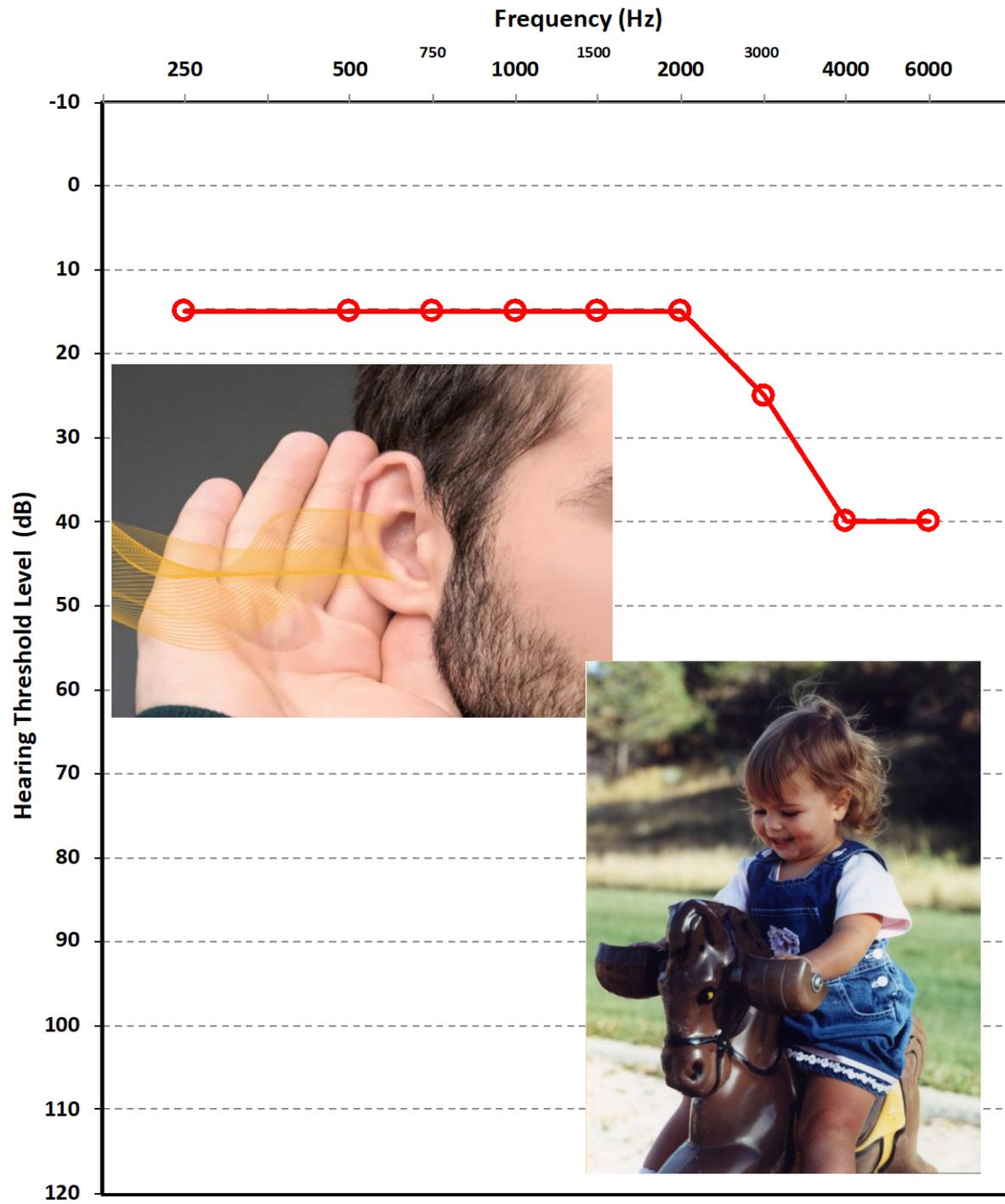


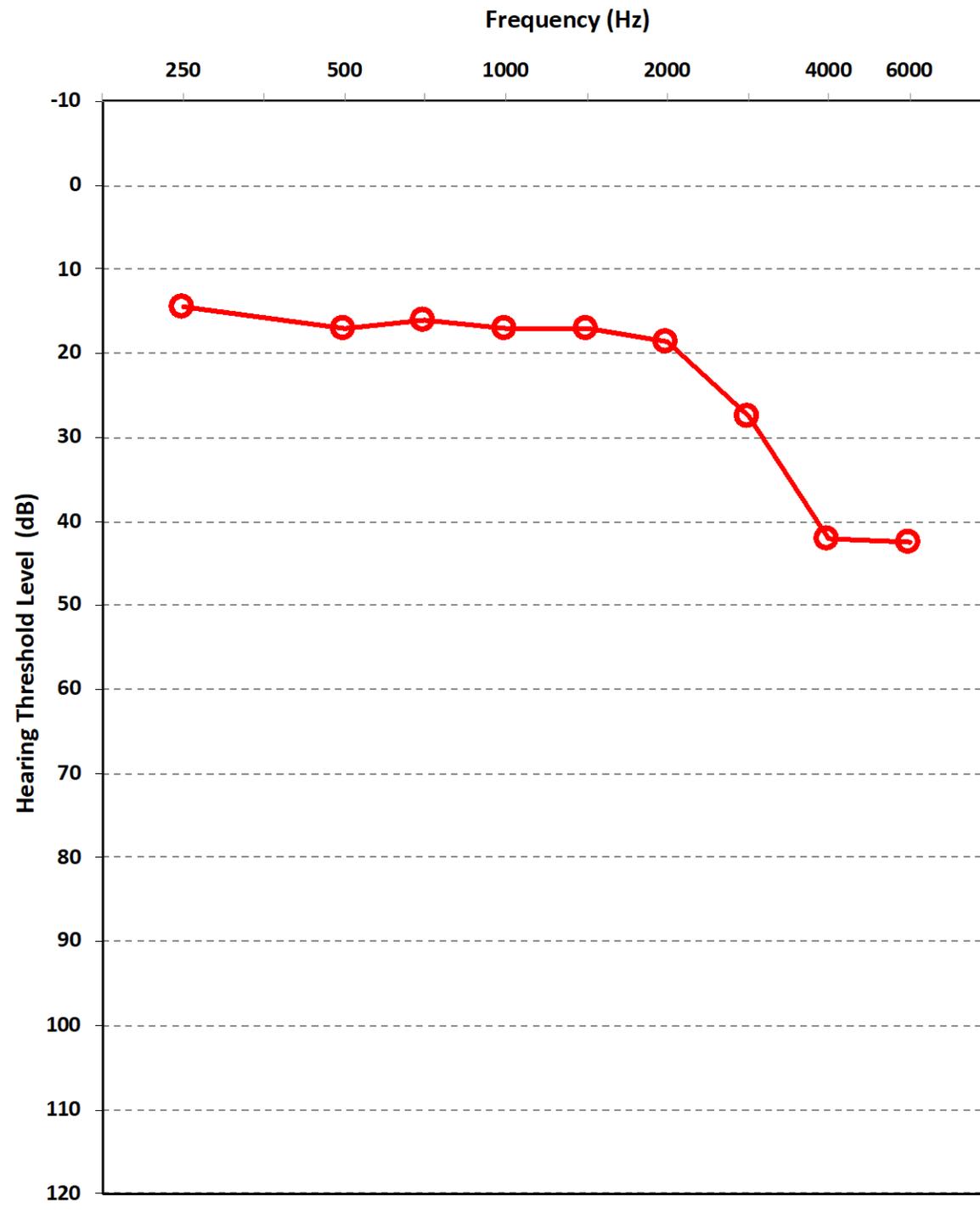
## AUDIOGRAM WORKSHEET

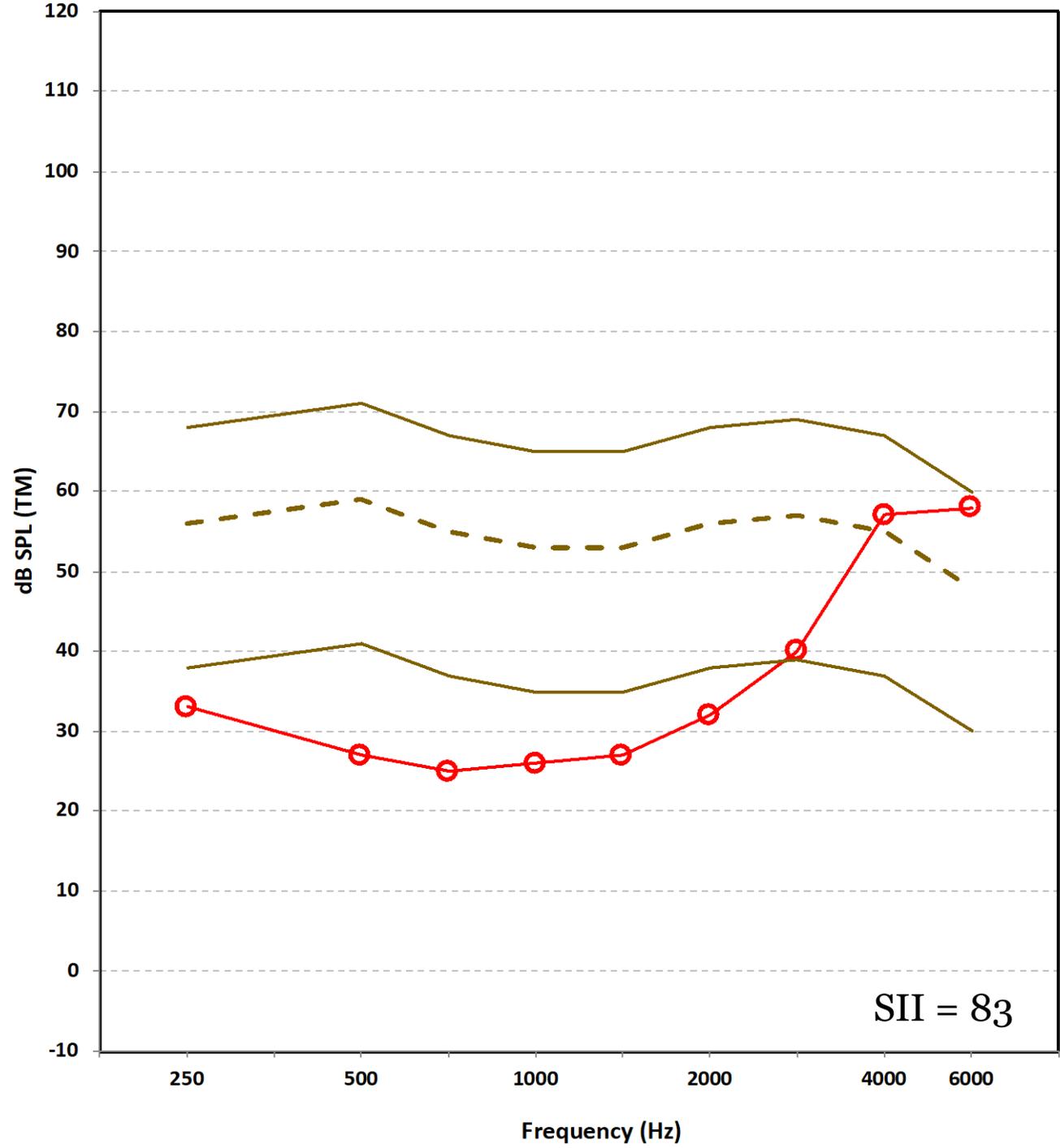
Audiogram Reliability	Right Air O	Left Air X	Sound Field	Test Type
Good <input type="checkbox"/>	Right Air Masked $\triangle$	Left Air Masked $\square$	Warble W	Standard <input type="checkbox"/>
Fair <input type="checkbox"/>	Right Bone <	Left Bone >	NBN N	Play <input type="checkbox"/>
Poor <input type="checkbox"/>	Right Bone Masked [	Left Bone Masked ]	Aided A	VRA/BOA <input type="checkbox"/>
	AC Right No Response $\mu$	AC Left No Response $\nu$		

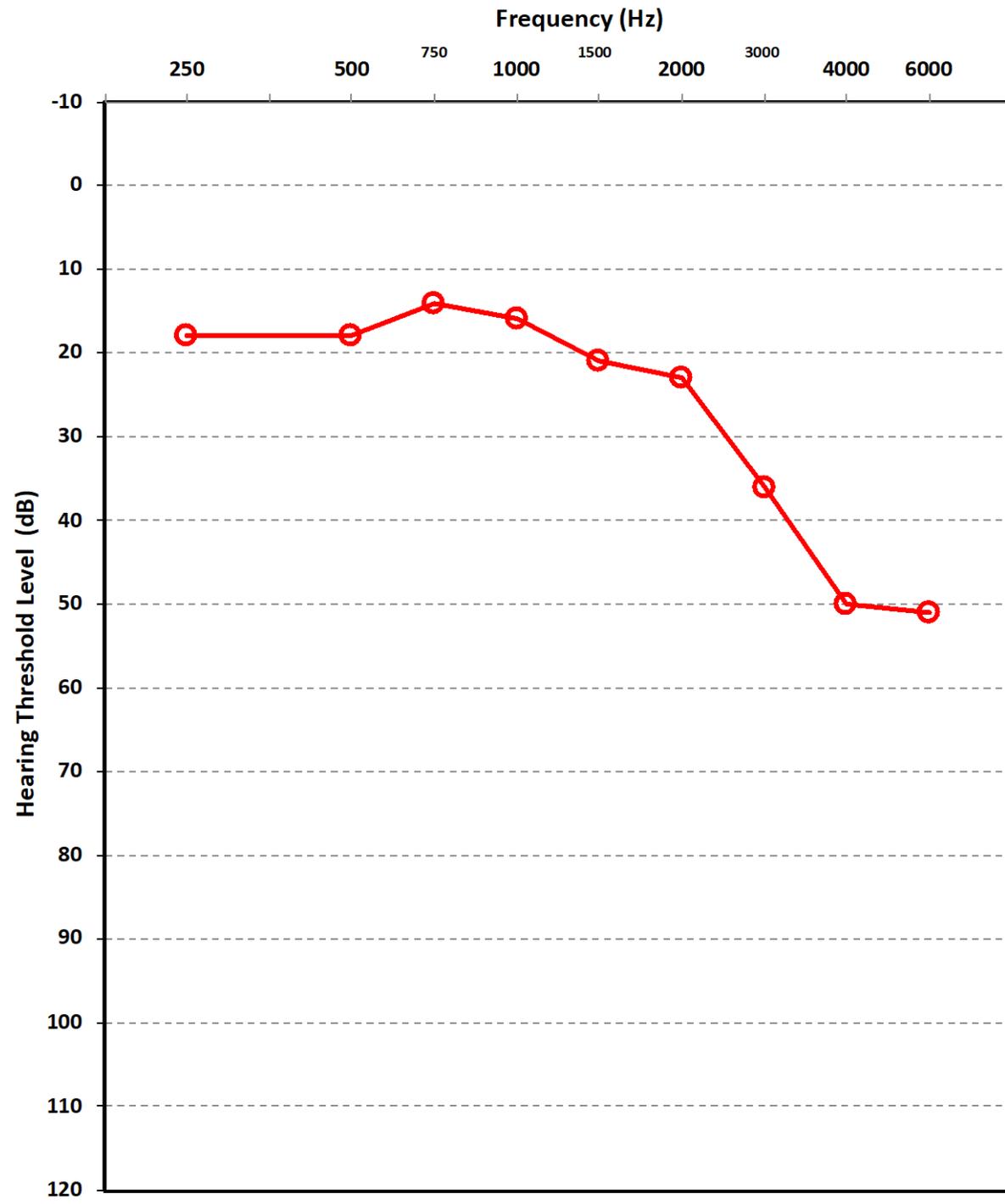


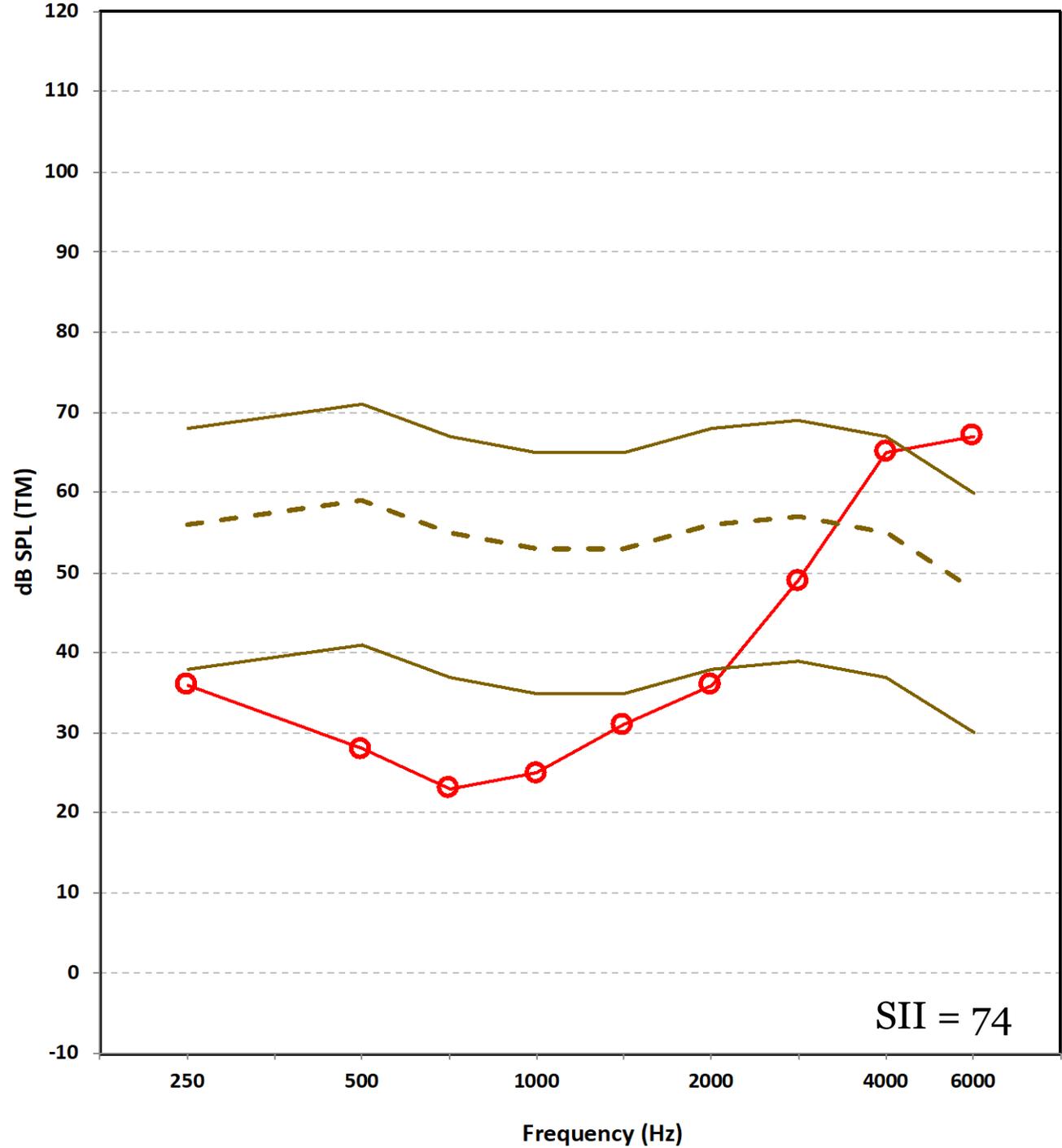


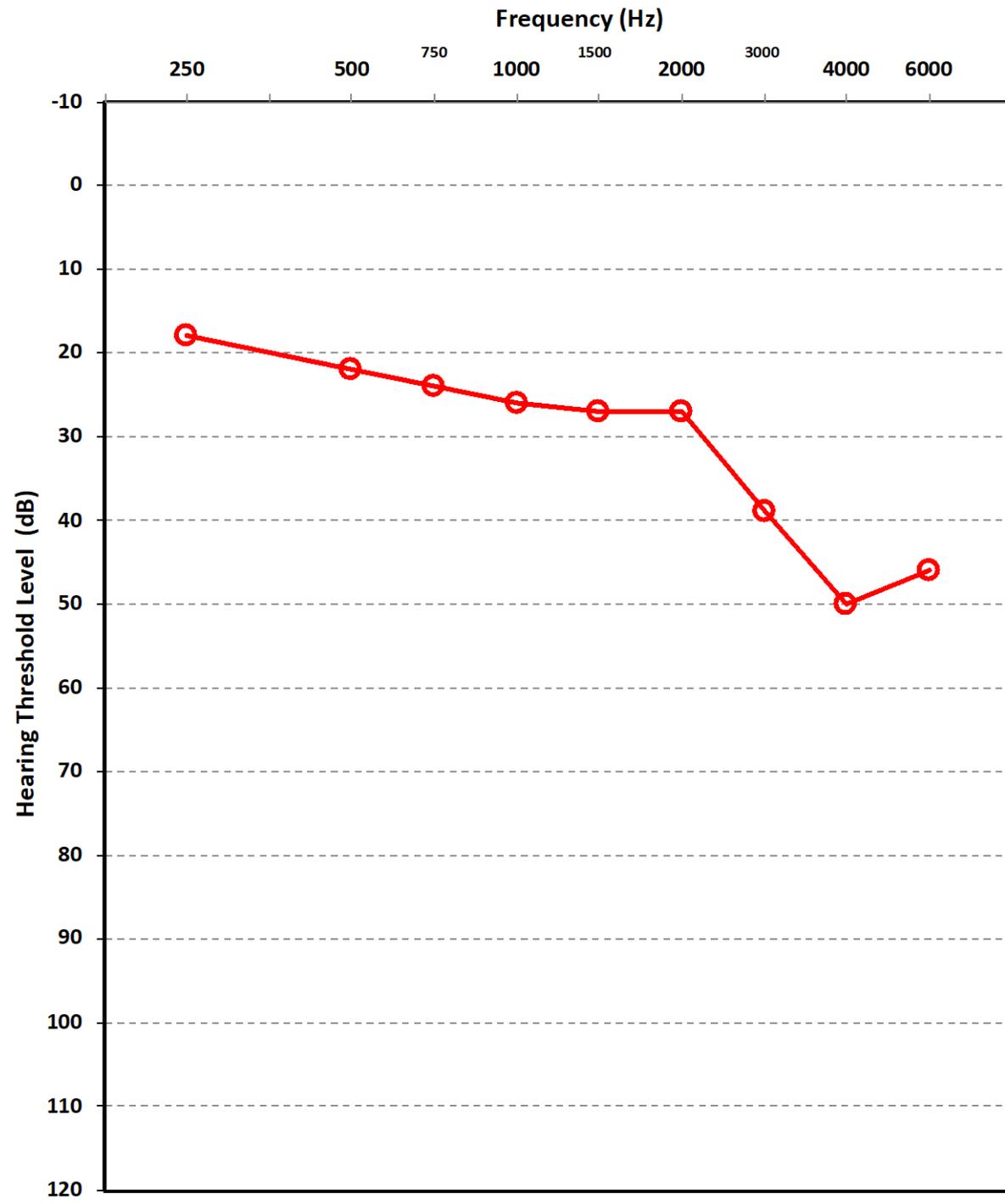


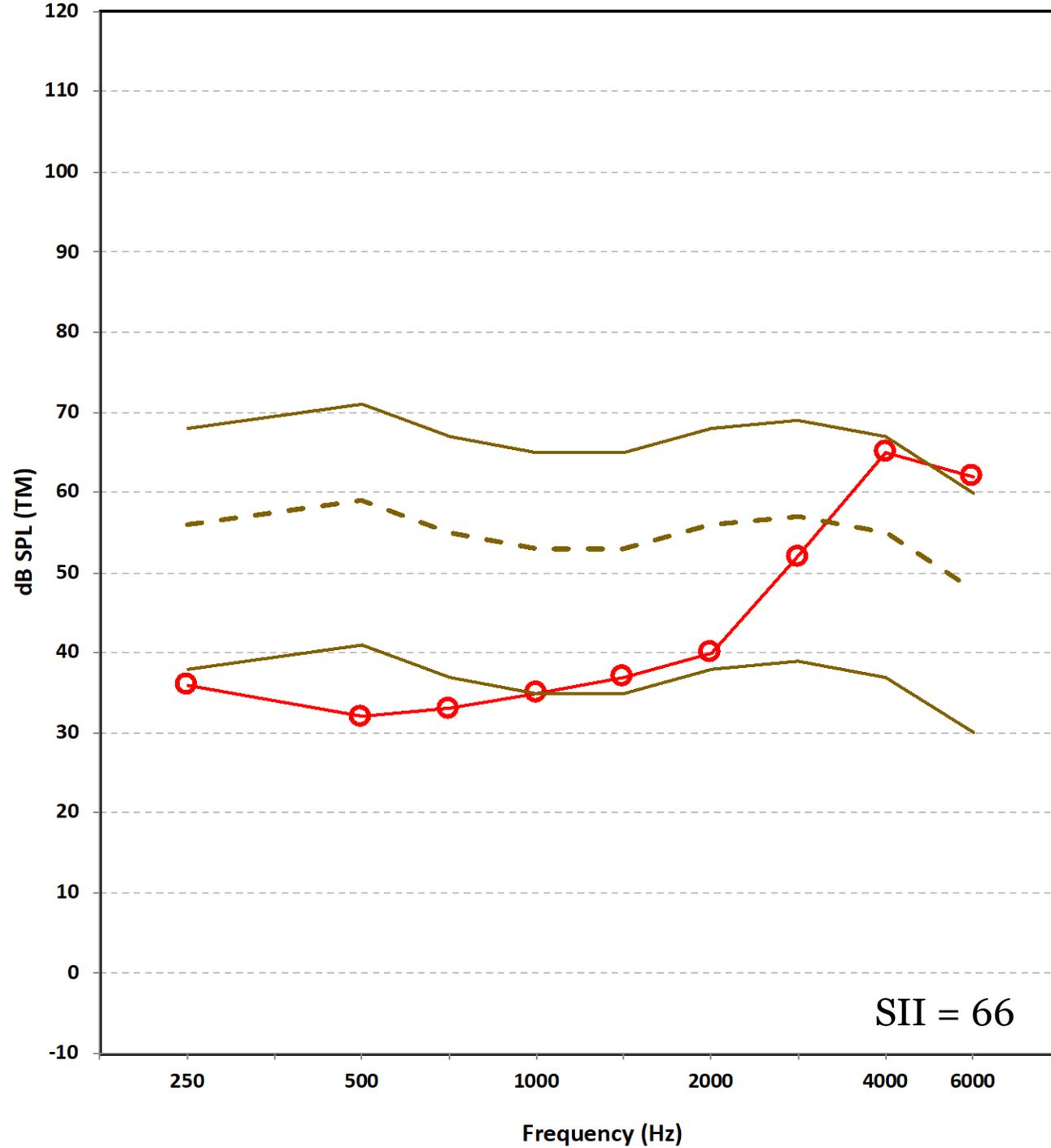


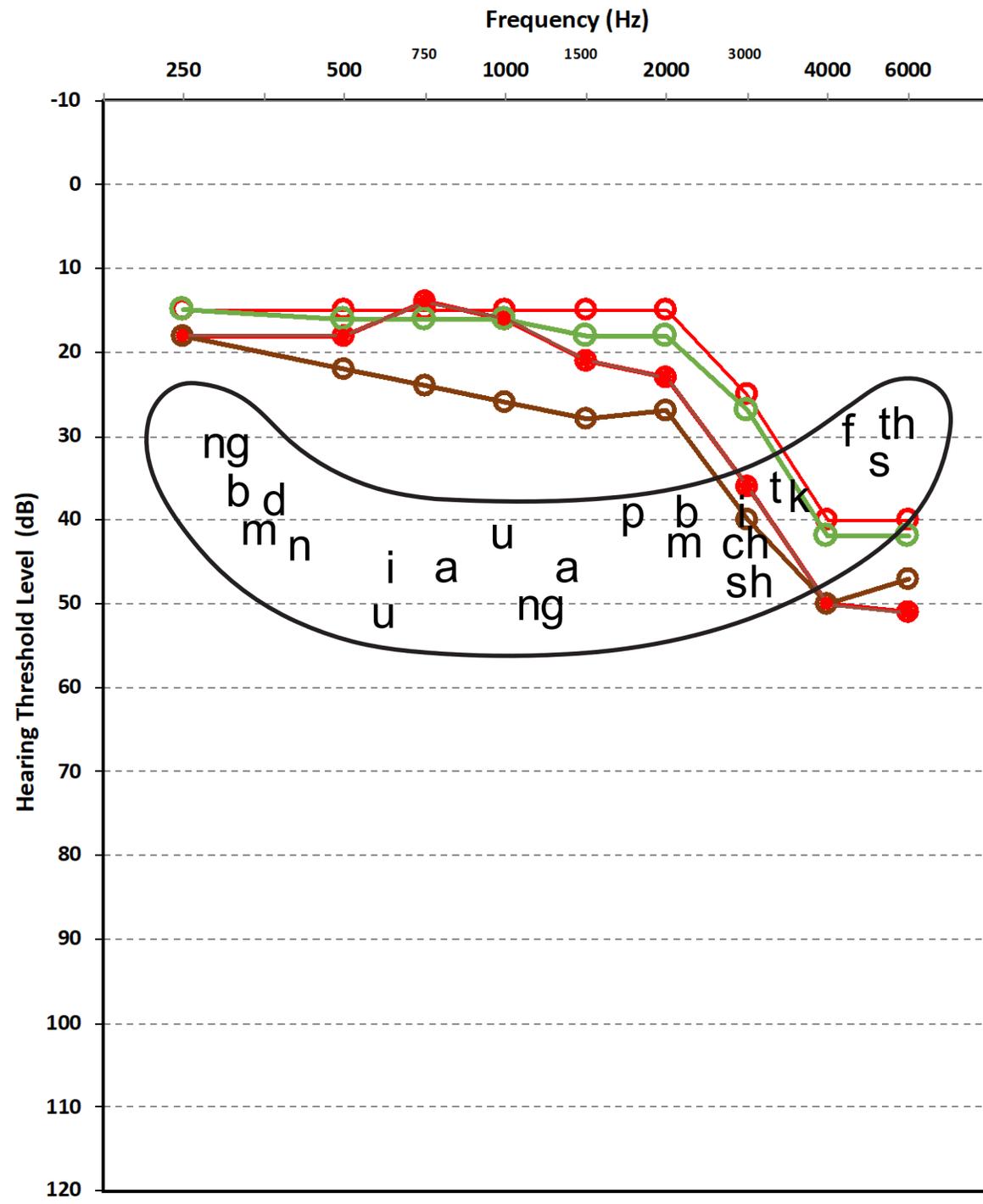


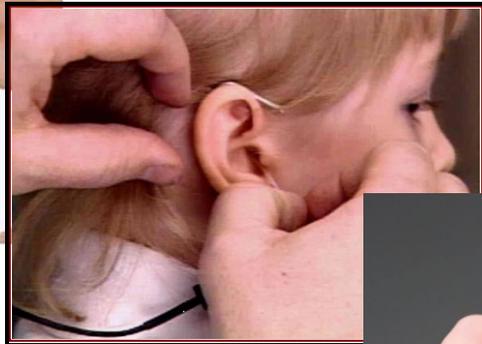












<https://www.ottoexcellence.com/blogs/check-your-hearing>



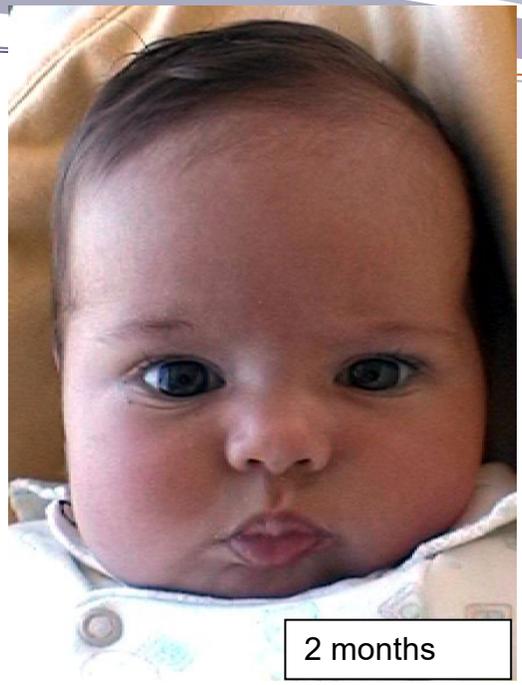
# Moodie et al., (2016) Survey of Pediatric Audiologists in N.A.

- **Most audiologists reported using insert earphones as their primary assessment transducer;**
- **20% reported using TDH or supra-aural earphones for children > 3 years of age when normal hearing thresholds were anticipated.**

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- **All respondents knew what an RECD was;**
- **Most audiologists reported never or seldom measuring the RECD at assessment;**
- **10% of respondents did not think that measuring the RECD at assessment provided any additional information.**

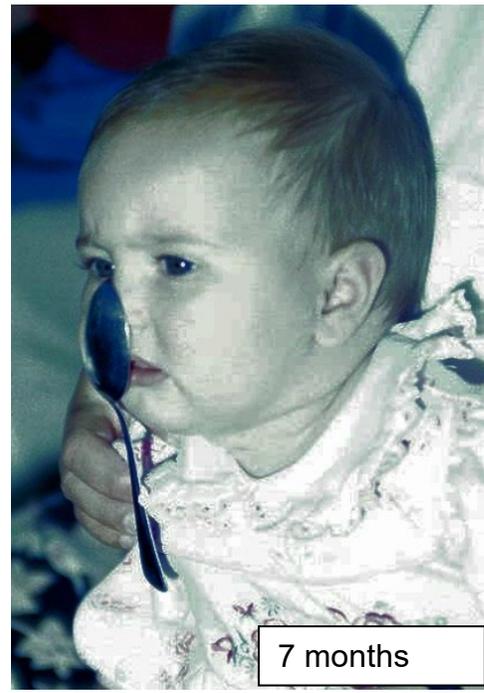
Newborn



2 months



5 months



7 months



9 months



1 year

18 months

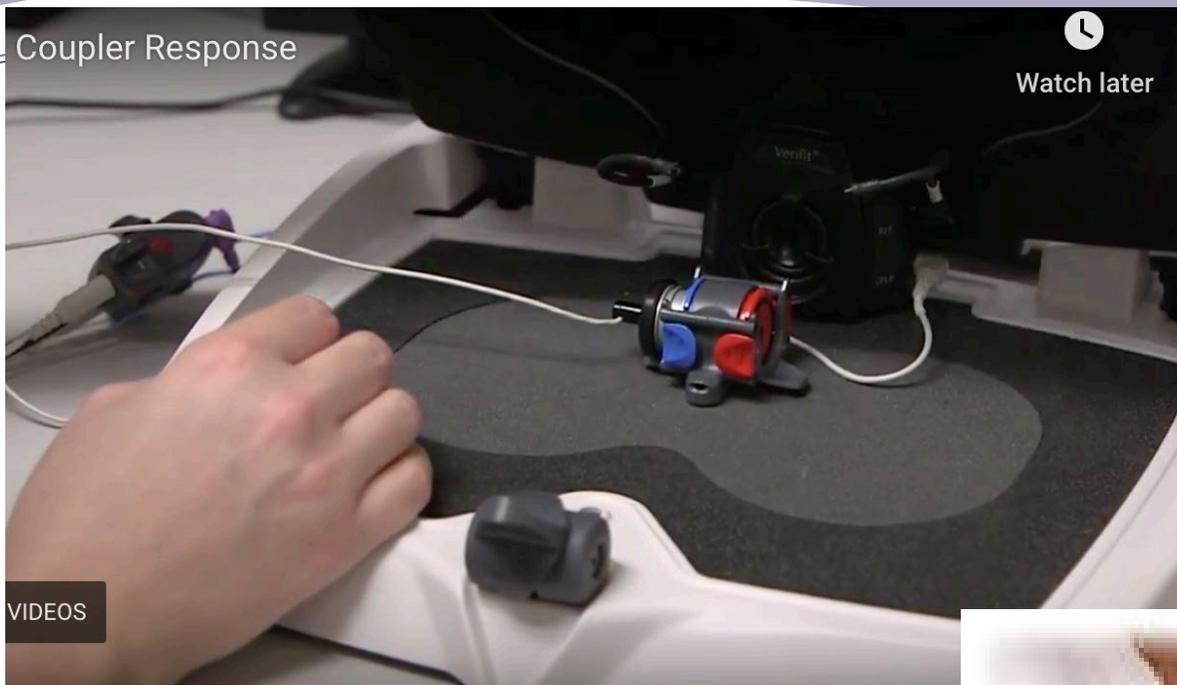


21 months



2 years





<https://www.babyhearing.org/resources/using-probe-microphone-measures>



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## **MEET COLIN**

Photo by [Eddie Kopp](#) on [Unsplash](#)

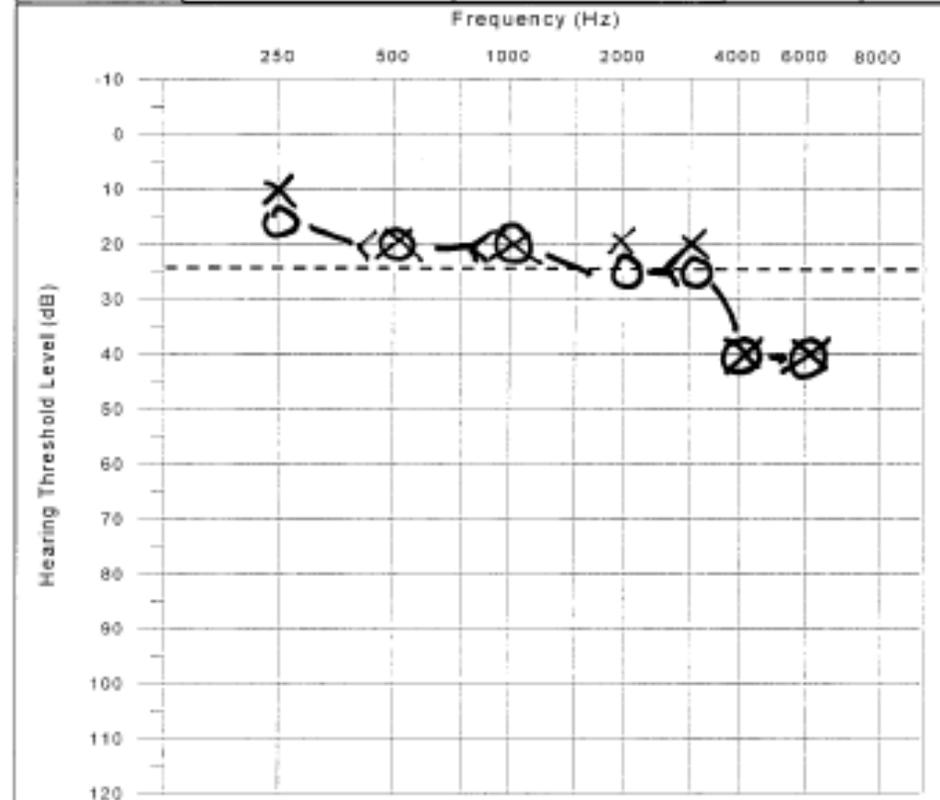
# Case Example 2

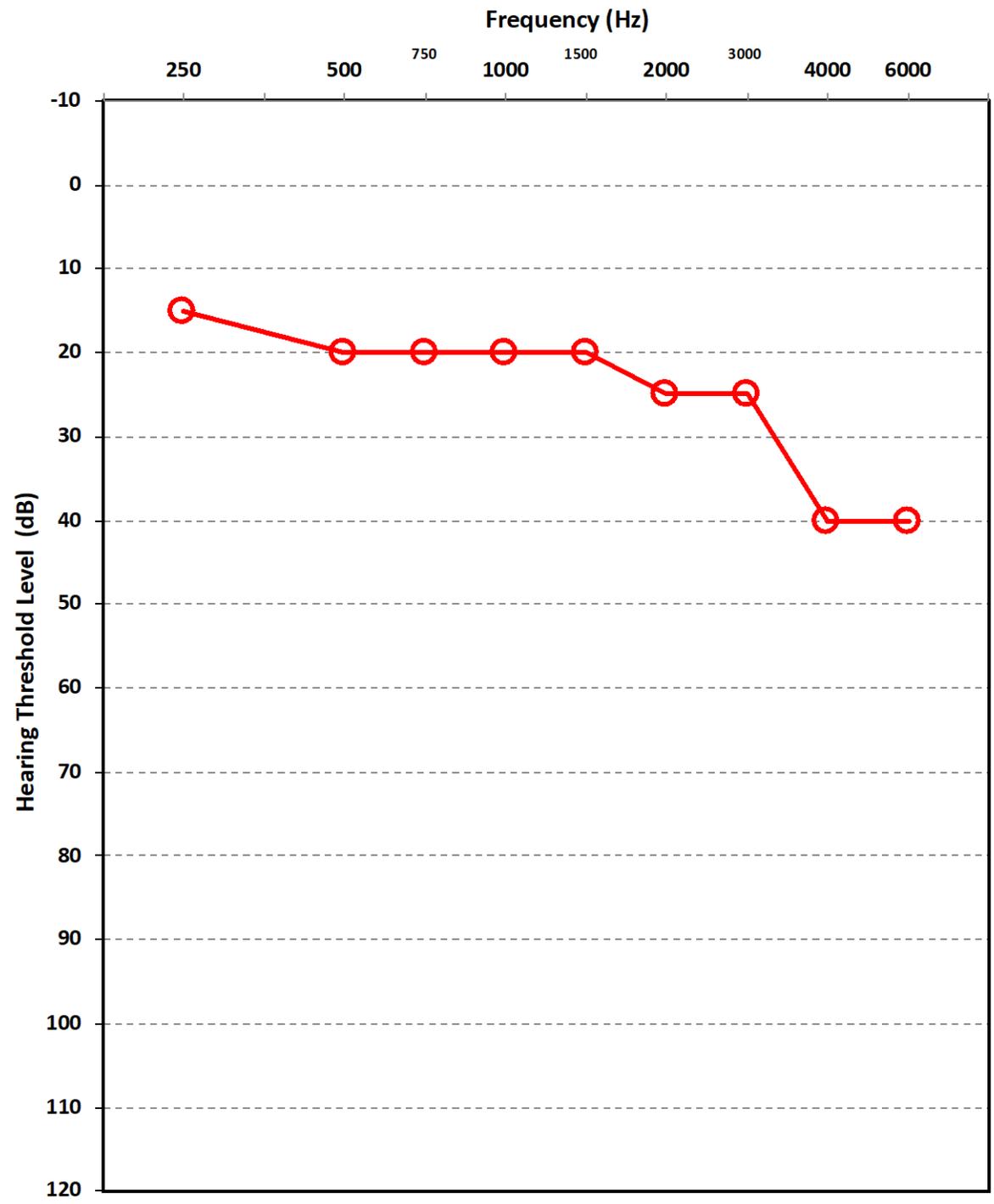
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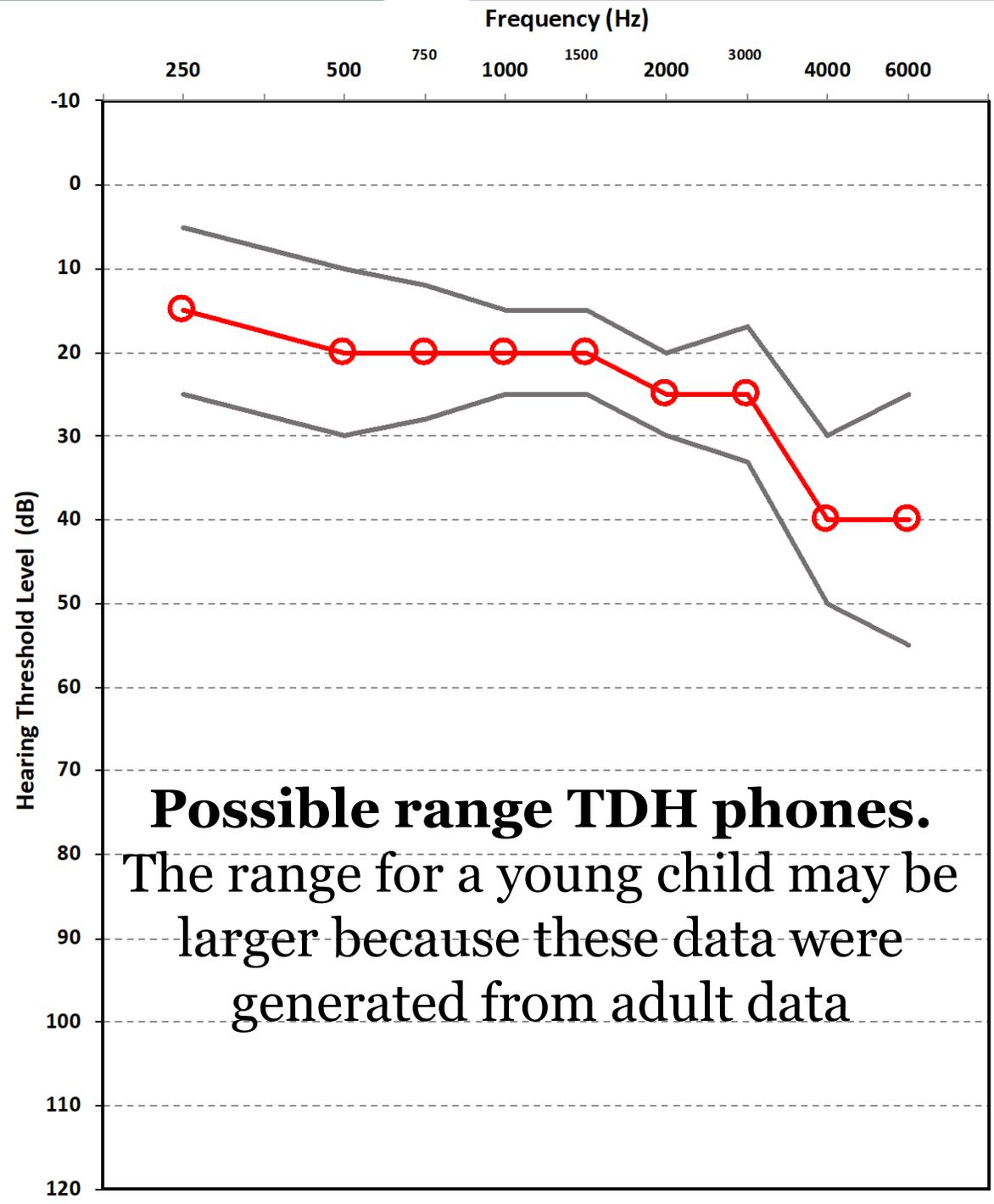


## AUDIOGRAM WORKSHEET

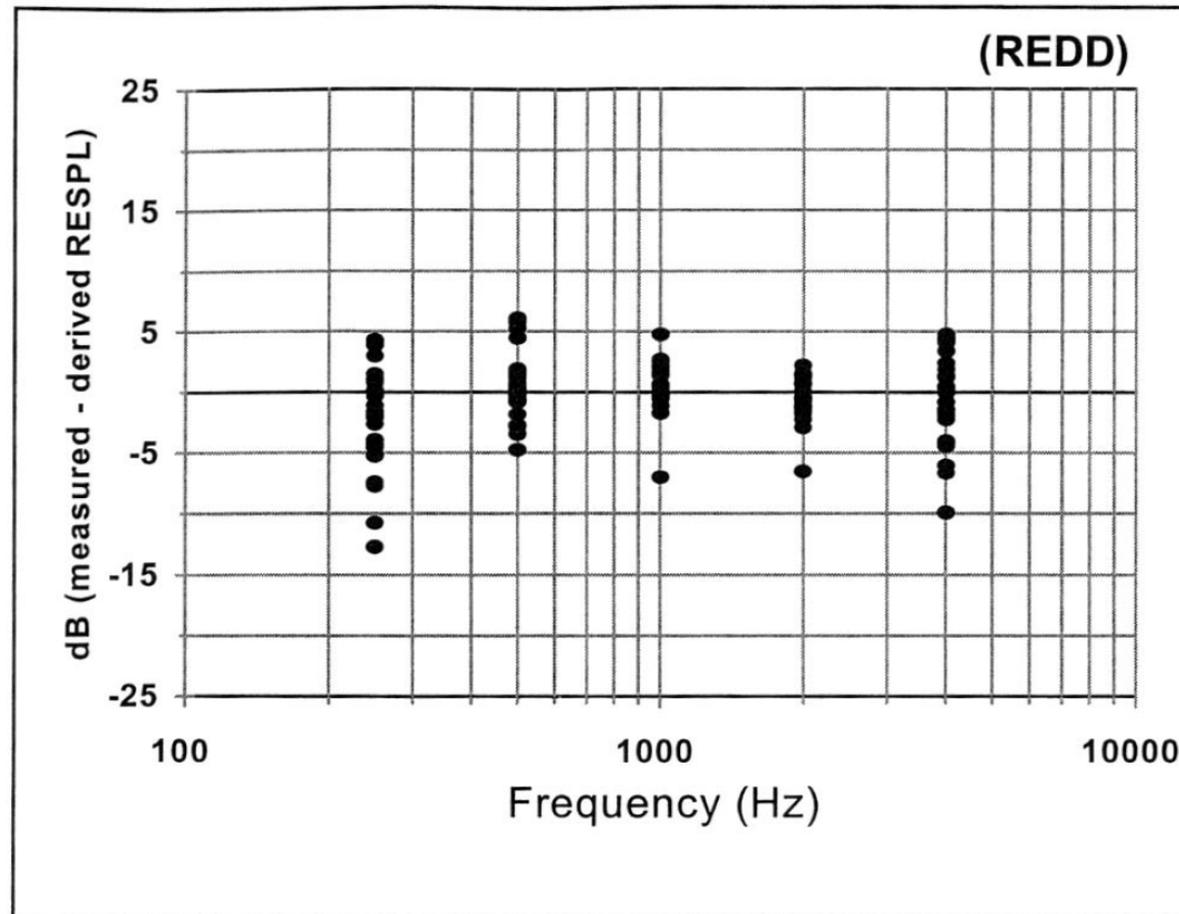
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Fair <input type="checkbox"/>	Right Bone <	Left Bone >	NBN N	Ply <input type="checkbox"/>
Poor <input type="checkbox"/>	Right Bone Masked [	Left Bone Masked ]	Aided A	VRABOA <input type="checkbox"/>
	AC Right No Response $\downarrow$	AC Left No Response $\searrow$		





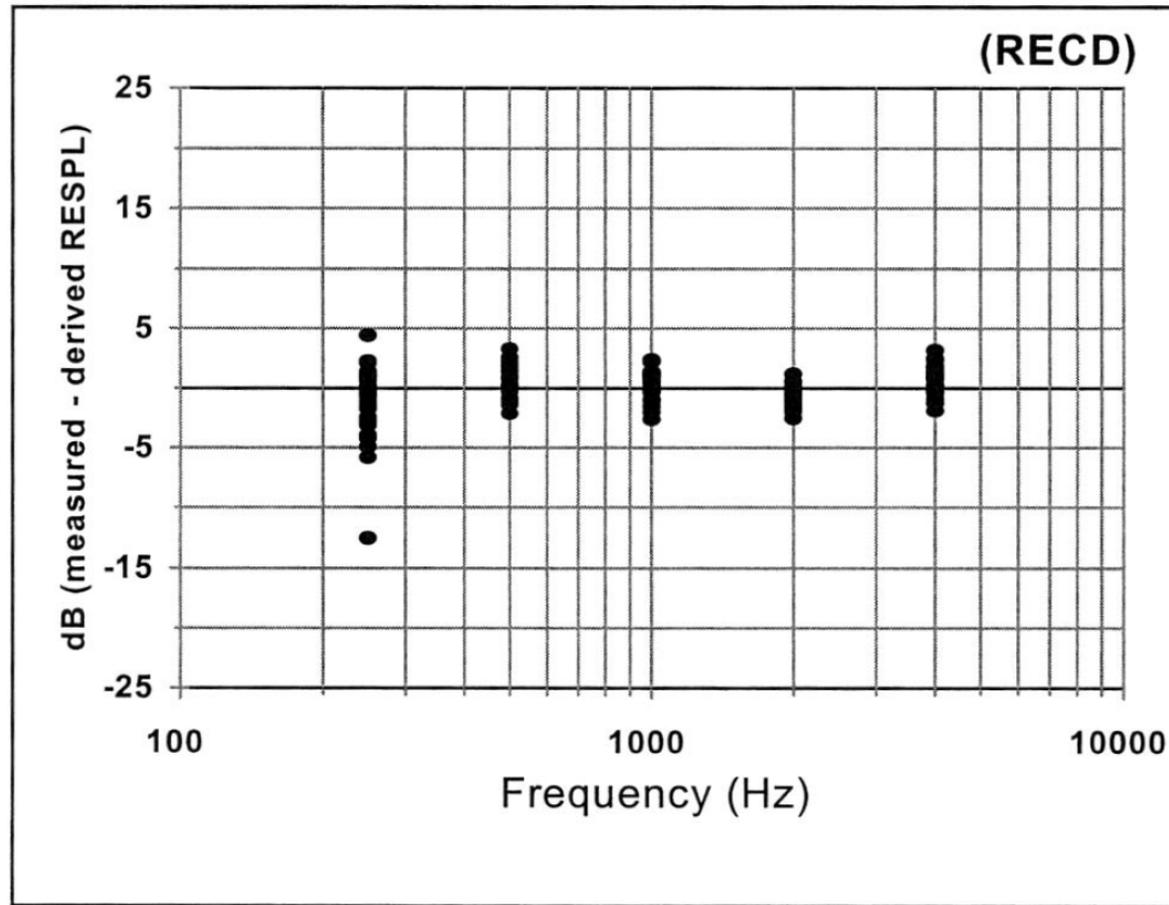


## Accuracy of using REDD values (6cc-eardrum) to calculate dB SPL Threshold (TM)



Scollie, Seewald, Cornelisse, & Jenstad (1998), p.411.

## Accuracy of using RECD values to calculate dB SPL Threshold (TM)



Scollie, Seewald, Cornelisse, & Jenstad (1998), p.411.

# Take home message #2

- **There is nothing mild about mild hearing loss.**
- **A threshold is a threshold is a threshold – or is it?**
- **Use insert earphones at assessment whenever possible.**
- **Don't make assumptions about normal hearing.**

# Take home message #3

- **The threshold values and unaided SII are just part of the decision-making process – you need more information and need to engage in shared decision-making with the family.**

# Moodie et al., (2016) Survey of Pediatric Audiologists in N.A.

- All respondents knew what an RECD was;
- Most audiologists reported never or seldom measuring the RECD at assessment;
- 10% of respondents did not think that measuring the RECD at assessment provided any additional information;
- 50% reported not using parent self-report measures prior to fitting a hearing aid

- 
- **We must understand more than the impairment, activity limitations and participation restrictions of the child, we must understand their everyday life situations and the context of their everyday listening situations.**

# “Auditory Squinting”



Photo by Kelly Sikkema on Unsplash



Photo by [Vivek Sharma](#) on [Unsplash](#)

# Access to Speech

Hearing aid  
gain/output  
& noise floor

Child  
Factors

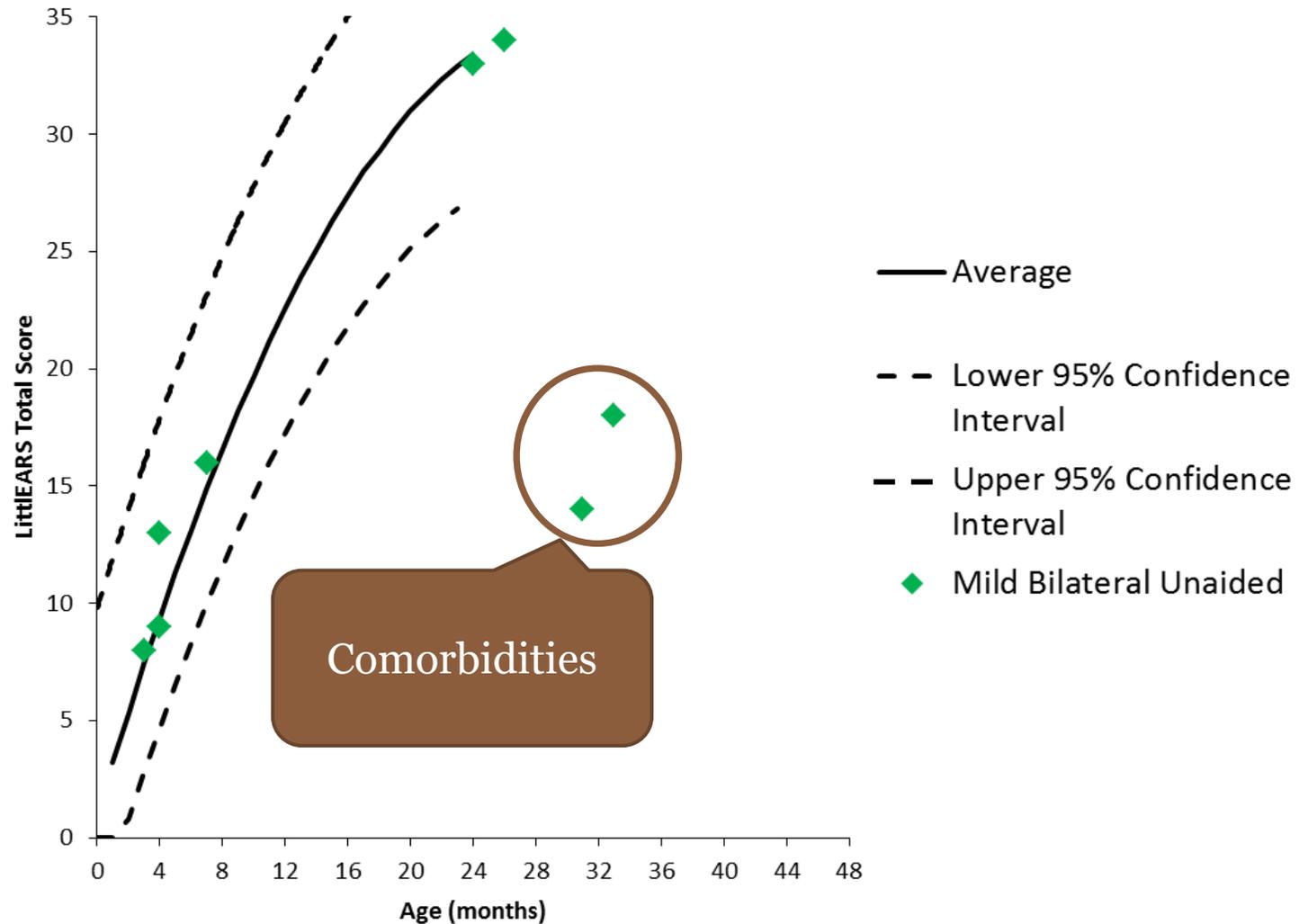
Developmental  
status,  
**Ambulatory  
status,**  
**Environment,**  
Outcomes

- **Speech audibility may be improved for some children with MBHL without hearing aids by:**
  - **Increasing vocal effort of talker**
  - **Decreasing distance from speaker to listener**
  - **Reducing background noise**

# Auditory Development Outcomes

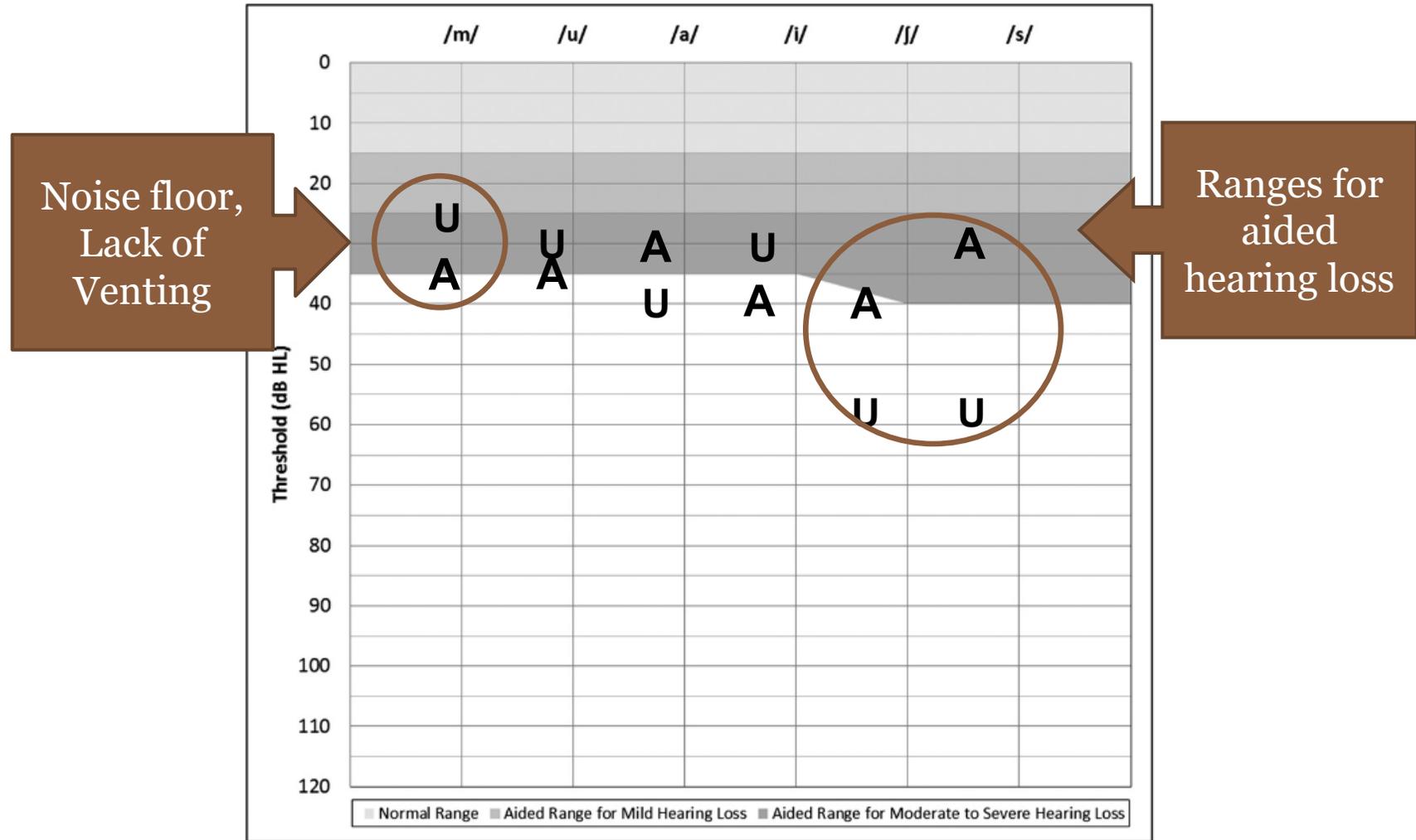
Child  
Factors

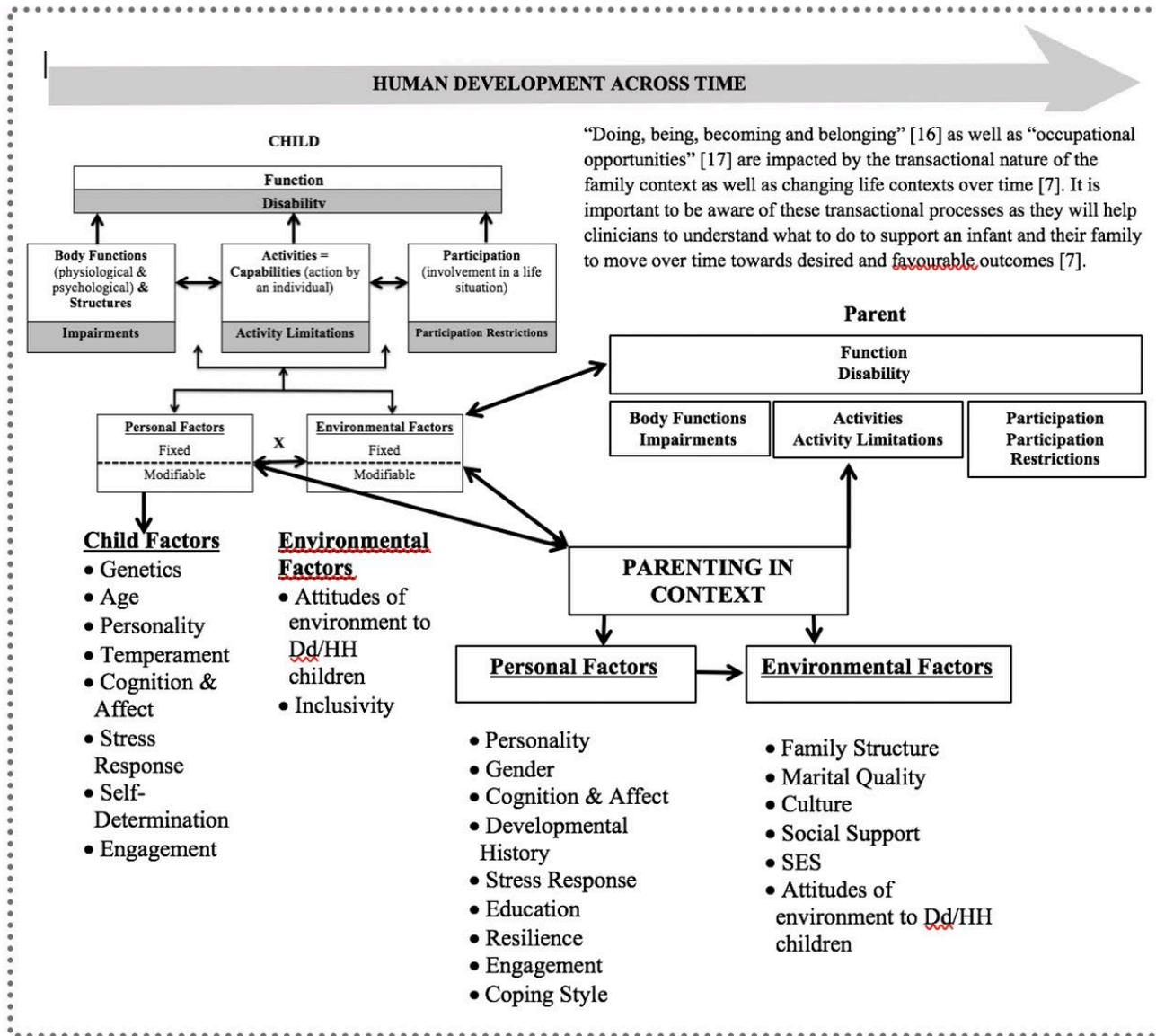
Family  
Factors



# Functional Assessment

Ling 6(HL); Glista et al, 2014





**Outcomes**

- Empowerment
- Knowledge
- Child well-being
- Family well-being
- High quality of life
- Life satisfaction
- “Positive experiences in multiple contexts” [7]
- “Occupational possibilities” [17]
- Self-determination
- Inclusion
- Human relationships

# Children's Hospital of Philadelphia: Audiology

## Pediatric Audiology Counseling Guidelines: Birth – Adolescence

Guidelines for Working with Families and Caregivers	
<b>At diagnosis:</b> <ul style="list-style-type: none"><li>○ Allow families to "tell their story".</li><li>○ Show kindness and empathy.</li><li>○ Be honest.</li><li>○ Express hope and confidence.</li></ul>	<ul style="list-style-type: none"><li>○ Parents should leave with:<ul style="list-style-type: none"><li>▪ Written information (i.e. information packet)</li><li>▪ A plan</li><li>▪ A phone number (to call whenever clarification is needed)</li><li>▪ The next appointment scheduled ASAP (in writing)</li></ul></li></ul>
<b>Within 4-6 months of diagnosis:</b> <ul style="list-style-type: none"><li>○ Recognize and acknowledge the emotional responses.</li><li>○ Facilitate healthy attachment between child and caregivers.</li><li>○ Acknowledge imbalance and support work toward re-establishing a healthy family system.</li><li>○ Actively involve family in intervention choices.</li><li>○ Support involvement of extended family (i.e. siblings and grandparents) direct contact with audiologist with parental consent.</li><li>○ Connect to other families with children of same age/similar hearing loss and to veteran families.</li></ul>	
Guidelines for Working with Children and Families Birth to Three Years of Age	
<b>Erickson's Stages:</b> <ul style="list-style-type: none"><li>○ <b>Trust vs. Mistrust:</b> Babies learn to trust their world if they are kept well-fed, warm, dry and receive regular human touch. Mistrust develops if they are left hungry, cold, wet and unattended.</li><li>○ <b>Autonomy vs. Shame and Doubt:</b> Toddlers want to rule their own actions and bodies. With success they develop autonomy but with failure they can develop shame and doubt in their own abilities.</li></ul>	
<b>Self-Concept:</b> <ul style="list-style-type: none"><li>○ <b>Birth to 14 months:</b> Babies have no sense of self. They view themselves as an extension of their parent/caregiver.</li><li>○ <b>15 months to 2 years:</b> Self-awareness emerges</li><li>○ <b>2 to 3 years:</b> Child identifies themselves concretely "Boy," "Girl," "Baby," "Big Girl/Boy"</li></ul>	

Table 4.  
*Everyday Parent Activities Identified Most Often as Contexts for Child Learning*

Rank	Interest-based parent activities	Ability-based parent activities
1	Cooking or preparing meals	Painting or drawing
2	Reading books, magazines, etc.	Skiing and other winter activities
3	Arts and craft activities	Reading books, magazines, etc.
4	Teaching my child new things	Playing with or caring for pets
5	Doing household chores	Crocheting
6	Attending or playing sports activities	Computer or tablet activities
7	Painting or drawing	Storytelling
8	Fixing things around the house	Teaching my child new things
9	Storytelling	Working in a flower or vegetable garden
10	Home decorating	Visiting neighborhood or local parks
11	Computer or tablet activities	Cooking or preparing meals
12	Camping	Haircare or styling
13	Doing yard work	Hiking or taking walks
14	Visiting zoos, wildlife preserves or farms	Playing board games
15	Playing board games	Visiting local or regional attractions
16	Playing with or caring for pets	Visiting zoos, wildlife preserves or farms
17	Working in a flower or vegetable garden	Arts and crafts activities
18	Visiting local or regional attractions	Fishing
19	Listening to music	Visiting beaches or lakes
20	Swimming or other water activities	Dancing and movement activities

- **Dunst, C. J. (2020). Parents' interests and abilities as sources of young children's everyday learning opportunities. *Journal of Family Strengths*, Vol. 20, Issue L, Article 4 Available at: [www.puckett.ors](http://www.puckett.ors) and <https://digitalcommons.librarv.tmc.eduffis/vol20/iss1l4>**

## Ottawa Personal Decision Guide



**2 Explore your decision.**

**Knowledge**  
List the options and benefits and risks you know.

**Values**  
Rate each benefit and risk using stars (★) to show how much each one matters to you.

**Certainty**  
Choose the option with the benefits that matter most to you. Avoid the options with the risks that matter most to you.

	<b>Reasons to Choose this Option</b> Benefits / Advantages / Pros	<b>How much it matters to you:</b> 0★ not at all 5★ a great deal	<b>Reasons to Avoid this Option</b> Risks / Disadvantages / Cons	<b>How much it matters to you:</b> 0★ not at all 5★ a great deal
Option #1				
Option #2				
Option #3				

Which option do you prefer?    Option #1    Option #2    Option #3    Unsure

**Support**

Who else is involved?			
Which option do they prefer?			

# The Road to Your Child's Language Success

A

## Access & Exposure

*Provide the best possible access to language through both eyes and ears. Remember Eyes Open Ears On!*

C

## Consistent access from early infancy

*Provide early access to lots & lots of language that engages your child all waking hours.*

C

## Create Connections & Opportunities

*Create connections with Deaf and hard of hearing families and communities. Access opportunities using family support resources.*



Western



E

## Environments that help with language learning

*Encourage a team approach so everyone important to your child supports your child's language development every day.*

S

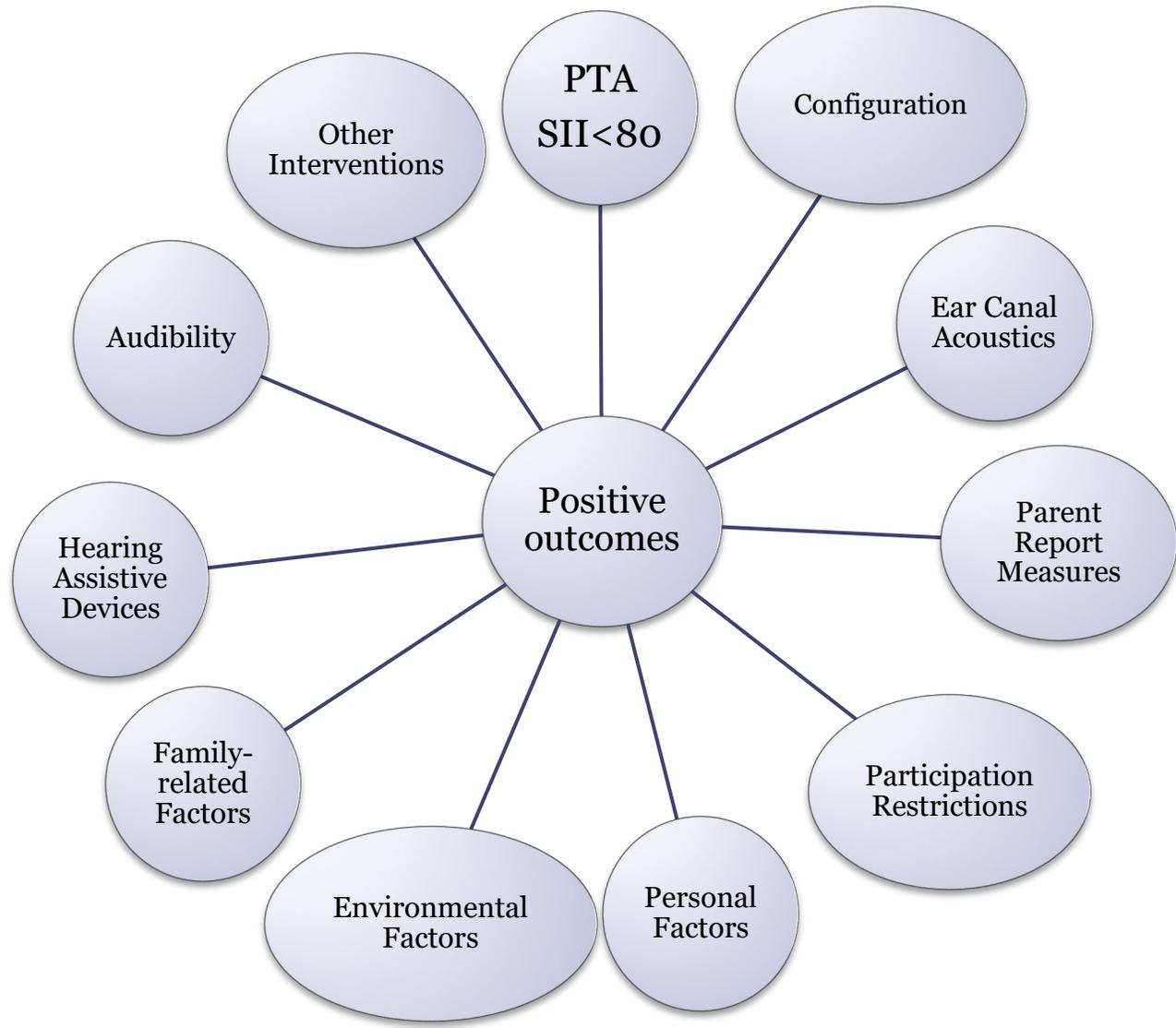
## Spotlight focus on language areas that require attention to better develop child's skills

*Focus and follow aspects of language your service provider tells you needs special attention. Early family-child conversation & reading is important right from birth.*

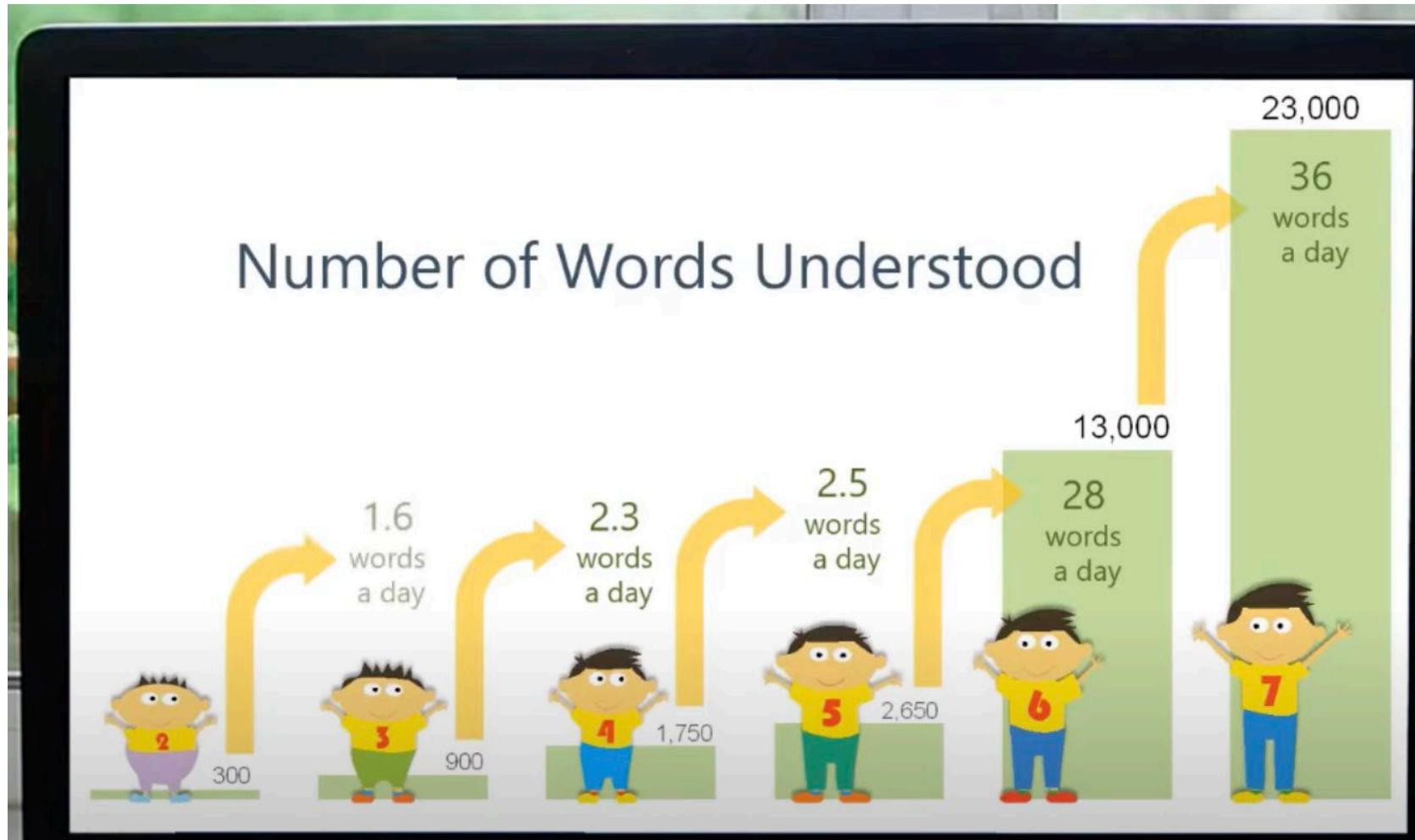
S

## Services received should meet family's needs

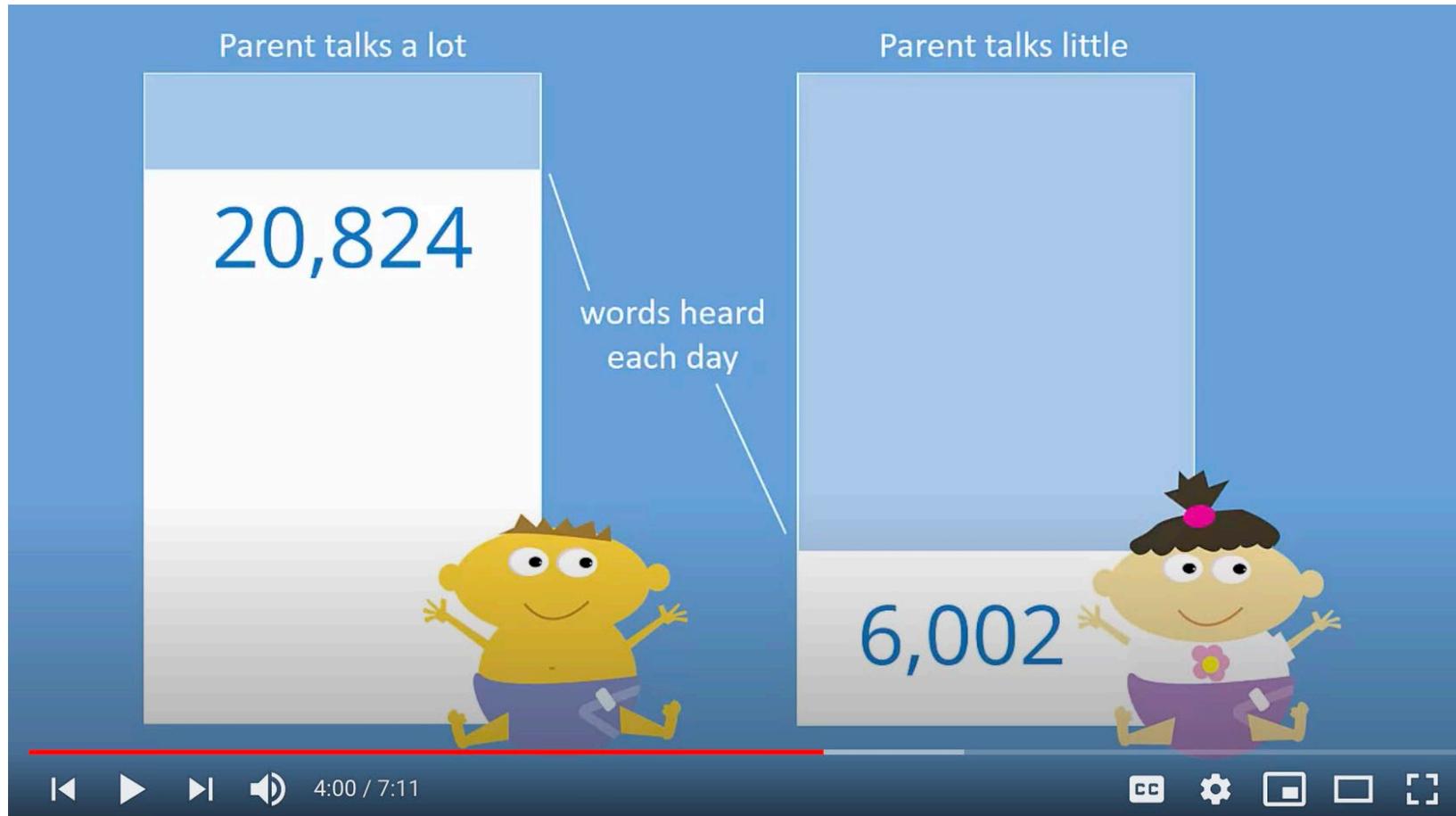
*Talk to & ask questions of the professionals on your team. Make sure they are aware of all the important things happening in your family.*



# YouTube.com/HearOnVideos



# YouTube.com/HearOnVideos





# **SUMMARY and TAKE-HOME MESSAGES**



**Think:**

**There's nothing mild about mild hearing loss.**

**A threshold is a threshold is a threshold ...**

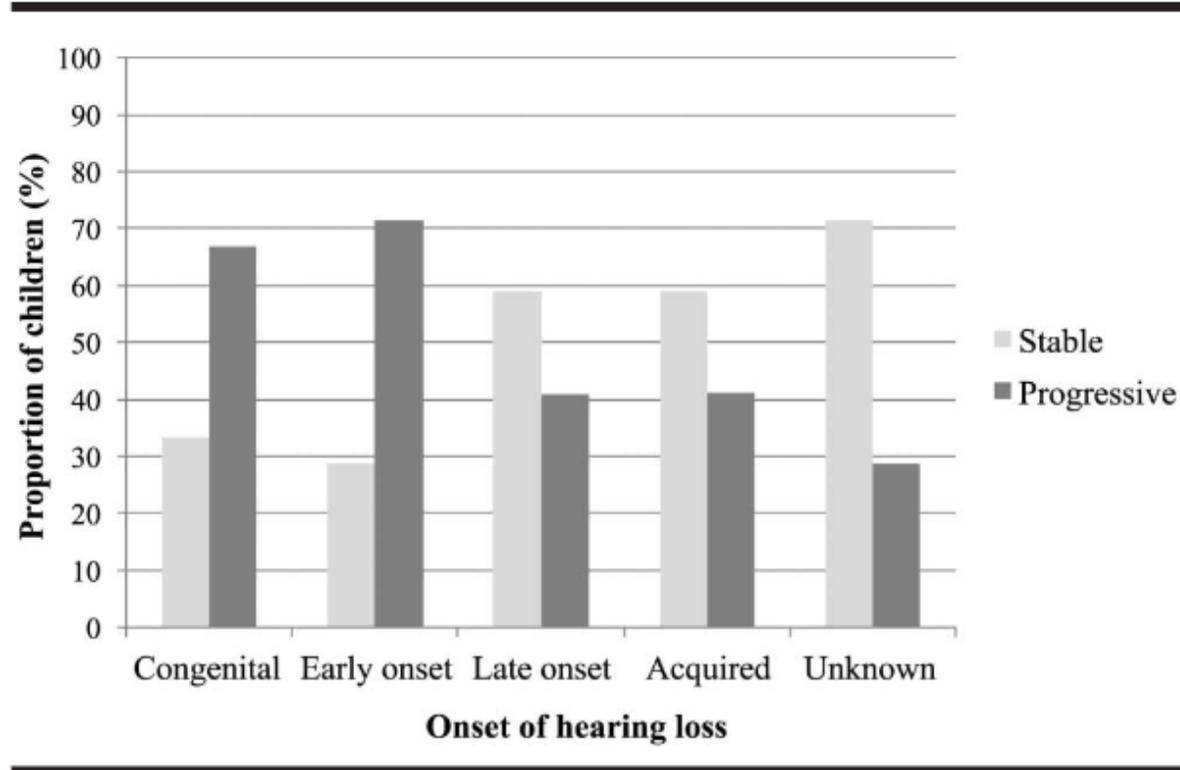
**OR IS IT ???**

**PS. That target may make no sense with those  
thresholds.....**

With respect to Gauthier & Rapisardi (1992).

# Importance of long-term monitoring

**Figure 6.** Progressive hearing loss as a function of onset of hearing loss.



Thank You  
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