



RESEARCH QUICK TAKES

3.1: The Hearing Aid Fitting Process— Getting it right: What are hearing aid users telling us?

Brian Taylor & Gus Mueller

In this Quick Takes, we'll look at some retrospective studies—can we tell from reports from hearing aid users what is driving:

- Adoption
- Acceptance
- Benefit
- Satisfaction

Results from HearingTracker



Abram Bailey

HearingTracker.com

Experience exceptional hearing care

 Address or Zip Code

Find a Pro

 Use my location



America's #1 Hearing Aid Resource

Results from HearingTracker

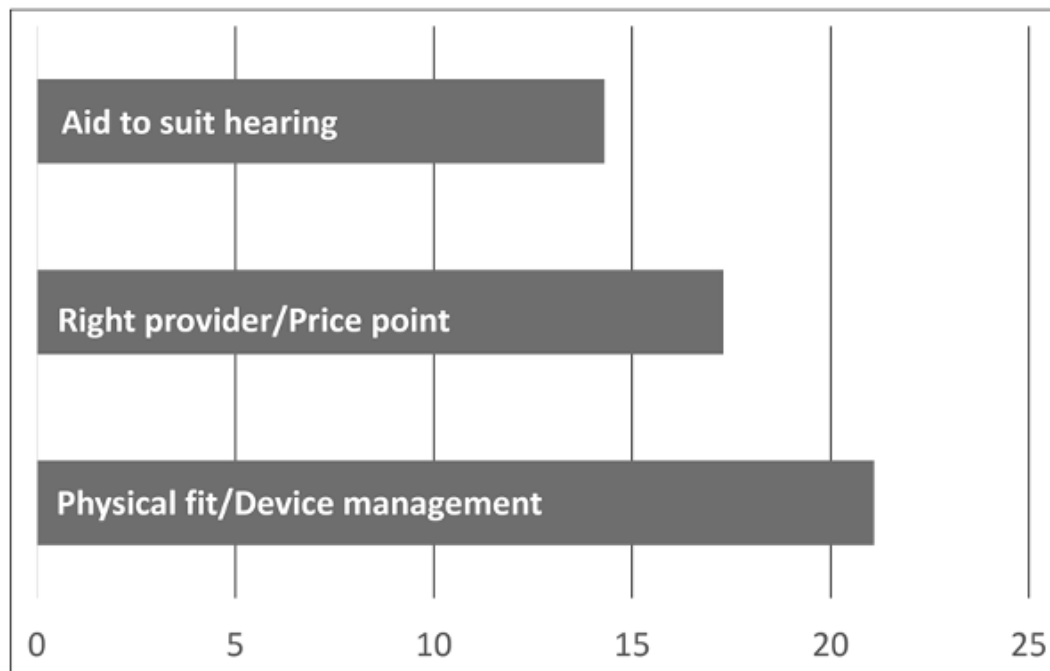
- Examined the data generated from online reviews during the period 2013 to 2019.
- Of 1378 reviews, 1274 (92.5%) of the consumers indicated owning bilateral hearing aids.
- They reported having between 0 and 10 years of experience using hearing aids (mean 4.8; SD 4.1).
- Over two-thirds indicated that they owned hearing aid models classified as the highest level of technology.
- The majority appeared satisfied with their hearing aids, with 36.5% and 43.1% self-reporting “Very Good” or “Good” respectively—this total of ~80% overall satisfaction is consistent with past findings from MarkeTrak.

Bennett RJ, Swanepoel DW, Ratinaud P, Bailey A, Pennebaker JW & Manchaiah V (2021) Hearing aid acquisition and ownership: what can we learn from online consumer reviews?, *International Journal of Audiology*, 60:11, 917-926,

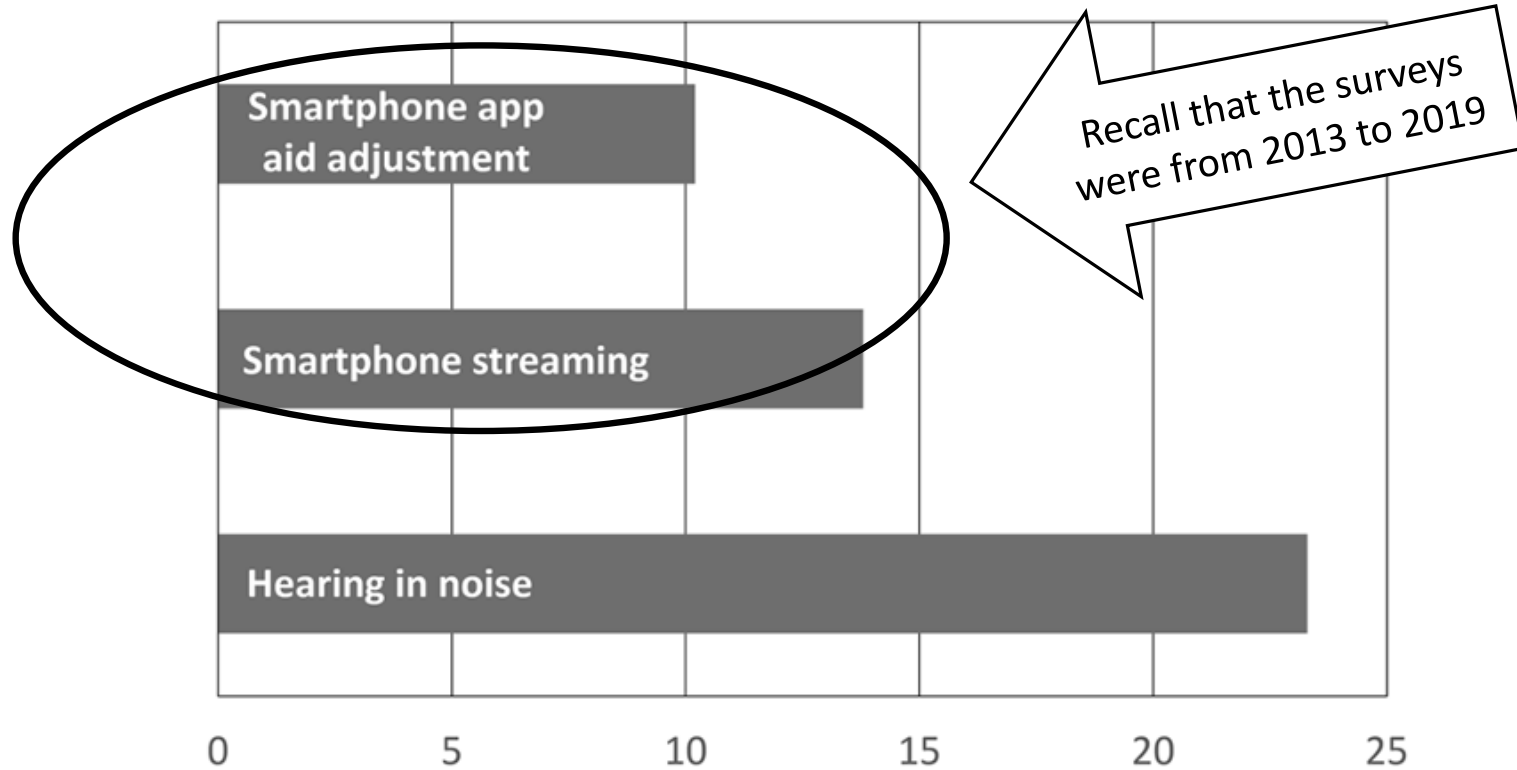
Qualitative data (open text responses) were analyzed using automated topic modelling software to identify themes, domains and clusters.

Two domains were identified: **Device Acquisition** and **Device Use**.

Domain=Device Acquisition (52.7%)



Domain=Device Use (47.3%)



The “words” that made up the clusters:

- *Right provider, device and price point:* cost, Costco, return, price, warranty, service.
- *Hearing aid to suit hearing loss:* loss, year, previous, severe, improvement.
- *Physical fit and device management:* ear, battery, dome, life, rechargeable, canal.
- *Smartphone streaming:* phone, call, stream, Bluetooth, connect, music.
- *Adjustment using smartphone:* app, control, volume, remote, reboot, treble.
- *Hearing in background noise:* noisy, noise, conversation, restaurant, loud, understand.

More 2021 research: Hearing aid adherents vs. non-adherents

All participants were first-time hearing aid users. Prior to hearing aid use, a series of unaided measures were completed:

- Sound-field speech-in-noise testing
- Acceptable noise level (ANL)
- Communication Profile of Hearing Impairment (CPHI)
- Expected Consequences of Hearing Aid Ownership (ECHO)
- Glasgow Hearing Aid Benefit Profile (GHABP).

Humes LE. (2021) Differences between older adults who do and do not try hearing aids and between those who keep and return the devices. *Trends in Hearing*. 25: 1-18

Hearing aid adherents vs. non-adherents

Following 1-month of hearing use the participants completed outcome measures:

- Hearing Aid Performance Inventory (HAPI)
- Satisfaction with Amplification in Daily Life (SADL)
- GHABP
- Satisfaction survey based on MarkeTrak.
- Connected Speech Test (CST).

Of the 105 new users, 84 chose to keep their hearing aids.

So, how did the adherents (80%) differ from the 20% of non-adherents?

Hearing aid adherents vs. non-adherents

- No significant differences for education level, income level, or duration of hearing loss.
- There was no difference between groups for the unaided ANL or for speech recognition in noise (CST; unaided and aided).
- The adherents had greater hearing loss.
- The non-adherents showed lower expectations for hearing aids. Non-adherents also reported better communication performance and better adjustment to hearing problems, but had significantly poorer awareness of communication-performance problems, and more denial of communication difficulties.
- And not surprisingly, for the GHABP, HAPI and SADL, adherents reported significantly more benefit and satisfaction.

More research from 2021: Weycker JM, Dillard LK, Pinto A, Fischer M, Cruickshanks KJ, Tweed TS. Factors Affecting Hearing Aid Adoption by Adults With High-Frequency Hearing Loss: The Beaver Dam Offspring Study. *American Journal Audiology*, 30 (8):1-9.

There was a landmark population-based Epidemiology of Hearing Loss Study in 1993-1995, designed to measure the prevalence of hearing loss in adults aged 48-92 years, residing in Beaver Dam, Wisconsin—often simply referred to as the Beaver Dam study. Of the 4,541 eligible people, 3,753 (82.6%) participated, with the average age of 65.8 years (57.7% were women).

The Beaver Dam *Offspring* Study was research to investigate hearing, vision, and olfaction in the children of the participants in the original Beaver Dam study. The purpose was to measure the 10-year incidence of hearing aid adoption in a sample of primarily middle-age adults with high-frequency hearing loss, and identify factors associated with hearing aid adoption.

The “Offspring” study:

This second study included 579 adults (ages 34–80 years) who all had a high-frequency pure-tone average >25 dB HL (3–8 kHz).

Most participants (75%) were aged between 45 and 65 years.

In addition to hearing threshold testing, word recognition measures in both quiet and in background noise were conducted for all participants, along with questionnaires.

And what did they find?

The number of individuals who adopted hearing aids within the 10-year period was 69 (12%). Factors significantly associated with adoption using a multivariable model included:

- Higher education
- Worse high-frequency pure-tone average
- Self-reported hearing handicap (screening versions of the HHIE)
- Answering “yes” to the question “Do friends and relatives think you have a hearing problem?”
- Clinical word recognition measures in background noise were *not* significantly associated, perhaps because the hearing losses were relatively mild.
- Effects of age and sex also were not significant.



RESEARCH QUICK TAKES

3.2: The Hearing Aid Fitting Process—
Getting it right: Does the level of technology
matter?

Brian Taylor & Gus Mueller

Levels of technology: A little history . . .

Wide dynamic range compression (WDRC): Fueled by the development of the K-Amp, hearing aid processing that received considerable scrutiny in the early 1990s was WDRC. Research comparing WDRC to linear processing for speech understanding was launched at several independent sites. The results of course, which are well known today, were that WDRC will improve audibility (and intelligibility) for soft inputs, and will do no worse than linear for average and loud inputs.

Levels of technology: A little history . . .

Number of channels: Multichannel products also were a hot topic in the 1990s. How many channels were enough? Were two better than one? Three better than two? Bragging rights among manufacturers were important. Several studies during this period suggested that for the purposes of shaping the frequency response, restoring audibility and optimizing speech recognition, something around 8 channels would be adequate.

Levels of technology: A little history . . .

Digital processing: The introduction of digital hearing aids in the late 1990s was the next feature to prompt strong promotional claims, from both manufacturers and hearing care providers (HCPs), which in turn encouraged researchers to initiate clinical studies to determine if these new digital products truly were superior.

For the last 10 years, research mostly has been focused on the “good,” “better,” “best” classification system



THE CLASSIC MATTRESS
GOOD



THE ELITE MATTRESS
BETTER



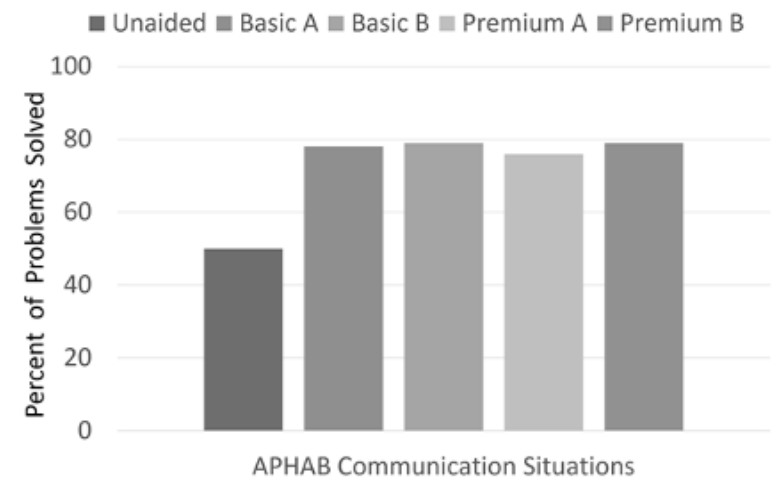
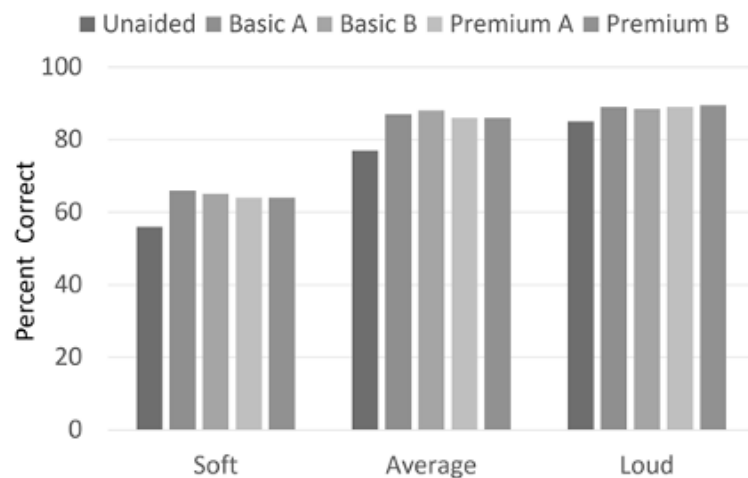
THE LUXURY MATTRESS
BEST

Large VA-funded Robyn Cox study



- Participants were 25 both new and experienced hearing aid users.
- Basic and premier products were compared from two different manufacturers. All four products were fitted to NAL-NL2 targets, and the participants used the products in the real world for one month.
- The premier model had more channels (e.g., 16 vs. 8) and more levels of noise reduction. All models from both manufacturers had adaptive directional processing.
- The participants received speech-in-noise testing, completed four different self-assessment scales following the real-world experience, and also maintained a diary, noting positive and negative experiences with the products.

Results for speech recognition in noise (left panel) and for the APHAB (right panel)



One significant finding, indirectly related to the purpose of the study, was that for all four products on the Hearing Quality of Life Scale, the average rating was "A Good Deal Better."

Similar study from the University of Iowa . . .

- Participants were 54 older adults fitted bilaterally with basic and premium products. Clinical testing was conducted for both models with noise reduction and directionality turned on and also turned off (total of four conditions).
- For each condition, participants wore the hearing for 5 weeks.
- Outcome measures included speech understanding, listening effort, sound quality, localization and satisfaction.
- Unique to this study was that real-world reports included ecological momentary assessment (EMA), and also completion of smartphone-delivered surveys.

Results for Features “On” vs. Features “Off”

Experimental Measure	Feature-On Better	Same	Feature-Off Better
Speech Understanding (Lab)			
Sound Quality (Lab)			
Listening Effort (Lab)			
Speech Understanding (Real World)			
Sound Quality (Real World)			
Listening Effort (Real World)			
Satisfaction (Real World)			

Results for Basic vs. Premium

Experimental Measure	Premium Better	Same	Basic Better
Speech Understanding (Lab)			
Sound Quality (Lab)			
Listening Effort (Lab)			
Speech Understanding (Real World)			
Sound Quality (Real World)			
Listening Effort (Real World)			
Satisfaction (Real World)			



Recent studies from the University of Tennessee . . .

Compared basic to premier in two different studies, one with experienced users, and the other with new users of hearing aids.

The outcome measures obtained from the participants were similar for both studies, and included:

- Acceptable noise level (ANL) test
- Speech recognition in noise (QuickSIN and HINT)
- Listening environment demands via data logging
- Self-report speech, spatial and qualities (SSQ-12) questionnaire
- Overall listener preference.

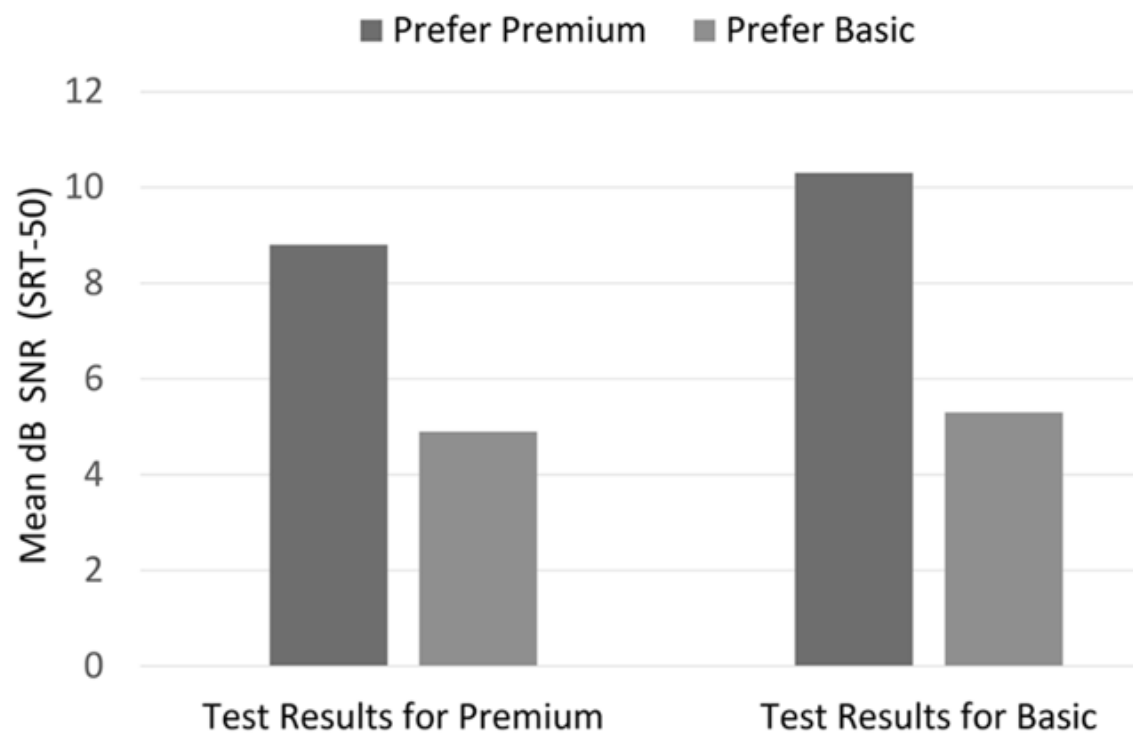
Results were similar for both groups

Differences observed in both studies were that the individuals who preferred premium:

- Had a larger (worse) ANL
- Spent more time in speech-in-noise listening situations.

There was a preference for premium in both studies, but it was the greatest (74% of participants) for the new hearing aid users.

Interesting data from one of their tables:





A slightly different approach from researchers of Western University

In a single-blinded crossover trial, premium vs. basic were compared. Aided behavioral outcomes that were measured were:

- Loudness ratings
- Speech recognition (sentences and syllables)
- Speech quality
- Preference between hearing aids

A unique aspect of this study was that group concept mapping was utilized to investigate preference results. Participants generated statements based on what influenced their preferences, which were then sorted into themes that were then rated for degree of importance on a 1-5 scale.

And the results . . .

The results of the laboratory testing found *no difference* between premium and basic technology for sentence recognition in noise, consonant recognition in noise, loudness ratings, or speech quality.

Following the field trial with both devices, 83% of the participants preferred the premium technology; 52% had a rating of “strong preference” (on a 7-point scale).

Nine clusters were identified. The clusters that were rated the highest for both groups were sound quality and intelligibility, comfort and appearance, and ease of use.

So why the high preference for the premium product?

Clusters that differed significantly in their importance rating between groups (i.e., rated considerably higher for the “prefer premium” group):

- Having access to smartphone application-based user-controlled settings.
- The ability to stream calls and music.
- Convenience features such as accessory compatibility.



RESEARCH QUICK TAKES

3.3: The Hearing Aid Fitting Process— Getting it right: A patient-centered approach

Brian Taylor & Gus Mueller

To get us started, a quick review from Quick Takes 3.2:

- We reviewed research from Western University. They used a unique approach, group concept mapping, to investigate hearing aid preferences.
- Participants generated statements based on what influenced their preferences, which were then sorted into themes that were rated for degree of importance on a 1-5 scale. What emerged was nine distinct clusters.
- Regardless of the participant's hearing aid preference (Premier vs. Basic), however, the three clusters that were rated the highest were sound quality and intelligibility, comfort and appearance, and ease of use.

The #1 factor, sound quality and intelligibility, will be the focus of the remaining issues of this Volume of Quick Takes.

Getting the fitting right: Guidelines certainly should help . . .

Vanderbilt/VA consensus statement (now 30 years old)

The Independent Hearing Aid Fitting Forum (IHAFF)

Guidelines from the ASHA

Guidelines from the AAA

Guidelines from the International Society of Audiology

And, guidelines from several other organizations and countries

But now, as of 2021 we have a “Standard”



APSO
AUDIOLOGY PRACTICE
STANDARDS ORGANIZATION

Standard S2.1[2021]
Adopted May 2, 2021

The profession of audiology is committed to providing auditory and vestibular care through ethical and evidence-based clinical practices that lead to optimal patient outcomes. Standard of practice documents outline basic services that audiologists are expected to include in the provision of quality healthcare. They reflect the values and priorities of the profession, providing direction for professional practice and a framework for the evaluation of practice. Standards of practice are prepared by subject matter experts, based on available evidence, peer-reviewed and subject to periodic updating.

HEARING AID FITTING STANDARD FOR ADULT & GERIATRIC PATIENTS

1. The hearing aid selection and fitting process is based on a comprehensive, valid audiological assessment. Each step of the selection and fitting process and the rationale is documented, where appropriate. ^{1, 2, 3}
2. Patient communication is conducted in a clear, empathetic manner consistent with the patient's communication mode, comprehension, and their health literacy level. Patient-centered and family-centered care is provided. The patient is encouraged to include communication partners (e.g., family members, significant others, companions) throughout the selection, fitting, and follow-up process. ⁴
^{5, 6, 7, 8}
3. A needs assessment is conducted in determining candidacy and in making individualized amplification recommendations. A needs assessment includes audiologic, physical, communication, listening, self-assessment, and other pertinent factors affecting patient outcomes. ^{9, 10}
4. Pre-fitting testing includes assessment of speech recognition in noise, unless clinically inappropriate, and frequency-specific loudness discomfort levels. Other validated measures of auditory and non-auditory abilities are considered, as appropriate for the individual patient. ^{11, 12, 13, 14, 15, 16, 17, 18, 19}
5. Fitting of bilateral hearing aids is the recommended protocol if the patient is a candidate for hearing aids in both ears and it is supported by the needs assessment. ^{20, 21, 22}
6. The hearing aid style and the ear coupling are chosen to be appropriate for the degree and configuration of the hearing loss. Style and coupling should reflect any physical limitations of the patient. Patient input regarding acceptable styles is taken into account. ^{23, 24, 25, 26, 27, 28, 29, 30, 31, 32}

7. The recommended hearing aids include signal processing and features that support the patient's listening needs. They have the appropriate gain and output, including reserve gain, to meet frequency-specific fitting targets as defined by a validated prescriptive method. ^{33, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43}
8. Assistive technology and accessories are considered to facilitate accessibility to other devices and to satisfy the patient's listening and communication needs. ^{23, 44, 45, 46, 47, 48}
9. An assessment of initial product quality is completed, using standard electroacoustic measures to verify either manufacturer or published specifications. ^{34, 49}
10. Hearing aids are fitted so that various input levels of speech result in verified ear canal output that meets the frequency-specific targets provided by a validated prescriptive method. The frequency-specific maximum power output is adjusted to optimize the patient's residual dynamic range and ensure that the output does not exceed the patient's loudness discomfort levels. ^{50, 51, 52, 53, 54, 55, 56, 57}
11. Following individualized verification of hearing aid gain and output, if the fitting is not acceptable to the patient, minor deviations in gain and output may be necessary. ^{58, 59}
12. Orientation is device- and patient-centered and includes use, care, and maintenance of the hearing aid(s) and accessories. ^{60, 61, 62, 63}
13. Counseling is conducted to ensure appropriate adjustment to amplification and to address other concerns regarding communication. Additional rehabilitative audiology is recommended if deemed appropriate. ^{64, 65, 66, 67, 68, 69}
14. Hearing aid outcome measures are conducted. These may include validated self-assessment or communication inventories and aided speech recognition assessment. ^{70, 71}
15. Short- and long-term follow-up is conducted to ensure that post-fitting needs are addressed. This includes updated audiological assessment, hearing aid adjustments and routine maintenance as needed to ensure the devices are functioning properly and appropriately for the patient. ^{23, 31, 72, 73, 74, 75}



John Coverstone

Why we need a standard . . .

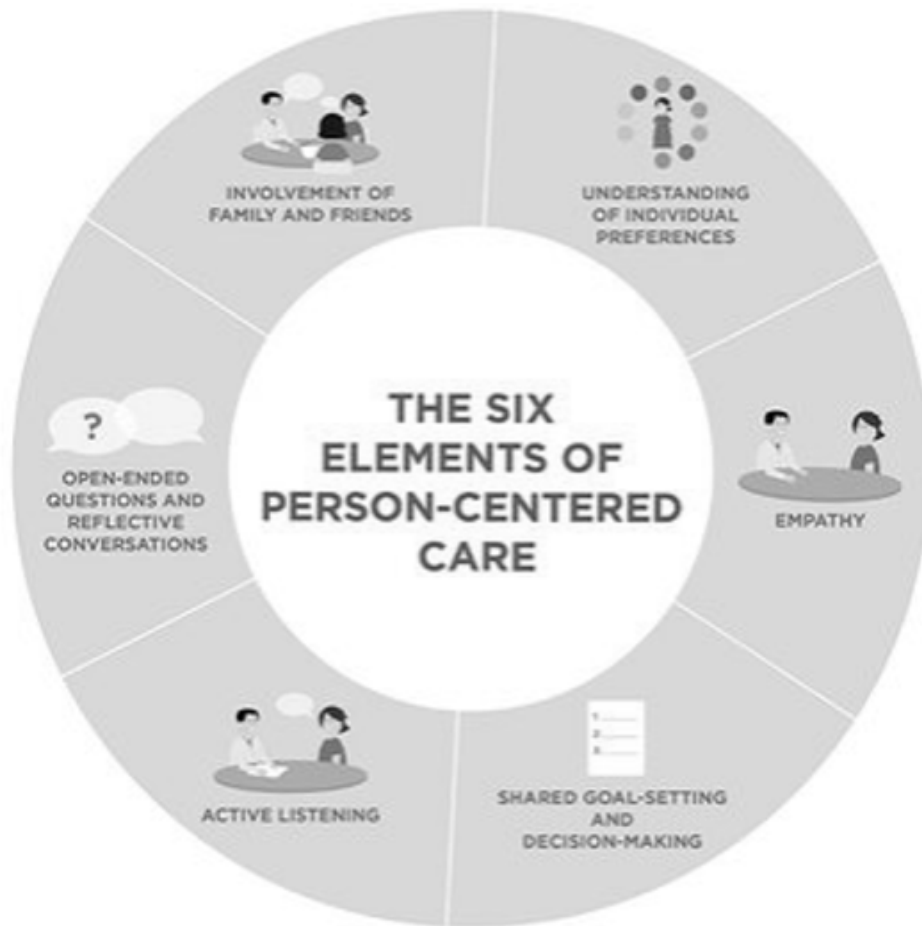
“A guideline is a document that describes how (that’s a key word) a procedure may be performed—often with multiple options . . . A guideline “guides” clinicians in how they should perform procedures.

A clinical standard, on the other hand, is more of a what document. Standards guide us as to what we should be doing with a specific patient in a specific circumstance. We label them a standard because we expect all providers to come to the same conclusion given a specific set of criteria . . . Standards don’t address best outcomes; they address minimum acceptable practices.”

The “Standard” starts us off with patient-centered care:

Item #2 of the APSO standard states in part: *Patient-centered and family-centered care is provided. The patient is encouraged to include communication partners (e.g., family members, significant others, companions) throughout the selection, fitting, and follow-up process.*

The Institute of Medicine defines patient-centered care as: *Providing care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions, requiring a true partnership between individuals and their healthcare providers.*



One method to facilitate patient-centered care is to administer pre-fitting self-assessment inventories:

- Hearing Handicap Inventory for Elderly/Adults (HHIE/A)
- Abbreviated Profile of Hearing Aid Benefit (APHAB)
- Client Oriented Scale of Improvement (COSI)

The HHIE/A family:

- HHIE: The original 25-item questionnaire. Designed for the “elderly”—people 65 and older.
- HHIE-S: S=Screening. A modification of the HHIE containing only 10 items.
- HHIA: A=Adult. A 25-item of the HHIE for individuals younger than 65 years.
- HHIA-S: S=Screening. A modification of the HHIA containing only 10 items.

HHIE-S vs HHIA-S

Question #3

- HHIE: Do you have difficulty understanding when someone speaks in a whisper?
- HHIA: Does a hearing problem cause you difficulty hearing/understanding coworkers, clients, or customers?

Question #6

- HHIE: Does a hearing problem cause you to attend religious services less often than you would like?
- HHIA: Does a hearing problem cause you problems in the movies or theater?

	Item	Yes (4 pts)	Sometimes (2 pts)	No (0 pts)
E	Does a hearing problem cause you to feel embarrassed when meeting new people?	_____	_____	_____
E	Does a hearing problem cause you to feel frustrated when talking to members of your family?	_____	_____	_____
S	Do you have difficulty hearing when someone speaks in a whisper?	_____		
E	Do you feel handicapped by a hearing problem?	_____		
S	Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?	_____		
S	Does a hearing problem cause you to attend religious services less often than you would like?	_____		
E	Does a hearing problem cause you to have arguments with family members?	_____		
S	Does a hearing problem cause you difficulty when listening to TV or radio?	_____	_____	_____
E	Do you feel that any difficulty with your hearing limits or hampers your personal or social life?	_____	_____	_____
S	Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?	_____	_____	_____
TOTAL SCORE = _____ (sum of the points assigned to each of the items)				

Scoring:

- 0–8: No significant perception of a hearing handicap
- 10–22: Mild to moderate perception of a hearing handicap
- >22: Perception of a severe handicap

Abbreviated Profile of Hearing Aid Benefit (APHAB)

The APHAB is composed of 24 items that are scored in four subscales (six questions each). The four subscales are:

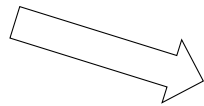
- Ease of Communication (EC): The strain of communicating under relatively favorable conditions.
- Reverberation (RV): Communication in reverberant rooms such as classrooms.
- Background Noise (BN): Communication in settings with high background noise levels.
- Aversiveness (AV): The unpleasantness of environmental sounds.

Hearing Aid Research Lab (HARL)

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Applications

Outcome Applications



APHAB



SADL



ECHO



IOI-HA



DOSO



WICIT

Hearing Aid Fitting Applications



RSIN



SIR



CST



VIOLA



Contour



AFAAF

ABBREVIATED PROFILE OF HEARING AID BENEFIT

A

NAME: _____
Last First

☐ Male ☐ Female

TODAY'S DATE: ____/____/____

INSTRUCTIONS: Please circle the answers that come closest to your everyday experience. Notice that each choice includes a percentage. You can use this to help you decide on your answer. For example, if a statement is true about 75% of the time, circle "C" for that item. If you have not experienced the situation we describe, try to think of a similar situation that you have been in and respond for that situation. If you have no idea, leave that item blank.

- A Always (99%)**
- B Almost Always (87%)**
- C Generally (75%)**
- D Half-the-time (50%)**
- E Occasionally (25%)**
- F Seldom (12%)**
- G Never (1%)**

Without Hearing Aid With Hearing Aid

1. When I am in a crowded grocery store, talking with the cashier, I can follow the conversation.	A B C D E F G	A B C D E F G
2. I miss a lot of information when I'm listening to a lecture.	A B C D E F G	A B C D E F G
3. Unexpected sounds, like a smoke detector or alarm bell are uncomfortable.	A B C D E F G	A B C D E F G
4. I have difficulty hearing a conversation when I'm with one of my family at home.	A B C D E F G	A B C D E F G
5. I have trouble understanding the dialogue in a movie or at the theater.	A B C D E F G	A B C D E F G
6. When I am listening to the news on the car radio, and family members are talking, I have trouble hearing the news.	A B C D E F G	A B C D E F G
7. When I'm at the dinner table with several people, and am trying to have a conversation with one person, understanding speech is difficult.	A B C D E F G	A B C D E F G
8. Traffic noises are too loud.	A B C D E F G	A B C D E F G

Background Noise

Reverberation

Ease of Communication

Aversiveness

signia | Audiology

Scoring guidelines available at HARL website

2005 APHAB Norms for WDRC-capable hearing aids

Users of WDRC capable hearing aids- Unaided					
Percentile	EC	RV	BN	AV	GBL
95	99	99	99	70	97
80	83	87	89	35	85
65	75	81	81	21	76
50	63	71	75	14	68
35	56	65	67	9	64
20	46	58	58	3	57
5	26	47	41	1	45

Users of WDRC capable hearing aids- Aided					
Percentile	EC	RV	BN	AV	GBL
95	86	79	82	82	67
80	39	57	58	64	50
65	29	46	49	53	42
50	23	37	40	38	34
35	17	29	32	23	28
20	12	21	22	14	20
5	5	12	14	2	13

Users of WDRC capable hearing aids- Benefit					
Percentile	EC	RV	BN	AV	GBL
95	76	70	56	16	59
80	52	52	47	0	47
65	46	41	39	-8	41
50	38	34	33	-3	33
35	29	27	23	-25	29
20	19	16	12	-41	22
5	-10	-3	-1	-61	3

Client Oriented Scale of Improvement (COSI)

Most famous inventory that starts as a “blank sheet”



National Acoustic Laboratories
A division of Australian Hearing

**NAL
CLIENT ORIENTED SCALE OF IMPROVEMENT**

Name : _____ Category. New _____ Degree of Change _____
 Audiologist : _____ Return _____
 Date : 1. Needs Established _____
 2. Outcome Assessed _____

Final Ability (with hearing aid)
 Person can hear
 10% 25% 50% 75% 95%

SPECIFIC NEEDS

Indicate Order of Significance

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

Worse	No Difference	Slightly Better	Better	Much Better	CATEGORY	Hardly Ever	Occasionally	Half the Time	Most of Time	Almost Always

Categories

1. Conversation with 1 or 2 in quiet
2. Conversation with 1 or 2 in noise
3. Conversation with group in quiet
4. Conversation with group in noise
5. Television/Radio @ normal volume
6. Familiar speaker on phone
7. Unfamiliar speaker on phone
8. Hearing phone ring from another room
9. Hear front door bell or knock
10. Hear traffic
11. Increased social contact
12. Feel embarrassed or stupid
13. Feeling left out
14. Feeling upset or angry
15. Church or meeting
16. Other

How the COSI works . . .

- The process begins by having the patient identify up to five specific listening situations in which he or she would like to hear better. We suggest having at least three.
- Make each item as specific as possible.
- Encourage patient to nominate situations that occur frequently everyday, not a recent unusual situation that may never occur again.
- After all situations have been identified, review all situations, and have the patient rank order them. Simply place a 1 for most important, 2 for the second most important, and so on in the box to the left of the item.

NAL
CLIENT ORIENTED SCALE OF IMPROVEMENT

Name : Kirby Mueller Category. New X
 Audiologist : _____ Return _____
 Date : 1. Needs Established _____
 2. Outcome Assessed _____

Aided Expectations

Final Ability (with hearing aid)
 Person can hear
 10% 25% 50% 75% 95%

SPECIFIC NEEDS

Indicate Order of Significance

- #5 *Hearing friends while shooting pool in Ryder Bar.*
- #4 *Understanding numbers called during Bingo.*
- #2 *Understanding wife when she is in another room.*
- #3 *Not have to turn the TV up so loud.*
- #1 *Understanding soft voices of grandchildren when they visit.*

Worse	No Difference	Slightly Better	Better	Much Better	CATEGORY	Hardly Ever	Occasionally	Half the Time	Most of Time	Almost Always
				✓						
			✓							
			✓							
			✓							
			✓							

NAL
CLIENT ORIENTED SCALE OF IMPROVEMENT

Name : Kirby Mueller Category: New X
 Audiologist : _____
 Date : 1. Needs Established _____
 2. Outcome Assessed _____

Aided Expectations

Final Ability (with hearing aid)
 Person can hear
 10% 25% 50% 75% 95%

SPECIFIC NEEDS

Indicate Order of Significance

- #5 *Hearing friends while shooting pool in Ryder Bar.*
- #4 *Understanding numbers called during Bingo.*
- #2 *Understanding wife when she is in another room.*
- #3 *Not have to turn the TV up so loud.*
- #1 *Understanding soft voices of grandchildren when they visit.*

Worse	No Difference	Slightly Better	Better	Much Better	CATEGORY	Hardly Ever	Occasionally	Half the Time	Most of Time	Almost Always
				✓						
			✓							
			✓							
			✓							
			✓							



RESEARCH QUICK TAKES

3.4: The Hearing Aid Fitting Process—
Getting it right: Importance of pre-fitting
testing.

Brian Taylor & Gus Mueller

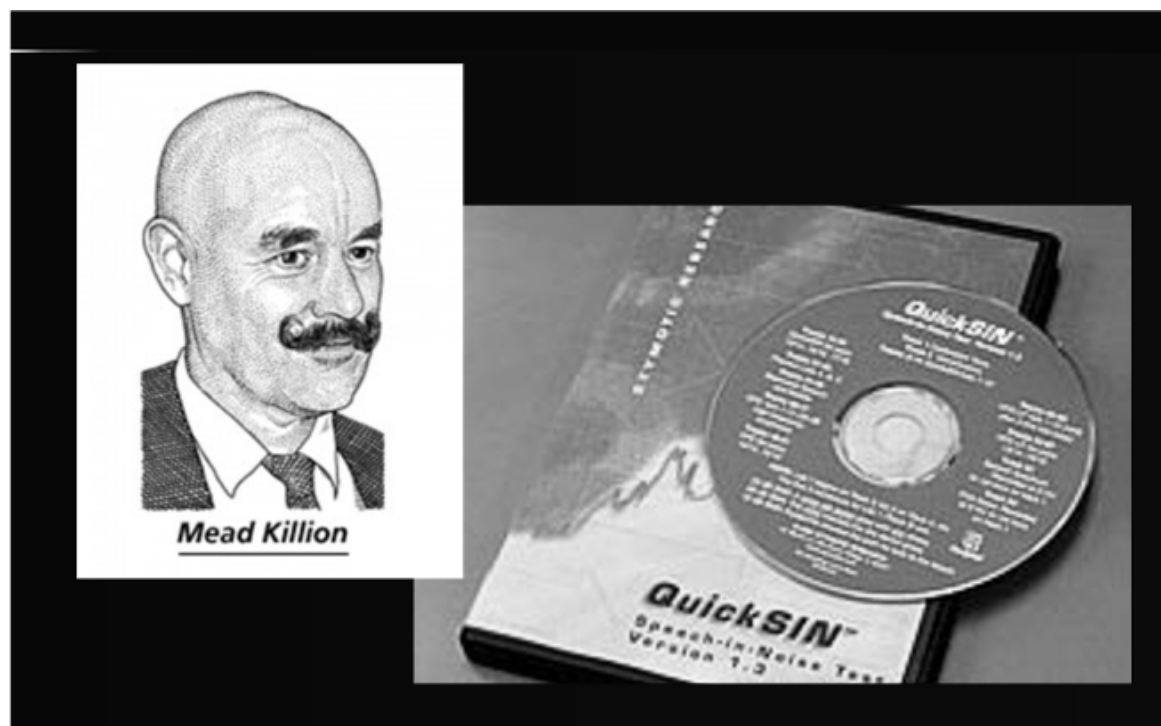
What does the APSO Standard say?

APSO Standard: #4. Pre-fitting testing includes assessment of speech recognition in noise, unless clinically inappropriate, and frequency-specific loudness discomfort levels. Other validated measures of auditory and nonauditory abilities are considered, as appropriate for the individual patient.

Specific (nine) areas where test results might be useful:

- Speech understanding in background noise
- Noise annoyance
- Listening effort
- Perception vs. Performance
- Loudness measures
- Central auditory processing
- Expectations
- Motivation
- Cognition

Speech-In-Noise testing: The QuickSIN



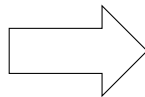
About the QuickSIN:

- Recorded with 6 different S/N ratios
- Six sentences/list; only one sentence at each level (yes it is quick!).
- Female talker with four competing talkers (yes there is informational masking)
- Recommended presentation level: 70-75 HL, or “Loud, But Okay” loudness rating
- Very easy to administer (use two lists)
- Fairly easy to score

Sample scoring of QuickSIN

List 1		Score
1. A <u>white</u> <u>silk</u> <u>jacket</u> goes with <u>any</u> <u>shoes</u> .	S/N 25	<u>5</u>
2. The <u>child</u> <u>crawled</u> <u>into</u> the <u>dense</u> <u>grass</u> .	S/N 20	<u>5</u>
3. <u>Footprints</u> <u>showed</u> the path he <u>took</u> up the <u>beach</u> .	S/N 15	<u>4</u>
4. A vent near the <u>edge</u> brought in fresh <u>air</u> .	S/N 10	<u>3</u>
5. It is a <u>band</u> of steel three inches <u>wide</u> .	S/N 5	<u>2</u>
6. The weight of the package was seen on the high scale .	S/N 0	<u>0</u>
25.5 - TOTAL = 6.5 SNR Loss	TOTAL	<u>19</u>

Scored in "SNR-Loss"



0-3 dB:	Normal or near-normal
4-7 dB:	Mild
8-15 dB:	Moderate
>15 dB:	Severe

The many uses of the QuickSIN findings . . .

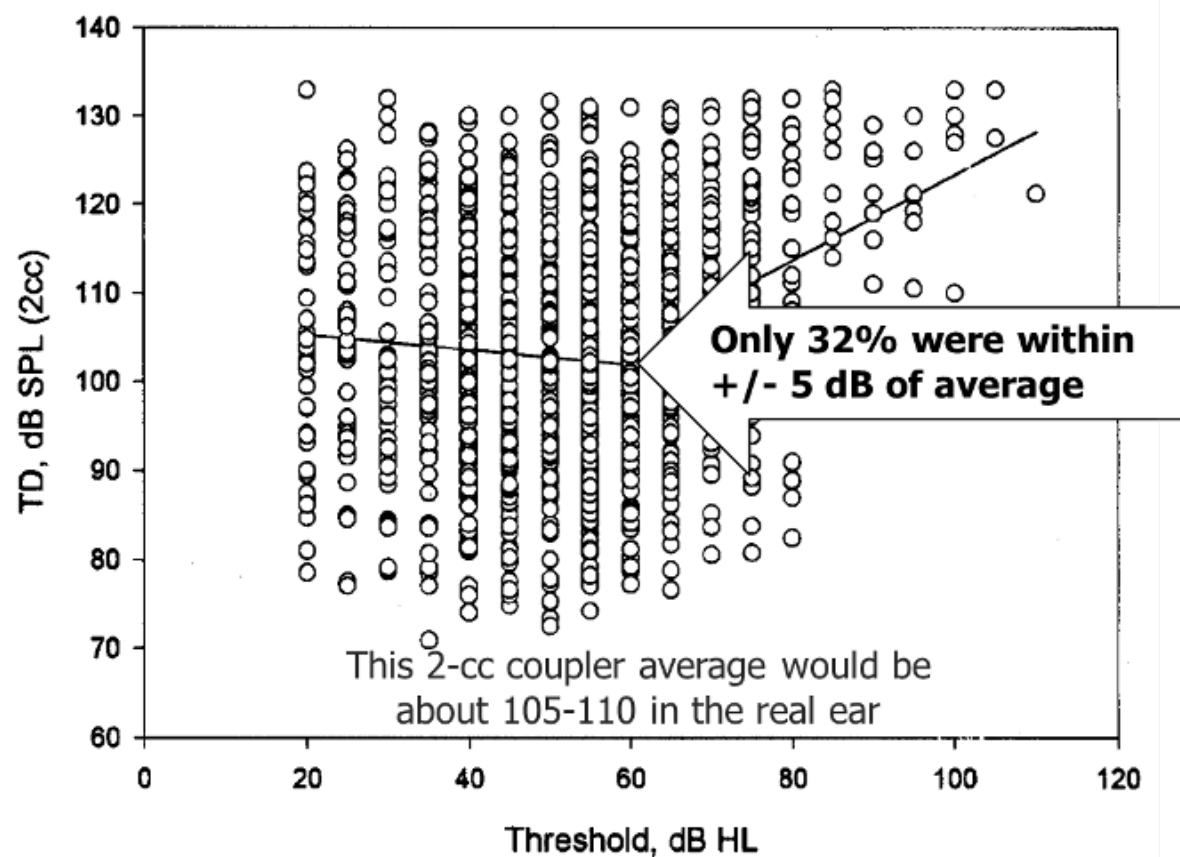
- Provides information for the treatment plan, selection of devices and accessories.
- Identifies asymmetry which can influence hearing aid selection.
- Provides information for both pre-fitting and post-fitting counseling—establishes boundaries for realistic expectations.
- Can identify “hidden hearing loss.”
- Can serve as screening test for central auditory processing issues.
- Adds credibility and patient trust. The patient is given a test that directly relates to their chief complaint.

Getting the MPO right: The porridge principle

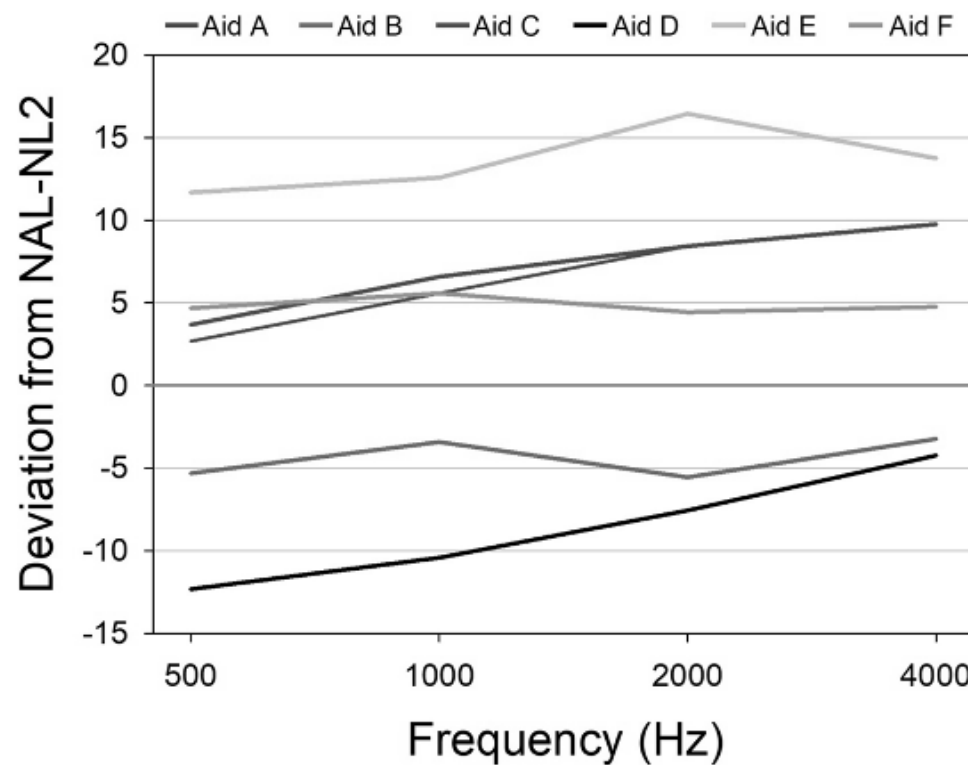
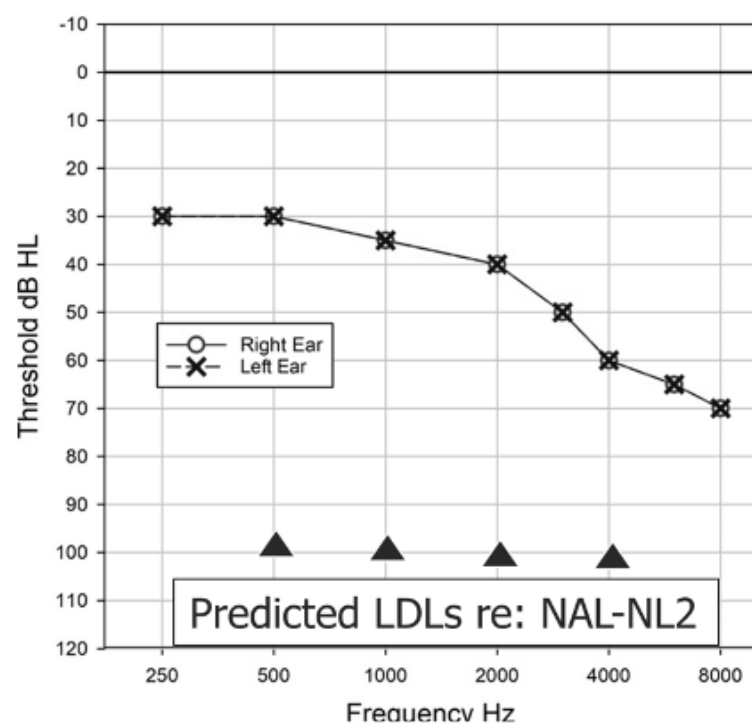
Rule #1: The MPO must be *low enough* so that loud sounds do not exceed the patient's LDLs.

Rule #2: The MPO must be high enough so that ample head room is available for the peaks of speech, music, and other louder sounds falling below the LDL.

Why LDLs need to be measured: Point #1



Why LDLs need to be measured: Point #2



Important tools for LDL measures

Loudness Anchors

- #7: Uncomfortably Loud
- #6: Loud, But Okay
- #5: Comfortable, But Slightly Loud
- #4: Comfortable
- #3: Comfortable, But Slightly Soft
- #2: Soft
- #1: Very Soft

INSTRUCTIONS FOR LOUDNESS TEST

THE PURPOSE OF THIS TEST IS TO FIND YOUR JUDGMENTS OF THE LOUDNESS OF DIFFERENT SOUNDS.

YOU WILL HEAR SOUNDS THAT INCREASE AND DECREASE IN VOLUME. YOU MUST MAKE A JUDGMENT ABOUT HOW LOUD THE SOUNDS ARE. PRETEND YOU ARE LISTENING TO THE RADIO AT THAT VOLUME. HOW LOUD WOULD IT BE?

AFTER EACH SOUND, TELL ME WHICH OF THESE CATEGORIES BEST DESCRIBES THE LOUDNESS.

KEEP IN MIND THAT AN UNCOMFORTABLY LOUD SOUND IS LOUDER THAN YOU WOULD EVER CHOOSE ON YOUR RADIO NO MATTER WHAT MOOD YOU ARE IN.

Recommended LDL test procedure:

- Testing is conducted using earphones, and is frequency and ear specific. The input signal is a pulsed pure tone, the same as used for threshold determination. There is no value in a speech LDL, as it does not assist in the programming of the hearing aids.
- It usually is most convenient to do the measure at the same time as the routine diagnostic, as the patient is already set-up for testing, and accustomed to hearing pulsed pure tones. This also allows for pre-programming the MPO prior to the patient's hearing aid fitting appointment.
- For a typical audiogram, it usually is adequate to only test two frequencies/ear. The two frequencies selected should be at the lower and higher boundaries of the key frequencies that are being amplified (e.g., you would not do LDL testing at 500 Hz for an open fitting).

Recommended LDL test procedure(cont.):

- An ascending method is used, either 2- or 5-dB steps. It is critical that the patient is provided a chart of loudness anchors, which they will then use for their responses. The test signal is increased until a #7 response is given, which is the LDL. Conduct two runs to ensure reliability.
- The instructions are very important, and should be read to the patient. The patient needs to know that we are looking for the point where sounds are “first uncomfortable,” not what is “tolerable.”
- Research has shown that if the procedures outlined here are used, test-retest for the LDL measure will be ~2.5 dB, about the same as for pure-tone threshold measures.

What to do with the HL LDLs?

- Convert HL values to 2-cc coupler values by adding the RETSPLs (see values below).
- Program the hearing aid MPO using these derived 2-cc coupler values

Example:

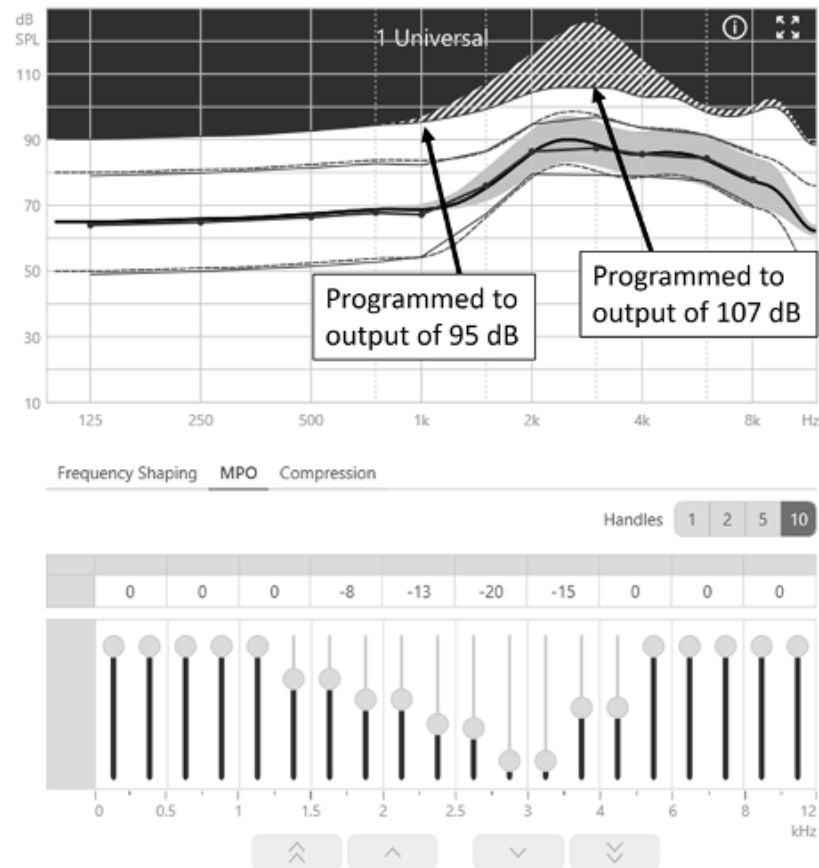
1000 Hz: HL LDL=92 dB. $92 \text{ dB} + 3 \text{ dB (RETSPL)} = 95 \text{ dB (re:2-cc coupler)}$

3000 Hz: HL LDL=104 dB. $104 \text{ dB} + 3 \text{ dB (RETSPL)} = 107 \text{ dB (re:2-cc coupler)}$

RETSPLs (insert earphones): 500 Hz=8 dB, 1000 Hz=3 dB, 2000 Hz=5 dB, 3000 Hz=3 dB, and 4000 Hz=7 dB.

Once LDLs have been converted to 2-cc coupler . . .

- Go to MPO programming in software
- Adjust handles to meet 2-cc values for key frequencies
- Adjust adjacent frequencies to obtain smooth output curve





RESEARCH QUICK TAKES

3.5: The Hearing Aid Fitting Process— Getting it right: Verification of gain and output

Brian Taylor & Gus Mueller

Verification vs. Validation:

Verification typically is used when discussing if specific design goals were met (e.g., the correct earcanal SPL)

Validation most commonly is used to describe whether the end user obtained what they wanted or needed (e.g., benefit and satisfaction when using hearing aids in the real world).

Simply put:

- Verification: Are we building the system right?
- Validation: Are we building the right system?

What the APSO Standard says about verification:

#10. Hearing aids are fitted so that various input levels of speech result in verified ear canal output that meets the frequency-specific targets provided by a validated prescriptive method. The frequency-specific maximum power output is adjusted to optimize the patient's residual dynamic range and ensure that the output does not exceed the patient's loudness discomfort levels.

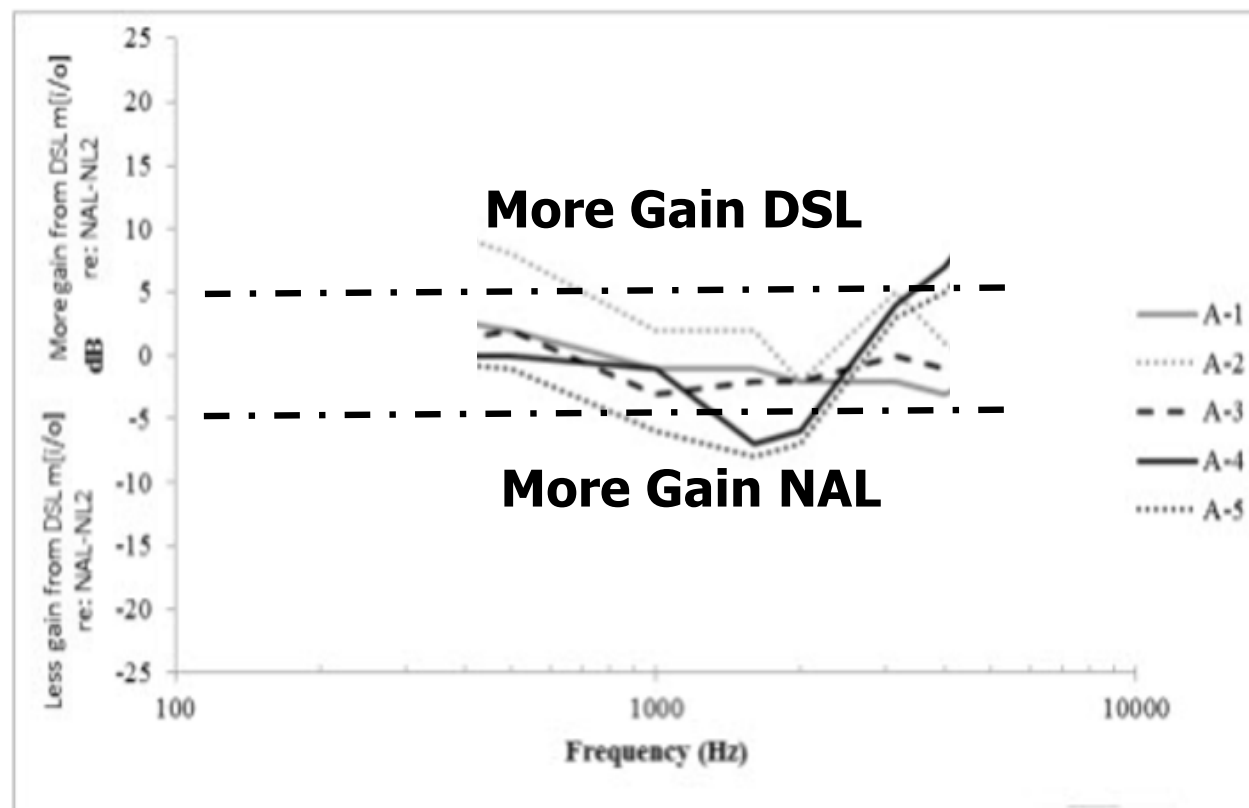
Start with a validated fitting approach

- Good audibility
- Optimized speech understanding
- Good sound quality
- Appropriate loudness
- Acceptable to patient

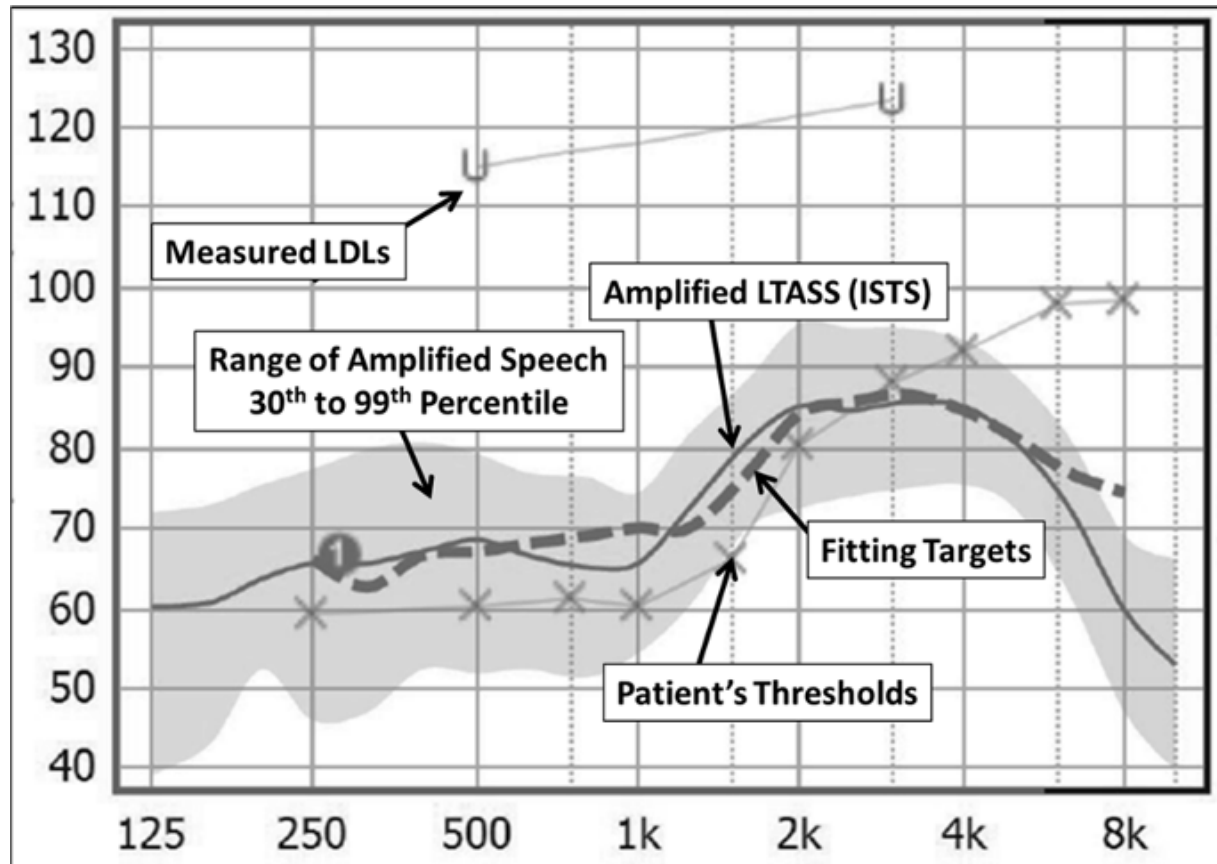


NAL-NL2 & DSLv5.0

NAL-NL2 vs. DSLv5.0

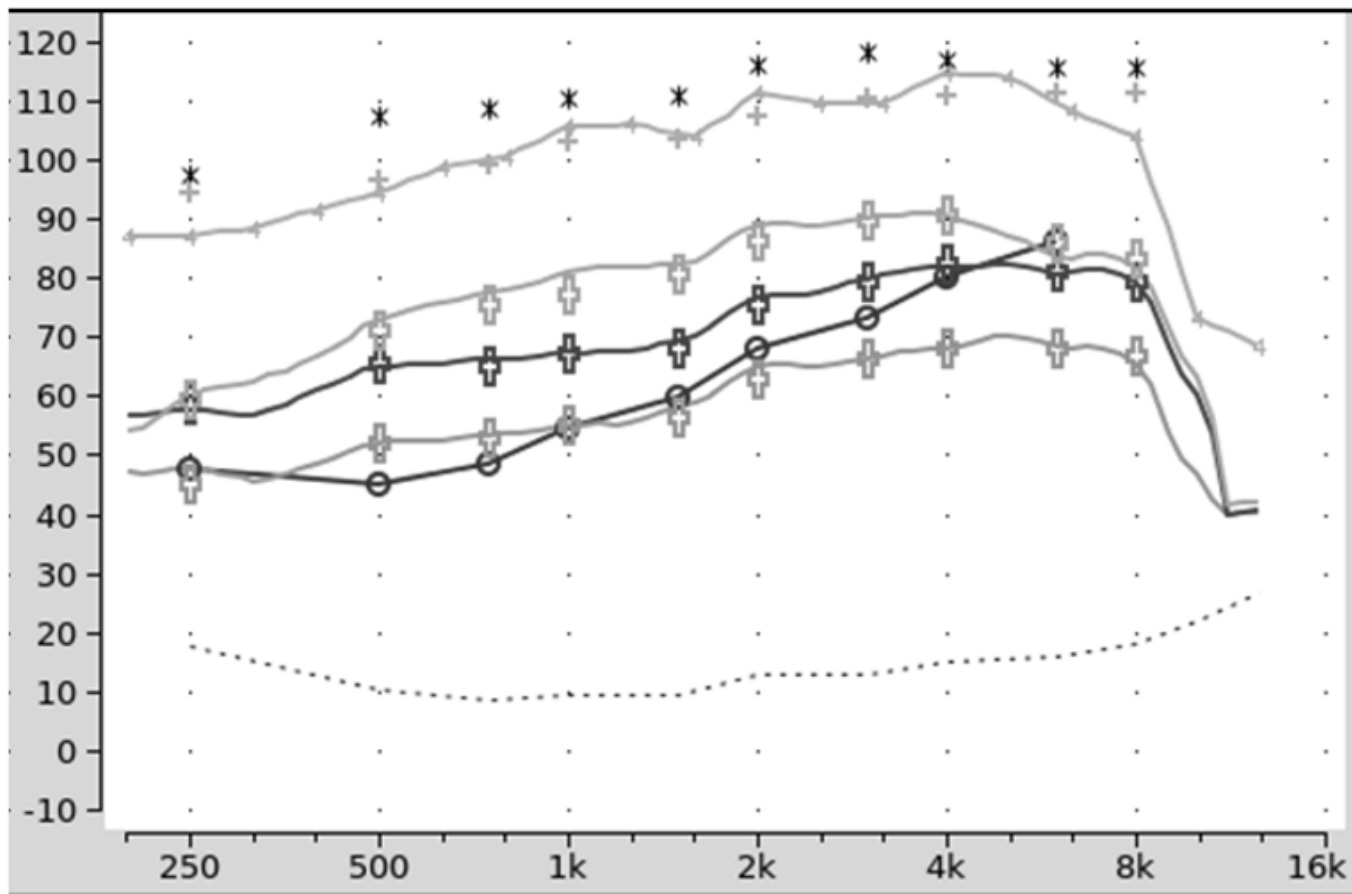


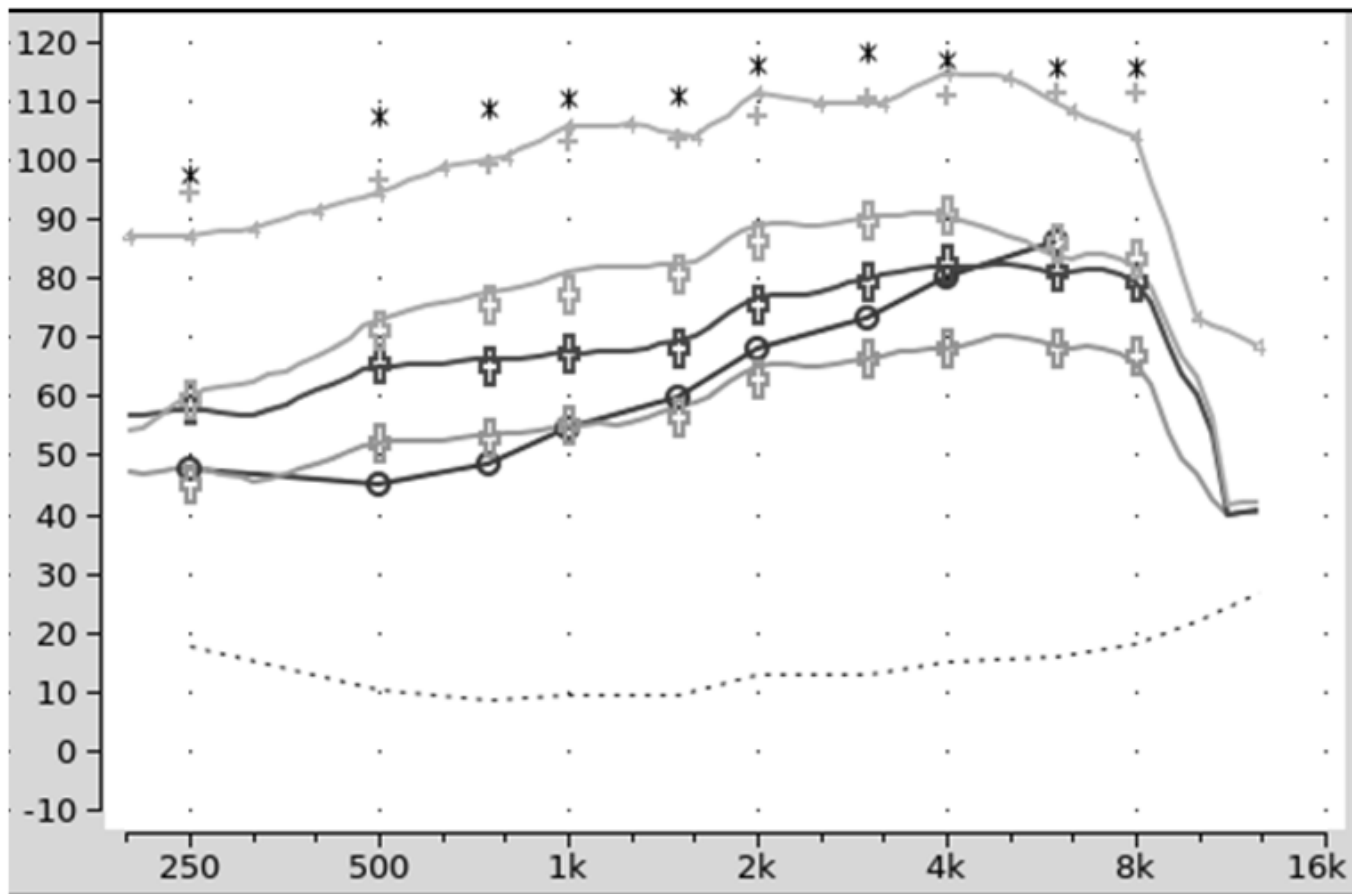
Verification only can be accomplished using probe-microphone measures



Sample Protocol . . .

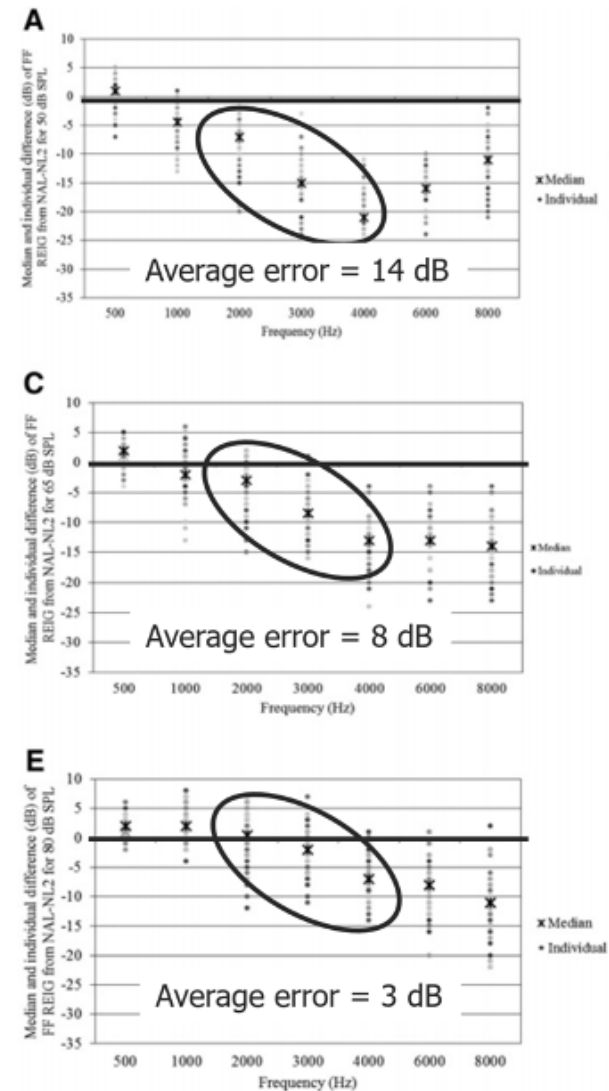
- Pre-program the hearing aids to the manufacturer's NAL-NL2 fitting. Note in the probe-mic software if this is an experienced or new user, a unilateral or bilateral fitting.
- Position the patient appropriately, with probe-microphones inserted—simultaneous bilateral testing is possible if desired.
- Select the appropriate calibrated speech signal input. The most commonly used, available on all probe-mic equipment, is the international speech test signal (ISTS). “Live speech mapping” is not an acceptable input for verification. It can be used for marketing and counseling after the hearing aids have been fitted appropriately.
- Conduct verification for the the inputs of 55, 65 and 75 dB SPL. Continue programming until the output is at least within 5 dB at each frequency and has a general contour consistent with the targets. Some probe-mic systems automatically will calculate rms error for the target fit.
- The order of testing that is the most efficient is first 55 dB SPL, then 75 dB SPL, and conclude with the 65 dB SPL input signal, which should already be very close to target, if the outputs for the 55 and 75 dB SPL inputs are okay.



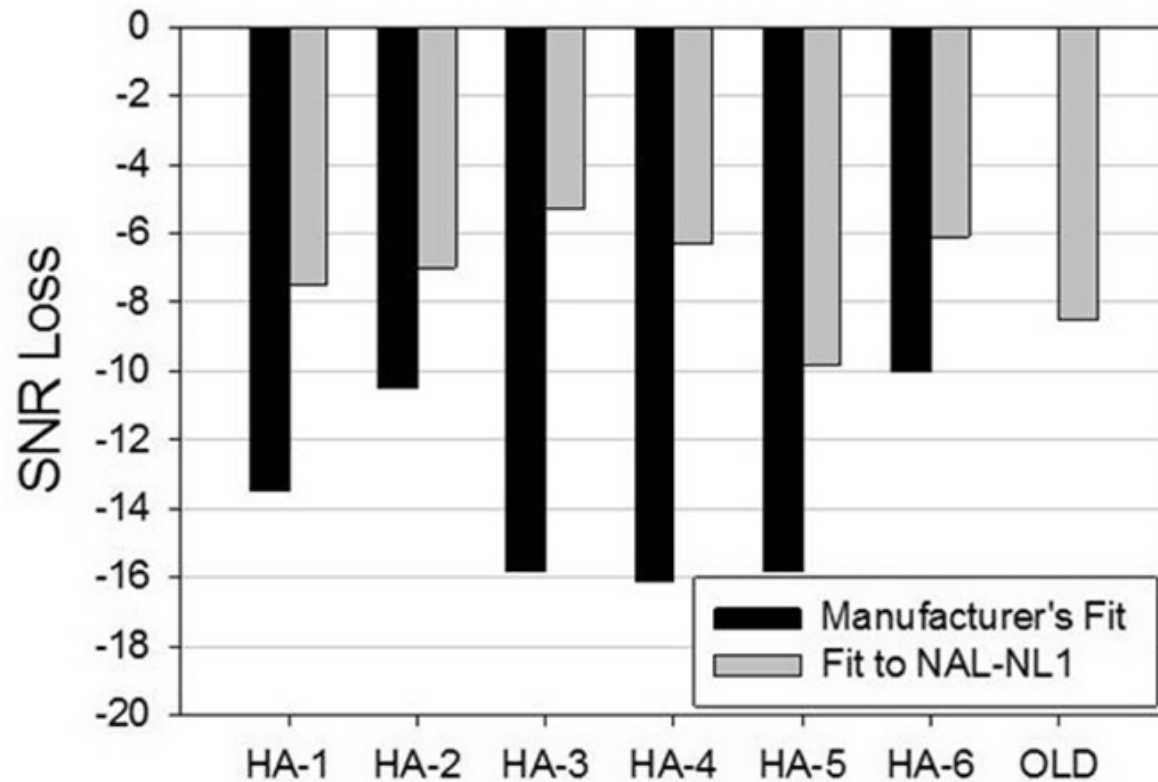


And what if . . . What if an HCP uses a manufacturer's proprietary fitting?

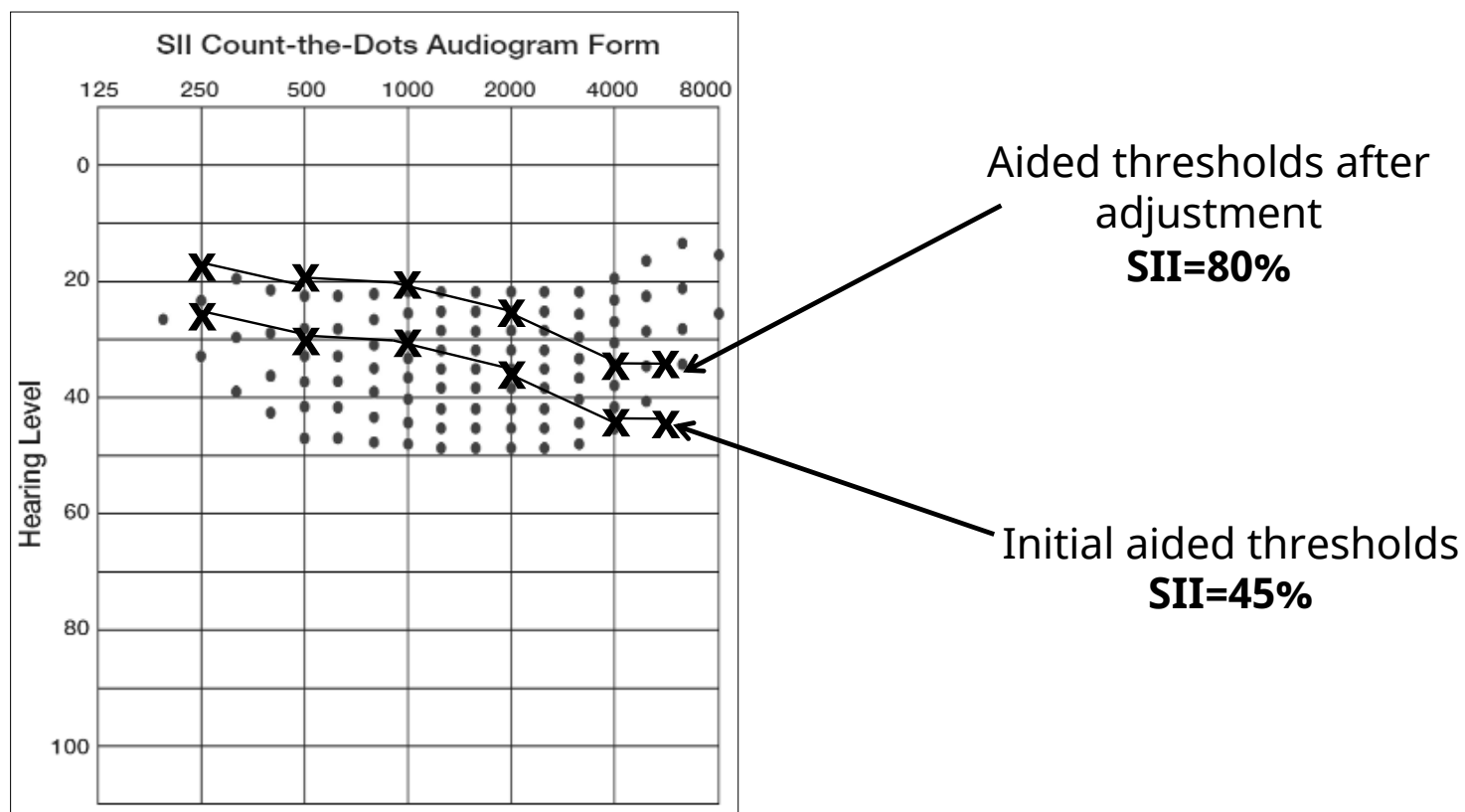
From Valente et al (2018) showing the degree that a proprietary fitting falls below the NAL target for soft inputs (Top Chart), average inputs (Middle Chart) and loud inputs (Bottom Chart).



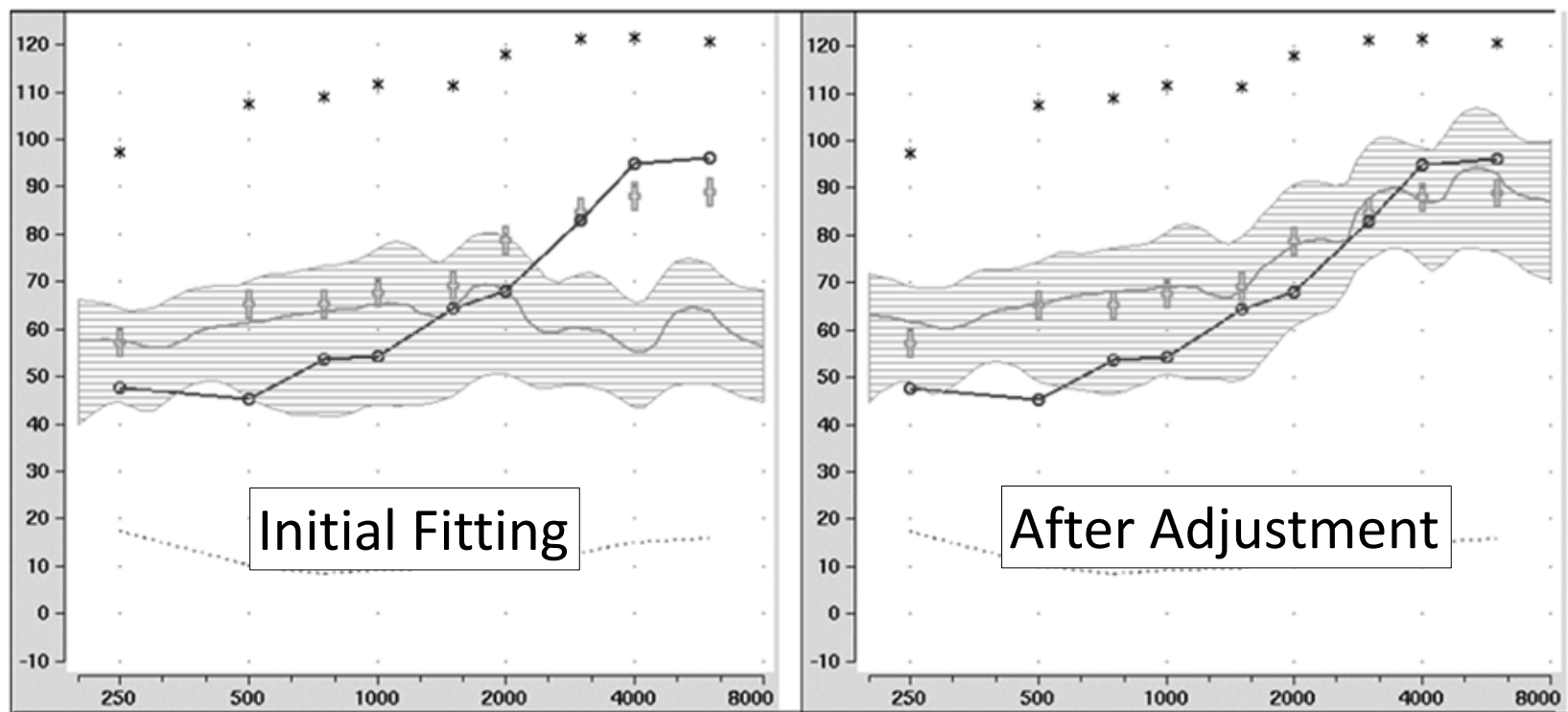
And how does the “lack of audibility” for proprietary fittings impact speech understanding in background noise?



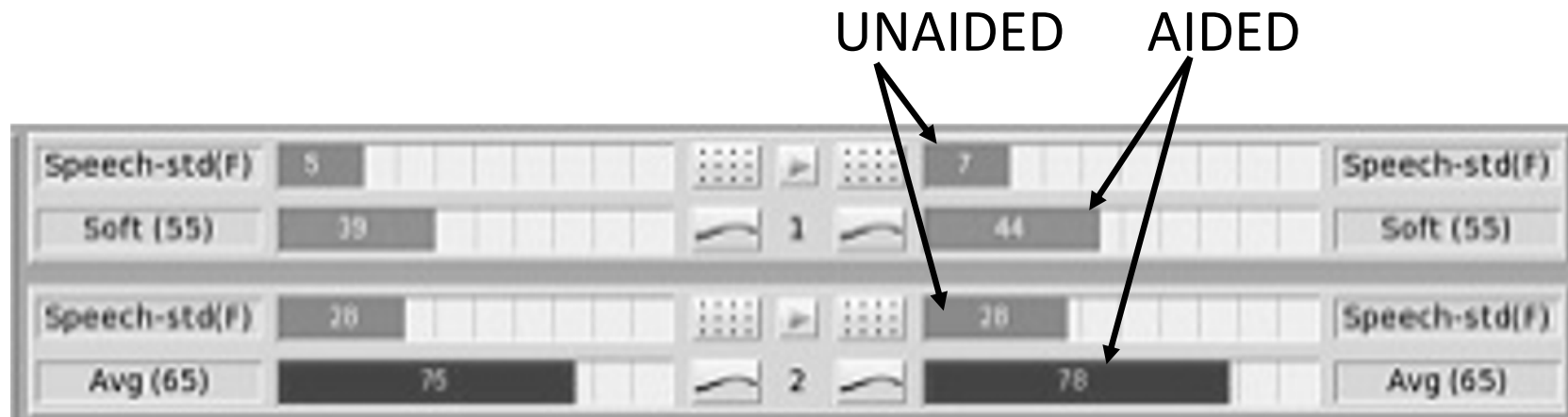
Audibility also must be verified . . .



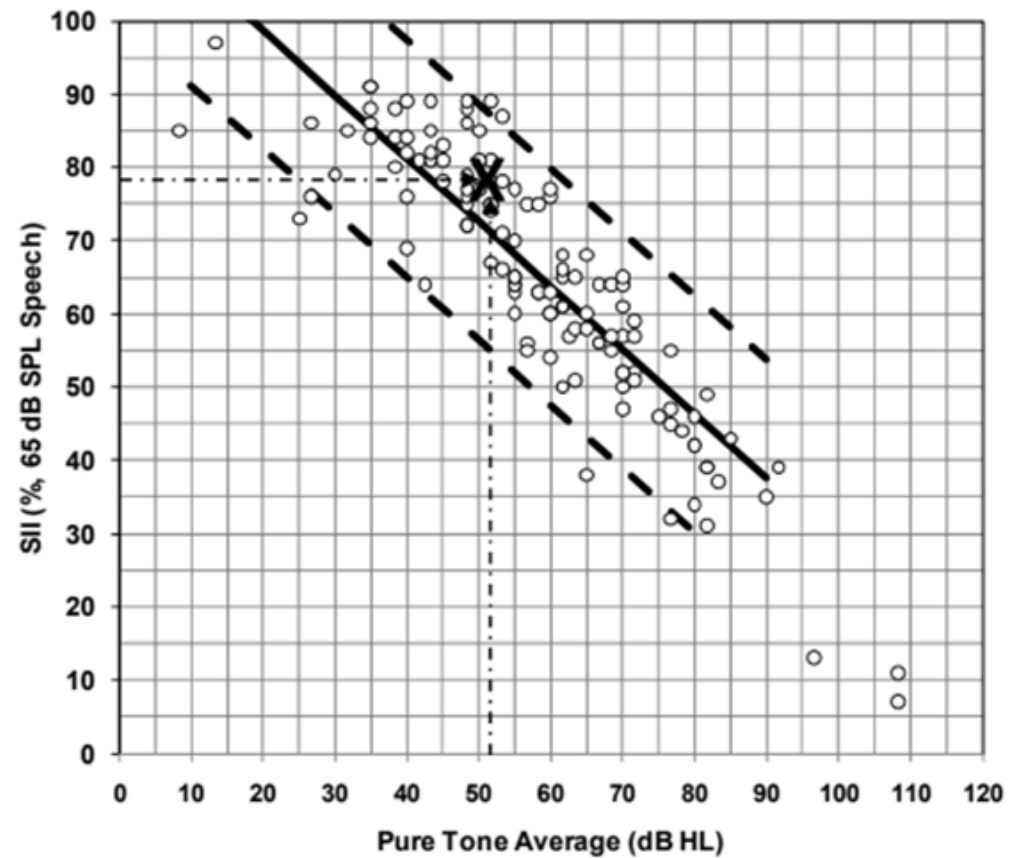
Optimizing Audibility



Most probe-mic equipment will calculate the SII



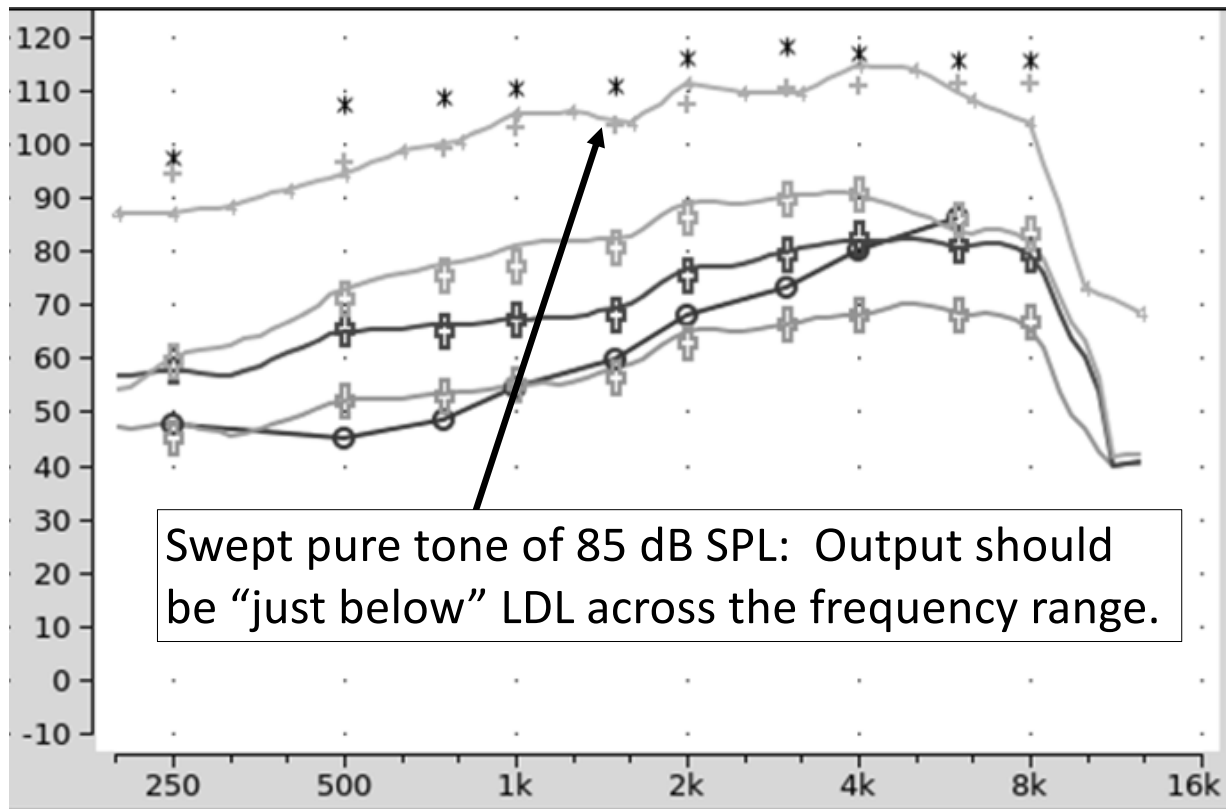
Guidelines for audibility *for pediatric patients* are available from the DSL folks in their PedAmp publication



Reasons why more audibility is not always better, especially in the high frequencies:

- It may lead to acoustic feedback, prompting the patient to turn down gain for all frequencies.
- It may lead to too much loudness, prompting the patient to turn down gain for all frequencies.
- It may cause unacceptable sound quality.
- If cochlear dead regions are present, it may lead to unacceptable distortions—speech recognition may become worse rather than better.

Verification of MPO is also part of the fitting process



Swept pure tone of 85 dB SPL: Output should be “just below” LDL across the frequency range.



RESEARCH QUICK TAKES

3.6: The Hearing Aid Fitting Process— Getting it right: Validation of the fitting

Brian Taylor & Gus Mueller

Verification vs. Validation

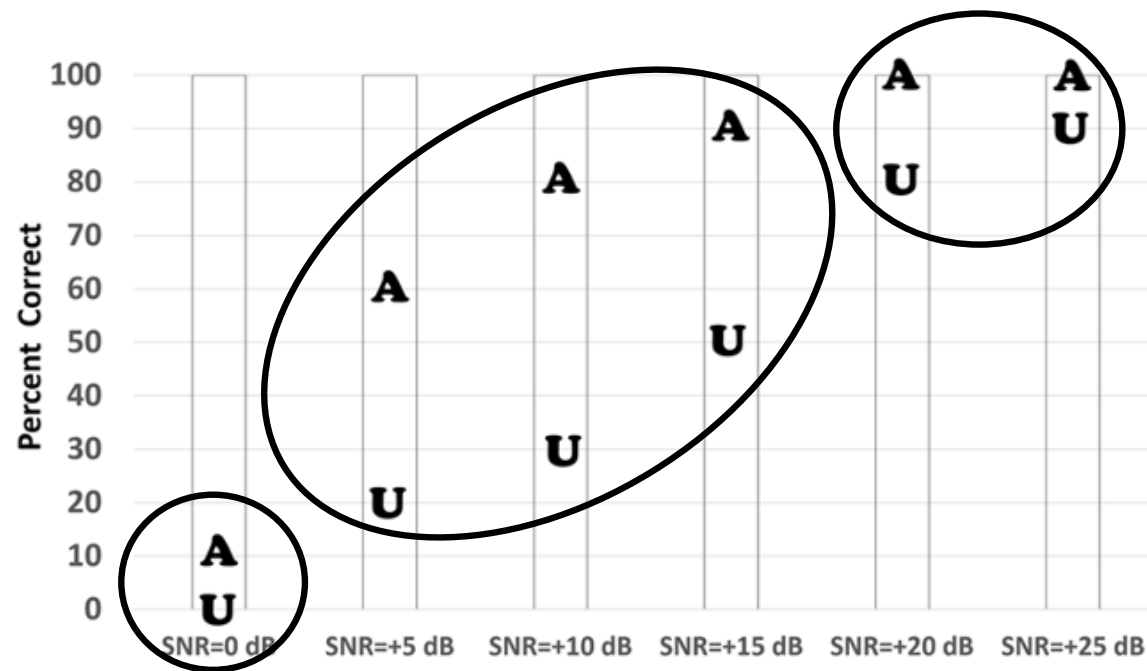


About the QuickSIN:

- Recorded with 6 different S/N ratios
- Six sentences/list; only one sentence at each level (yes it is quick!).
- Female talker with four competing talkers (yes there is informational masking)
- Very easy to administer (use two lists)
- Fairly easy to score

Recommended test protocol:

- Construct a score chart (we'll show you shortly). Results (percent correct) can be annotated by using a "U" for unaided and an "A" for aided.
- Usually testing conducted in the soundfield in the audiometric test booth, but could be conducted in a quiet clinic office (with careful SPL measurements of the QuickSIN signal).
- First, conduct the testing with the patient unaided. Present two lists of the QuickSIN at 50-55 dB SPL, which would be 35-40 dB HL for most audiometers.
- For each SNR-level, calculate the percent correct for these 10 key words for the 2 sentences. Record these for each SNR on the chart.
- Repeat the procedure with the patient aided bilaterally. Record these scores on the chart.
- Review the results with the patient, using real-world situations to describe performance for each SNR tested.



Behavioral validation of loudness:

Loudness Anchors

- #7: Uncomfortably Loud
- #6: Loud, But Okay
- #5: Comfortable, But Slightly Loud
- #4: Comfortable
- #3: Comfortable, But Slightly Soft
- #2: Soft
- #1: Very Soft

Loudness validation: Can be conducted with probe-mic equipment, in test booth, or in quiet office:

- The patient is aided bilaterally, with the hearing aids programmed appropriately to validated targets.
- Provide the patient with the loudness anchors chart. This is the same chart that was used for the unaided LDL measures, so should be familiar to the patient.
- Deliver a 45 dB SPL continuous speech signal (the ISTS works well). An acceptable rating is a #1, #2, or #3.
- Deliver a 65 dB SPL continuous speech signal. An acceptable rating is #3, #4, or #5.
- Deliver an 85 dB SPL continuous speech signal. An acceptable rating is #5 or #6. Patients are sometimes startled by this loud signal, and immediately give a #7 rating. Confirm that it truly is uncomfortable (it usually isn't) and then retest.

Real-world outcome measures:

These outcome measures allow us to assess the impact of the management or treatment scheme on the following important clinical outcomes:

- How did the intervention affect the patient's quality of life?
- Did the management plan meet the needs of the individual?
- Did our intervention improve the patient's hearing abilities of the individual?
- And most importantly, did we meet our intervention goals that were identified in the hearing needs assessment?

And by the way . . . If you don't ask your patients "how they are doing," they will probably find a way to tell the world without your help!

Client Oriented Scale of Improvement (COSI)

Most famous inventory that starts as a “blank sheet”



National Acoustic Laboratories
A division of Australian Hearing

NAL CLIENT ORIENTED SCALE OF IMPROVEMENT

Name : _____ Category. New _____ Degree of Change _____
 Audiologist : _____ Return _____
 Date : 1. Needs Established _____
 2. Outcome Assessed _____

Final Ability (with hearing aid)
 Person can hear
 10% 25% 50% 75% 95%

SPECIFIC NEEDS

Indicate Order of Significance

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

Worse	No Difference	Slightly Better	Better	Much Better	CATEGORY	Hardly Ever	Occasionally	Half the Time	Most of Time	Almost Always

Categories

1. Conversation with 1 or 2 in quiet
2. Conversation with 1 or 2 in noise
3. Conversation with group in quiet
4. Conversation with group in noise
5. Television/Radio @ normal volume
6. Familiar speaker on phone
7. Unfamiliar speaker on phone
8. Hearing phone ring from another room
9. Hear front door bell or knock
10. Hear traffic
11. Increased social contact
12. Feel embarrassed or stupid
13. Feeling left out
14. Feeling upset or angry
15. Church or meeting
16. Other

How the COSI works . . .

- The process begins by having the patient identify up to five specific listening situations in which he or she would like to hear better. We suggest having at least three.
- Make each item as specific as possible.
- Encourage patient to nominate situations that occur frequently everyday, not a recent unusual situation that may never occur again.
- After all situations have been identified, review all situations, and have the patient rank order them. Simply place a 1 for most important, 2 for the second most important, and so on in the box to the left of the item.
- After several weeks of hearing aid use, have the patient report the degree of benefit for each listening experience.

NAL
CLIENT ORIENTED SCALE OF IMPROVEMENT

Name : Kirby Mueller Category. New X
 Audiologist : _____ Return _____
 Date : 1. Needs Established _____
 2. Outcome Assessed _____

Degree of Change

Final Ability (with hearing aid)
 Person can hear
 10% 25% 50% 75% 95%

SPECIFIC NEEDS

Indicate Order of Significance

- #5 *Hearing friends while shooting pool in Ryder Bar.*
- #4 *Understanding numbers called during Bingo.*
- #2 *Understanding wife when she is in another room.*
- #3 *Not have to turn the TV up so loud.*
- #1 *Understanding soft voices of grandchildren when they visit.*

Worse	No Difference	Slightly Better	Better	Much Better	CATEGORY	Hardly Ever	Occasionally	Half the Time	Most of Time	Almost Always
		X						X		
				X						X
		X					X			
				X						X
				X					X	

Abbreviated Profile of Hearing Aid Benefit (APHAB)

The APHAB is composed of 24 items that are scored in four subscales (six questions each). The four subscales are:

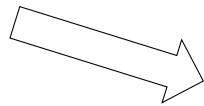
- Ease of Communication (EC): The strain of communicating under relatively favorable conditions.
- Reverberation (RV): Communication in reverberant rooms such as classrooms.
- Background Noise (BN): Communication in settings with high background noise levels.
- Aversiveness (AV): The unpleasantness of environmental sounds.

Hearing Aid Research Lab (HARL)

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Applications

Outcome Applications



APHAB



SADL



ECHO



IOI-HA



DOSO



WICIT

Hearing Aid Fitting Applications



RSIN



SIR



CST



VIOLA

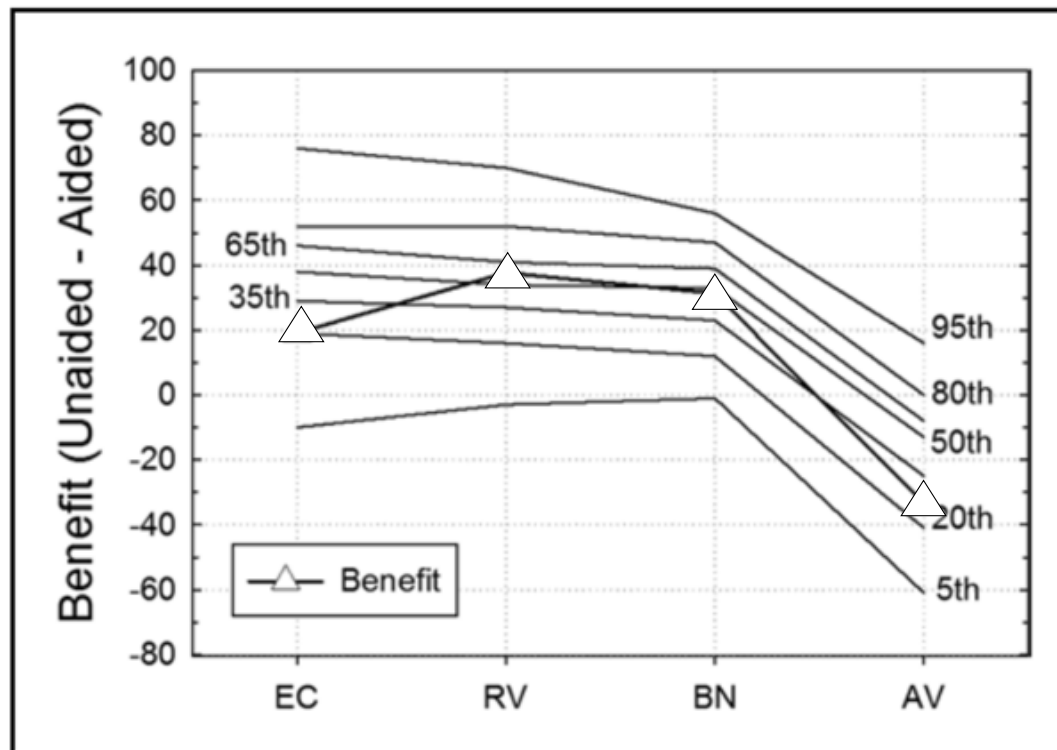


Contour

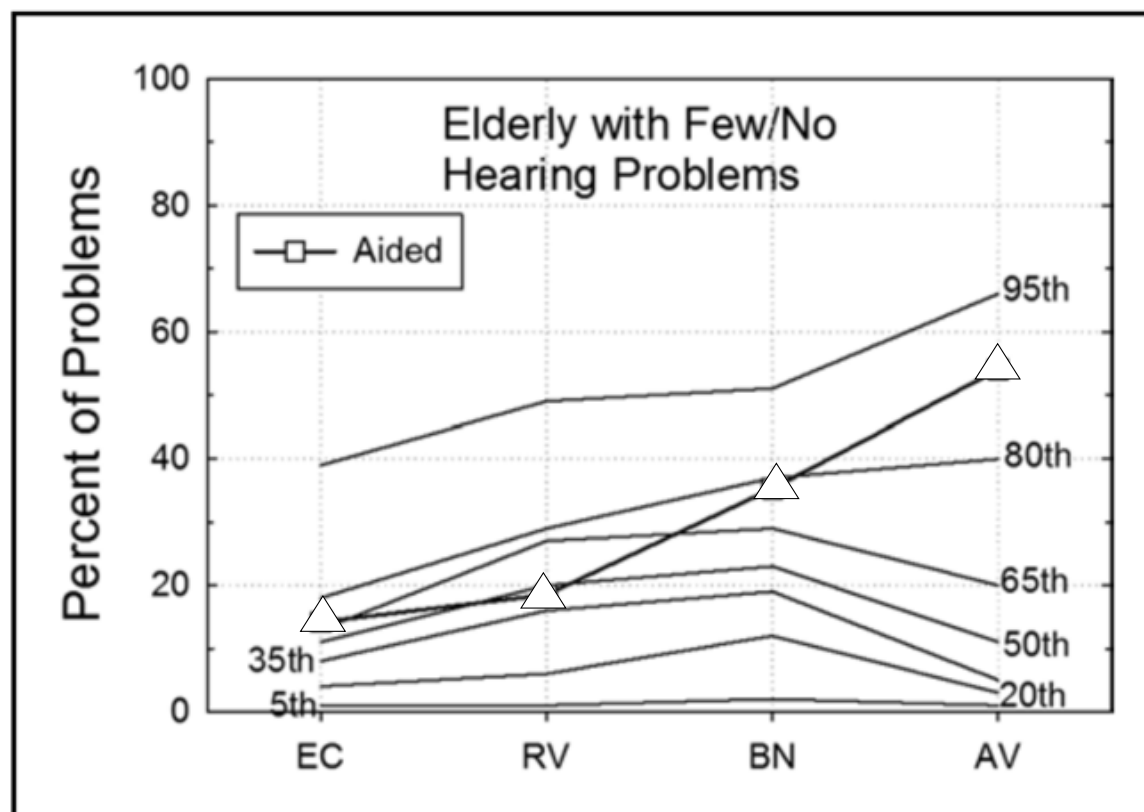


AFAAF

Using APHAB norms for patient counseling



Using APHAB norms for patient counseling



International Outcome Inventory for Hearing Aids (IOI-HA)

Hearing Aid Research Lab (HARL)

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Applications

Outcome Applications



APHAB



SADL



ECHO



IOI-HA



DOSO



WICIT

Hearing Aid Fitting Applications



RSIN



SIR



CST



VIOLA



Contour



AFAAF

signia | Audiology

<https://harlmemphis.org/applications/>

About the IOI-HA

- Easy to administer and score (paper and pencil)
- Available in 20+ languages
- Only 7 questions—but covers 7 different domains:
 - Benefit from hearing aids
 - Daily use
 - Satisfaction with amplification
 - Impact of using hearing aids on significant others
 - Residual activity limitation
 - Residual participation restriction
 - Impact on quality of life

Translations Available:

Arabic
 • Chinese (Simplified)
 • Chinese (Traditional)
 • Danish
 • Dutch
 • English
 • Finnish
 • French
 • German
 • Greek
 • Hebrew
 • Hungarian
 • Italian
 • Japanese
 • Korean

• Malay
 • North Dakota
 • Norwegian
 • Polish
 • Portuguese (Brazil)
 • Portuguese (Portugal)
 • Russian
 • Serbian
 • Sinhalese
 • Slovak
 • Slovenian
 • Spanish
 • Swedish
 • Turkish
 • Welsh

signia | Audiology

INTERNATIONAL OUTCOME INVENTORY – HEARING AIDS (IOI-HA)

1. Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?

none	less than 1 hours a day	1 to 4 hours a day	4 to 8 hours a day	more than 8 hours a day
☐	☐	☐	☐	☐

2. Think about the situation where you most wanted to hear better, before you got your present hearing aid(s). Over the past two weeks, how much has the hearing aid helped in that situation?

helped not at all	helped slightly	helped moderately	helped quite a lot	helped very much
☐	☐	☐	☐	☐

3. Think again about the situation where you most wanted to hear better. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?

very much difficulty	quite a lot of difficulty	moderate difficulty	slight difficulty	no difficulty
☐	☐	☐	☐	☐

4. Considering everything, do you think your present hearing aid(s) is worth the trouble?

not at all worth it	slightly worth it	moderately worth it	quite a lot worth it	very much worth it
☐	☐	☐	☐	☐

5. Over the past two weeks, with your present hearing aid(s), how much have your hearing difficulties affected the things you can do?

affected very much	affected quite a lot	affected moderately	affected slightly	affected not at all
☐	☐	☐	☐	☐

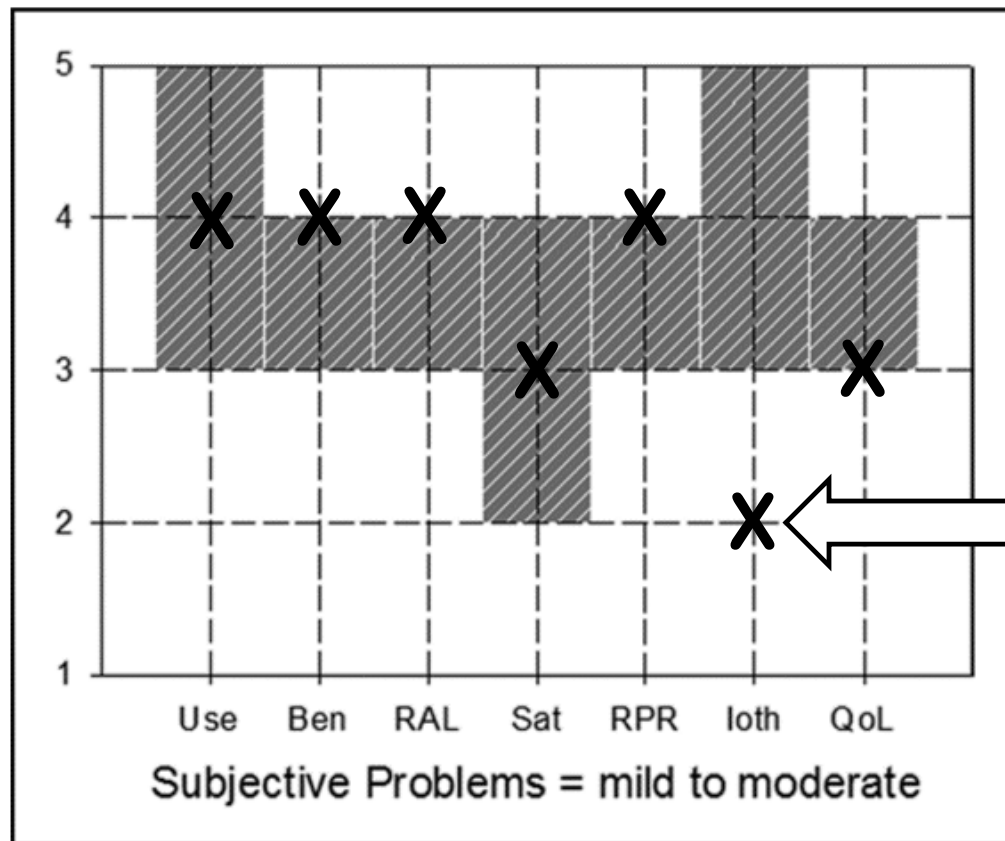
6. Over the past two weeks, with your present hearing aid(s), how much do you think other people were bothered by your hearing difficulties?

bothered very much	bothered quite a lot	bothered moderately	bothered slightly	bothered not at all
☐	☐	☐	☐	☐

7. Considering everything, how much has your present hearing aid(s) changed your enjoyment of life?

worse	no change	slightly better	quite a lot better	very much better
☐	☐	☐	☐	☐

IOI-HA Norms: Sample Patient



Q: Over the past two weeks, with your present hearing aids, how much do you think other people were bothered by your hearing loss?

A: "2" Rating—"Bothered quite a lot"



And a final helpful tip
from Brian and Gus . . .

Research has shown that asking a
patient if they are satisfied
improves their satisfaction by 7%!