HOW TO GET THE MOST FROM ANY HEARING AID

Ron Leavitt, Au. D.; Colette Welch, BS; David Viers, MS RCD; Nikki Clark



OUTLINE:

1.About Us 2.About You 3. Measurement Considerations 4. Hearing Aid Considerations **5. Your Checklist** 6.Q/A

1. ABOUT US

Website: www.betterhearingus.com

Better Hearing US

Technology and Expertise for Today's Listening Demands

1025 NW 9th Street, Suite A, Corvallis OR 97330 Call: 541-754-1377 or Email: <u>chscenter@qwestoffice.net</u>

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1. ABOUT US AWARDS:



ROBERT W. YOUNG STUDENT RESEARCH AWARD 2012



BEST OF HEARING AID RESEARCH 2012 AM. ACAD AUDIOLOGY



The importance of audibility in successful amplification of hearing loss December 2012

Leavitt, RJ & Flexer, C



GOVERNOR'S AWARD FOR OUTSTANDING SERVICE TO PEOPLE WHO ARE H/H AND DEAF





PUBLICATIONS:



Cost-effective Pricing for Hearing Aids and Related Audiological Services

Ron J. Leavitt, AuD; Colette B. Vossler, BS; and Liza R. Knowles, MS, CRC November 2011







1. ABOUT US

PUBLICATIONS:



MAINTAINING FUNCTIONALITY OF ANALOG ASSISTIVE LISTENING DEVICES IN THE DIGITAL AGE

Leavitt, RJ; Clark, AN and Vossler-Welch, CB November 2012









PUBLICATIONS:



The Importance of Audibility in Successful Amplification of Hearing Loss December 2012 Leavitt, RJ and Flexer, C





1. ABOUT US

PUBLICATIONS:



Invisible In-the-Canal (IIC) Hearing Aids and Deep-canal Hearing Aid Fittings: Medical and Audiological Concerns

Leavitt, RJ, Welch, CB & Thompson, CR May/June 2013









PRESENTATIONS 2011-2013:

2. ABOUT YOU How many here have normal hearing?





How many have cochlear implants?



How many have hearing aids?



How many have severe to profound hearing losses?

Do you know the percent of speech cues you hearing with and without your hearing aid or cochlear implant?

	Enter an HL threshold in EACH box below. Leave no blanks.									
Frequency (Hz)	250	500	1000	2000	3000	4000	6000	8000		
Enter HL Threshold >>	20	30	80	75	80	65	70	70		
SPL of speech @ 1m >	65	dB	SII >	0.193	Predicted best CST score			21%		

2. ABOUT YOU Have you used loops systems 10 times or more in the last 12 months?



Do you wear your hearing aids most waking hours (except when sleeping or in water)?



Do you wear your cochlear implants most waking hours (except when sleeping or in water)?



2. ABOUT YOU Did you definitely have your hearing aids fine tuned with a real-ear measurement system?



How many of you are not sure if you had your hearing aid fine tuned with a realear measurement system?



Cochlear implant users, do you know your aided (implanted) pure tone threshold levels?



1 1

Hearing aid users, have you taken a speech understanding test in the presence of background noise?



Cochlear implant users, have you taken a speech understanding test in the presence of background noise?



Hearing aid users, are you satisfied or very satisfied with the performance of your hearing aids?

Development of the Device-Oriented Subjective Outcome (DOSO) Scale											
Robyn M. Cox, Genevieve C. Alexander & Jingjing Xu Hearing Aid Research Laboratory, University of Memphis, Memphis, TN Presented at the American Auditory Society Convention, Scottsdale, AZ, March 2009											
	A	NOT AT AII									
This questionnaire measures how well your hearing aids	в	3 A little									
work. Please read each question and circle one letter to	C Somewhat										
show the answer that is closest to your opinion.	D	Medium									
The guide shown on the right describes the meaning of	Е	Considerably									
each letter.	F	Greatly									
How good are the hearing aids at	G	Tremendously									
1 Making loud speech clear? A	в	С	D	Е	F	G					
2 <u>NOT</u> whistling during use? A	в	С	D	Е	F	G					
3 Providing a pleasing sound quality? A	в	С	D	Е	F	G					

Cochlear implant users, are you satisfied or very satisfied with the performance of your cochlear implant?



2. ABOUT YOU Hearing aid users, do you have a wireless capable hearing aid for telephone use?



Hearing aid users, do you use a wireless capable hearing aid for noisy restaurants and in the car?







Hearing aid users, do you wear a receiver in the canal type hearing aid?



LOUDSPEAKER IS HERE

Hearing aid users, do you wear a conventional behind the ear hearing aid?



LOUDSPEAKER IS HERE

3. MEASUREMENT CONSIDERATIONS



When errors are made during the initial evaluation, no hearing aid will work well.

3. MEASUREMENT CONSIDERATIONS



What measurements are we talking about ?

A. Medical Considerations B. Unaided vs Aided Speech Audibility C. Best speech understanding Measures **D. Speech Understanding in Noise** Measures E. Real-ear Measures F. Hearing Aid Benefit Measures **G. Uncomfortable Listening Measures** H. Related Problem Measures

A. Medical: Outer Ear: No hearing aid works well with your ears plugged.





BUT I JUST SAW MY DOCTOR....





3. MEASUREMENT CONSIDERATIONS

Video otoscopy is the gold standard for diagnosing and treating problems of the outer ear













IMPEDANCE IS THE GOLD STANDARD Middle Ear





Do <u>NOT</u> get a hearing aid until middle ear problems are addressed
IMPEDANCE IS THE GOLD STANDARD



Do <u>NOT</u> get a hearing aid until middle ear problems are addressed

IMPEDANCE IS THE GOLD STANDARD

Middle Ear





Do <u>NOT</u> get a hearing aid until middle ear problems are addressed

B. Unaided Speech Audibility Measures



David Viers

Colette Vossler-Welch

Your unaided speech audibility score helps predict the number of speech sounds you hear with any hearing aid.

C. Best Speech Understanding in quiet with single syllable words.

01. Laud 02. Boat 03. Pool 04. Nag 05. Limb 06. Shout 07. Sub 08. Vine 09. Dime 10. Goose 11. Whip 12. Tough 13. Puff	 Keen Death Sell Sell Take Fall Raise Raise Third Gap Fat Met Jar Door 	26. Mill 27. Hush 28. Shack 29. Read 30. Rot 31. Hate 32. Live 33. Book 34. Voice 35. Gaze 36. Pad 37. Thought 38. Bought	39. Turn 40. Chair 41. Lore 42. Bite 43. Haze 44. Match 45. Learn 46. Shawl 47. Deep 48. Gin 49. Goal 50. Far
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The higher the score the better your chances of understanding speech through any hearing aid

D. Speech understanding in noise



You need a measure of how well you will understand speech in background noise.

	AzBio Sentence Test List 1		
	MSTB CD – Track 01 (Left Channel = Speech, Right Channel = Nois	e)	
entence	Text	Poss	Score
1	I could hear another conversation through the cordless phone.	9	
2	She relied on him for transportation.	6	
3	He was an ordinary person who did extraordinary things.	9	
4	How long has this been going on?	7	
5	His class was on Saturday.	5	
6	She was entitled to a bit of luxury occasionally.	9	
7	The vacation was cancelled on account of weather.	8	
8	The salon is not open on Mondays.		
9	She had a way to justify any of her wrongdoing.		
10	I feel sorry for my brother.		
11	On numerous occasions they left early.		
12	In private she let her hair down.		
13	A mother always has something better to do.		
14	You should be used to taking money from ladies.		
15	Who would lie about cancer for attention?		
16	Hang the air freshener from your rearview mirror.		
17	You can use your computer to make greeting cards.		
18	I guess you know what you're doing.		
19	You must live in a gingerbread house!		
20	The cat was born with six toes.	7	
	Warda Carrad		
	Words Correct Words Possible		151
	Words Possible		1.51
	Percent Correc	t	

Page 1

E. Aided real-ear measures



This is the best way to see how your hearing aid is performing.

E. Real-ear measures: (Unaided vs Aided Speech Audibility)



This measure quickly shows how many speech sounds you will hear with your hearing aid.

Remember hearing speech does not guarantee speech understanding but it's a good first step.



3. MEASUREMENT CONSIDERATIONS F. USER SURVEY: WE LIKE THE APHAB

Please circle the answer that comes 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 percent Of the time, circle "C". If you have not experienced the situation as described, Try to think of a similar situation that you have been in and respond to that situation. If you have no idea, leave the 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 my hearing aid With my hearing aid ABCDEFG ABCDEFG The sound of a fire engine siren close by is so loud that I need to cover my ears. ABCDEFG ABCDEFG 2. When a speaker is addressing a small group, and everyone is listening quietly. I have to strain to understand. ABCDEFG ABCDEFG 3. It's hard for me to understand what is being said at lectures or church services ABCDEFG ABCDEFG 4. When I am at the dinner table with several people and am trying to have a conversation with one person, understanding speech is difficult. ABCDEFG ABCDEFG 5. When I am in a theater watching a movie or play and the people around me are whispering and rustling paper wrappers. I can still make out the dialogue. 6. When I'm in a quiet conversation with my doctor in an ABCDEFG ABCDEFG examination room, it is hard to follow the conversation. ABCDEFG ABCDEFG 7. When I am listening to the news on the car radio and family members are talking I have trouble hearing. 8. The sounds of running water, such as a toilet or shower, are ABCDEFG ABCDEFG uncomfortably loud.

This shows your awareness of your problem.

The APHAB gives a quick estimate of your unaided and aided hearing problems



G. Direct measures of Uncomfortable Listening Levels are essential because you can't wear a hearing aid that is too loud.



Bentler, R. & Cooley, L. (2001). An examination of several characteristics that affect the prediction of OSPL90. Ear & Hearing, 22, 3-20.

Mueller, Bentler, & Wu (2008) discovered a 20 dB variation between different manufacturers best guess for loud sounds using the same exact audiogram.

Mueller, H.G., Bentler, R.A., & Wu, Y. (2008). Prescribing maximum hearing aid output: Differences among manufacturers found. *The Hearing Journal, 61*(3), 30-36.

3. WHY DO I CARE ABOUT UCL?

G. Uncomfortable listening levels



If you are using your volume control a lot something is wrong somewhere.

H. Brainstem problems may dramatically effect your speech understanding in noise.

Humes* LE,; Dubno JR, Gordon-Salant S, Lister JJ, Cacace JT, Cruickshanks KJ, Gates GA, Wilson, **RH and Wingfield A.** (2012). Central **Presbycusis: A Review and Evaluation of the** Evidence. J. Am. Acad. Audiol, 23, (8), 635-666



Impedance may identify a problem.





ABR testing may identify a problem.





The Quick SIN test gives an overview of the entire auditory system including peripheral, central auditory, and cognitive influences.

Humes* LE,; Dubno JR, Gordon-Salant S, Lister JJ, Cacace JT, Cruickshanks KJ, Gates GA, Wilson, RH and Wingfield A. (2012). Central Presbycusis: A Review and Evaluation of the Evidence. J. Am. Acad. Audiol, 23, (8), 635-666

3. MEASUREMENT CONSIDERATIONS H. What if the communication problem is mostly cognitive not hearing loss?

Stroop Mixed	GREEN RED	RED YELLOW		
	RED GREEN	GREEN BLUE		
	BLUE	RED		
	BLUE	YELLOW		
	GREEN	BLACK		

Lin, FR (2012). Hearing loss and healthy aging, presented at annual meeting of the American Geriatrics Society, Seattle, WA

3. TO SUMMARIZE WHY MEASUREMENT IS CRITICAL



A. No hearing aid will help you much when your ear canal is blocked B. You should not get a hearing aid if your middle ear problem can be cured and hearing loss eliminated.



C. If you have a very low aided audibility you will have lots of trouble understanding speech with any hearing aid.



D. If your aided speech audibility is only 3% better than your unaided speech audibility you are not getting the most out of any hearing aid...



Leavitt R., & Flexer, C. (2012). The importance of audibility in successful amplification of hearing loss. The Hearing Review, 19(13), 20-23

D. ...because audibility trumps all other hearing aid features.

TABLE 4 : Average Aided Quick SIN SNR Loss values for five subjects comparing the manufacturer's best fit to the NAL-R aided fitting for sweep frequency pure tones.

Hearing Aid Model							
	HA 1	HA 2	HA 3	SIEMENS Infinity III	HA 5	HA 6	HA 7
Manufacturer's Ave. Aided Quick SIN SNR Loss for Five Subjects	13.3 dB	10.5 dB	15.7 dB		16.1 dB	15.7 dB	10.9 dB
NAL-R Ave. Aided Quick SIN SNR Loss for Five Subjects	7.5 dB	7.16 dB	5.5 dB	8.3 dB	6.5 dB	9.83 dB	6.16 dB
Average Aided SNR Loss improvement between manufacturer best fit and NAL-R fitting achieved with sweep frequency pure tones	5.8 dB	3.34 dB	10.2 dB		9.6 dB	5.87 dB	4.74 dB

Leavitt R., & Flexer, C. (2012). The importance of audibility in successful amplification of hearing loss. The Hearing Review, 19(13), 20-23

E. If your hearing aid exceeds your measured uncomfortable listening levels you won't wear it or you'll wear out your volume control.



Bentler, R. & Cooley, L. (2001). Effect of spectral shaping on loudness discomfort. Journal of the American Academy of Audiology, 12(9), 462-470.



A. Feedback control B. Maximum aided speech audibility **C.** Proof of benefit **D. Enhanced SNR** E. Protection from loud sounds F. Listening strategy training/practice G.Full-time use

A.Feedback Control..... They are <u>not</u> all created equal.



4. HEARING AID CONSIDERATIONS Why do I care about feedback control?



Because a hearing aid that is whistling all the time cannot provide maximum aided speech audibility.

AND maximum aided speech audibility is essential for speech understanding.

Prove It.....



Performance for the aided QuickSIN presented soundfield at 57 dB SPL. Bars indicate "SNR-Loss": The average SNR *disadvantage* compared to individuals with normal hearing



Manufacturer's Fit Fitted To NAL-NL1

You just saw how aided speech sound audibility creates better speech understanding in noise....

So we must look at ways to get maximum aided speech audibility (maximum amplification without feedback).

B. Maximum Aided Speech Audibility



So choose the most powerful styles..

4. HEARING AID CONSIDERATIONS Whatever style, make sure to get maximum insertion depth when hearing loss is severe.



Why get maximum insertion depth when hearing loss is severe?


Choose the right earmold for maximum volume



SKELETON EARMOLD IS THE WINNER



Figure 2 Maximum usable REIG permitted by the standard (open circle), shell (closed circle), canal (inverted open triangle), and skeleton (closed inverted triangle) earmolds (no vent). The magnitudes of the standard deviation (σ_{n-1}) for each earmoid at 250, 500, 1000, 2000, and 4000 Hz are shown at the bottom of the figure.



STANDARD FULL-SHELL EARMOLD IS THE LOSER

Bigger is not better

Kuk, FK (1994). Maximum Usable Real-Ear Insertion Gain with Ten Earmold Designs. J. Amer. Acad. Audiol., 5: 44-51

4. HEARING AID CONSIDERATIONS Avoid vents if possible

Even small vents reduce maximum volume. Do not use a vent if you need max volume.



Kuk, FK (1994). Maximum Usable Real-Ear Insertion Gain with Ten Earmold Designs. J. Amer. Acad. Audiol., 5: 44-51



SKELETON EARMOLD IS THE WINNER



STANDARD FULL-SHELL EARMOLD IS THE LOSER

4. HEARING AID CONSIDERATIONS Move the loudspeaker closer to the ear drum



C. Proof of Benefit

Both Nikki and David benefit from hearing aids even though their scores are very different





C. Proof of benefit: Aided vs. Unaided



C. Proof of benefit

Y AND I NOISE **QUICK SPE** AIDED AUI **MPLE** ATISFI

DEGREE OF HEARING AID SATISFACTION

D. ENHANCED SIGNAL TO NOISE RATIO

All these systems decrease the distance between you and the person talking.



4. HEARING AID CONSIDERATIONSD. ENHANCED SIGNAL TO NOISE RATIO

That makes the speech you want to hear louder and the noise quieter



D. ENHANCED SIGNAL TO NOISE RATIO

Improving the speech-to-noise ratio is always warranted, regardless of the underlying cause of the hearing problem.



We like discrete assistive listening devices



Like these....







E. PROTECTION FROM LOUD SOUNDS



Bentler, R. & Cooley, L. (2001). An examination of several characteristics that affect the prediction of OSPL90. Ear & Hearing, 22, 3-20.

level for subjects with hearing loss (total 607 ears).

F. Listening strategy training/practice

DAVID AND KAREN'S PRESENTATION



G. Full-time hearing aid use:



"I can't remember if I'm wearing my hearing aid or my bluetooth headset..."

5. YOUR CHECKLIST

A. Real-ear measures of speech audibility **B.** Feedback controlled C. Word understanding in quiet and noise **D.** Realistic expectations E. Self-report of hearing aid benefit F. Listening strategies employed G. Use of assistive listening devices H. Full-time hearing aid use



F. If you have brainstem, brain or cognitive problems your hearing aid alone cannot fix that.

Stroop Mixed	GREEN	RED
	RED	YELLOW
	RED	GREEN
	GREEN	BLUE
	BLUE	RED
	BLUE	YELLOW
	GREEN	BLACK

Lin, FR (2012). Hearing loss and healthy aging, presented at annual meeting of the American Geriatrics Society, Seattle, WA?