HOW TO GET THE MOST FROM ANY HEARING AID

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

Website: www.betterhearingus.com
1. ABOUT US

AWARDS:

ROBERT W. YOUNG
STUDENT RESEARCH
AWARD 2012

WESTERN U.S.
GOVERNOR’S AWARD FOR
OUTSTANDING SERVICE TO PEOPLE
WHO ARE H/H AND DEAF

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
1. ABOUT US

**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
1. ABOUT US

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
1. ABOUT US

PRESENTATIONS 2011-2013:
2. ABOUT YOU

How many here have normal hearing?
2. ABOUT YOU

How many have cochlear implants?
2. ABOUT YOU

How many have hearing aids?
2. ABOUT YOU

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?

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>6000</th>
<th>8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter HL Threshold &gt;&gt;</td>
<td>20</td>
<td>30</td>
<td>80</td>
<td>75</td>
<td>80</td>
<td>65</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

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?
2. ABOUT YOU

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

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?
2. ABOUT YOU

How many of you are not sure if you had your hearing aid fine tuned with a real-ear measurement system?
Cochlear implant users, do you know your aided (implanted) pure tone threshold levels?
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?
2. ABOUT YOU

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

This questionnaire measures how well your hearing aids work. Please read each question and circle one letter to show the answer that is closest to your opinion.

The guide shown on the right describes the meaning of each letter.

How good are the hearing aids at…

<table>
<thead>
<tr>
<th></th>
<th>Making loud speech clear?</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td></td>
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<table>
<thead>
<tr>
<th></th>
<th>NOT whistling during use?</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
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<tr>
<td>2</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Providing a pleasing sound quality?</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
2. ABOUT YOU

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?
2. ABOUT YOU

Hearing aid users, do you wear a receiver in the canal type hearing aid?
2. ABOUT YOU

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.
Middle Ear: Impedance Is the gold Standard
IMPEDANCE IS THE GOLD STANDARD

Middle Ear

Do **NOT** get a hearing aid until middle ear problems are addressed
IMPEDANCE IS THE GOLD STANDARD

Middle Ear

Do *NOT* get a hearing aid until middle ear problems are addressed.
IMPEDANCE IS THE GOLD STANDARD

Middle Ear

Do **NOT** get a hearing aid until middle ear problems are addressed.
Your unaided speech audibility score helps predict the number of speech sounds you hear with any hearing aid.
3. MEASUREMENT CONSIDERATIONS

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

| 02. Boat | 15. Death | 27. Hush |
| 04. Nag | 17. Take | 29. Read |
| 05. Limb | 18. Fall | 30. Rot |
| 06. Shout | 19. Raise | 31. Hate |
| 07. Sub | 20. Third | 32. Live |
| 09. Dime | 22. Fat | 34. Voice |
| 12. Tough | 25. Door | 37. Thought |
| 13. Puff |         | 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 |

The higher the score the better your chances of understanding speech through any hearing aid.
3. MEASUREMENT CONSIDERATIONS

D. Speech understanding in noise

You need a measure of how well you will understand speech in background noise.
E. Aided real-ear measures

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

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

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

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 “75%”. 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 (10%)

1. The sound of a fire engine sirens close by is so loud that I need to cover my ears.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G
2. When a speaker is addressing a small group, and everyone is listening quietly, I have to strain to understand.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G
3. It is hard for me to understand what is being said at lectures or church services.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G
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.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G
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.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G
6. When I'm in a quiet conversation with my doctor in an examination room, it is hard to follow the conversation.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G
7. When I am listening to the news on the car radio and family members are talking, I have trouble hearing.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G
8. The sounds of running water, such as a toilet or shower, are uncomfortably loud.
   - Without my hearing aid: A B C D E F G
   - With my hearing aid: A B C D E F G

This shows your awareness of your problem.
The APHAB gives a quick estimate of your unaided and aided hearing problems.

Unaided (U)

- 95%
- 80%
- 65%
- 50%
- 35%
- 20%
- 5%

Aided (A)

- 95%
- 80%
- 65%
- 50%
- 35%
- 20%
- 5%

In Quiet

Echoes

Background Noise

Too Loud!
3. MEASUREMENT CONSIDERATIONS

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

Mueller, Bentler, & Wu (2008) discovered a 20 dB variation between different manufacturers best guess for loud sounds using the same exact audiogram.
3. WHY DO I CARE ABOUT UCL?

G. *Uncomfortable listening levels*

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

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

3. MEASUREMENT CONSIDERATIONS

*Impedance may identify a problem.*
3. MEASUREMENT CONSIDERATIONS

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.

3. MEASUREMENT CONSIDERATIONS

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

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...

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

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

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

4. HEARING AID CONSIDERATIONS

“NO DOUBT ABOUT IT—HIS HEARING’S GETTING WORSE.”
4. HEARING AID CONSIDERATIONS

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
4. HEARING AID CONSIDERATIONS

A. Feedback Control.....

They are **not** all created equal.
Why do I care about feedback control?

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

**AND** maximum aided speech audibility is essential for speech understanding.
"That's what I want to say. See if you can find some statistics to 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.
4. HEARING AID CONSIDERATIONS

You just saw how aided speech sound audibility creates better speech understanding in noise....
4. HEARING AID CONSIDERATIONS

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

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.
4. HEARING AID CONSIDERATIONS

Why get maximum insertion depth when hearing loss is severe?

<table>
<thead>
<tr>
<th>EM Length</th>
<th>Audibility Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.47 mm</td>
<td>90%</td>
</tr>
<tr>
<td>16.02 mm</td>
<td>45%</td>
</tr>
</tbody>
</table>
4. HEARING AID CONSIDERATIONS

Choose the right earmold for maximum volume

SKELETON EARMOLD IS THE WINNER

STANDARD FULL-SHELL EARMOLD IS THE LOSER

Bigger is not better

4. HEARING AID CONSIDERATIONS

Avoid vents if possible

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

4. HEARING AID CONSIDERATIONS

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

C. Proof of Benefit

Both Nikki and David benefit from hearing aids even though their scores are very different.
4. HEARING AID CONSIDERATIONS

C. Proof of benefit: Aided vs. Unaided

QuickSIN™
Speech-in-Noise Test
4. HEARING AID CONSIDERATIONS

C. Proof of benefit

- NOT SATISFIED
- MOSTLY SATISFIED
- COMPLETELY SATISFIED

AIDED AUDIBILITY AND QUICK SPEECH IN NOISE RESULTS

DEGREE OF HEARING AID SATISFACTION
4. HEARING AID CONSIDERATIONS

D. ENHANCED SIGNAL TO NOISE RATIO

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

4. HEARING AID CONSIDERATIONS

D. ENHANCED SIGNAL TO NOISE RATIO

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

4. HEARING AID CONSIDERATIONS

D. ENHANCED SIGNAL TO NOISE RATIO

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

4. HEARING AID CONSIDERATIONS
We like discrete assistive listening devices
4. HEARING AID CONSIDERATIONS

Like these...
4. HEARING AID CONSIDERATIONS

E. PROTECTION FROM LOUD SOUNDS

Figure 1. Discomfort measures as a function of hearing level for subjects with hearing loss (total 607 ears).

4. HEARING AID CONSIDERATIONS

F. Listening strategy training/practice

www.neurotone.com

DAVID AND KAREN’S PRESENTATION
4. HEARING AID CONSIDERATIONS

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.