I do recall we also talked about this:

- A large percent of people using hearing aids are not satisfied with how the hearing aids handle loud sounds.
- Neither audiologists or HIS’s are very interested in conducting LDL measures, or using these measures when fitting hearing aids.
I do recall we also talked about this:

- A large percent of people using hearing aids are not satisfied with how the hearing aids handle loud sounds.
- Neither audiologists or HIS’s are very interested in conducting LDL measures, or using these measures when fitting hearing aids.

What we don’t really *know*, but logic certainly would suggest it is true: If dispensers put more effort into getting the output “right”, hearing aid users would be happier (and the world would be a better place!)

**LDL variance as a function of hearing loss**

(From Bentler and Cooley, 2001)

Only 32% fall within 5 dB of average

*Do you really want your fitting software to “take a guess?”*
Do you really want your computer software to do your thinking for you?

- Maximum output levels were measured for when LDLs were not entered, and also when they were.
- Actual measured output values were compared to values shown on the fitting screen.

Maximum output selected by fitting software for 50 dB loss when no LDLs were entered.

I don’t know who is right, but they can’t ALL be right!
**Change in maximum output when 90 dB LDLs were entered**

![Graph showing change in maximum output across different frequencies and hearing aids.](image)

**Change in measured versus software when 90 dB LDLs were entered**

![Graph showing difference in software display versus measured OSPL90 across different hearing aids.](image)

WHAT?
A “must read” article from the November 2008 Hearing Journal

A comparison of manufacturer-specific prescriptive procedures for infants
By Richard Swioklo, Jillian Mills, Marlene Bagatto, Swaren Sodhi, and Sheila Moodie

These authors compared software differences for a young child, but you’ll see similar differences for adults.

Measured S-RESR output for five different manufacturers
(Gently sloping moderate hearing loss)

25-30 dB difference in high frequency maximum output!
So . . . It seems like we really need to do some testing, which could be:

- Pre-testing of LDLs to assist in getting the maximum output set correctly, or
- Verification of real ear output at time of the fitting using probe-mic measures, or
- Verification of real ear output at time of the fitting using aided behavioral measures, or
- Verification of real ear output following the fitting using questionnaires about real-world experiences, or

YOU COULD DO ALL FOUR!

What we’re going to talk about today

- How to use the HL LDL to make software hearing aid output adjustments
- How to use both AGCi (WDRC) and AGCo compression to “get the output right”.
- How to verify the output using probe-mic REAR and RESR measures
- How to verify the output using aided behavioral measures
- How to verify the output using self-assessment questionnaires
To get started—let’s talk about earphone LDL testing:  Recall that we covered all these topics in Part I

- When do I do the testing?
- What stimuli do I use?
- What psychophysical procedure do I use?
- How do I define the point of “uncomfortable?”
- What instructions do I use?
- What frequencies should I test?

Loudness Chart from Cox Contour Test

- #7 Uncomfortably Loud
- #6 Loud, But Okay
- #5 Comfortable, But Slightly Loud
- #4 Comfortable
- #3 Comfortable, But Slightly Soft
- #2 Soft
- #1 Very Soft
- #0 Cannot Hear
A reminder on terminology:

- RETSPL: The difference between the output of an audiometer in HL and its output in a 2-cc or 6-cc coupler. Because we're working with hearing aids, we'll talk insert earphones which are calibrated in a 2-cc coupler (Just Like Hearing Aids!)
- REDD (Real Ear Dial Difference): The difference between the HL (e.g., in this case the patient's LDL) and the earcanal SPL for the same dial setting.

More on terminology:

- If you want to go from HL to 2-cc coupler:
  \[ HL + \text{RETSPL} = \text{2-cc Coupler} \]
- If you want to go from 2-cc coupler (SPL) to the real ear SPL (RESPL):
  \[ 2\text{-cc coupler} + \text{RECD} = \text{RESPL} \]
- Therefore if you want to go from HL (dial setting) directly to the real ear SPL:
  \[ \text{HL} + \text{RETSPL} + \text{RECD} = \text{RESPL} \]
- The \((\text{RETSPL} + \text{RECD})\) is termed the REDD, so:
  \[ \text{HL} + \text{REDD} = \text{RESPL} \]
Relax, it’s all pretty easy—let’s put it to practice:

- Your patient has a downward sloping hearing loss going from 35 dB in the lows to 70 dB in the highs. You just finished testing earphone LDLs (insert phones) at two frequencies: 500 Hz and 2000 Hz.
- You used 2-dB steps and found LDLs (#7 rating on Cox Chart) of 102 dB for 500 Hz and 108 dB for 3000 Hz.
- You need to know where to set the AGCo kneepoint, so we need to convert to 2-cc coupler—remember the formula?
- All we need is our RETSPLs and we’re ready to go . . .

Let’s assume your audiometer is calibrated correctly:

So we now know:
RETSPL 500 Hz = 6.0 dB
RETSPL 3000 Hz = 2.5 dB
So now we easily can determine our 2-cc coupler settings:

- 500 Hz: 102 dB + 8 dB = 110 dB;
- 3000 Hz: 108 dB + 2.5 dB = 110.5 dB

Now: Some might say these settings could be too high, as we used #7 rather than #6

On the other hand: Some might say they are too low, as we’re basing it on tones, not broad-band signals (narrow-band signals drive the hearing aid to a higher MPO than broad-band signals)

Regardless: We’re in a much better place than if we’d just taken a guess!
High level compression works to limit loud sounds, but usually average-to-loud inputs are “stacked” at the top. Can make the world “muffled” and less dynamic and exciting.

WDRC can be used to effectively “repackage” sounds of all inputs into the user’s residual dynamic range.
Easy method to assure that loud sounds aren’t too loud (assuming you program it correctly)

Example of changing the ratio and leaving the kneepoint at 40 dB SPL

Notice that this can also affect the maximum output if the ratio is set relatively aggressive; for the lower setting, a 100 dB input doesn’t reach the AGCo kneepoint (of course, if gain were turned up it might)
Go to Robyn Cox’s lab at: www.ausp.memphis.edu/harl

There is a “treasure chest” of useful stuff here, but for now we’re going to go to VIOLA
# Contour Data

## Right Ear

<table>
<thead>
<tr>
<th>Frequency</th>
<th>THR</th>
<th>VS</th>
<th>S</th>
<th>CSS</th>
<th>C</th>
<th>CSL</th>
<th>LOK</th>
<th>UCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 KHz</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2 KHz</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>3 KHz</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4 KHz</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Left Ear

<table>
<thead>
<tr>
<th>Frequency</th>
<th>THR</th>
<th>VS</th>
<th>S</th>
<th>CSS</th>
<th>C</th>
<th>CSL</th>
<th>LOK</th>
<th>UCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 KHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 KHz</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 KHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 KHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All values in grey are predicted using THR and UCL.

### Display Frequencies (Right Ear)

- **Left Graph**: 500 Hz
- **Right Graph**: 3 KHz

### Display Frequencies (Left Ear)

- **Left Graph**: 500 Hz
- **Right Graph**: 3 KHz

Data manually entered.
Software converted HL LDL to 2-cc coupler value
Gain adjusted to match average inputs

AGCo adjusted to match patient’s LDL

WDRC kneepoint lowered to 60 dB; ratio 2:1

Loud sounds are still too loud so we need to:
• Make the kneepoint lower, OR
• Make the ratio more aggressive
WDRC kneepoint lowered to 50 dB; ratio 2:1

Notice now, because the WDRC kneepoint is low, it is limiting the output below the LDL for inputs up to ~95 dB
But what if his LDL was really 110 dB, not 95 dB?

Would we still have a good fitting?
Regarding the “treatment” for “things are too loud”

- If soft and average sounds are also too loud, simply turning down overall gain may solve the problem (although this does not lower the MPO, only reduces the likelihood it will be reached).
- If loud environmental sounds are too loud (e.g., “uncomfortably loud”), then turning down the AGCo kneepoint is recommended.
- If loud environmental sounds are “loud, but okay,” but loud speech is too loud, then adjusting WDRC is recommended:
  - Make the compression ratio more aggressive
  - Make the compression kneepoint lower

Remember this slide from earlier?

- If you want to go from HL to 2-cc coupler:
  \[ \text{HL} + \text{RETSPL} = 2\text{-cc Coupler} \]
- If you want to go from 2-cc coupler (SPL) to the real ear SPL (RESPL):
  \[ 2\text{-cc coupler} + \text{RECD} = \text{RESPL} \]
- Therefore if you want to go from HL (dial setting) directly to the real ear SPL:
  \[ \text{HL} + \text{RETSPL + RECD} = \text{RESPL} \]
- The \( \text{(RETSPL + RECD)} \) is termed the REDD, so:
  \[ \text{HL} + \text{REDD} = \text{RESPL} \]
Just for fun, let’s do some math!

- Let’s say that you just tested your Monday morning patient, and learned that his HL LDL is 100 dB (we’ll keep it easy; round numbers and only do one frequency).
- Therefore, using our RESPL formula:

\[100 + \text{RETSPL} + \text{RECD} = \text{RESPL LDL}\]

Let’s assume our audiometer is calibrated, and that we used insert earphones: Here is the RETSPL table that you saw before.
Just for fun, let’s do some math!

- Let’s say that you just tested your Monday morning patient, and learned that his HL LDL is 100 dB (we’ll keep it easy; round numbers and only do one frequency).
- Therefore, using our RESPL formula:

\[
100 + 2.5 + \text{RECD} = \text{RESPL LDL}
\]

Since we’re not going to measure the RECD, we’ll just look at a table of average values

<table>
<thead>
<tr>
<th>Age/Freq</th>
<th>250</th>
<th>500</th>
<th>750</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
</tr>
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<tbody>
<tr>
<td>1 month</td>
<td>3</td>
<td>8</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>12 months</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>24 months</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>36 months</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>9</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>60 months</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>8 yrs - Adult</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

(RECD (average) for 2kHz is 7 dB)
Just for fun, let’s do some math!

Let’s say that you just tested you Monday morning patient, and learned that his HL LDL is 100 dB (we’ll keep it easy; round numbers and only do one frequency).

Therefore, using our RESPL formula:

$$100 + 2.5 + 7 = 109.5 \text{ (earcanal SPL LDL)}$$

So we now have an REDD to convert both the patient’s thresholds and the LDL to earcanal SPL values.
Using real speech you would first verify your fitting for soft and average inputs (That’s a talk for another day!)

For today, we’re interested in:
> Output for speech at 75 dB SPL
> Maximum output for swept tone (RESR)

Is this RESR okay, or do you still have work to do?
Let’s consider the possibilities:

- If we can’t get rid of the peak at 100 Hz, then we really can’t raise the AGCo kneepoint.
- If we can get rid of the peak, then the AGCo kneepoint could go up by 10 dB or so. Looks like maybe we need more AGCi compression for the 1000 Hz range.
- But... it could be the WDRC not the AGCo is limiting the output in the 1500 to 4000 Hz region. Raising the AGCo kneepoint might not change anything.
- If we need that aggressive AGCi compression to match our 75 dB SPL speech inputs, then we probably shouldn’t mess with things.

The beauty is: Our repeated probe mic measures will tell us what works and what doesn’t!

And, as we discussed in Part I, because of residual earcanal resonance, there are often output issues with OC fittings too. In fact, the MPO for open often is higher than for a closed fitting.
Getting the output right . . .

- If you conduct frequency-specific LDL measures and then set the WDRC parameters and AGCo knee-points accordingly, and . . .
- Using probe-mic testing you carefully measure the RESR and the output for high level speech inputs (and then adjust the hearing aid’s gain and output accordingly) . . .
- Is there any need to conduct aided behavioral testing for loudness verification?

**YES . . . And here are the reasons why!**

A few reasons why aided behavioral measures are a useful cross-check

- **Reason #1:** Monaural loudness summation: Much of our testing and hearing aid adjustments are based on pure-tone information. We know that there is summation for broad-band signals (speech) and this is accounted for in our calculations—for the average patient.

- **Reason #2:** There is also channel summation—prescriptive methods attempt to account for this, but it is difficult to predict—a quick tutorial on channel summation and how it could affect loudness:
A simplified version of channel summation, for a four channel WDRC instrument:

Let's say you delivered a flat 60 dB SPL signal to a single-channel instrument that had a WDRC kneepoint of 50 dB SPL. The WDRC would “see” 60 dB and provide whatever gain you prescribed for this input. We'll say it was 20 dB.

Now, we'll make this a four-channel hearing aid (equal channels) and deliver the same input signal. That 60 dB is now divided among four channels, so (in theory) you would have 54 dB SPL in each channel: 54 + 54 + 54 + 54 = 60 dB (your second grade math teacher might not have agreed with this, but it's true).

A simplified version of channel summation, for a four channel WDRC instrument:

The hearing aid now delivers the gain programmed in each channel for a 54 dB SPL signal, not 60 dB. This of course is more than 20 dB (as you know, with WDRC, the lower the input the more the gain).

The extra gain from these four channels now sums, and the net result is that the overall output is higher. The more the channels, the greater the possibility of summation.

For now, let's just conclude by saying that it happens, and the magnitude is difficult to predict.
Bilateral (binaural) summation

- Much of the “summation research” has been conducted under earphones or soundfield. Is summation using hearing aids the same?
- Probably not, and for this (and other) reason(s) hearing aid bilateral summation research has not all reached the same conclusions.
- What we generally know (or tend to believe):
  - Summation is around 2-3 dB at threshold and becomes greater as the input become higher.
  - Bilateral summation varies considerably among patients (~3 to 10 dB or so); average for average-level inputs is considered to be around 3-6 dB.
  - Most fitting methods account for this summation effect.

General procedures (modeled after 1994 IHAFF protocol):

- Use the 7-point loudness anchors from the Cox Contour test.
- Present continuous discourse “soundfield.” (Could be in test booth, but reverberant room is okay too, and maybe even better).
- Conduct loudness ratings (speech inputs) for soft (~45 dB SPL), average (~60-65 dB SPL) and loud (~80-85 dB SPL).
- Conduct testing with patient aided bilaterally (although if problems exist, you may have to do some individual ear identification).
- Also a good idea to include loudness ratings for “obnoxious noises”—more on that shortly.
Conducting the test: What is okay?

For the 45 dB SPL input . . .

- #7 Uncomfortably Loud
- #6 Loud, But Okay
- #5 Comfortable, But Slightly Loud
- #4 Comfortable
- #3 Comfortable, But Slightly Soft
- #2 Soft
- #1 Very Soft
- #0 Cannot Hear

Conducting the test: What is okay?

For the 65 dB SPL input . . .

- #7 Uncomfortably Loud
- #6 Loud, But Okay
- #5 Comfortable, But Slightly Loud
- #4 Comfortable
- #3 Comfortable, But Slightly Soft
- #2 Soft
- #1 Very Soft
- #0 Cannot Hear
Conducting the test: What is okay?

For the 85 dB SPL input . . .

- #7 Uncomfortably Loud (NOT OKAY)
- #6 Loud, But Okay (GREAT!)
- #5 Comfortable, But Slightly Loud (OKAY)
- #4 Comfortable
- #3 Comfortable, But Slightly Soft
- #2 Soft
- #1 Very Soft
- #0 Cannot Hear

Obnoxious noise testing . . .

- The aided obnoxious noise test for loudness has been around for quite a while. Many of you have used:
  - The hand clap
  - The drawer slam
  - The book drop

But now . . . From the lab of Robyn Cox, we have a test with some science behind it . . .
What’s contained in the HONK:

- **Metal 12 oz coffee can with plastic cover**
  - Contains three ¾ x 1½ hex-head bolts; four 5/8 inch hex nuts
  - Hold horizontally and shake can near the patient
  - Makes flat broad-band noise of about 80 dB SPL with peaks about 100 dB SPL

- **Two glass jars (16 oz) with 24 or so marbles**
  - Poor the marbles back and forth between jars near the patient
  - Makes high-frequency noise in 5-10K range with a level around 100 dB SPL and peaks up to 115 dB SPL.

Use the same anchors and decision making as before:

**For either of the noise makers . . .**

- #7 Uncomfortably Loud → **NOT OKAY**
- #6 Loud, But Okay → **GREAT!**
- #5 Comfortable, But Slightly Loud → **OKAY**
- #4 Comfortable
- #3 Comfortable
- #2 Soft
- #1 Very Soft
- #0 Cannot Hear

For details and supporting research, check out Robyn’s Page Ten articles in the September and October, 2009 *Hearing Journal*
Getting to know your new “PAL”

**PROFILE OF AIDED LOUDNESS**

Name: ________________________________
Date: ________________

Status: __ unaided __ previous hearing aids
__ current hearing aids

**Instructions:** Please rate the following items by both the level of loudness of the sound and by the appropriateness of that loudness level. For example, you might rate a particular sound as “Very Soft.” If “Very Soft” is your preferred level for this sound, then you would rate your loudness satisfaction as “Just Right.” If, on the other hand, you think the sound should be louder than “Very Soft,” then your loudness satisfaction rating might be “Not Too Good” or “Not Good At All.” The Loudness Satisfaction rating is not related to how pleasing the sound is to you, but rather, the appropriateness of the loudness. Here is an example:

<table>
<thead>
<tr>
<th>Loudness rating</th>
<th>Satisfaction rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Do not hear</td>
<td>1. Not good at all</td>
</tr>
<tr>
<td>1 Very soft</td>
<td>2. Not too good</td>
</tr>
<tr>
<td>2 Soft</td>
<td>3. Okay</td>
</tr>
<tr>
<td>3 Comfortable, but slightly soft</td>
<td>4. Pretty good</td>
</tr>
<tr>
<td>4 Comfortable</td>
<td>5. Just right</td>
</tr>
<tr>
<td>5 Comfortable, but slightly loud</td>
<td></td>
</tr>
<tr>
<td>6 Loud, but OK</td>
<td></td>
</tr>
<tr>
<td>7 Uncomfortably loud</td>
<td></td>
</tr>
</tbody>
</table>

The hum of a refrigerator motor:

In this example, the hearing aid user rated the loudness level of a refrigerator motor running as “Comfortable, but slightly soft” and rated his loudness satisfaction for this sound as “Just right.” This satisfaction rating indicates that the person believes that it is appropriate for a refrigerator motor to sound “Comfortable, but slightly soft.”

There are four questions related to loud sounds, which ~75% of normal hearing people rate as #6

**10. A barking dog:**

<table>
<thead>
<tr>
<th>Loudness rating</th>
<th>Satisfaction rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Do not hear</td>
<td>1. Not good at all</td>
</tr>
<tr>
<td>1 Very soft</td>
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<td></td>
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<tr>
<td>6 Loud, but OK</td>
<td></td>
</tr>
<tr>
<td>7 Uncomfortably loud</td>
<td></td>
</tr>
</tbody>
</table>
### Score sheet for the PAL

#### Aided Performance

<table>
<thead>
<tr>
<th></th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q8</th>
<th>Category average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft sounds</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>(target = 2)</td>
</tr>
<tr>
<td>Loudness</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>Average sounds</td>
<td>Q1</td>
<td>Q6</td>
<td>Q7</td>
<td>Q12</td>
<td>Category average</td>
</tr>
<tr>
<td>Loudness</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>(target = 4)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td></td>
</tr>
<tr>
<td>Loud sounds</td>
<td>Q2</td>
<td>Q9</td>
<td>Q10</td>
<td>Q11</td>
<td>Category average</td>
</tr>
<tr>
<td>Loudness</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>(target = 6)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>___</td>
<td>___</td>
<td>___</td>
<td>___</td>
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### Possible outcomes for the PAL

“Life is Good”

<table>
<thead>
<tr>
<th></th>
<th>Q2</th>
<th>Q9</th>
<th>Q10</th>
<th>Q11</th>
<th>Category average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loud sounds</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>5.7 (target = 6)</td>
</tr>
<tr>
<td>Loudness</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4.7</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
Possible outcomes for the PAL
“Life is a little strange: Need to talk”

<table>
<thead>
<tr>
<th>Loud sounds</th>
<th>Q2</th>
<th>Q9</th>
<th>Q10</th>
<th>Q11</th>
<th>Category average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loudness</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td><strong>6.2</strong> (target = 6)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td><strong>2.7</strong></td>
</tr>
</tbody>
</table>

Possible outcomes for the PAL
“Life not good: Time to start over”

<table>
<thead>
<tr>
<th>Loud sounds</th>
<th>Q2</th>
<th>Q9</th>
<th>Q10</th>
<th>Q11</th>
<th>Category average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loudness</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td><strong>6.7</strong> (target = 6)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td><strong>1.7</strong></td>
</tr>
</tbody>
</table>
We’re going back to visit Robyn Cox: www.ausp.memphis.edu/harl

There is a “treasure chest” of useful stuff here, but for now we’re going to go to APHAB
Total of 24 questions, 6 questions for four different scales

- EC: Ease of Communication (listening in quiet)
- BN: Listening in Background Noise
- RV: Listening in Reverberation
- AV: Aversiveness (tolerance/annoyance loud sounds)

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Download Now Norsk
Download Now Polish
Download Now Portuguese
Download Now Slovene
Download Now Spanish
Download Now Swedish
Download Now Suomi
Download Now Turkish
Sample APHAB questions:

<table>
<thead>
<tr>
<th>Question</th>
<th>Without Hearing Aid</th>
<th>With Hearing Aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I am in a crowded grocery store, talking with the cashier, I can follow the conversation.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>2. I miss a lot of information when I'm listening to a lecture.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>3. Unexpected sounds, like a smoke detector or alarm bell are uncomfortable.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>4. I have difficulty hearing conversation when I'm with one of my family at home.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>5. I have trouble understanding the dialogue in a movie or at the theater.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>6. When I am listening to the news on the car radio, and family members are talking, I have trouble hearing the news.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>7. When I'm at the dinner table with several people, and I'm trying to have a conversation with one person, understanding speech is difficult.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>8. Traffic noises are too loud.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>9. When I am talking with someone across a large empty room, I understand the words.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
</tbody>
</table>

More sample questions:

<table>
<thead>
<tr>
<th>Question</th>
<th>Without Hearing Aids</th>
<th>With Hearing Aids</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. The sounds of running water, such as a toilet or shower, are uncomfortably loud.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>14. When a speaker is addressing a small group, and everyone is listening quietly, I have to strain to understand.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>15. When I'm in a quiet conversation with my doctor in an examination room, it is hard to follow the conversation.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>16. I can understand conversations even when several people are talking.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>17. The sounds of construction work are uncomfortably loud.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>18. It's hard for me to understand what is being said at lectures or church services.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>19. I can communicate with others when we are in a crowd.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
</tbody>
</table>
APHAB norms expressed as “percent of problems” (small numbers are good)

<table>
<thead>
<tr>
<th>Percentile</th>
<th>EC</th>
<th>RV</th>
<th>BN</th>
<th>AV</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>88</td>
<td>88</td>
<td>98</td>
<td>70</td>
</tr>
<tr>
<td>80</td>
<td>83</td>
<td>87</td>
<td>90</td>
<td>25</td>
</tr>
<tr>
<td>65</td>
<td>76</td>
<td>81</td>
<td>81</td>
<td>24</td>
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<tr>
<td>60</td>
<td>63</td>
<td>72</td>
<td>72</td>
<td>14</td>
</tr>
<tr>
<td>55</td>
<td>59</td>
<td>67</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>48</td>
<td>56</td>
<td>58</td>
<td>3</td>
</tr>
<tr>
<td>40</td>
<td>28</td>
<td>47</td>
<td>41</td>
<td>1</td>
</tr>
</tbody>
</table>

Important things to remember about self-assessment questionnaires on loudness:

- The patient may not have experienced all of the items on the list—you might have to come up with “similar” items on your own.
- It’s very likely that the patient will rate loudness “worse” when aided, even when output has been programmed correctly.
- Whenever possible, try to compare patient’s ratings with satisfied hearing aid users, or with people with normal hearing.