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Research QuickTakes Volume 6 (Pt. 1):  
Hearing Aid Fitting Toolbox - Getting Ready for the Fitting  
Presenter: H. Gustav Mueller, PhD; Brian Taylor, AuD

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## Introduction - Volume 6

- Hi, I'm Brian Taylor, senior director of Audiology at Signia, and I'm pleased to introduce you to volume six of our research Quick Takes series. Believe it or not, Gus Mueller and I have already created five other Quick Takes series based on research trying to answer relevant clinical questions. In volume six, we take a slightly different take. Rather than focusing on newer research that might be of clinical interest, we're taking a more of a back to basics approach, talking about how to conduct and do other essential elements of the fitting process. Whenever necessary, we do talk about research, much of it conducted decades ago, but we do really focus, what we try to do is focus on the most important evidence-based clinical procedures that are needed to fit hearing aids.

We've broken this up into eight sections. You see them listed here on the slide, and Gus will do most of the presenting because he is the resident expert on many of these, and most of you already know his name, and may already be familiar with some of his work. So we're gonna lean heavily on Gus and his expertise. But before we get started, just to kind of take you through volume 6.1, we're gonna be talking about single syllable word recognition measures namely the NU-6 ordered by difficulty recorded list. In episode two, we'll talk about speech and noise testing, focusing on the Quick SIN. In 6.3, we'll be talking about LDL testing and how you use that to set and verify the hearing aids maximum power output In 6.4, we'll talk about pre-fitting needs assessments such as the HHIA, the APHAB, and the CISO, how to conduct those in the clinic, and the value that they bring.

In 6.5, we'll talk about realer measures, in particular matching the now target. In 6.6, we'll talk about why it might be important, in a pinch, to rely on aided sound field measures and how they might compliment REM measures. In 6.7, we'll talk about the identification and management of the occlusion effect as it relates to wearing hearing aids. Kind of a classic topic that doesn't always get a lot of coverage. And then finally,

we'll round out this session, by talking about self-assessment outcome measures and the value that they add in a clinic out there.

These are the eight modules. Each module's 30 minutes or less. You should be able to get CEUs for these and you can find those details at [AudiologyOnline](#). Anyway, welcome to the series. We are very pleased to have you with us. And just to remind everybody, this series is really aimed at students, less experienced clinicians, and anyone that might be having a serious interest in best practice approaches. And we tried to align these modules in volume six of our Research Quick Takes series. We tried to align them with the Audiology Practice Standards Organization, APSO. You can find them with a quick Google search. Again, that's Audiology Practice Standards Organization. That organization, APSO, has done an absolutely fantastic job of raising the bar on standards and why and how they're important.

And we think that this volume number six of our Research Quick Takes series aligns nicely with the APSO guidelines for selecting and fitting hearing aids for adults. Anyway, enjoy the series. Please provide any feedback to us at Signia and me in particular, if you have any questions or comments, we'd love to hear from you. And like I said, thanks for joining.

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## Monosyllabic Word Recognition Measures

- Hi, everybody, and welcome back to another volume of Research Quick Takes. It's hard to believe, but we're already on volume number six. And with me today, as usual, is Dr. Gus Mueller, Senior Consultant for Signia.

- Welcome back, Gus.

- Hey.

- Good to see you.

- Yeah, I know. You're right, volume six. Wow, I don't know how many we have in the bank, but there there's a few, and it's been a couple months, I guess, since we've done any of these. So this should be fun, lookin' forward to it.

- Yeah, no, this is a really, I think, gonna be a fun volume to do because we're gonna be talking about some really practical things that people do during the hearing aid fitting process. In fact, I think the slide kind of says it all here, Hearing Aid Fitting Toolbox. And we have eight different tools, I think, that you can put into your toolbox if you look at it that way.

- Yeah, exactly. You know, in fact, Brian, some of this stems from, a while back, we went through some best practice guidelines back from the APSO standard, and what happened after we went through those different things, we started to get some questions of people saying, "Well, you talked about such and such, but you didn't tell us how we're supposed to do it." So that sort of led, you and I talked about that and thought, well, we could sort of have, we could take each one of those and have more of a "how to do it" for people who either need a refresher or are just getting started. So hopefully that works out.

- Yeah, I think so. I think everybody's always looking for good how-to information. And we'll kick things off in number one here by talking about single-syllable word recognition measures.

- Yeah, yeah, that takes us back to, I think 1948 or so was when the first LP record came out on that. So first of all, one could say there's no reason at all to ever do that when you're fitting a hearing aid. And I could almost agree with that, but I did come up with three reasons why I think that it is useful. And the fact of the matter is people tend to do them as part of the diagnostic. So it's information that you'll probably have anyway. So the theme here is really, if you're going to do it, you might as well do it right. But why do we want this information? One of 'em is you wanna get a sense of what aided performance might look like.

And so we'll talk about that. That impacts how you do the testing. 'Cause you wanna know, how good does it get when I restore audibility? A second thing is, there are times when a person has reasonable symmetry between ears for pure tones, but yet there's an asymmetry in monosyllabic word recognition. This could impact for those people who maybe only want to use one hearing aid, or you fit them bilaterally, and they're saying, "Well, the right one sounds good, but I don't do so well with the left one." So it's good to know if there's asymmetry. And number three, there are times, of course, when we might want to eliminate an ear. And in those cases, when we fit a CROS or BiCROS, that decision, usually, also, we look at the monosyllabic word recognition when we make that decision.

And of course, more and more, as cochlear implants become more fashionable, I'll say, it seems like the rules for getting a cochlear implant become more lenient. And people look at word recognition scores a lot to see who qualifies as a cochlear implant candidate. So those are three reasons. Anything else you can add, Brian?

- No, I think those are three good reasons. I do think it's important to preface that we're talking about using word recognition in the hearing aid fitting process.

- Correct.

- And that stands alone and is a little different in, of course, than if you're using it for diagnostic purposes.

- Yeah, exactly, which is a whole nother talk, but we won't get into it. Because the utility for diagnostics is pretty limited. But anyway, the theme of this whole thing, really, is this statement. Ben Hornsby and I used this in an article we wrote five years ago or so. And that is, "The words are not the test. The test is the test." And I think, unfortunately, people tend to forget about that. And they think that it's just the words, but it isn't. It's the test. And if we say, "What is the test?" the test that we're gonna be referring to is the NU-6, recorded by Bill Carver from Auditec of St. Louis, and the 50-word list. That is the test.

All the research that we'll be referring to relates to... Well, not all of it, because there's one one bit of research that relates to a different test. But almost, essentially, all of it relates to this particular test. So anytime you stray away from this, all these rules that we'll be talking about no longer apply. More and more, when you purchase a new audiometer, you're gonna have these word lists embedded in the software in your audiometer. So it's always good to check to make sure that you have the right word list embedded there and not something else. So number one, I think we have five different steps, most importantly, make sure that you've maximized audibility. And it's a simple rule.

Go as loud as you can without exceeding the patient's LDL. And there are still some people who say, at least, that they do word recognition testing at MCL. This is not



good. MCL will not maximize audibility. Rarely would a patient report an MCL that's loud enough to maximize audibility. So our goal here is to say, how good is it? How good does it get? The term that has been used for 50 years is PB max, and that is, what is the maximum performance? If we were in a research setting, we would go up in 2-dB steps, and you'd keep going up, up, up, up, up, which has been done in many studies, and you would actually find that person's PB max.

In the clinic, we have to say, "I really only wanna do it at one presentation level. What's my best shot at getting it right?" And the best information that we can present for you that works most of the time, on a mild to moderate downward-sloping hearing loss, is the rules that you see right here, all based on the 2000-hertz threshold. So you look at the pure-tone threshold at 2000, and then you add a given number to that. And as you see, it's gonna put you, in most cases, right around 75 or 80 db. In fact, I think in all cases, you're gonna be right around 75, 80, maybe 85. If you assume that the person's LDL is around 90 or 95, what you see this procedure does is it gets you sitting right under the LDL, which is where you wanna be, as loud as you can.

It's gonna be loud for the patients, but not too loud, and that's... Now, you could do an LDL and then back it down a little bit. But just using this particular procedure will save you the time of having to do that. The only times I could see maybe this wouldn't work so well would be maybe in an upward sloping loss. It probably won't work. You'll have to think a little bit more there because 2K, maybe in some cases, is normal. So you then, in that case, I would go back to the just below LDL. Also, in a severe to profound case, this may not work. So, again, then you'd have to do some other manipulation. But this is gonna work, I would say, for probably 90% of your patients.

Oh, I already said this, I guess, when it may not work. But I think I had an extra one in here. One point is when you start doing this, the patients find that it's really too loud. And they'll say, "Oh geez, that's loud." An important point then is to talk to them and

say, "Okay, Bertha, is it uncomfortably loud, or is it just louder than you'd like?" I would say 80, 90% of the time, after you talk to them for a while, they start to get used to it, and they say, "Well, it's loud, but it's okay." I think these other things, we already mentioned.

- Yeah, and I think that it's a really great approach. I've used it myself, and I agree with you. I think 90% of the time, it gets you where you need to be without having to do multiple presentation levels.

- Yeah, exactly. Step number two, always use the 50-word list. I think we all know that some places or some individuals, using a half list is popular. It will indeed save you about one minute of test time per ear. But you can make some serious mistakes, and here's why. First of all, when these tests were developed by Tom Tillman and Raymond Carhart, it never occurred to them that somebody would only use half the test. Remember, the test is the test. The words aren't the test. The test is the test. It never occurred to them that somebody would take their well-established test and only do half of it. So the list equivalencies are based on all 50 words.

We're gonna talk about sample size in a little bit. And the third thing, which, it's the most important, is they made no effort to balance for difficulty on the first half versus the second half. 'Cause, again, they didn't think anybody'd be only doing one half. So they balanced for difficulty from this 50-word list to 50-word list to 50-word list. And here's why this now is a problem. If you take their 50-word test and start chopping it up to save one minute, let's just take list 1a, which is showing right here, as we'll get to in a moment, there's been studies done to say what are the hardest words on that list. And there's a huge difference.

And I have that list coming up on another slide. But for now, take my word for it that on list 1a, essentially all the hard words are on the first half. So you know right away, a

given individual is gonna do much worse on the first half than they are on the second half, unless they have really good hearing and score 100%. So let's just take a person that has a moderate word recognition problem of around 80%. But if you chop the list in half, what would actually happen then, and you did his right ear first, he would score 68% on the first half but 92% on the second half just because all the easy words are on the second half.

Now, I don't work in an ENT clinic anymore, but there are days when I did. I can tell you that there are ENT docs who would see that asymmetry and refer for an MRI simply because they have books and guidelines that says when there's an asymmetry of 20% or more, it's a red flag for an acoustic neuroma, refer for MRIs. So now you've got a guy, because his audiologist or HCP wanted to save a minute of time, or two minutes, you've got a guy who goes home and waits for two weeks to get his MRI. While waiting, of course, he googles why you get an MRI for hearing loss, thinks he has a tumor, all because somebody wanted to save a couple minutes. I mean, this is ridiculous.

- It happens all the time, in my experience.

- Yeah, and it's sad. It's sad. You know, Brian, you were telling me of an article that you ran across recently by Barb Margolis and about, they showed that you could indeed use 25 words, I think, was the sense. Except, when you and I dug into the article, what we found is they had rebalanced the list.

- Right, they were using-

- They had taken the words-

- A very specific list.

- And turned it into a different form, and so-
- Exactly.
- That's a whole different story, you know, than just-
- Right, exactly.
- Grabbing a 50-word list and chopping it in half.
- Well, and to your point, the list is not the test; the test is the test.
- Exactly. Step number three, this is, for people who indeed are in a hurry, and I get it, this is a way that you should be able to save some time, and that is actually use the NU-6 list that is ordered by difficulty. So it's the same words, but they reordered them from the hardest to the easiest. And there's no downside to doing this, because the worst case is you'll do all 50 words anyway. So let's go through how this works. So there's just the first 25. For those of you out there who think "laud" is the most difficult, it isn't, comes in third place. The most difficult word is "death" followed by "knock." Just to get some warmth into this presentation, the easiest word, which is only missed 4% of the time, is "love," but we won't get too carried away on that. So you go from death to love. How about that? That's some kind of bookends.
- Very interesting, yeah.
- Anyway, here's how this test works. You know, it's all off of a recording. You don't have to do a lot of thinking. At the end of the first 10 words, if the patient only misses one, you're done. You are 95% confident that his or her score is 96% or better.

Because if you only miss one of the hardest, you'll probably get all the rest right. And so you know, and so you just mark on your audiogram 96% or better, okay? Then if, let's say, they miss two on the first 10, well, then you do the next 15, and at the end of 25, you stop. And if the patient has only missed three out of the first 25, then you mark on your audiogram 94% or better.

'Cause, you know, if they only missed three out of the first 25, they're gonna get the next 25 correct, and there's no reason to give those 25 words to them. Now, by the way, I know some people make the mistake that they stop at 25, and they say, "Well, he missed three," and then they take 3 times 4 is 12, 12 from 100 is 88%. Not right, because you gave 'em the 25 hardest words. So, you know, so you don't score the whole test based on that. You just say it's 94% or better. And who cares if it's 96 or 98 or whatever it is? You just know it's 94% or better. And finally, if the patient misses three or more, then you don't do the full 50-word list. But that's what you're gonna be doing anyway. So as I say, there's no downside.

- If they miss more than three?

- More than three, more than three on the first 25, correct, correct. So that takes us to number four, and that is knowing when a difference is really a difference. And this, of course, is important for patient counseling. If you're writing a report in medical records, it's really important. If you say somebody's word recognition is worse than the right ear, then it better be worse than the right ear. And so, and it's also gonna alter your counseling to the patient. So I think we can go through this just with one example. The chart that has been used since the 19, when was that?

- 1978.

- [Gus] '78, right? Right.

- Right around there, I think. Yeah.

- I think right in-

- Late '70s.

- The late '70s. And actually, other people have repeated this study, and they've come up with values very, very similar. So I have no problem in using this, even though it's been around for a while. And so this is with the 95th percent level of confidence. And so you simply pick a score, and then you see what the critical difference is. And I have an example here, so we'll walk through one case. Here's a woman who has a nasty hearing loss in both ears and poor word recognition. Her scores are 68% in the right ear and 44% in the left. So the question is, are those scores different, or are they the same? Are they just two estimates of what the true score is?

Well, the way we do this is we can do it either way. You can look at the lowest score. You can look at the highest score. If you look over on the left, here, we picked the lowest score, which was 44%. And you can see under the 50-word list, which of course is what we do, to be different from 44, the other score would have to be bigger than 62. Is it bigger than 62? Yes, it was 68. So, and indeed those scores are different. Now you can flip-flop it, and you can go over and look at 68% on the right side. And you'll see there that to be different from 68, the score has to be less than 50. Was it less than 50? Yes, it was 44. Therefore, they are different. So you reached a conclusion either way.

- Yeah, Gus, could you go back to that a minute? Because I think that also illustrates an important point that you made a minute ago. When you look at the variability

between the 50-word list and the column next to it where they used 25, and you can see, I mean, that's just a huge amount of variability to that.

- Oh yeah, and you know, well, you see right away, if you'd only done 25 words, they wouldn't be different.

- Exactly, well, and look at the variability for 44, between 20 and 68. I mean, that's just sort of absurd to think-

- I know it's huge.

- That that's even, you know-

- Yeah.

- The difference between those.

- You might say, what's... You know, Gerry Studebaker did some research on this and published it in an interesting article. And that is, this is back when people were saying that hearing aid A was better than hearing aid B if there was a 6% difference. And I believe his calculation is, if you wanted 6% to be different, you had to do like 1,380 words or something like that before 6% would ever become different, you know, right? Yeah, this can make a big difference. So, I mean, here's just some examples of how you would do it in your everyday practice. So a patient had a score of 72% in the right, 60% in the left, and he says, "Hey, is my right ear better than the left?"

You say, "No, they aren't. It's the same." And, and you know, here's an example for some of you who don't, because I bet there are people out there who would say, "Yeah, your score's better than the right ear." Here's an example of this. Brian and I,

now and then, have been known to sit and have a beer together. And let's say that we were flipping quarters, and I flipped, and I got six heads, and he flipped the quarter 10 times, and he got four heads. Would you say that I'm better at flipping heads than him? You would say, "No, 'cause you only flipped it 10 times." Well, what if we flipped it a hundred times, and I got 60 heads, and he got 40 heads.

You might start to say, "Mueller has a trick coin, or something's going on." So this is just a sampling error. It's that you have to do more samples to make a difference, really a difference. There's nothing mysterious about this. Another patient, post-op stapedectomy, the doc wants to know. If the word recognition stayed the same, the doc will probably call it discrim, because they don't know any better. And so, you know, it dropped from 88% to 76% on post there. The doc said, "Wow, looks like it got worse." And you say, "No, it didn't." 76 is the same as 88. They're the same. It didn't change. And finally, a patient score, when the right ear was 92%, today at 74, she asked if it's gotten worse, and you say, "Yeah, it has," because it has. So this is, I don't know how one could communicate with the patient or write a report without having this chart with them. You know, it's-

- Could be on the side of your audiometer or-

- Yeah, exactly. We used to, when I was in a clinic, well, it was so long ago that we actually, people still had clipboards. Remember those days, clipboards? The chart was on the back of every clipboard, And it was posted on the wall right by the audiometer in every booth, yeah. And finally, the last one, use the "red flag" chart. I'm calling it "red flag." This isn't what Judy Dubno called it. It's just, how do you tell when a word recognition score is so low that you go, wow, is something else going on here other than a cochlear pathology? And so Judy Dubno and her colleagues made a very handy list, which doesn't get used as much as it should.



This is the original list that was published in their article. And so what you do is you look at the average, the pure-tone average for 5, 1, and 2, and then you look at the score that would be the red flag. Now, what I did is I went back to that woman earlier who had 44%. She had speech... Her pure-tone average was 52 dB. I went down and circled there 51.7 is close enough to 52 for me. And notice that the cutoff score is 46%. She was 44, so that would be a red flag for perhaps something else going on, which, in many case, would trigger a referral to otolaryngology because that's just, you just shouldn't have word recognition that low with a pure-tone average of 52. Again, this is at the 95% confidence level.

- So really, oh, and here, this is one of my most favorite tools because it combines the best of both worlds here. It does. It does. Thanks. Thanks to Linda Thibodeau. This is a SPRINT chart. This is something that you can all Google. This is for 50 words, which is a little harder to find than the 25-word one. But the upper, the left half, not... I don't know. How do I term that? Well, the shaded area, let's talk about shaded area.

- Kind of hard to see.

- That's the red flag stuff. That's the red flag stuff. And you don't want the scores to fall in that shaded area. But they do, and we just talked about that before. That's the two red arrows. That compares word recognition and pure-tone average. The bottom blue areas compare the two-word recognition scores. And you want them to fall within the vertical arrows. It does not. It falls below. So we would conclude that they were significantly different, which is what we concluded before.

- Yeah, so I think it's, this is such a handy chart that I spent, you know, just a little time on it, just so everyone's clear. If the score is, if the word recognition score is abnormally low relative to the pure-tone average, it will show up in that shaded area, which is sort of the top left diagonal on the box, right?

- Yep, yep.
- And if the two scores are different, critically different from each other, it'll show up outside of that hatched area that sort of goes through the center of the square.
- Yep, yeah, and this is the exact numbers from Thornton and Raffin, and it's the exact numbers from Judy Dubno. It was just very clever of her to put them all on one chart.
- Exactly, that's what makes it great, because it addresses both the abnormally low score and the critical difference between the scores.
- Yep, and don't ask me what SPRINT stands for. I'm guessing the S is speech.
- Speech, yeah, the I-N-T is interpretation, I think.
- Okay, speech recognition interpretation or something.
- I think that's it.
- Yeah, good.
- I think that's it, speech recognition interpretation.
- Sometimes people get this confused with the sprint tests, which is something that was developed in the military for fitness for duty, so don't, it has nothing to do with this particular chart.

- That's a really good point. And now I wonder if there's any computer-based audiometers that have this built in.
- It would be... You would hope so, because it wouldn't be that difficult to do. I mean, that would be a nice thing that when you get your, when you do your automated scoring, you would then actually get a statement saying this falls outside or within. It would be pretty easy to calculate. I mean, you and I just did it by hand. If you and I can do it, I think a computer could do it too.
- Yeah, probably. That's a good... Well, just to let everybody know, we're gonna have some frequently asked questions that accompany this version of Quick Takes, and we'll answer that question, or at least we'll get answer.
- Yep, yep, good, good. Not today, we won't have the FAQs, but on another day.
- Right.
- Or maybe today. I don't know. I don't know what you have planned. We'll find out.
- [Brian] Well.
- Okay, to summarize what we've been saying, it's really simple. It's boiled down into five tips. Always use a presentation level that ensures audibility. Always use a complete 50-word list unless they pass the ordered screening. Always use the Auditec ordered by difficulty, because you want to do a screening. The research on this, the group of hearing-impaired subjects, they said 25% of the people passed the 10-word screening. So, you know, that could be 25% that you don't have to do the full 50-word list. But, and by the way, if they only miss 1 on the first 10, you don't score it 90%. I've seen

that done. You would score it as equal to or better than 96%. Always use the Thornton and Raffin chart.

We talked about that. Always use the Dubno, Dubno or using the SPRINT, to determine when recognition score is abnormally low. And the question everybody always asks, what about monitored live-voice testing? That's the easiest one at all to answer. Never, unless you also whistle your pure tones when you do air conduction testing. And if you do that, then go ahead and use live voice for speech too. Live voice, live whistle, the mistakes are all the same. If a HCP was bold enough to conduct live-voice speech recognition testing, think about this, you cannot compare it to previous testing because your voice is not gonna be the same. You can't compare one ear to the other, because your voice isn't the same in one, when you're testing one versus the other.

You cannot use the Thornton and Raffin critical differences, 'cause that's all based on the recorded material. You can't use the Dubno "red flag." Dubno indeed used the Auditec of recording NU-6. Those numbers would be different with, even if you'd used the different recorded list, those numbers would be different. You can't use the 10-word screening, because you have no idea what the 10 hardest words are for your voice. I mean, they came up with that data by testing over 200 people to find out what are the 10 hardest words. And that was for the recorded NU-6. So basically, I think, in summary, is this is a test that we've been doing for 70 years, and we might as well do it right.

- Exactly, if you're gonna-

- You know, and-

- Take the time to do-

- It's not that hard-
- Do it right.
- To do it right.
- Exactly, especially with computerized audiometers these days, most of these tests that we've talked about ordered-by-difficulty word lists are built in.
- Yeah, exactly, you know, and in the old days, people would say, "Well, I use live voice 'cause it's faster." But, you know, today, when you go word to word with a mouse click, live voice really isn't any faster.
- Exactly. Exactly. All right, well, we got the first one done. We got seven more to go, Gus, so great seeing you.
- All right, looking forward to it.
- Catch up again soon.
- All right.
- All righty.
- See you next time.

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## Speech-in-Noise Testing

- Hi everybody, and welcome back to another Research Quick Takes 6.2, and we're talking about speech-in-noise testing, part of our hearing aid fitting toolbox. And with us today as usual, Gus Mueller. Gus, welcome back. Good to see you.

- Hey, thank you, thank you. It wasn't that long ago when we were on talking about speech testing and quiet, and we're working our way up the ladder, I guess we'll call it, to speech-in-noise.

- Exactly. So we're gonna spend some time today talking about how and why speech-in-noise testing should be part of your fitting approach.

- Well, here's, I tried to get it to give an intro here that we could also relate to. So I thought I'd go to our colleagues in optometry, and that is you walk into their office with a trouble of seeing things at a distance, and you say, yeah, I'm having trouble with things far away. And they do this test where you read the Snellen chart at 20 feet. Makes sense. Most of us have done that. Some of us are getting a little older and having trouble reading magazines and our computer screen and those kind of things. And they have this little test that they do where you, you hold it at arm's length or close to that and see how small of a print you can read. And then sometimes you're having trouble differentiating colors, and they have this little chart that tells you you have to name what color is embedded in all those dots.

- That's not easy.

- Right now, I'm seeing what number it is.

- I'm gonna take a guess and say it's 10.

- I might need help, but anyway, they do that test.

- They take to heart that standard.

- Maybe they do 10 of these little cards, because I mean, this only makes sense as a healthcare provider, you do whatever the person has their complaint. I mean, if you're going into family physician, and you said, my wrist hurts, if your family physician examined your elbow, you would think that would be quite weird. Well, how about this? Let's go to a typical hearing care professional. The average patient walks in with the complaint of not being able to understand speech in background noise. And what does the average HCP do? Sits them down and tests speech understanding in quiet. Rather bizarre, one would think. Here's some interesting research from Richard Wilson. He developed a speech-in-noise test that's very popular, particularly in the VA, called the WIN, Words-in-Noise, but the test itself is not as critical as seeing these results from over 3000 individuals.

So, two important statements here. The first one. Of the people that he tested, about 70% had speech recognition scores in quiet that were good or excellent. Of this very same group, only 6.9 had normal speech-in-noise scores. Now looking at it the other way around, 6% of the entire group had normal performance for speech-in-noise, and of these who had normal for speech-in-noise, 98.5 had a good score for speech-in-quiet. So the bottom line was speech-in-quiet tells you absolutely nothing about speech-in-noise. Speech-in-noise testing tells you everything about speech-in-quiet. So if somebody told you you only had time to do one of the two tests, the one you would do is speech-in-noise. I mean, this is pretty simple logic.

- Mm hmm.

- But that's not the way people operate. Routinely, why would you want to do this? And we'll go through these quickly. All of these are detailed in the paper version of this



particular talk, which you all have access to. So this, the first one's what I already said. To get patient rapport, you want to address the problem that they have, which in most cases is understanding speech-in-noise. This will also help you identify ear-asymmetry. And here's a reason that should be, that really stands out to me. In the past few years has been all this talk about hidden hearing loss. My thought has always been maybe it's not really hidden. Maybe people just aren't doing the right test.

My guess is if that you routinely did a speech-in-noise testing, a lot of these hidden hearing losses would not be hidden anymore. These people have a true problem, but the problem isn't understanding speech-in-quiet. It's understanding speech in background noise. These speech-in-noise results will help in making decisions regarding hearing aid technology, assistive devices, when you might need a remote mic. It will help you later on to determine the goodness of the fit. Is the aided performance as good as you would expect based on what the unaided speech-in-noise score was? And it's also useful for counseling. Patients come in and they say, geez, I paid all this money for these new hearing aids, I just went down to my favorite restaurant, and I still can't understand.

Well, all you have to do is pull out their speech-in-noise score, and you'll know if that's a function of the hearing aid, or is that a function of their cochlea? Because you'll have the data to do that counseling. There's a lot of speech-in-noise, a lot of speech-in-noise tests out there. Today, I'm just gonna talk about the QuickSIN, simply because it's the one that's the most commonly used. Survey after survey have shown that. And it's readily available on most all modern audiometers. In fact, it might be the only speech-in-noise test, I think, that is commonly available when you get your audiometer loaded up with different speech tests.

- Yeah. Something like 80% of all computerized audiometers have the QuickSIN built into it.

- Okay. I did not know that value, but that doesn't surprise me. And can you think of any other speech-in-noise test, Brian, that might be on there?

- Well, it's possible that the WIN is on there or some of the other, the BKB-SIN might be on there. I know the one that's not on there is probably the HINT.

- You know, I've talked, yeah, I don't, no, I'm pretty sure the HINT wouldn't be on there due to the licensing. You know, and I've talked to some manufacturers, audiometer manufacturers, regarding this, and their general comment was, you tell us what you want on there, and we'll find it and put it on there. Although I have heard that the licensing fee for the Matrix test, you know, it used to OLSA, that the licensing fee for that might be quite high. But anyway,

- That's a good research test.

- That would be for our European listeners.

- It doesn't make any sense, in my opinion. If you're in a clinic, the QuickSIN is really the test to do.

- Yeah, it is. And there's, and here's just a quick summary for those of you who have not used it. What is nice is there's signal to noise ratios, prerecorded. Six sentences. It's a female talker with four competing talkers. This is not a babble, in that when you get to the higher levels of the background noise, you actually can pick out some of the words if you allow yourself to do so. Some of the words from the competition. So there's some perceptual masking going on as well as the energetic masking. The recommended presentation level, and we'll get into this later is, it should be loud, but okay. For those of you who listened to our presentation relative to monosyllables and

quiet, it's basically the same rules here. You want to get loud enough to give the person every shot of doing as good as they can. This is for the earphone testing.

- Right.

- And it's very easy to administer. I would say always use at least two lists.

- Just as a little side note here, for anybody that likes Chicago-style pizza, the background noise comes from a very famous Chicago-style pizza restaurant in Chicago.

- And the name is?

- Lou Malnatis.

- Lou, good old Lou's pizza. I indeed, I've been to, well Lou has, there's a lot of 'em, as I recall.

- Free advertising for Lou.

- Good, good boy Lou. This is a score sheet. And of course, today on all the modern audiometers, this, you don't have to even do any thinking. It'll score it for you. But it doesn't require too difficult math. Each, there's five keywords at each sentence. You look at how many the person got right. You add all those together, which in this case was 19. You subtract 19 from 25.5 and you get 6.5. And this is SNR loss, SNR loss. And this means how much worse is this person doing than somebody with normal hearing? Normal hearing people do not score 100% on this, which is why you don't subtract this from 27.5. You subtract it from 25.5, which is, the normal hearing people usually miss two words.

So if your patient says, oh my God, that last sentence, I couldn't get any of those, a reasonable answer from you would be, well, normal hearing people don't get them all right either. Here's the norms for SNR loss, and nothing too unusual there. Your average patients I have found tend to fall down in around six to nine caret category is real common. Meaning that they need the noise to be turned down by nine dB so they can perform as well as somebody with normal hearing. Also, and hopefully, the people who have loaded these on your audiometer have accounted for this. The lists are not all equivalent, and so there are lists that you should not use 'cause they're not equivalent.

What I listed, I think here are the ones that are not within critical range. On a later slide, I think I listed the ones that are to make it easier. The last presentation we did on this, Brian and I, we talked about critical differences for monosyllable words. There's also critical differences for the QuickSIN score that's based on the number of lists that you do. We recommend doing two lists. So what I have circled here is the critical difference, which is 2.7, meaning that if the patient had a score of SNR loss of eight unaided and an SNR loss of five aided, you would say that they did significantly better with the hearing aids. If it was only better by one or two dB, that would not be significantly different.

- Yeah, I think in a busy clinic, three dB is probably a nice round number to use.

- Yep, yep. Exactly. And as I say, we wouldn't, we don't recommend only using one. First of all, notice the critical difference is considerably bigger. And that's only 30 items. And so if you use two, now you're up to 60 items, and that'll get a much better shot at, this really is quick. So I don't think you have to be concerned that it's gonna take too much time.

- You're saying two lists per ear, correct?

- Two lists per ear, correct, yeah. Two lists per ear. Except at the end, I have, Brian, well, I guess you know because we talked about it. Well, there's, there could be a time when you'll do testing bilaterally but not under earphones. Under earphones, it's always unilaterally. So you'll have two scores, two lists per ear. You'll end up with a score for the right ear and the left ear. Okay, a few cases. We'll go through these quickly. Here's a patient whose pure tone thresholds are no worse than 15 dB, but she says she's having problems, but she scored 100% on the NU-6. What if you did the QuickSIN? You would've found that her scores are five dB for the right and six dB for the left.

So let's imagine there's an HCP who does the QuickSIN on everybody, there's another HCP who never does it. If you didn't do it, you might think she has some other things going on in her life. You know what? Why is she complaining about this when she has no problems? Not doing well at work. Maybe she easily gets frustrated. Maybe she has some kind of attention problems. Had you done the QuickSIN, you would quickly realize this is a legitimate complaint. Problems, maybe a hearing aid candidate. Results, a recent article that we talked about in one of our other presentations where they fitted individuals with normal hearing, I think it was about half of them ended up using and keeping their hearing aids.

These were all people who had documented speech-in-noise problems, not just random people. Here's a patient with a bilateral high frequency loss. He wants the tiniest hearing aid possible, but you know he'd do much better in background noise using bilateral beamforming mini-BTEs, which people like to call RICs. Except the CIC is also a RIC, but we won't get into that. So his QuickSIN scores are two dB for the right ear and 1.5 dB for the left. Wow, that's great. That's great. That's normal. That's like normals do. So now how would that impact your counseling? Well, without SIN

results, you would give him a little lecture on all the advantages of directional processing, point out that the mini-BTE style really isn't all that visible, and you can do all these kind of things for him.

After SIN testing, you realize, hey, you know, all he needs is audibility, and he'll do just fine. You know, why not go with what he wants, and he'll probably be a much happier hearing aid user. But you only know that after you have the QuickSIN results. This patient insists she'll only wear one hearing aid. Her hearing's pretty symmetrical. Word recognition, 84, 88% in both ears. QuickSIN, five dB for the right, but 10 dB for the left. I'll say that this isn't common, but it does happen in maybe, well, one out of 15 patients or something like that, where you have about a five dB asymmetry. Without SIN, you have a whole long discussion with her, what ear to fit. You know, you go through the whole thing.

What does she use on a phone? Do you, are you in a car? Where's the, where's your communication partner usually, on the right or left? After SIN testing, it's easy. You say we're gonna fit the right ear because that's gonna give you the best shot for doing well when you're out in background noise, 'cause we're gonna give you the audibility. With the audibility, you're gonna do okay. This fellow's anxious to obtain hearing aids. He's had trouble understanding at dinner at his two favorite restaurants. Item one on his COSI. You live in a relatively small town, and you've been to those restaurants, and you know what the SNR is because like any good HCP, you pull your cell phone out at most every restaurant and check out the background noise and how long you're talking, and do a quick calculation of SNR that you can use for patient counseling.

Some people have a list of 10 or 12 different restaurants like that that they just pull out and do their counseling when the person starts talking about dining out. His QuickSIN scores are four dB. That's almost in the normal range. Darn good. Without SIN results, what do you do? You'll probably be pretty neutral in your counseling. You don't want to

get his hopes up about understanding in noisy restaurants. But if you have the SIN results, you can say, hey buddy, you know what? With these new hearing aids that I'm giving you, I will guarantee that you're gonna do, you're gonna do good in those restaurants that you're going to. And I think you're gonna understand most everything because it has to be, you know, it has to be.

That's the way, that's the way it works. Here's another patient who also likes to dine out, and you know her favorite restaurants. The SNR in her favorite restaurants are about two dB, and that's actually pretty common for a fun restaurant. Her QuickSIN scores, uh oh, I see a problem here already. Her QuickSIN scores are 12 dB for the right and 14 for the left. You would've given her the same counseling you did the other guy, had you not been the prudent person doing speech-in-noise testing. After SIN testing, you could say with confidence that she has no chance of understanding in these restaurants. It's not gonna happen. There's no way you can take 14 dB and pull it all the way down to two.

That would be a 12 dB improvement in SNR. Not gonna happen. Well, it could happen if she had a remote mic and used assistive technology, then indeed she could get that improvement. So you need to go straight to that kind of counseling before you send her out the door with high hopes, only because you have the QuickSIN results. Here's a fellow that is interesting, and I remember this guy well, that's not his real photo, but he had had a slight stroke but he noted, he was saying he was having some problem that he thinks is one hearing aid isn't working very well, and comparing tests from that he'd had before, hearing thresholds did not change in speech recognition change, but his QuickSIN score in the right ear went from six dB to 12 dB.

So again, without SIN results, you're not really sure what's going on. It could be the hearing aid. After SIN testing, you realize it isn't the hearing aid. What's going on here is that his speech understanding in background noise has gotten worse. And I think

this is our last guy. He just purchased hearing aids a little while ago. He wanted to do better in background noise. He's back today saying, you know, I don't think these things are really working. You know, and you don't know if that's because his Visa bill just landed in his mailbox or if the hearing aids really aren't working. His QuickSIN in scores are eight dB and nine dB, which is not uncommon.

What are you gonna do with this guy? Well, what if we did aided QuickSIN testing? So you could do two things. Now remember, you already have his earphone scores, 'cause you did that a while back before you ordered the hearing aids. So you already know how well he did under earphones, which is what that score was I presented there, was eight or nine dB. So the first thing you could do is sit him down in a test booth and do testing at average speech level, which is around 62 or so dB, roughly 50 dB HL, depending on how your loudspeakers are calibrated. This will convince you that all is well, that he's performing where he should be performing.

You then can conduct aided bilateral QuickSIN for soft speech. And you would do this at a soft level, and you would do it unaided and aided. And that should convince the patient that the hearing aids really work in background noise. That takes us to the three different reasons why you would do the QuickSIN. And I'm gonna go through this real quickly because all of this is in the article. And so what Brian and I did is gave you a step-by-step procedure so that you first have to ask yourself, why am I doing this test? And once, and there's three answers to that. You could be doing it because you want to know how good does it get.

That would be one reason. A second reason you might want to do the test is you might say with the hearing aids on for normal average conversational speech, is he doing as good as it gets, as he should? And number three, you might say, I want to do this test because I want to demonstrate to the patient that hearing aids really work. Three different reasons for doing the test. Three different protocols. So the first of these we've



already talked about, and this is where you're in your, this is under earphones, each ear specifically, and you're doing it at a loud level just below the LDL, and you want to determine how good does it get when I make things audible.

Now, reason number two, which I'm gonna call verification, and for verification, what we do is we now present at average conversational speech. Now, I saw a survey on one of these Facebook pages where they asked what is a good level to do speech-in-noise testing. The number one answer was by 55% of the respondees, there was almost 200 people responded, 55% said MCL. I can't think of one reason why you would want to do it at MCL. First of all, it's not gonna tell you how good does it get. Second of all, out in the real world, people don't come up to me and say, hey Gus, what's your MCL? And I'll talk to you at that level.

They just talk to you the way they talk to everybody. And third of all, it's not gonna demonstrate a lot of benefit because it's too loud to demonstrate where the benefit's gonna be greatest. So take MCL and toss that away and use these three steps. So on this step number two, now we have the person sitting in the sound field, and we're doing average level speech. Now, depending who you read, average level speech is as soft as 58 or as high as 65, anywhere in there is probably okay. The main concern here is to make sure that your loudspeakers are calibrated correctly, which isn't always true in all clinics. Generally, that's around an HL setting of 50. But you need to check it out on your own equipment.

And now what I would recommend is do your testing bilaterally, okay? And to see what the score will be. Hopefully it is at least as good as the earphone score, and in most cases, it will be better simply because you're shaping the signal better than when you did the earphone testing. Now, the way we recommend doing this is that you do the speech and noise out of the same loudspeaker directly in front of the patient. So you're not gonna see directional benefits, but you can be assured that that's going to be

added on for many listening situations where the person should pick up another two, three dB of SNR improvement, depending on the reverberation, the location of the speaker, and those types of things.

So this is the second reason. And then the third reason is just to give the patient a shot in the arm. Because, you know, remember they walked in the door with this complaint of speech-in-noise. And now before you send them home with their new pair of hearing aids, you can sit them down in the test booth. Again, you do this bilaterally, and in this case you wanna do it for soft speech. And I would recommend something around 50 to 55 dB SPL. You're doing it bilaterally, that will be around 40 dB HL. And in this case, you do unaided and aided, and you compare the results. Now, these scores will probably be worse than had you done it louder, but that's not the point to doing this.

The point to doing it is to show the patient that hearing aids work in background noise. What I've always used is a chart, something like this, easy, something you could easily design on your laptop and show on a nice big monitor to the patient. So what I did here, what we recommend doing here for all your patients is to simply, you've already doing two lists. So that means you've got 10 words per SNR. So that's easy math. That's 10% for each word correct. So what you see here is if we start at the most difficult situation, the person did no better aided than unaided. And that's the first thing I would talk about, and say, you know what, Bob, you did, remember that really difficult situation?

Hearing aids aren't helping you. But you know what? I can't understand in that situation either. Stay out of those situations. In fact, I'm guessing you probably don't even go into them. And you know, there was the other situation when it was really quiet when you didn't even hear the background noise. Well, you didn't notice a big difference there either because you do okay in that situation. But you know what I really want to talk about? I want to talk about those other situations. And these are the most

common listening situations when you're in background noise. In fact, that's been documented. Several research studies, when people are out listening in background noise, around plus five, plus eight is a very, very common SNR.

So if you want to get into the ecology aspect of it. So these are the areas where the, you see the most improvement. This is all percent correct. In fact, I can tell you that Bob will immediately tell you this, because the differences are so great and because it's all about audibility. When you make it audible, people do better in background noise. So this would be, you know, you could do this for everybody, or you could do it for those patients who are just a little going, oh, I don't know if these are gonna work. Or that patient who came back and said, I don't think these work in background noise. Sit them down and do the testing and say, look at that. They work really well in background noise. You did 60% better in background noise. So, and one final personal endorsement, an old friend of Brian's. I don't know if he's from Wisconsin or not, but he.

- I think he's Mexico.

- At least it was nice to have an endorsement in all this. And I'm sorry, I sort of got on a roll here and didn't allow you to comment much.

- No, it's okay, because I think that, you know, this is one area where it's kind of a no-brainer that speech-in-noise testing is an essential part of the process. I think all the things you talked about are excellent counseling tools, a great way to give a confident recommendation. So I don't think I really need to say any more than that.

- Yeah, well I think, you know, you did, a few years ago, you did a little chart where didn't you compare speech-in-noise testing and then ANL as to.

- Well, speech-in-noise, the QuickSIN, looks at word recognition, standing ability in noise, and the acceptable noise level looks at how bothered by noise somebody are. And I think there's some data out there that show those are kind of two different things and then you can kind of.

- Totally. Totally uncorrelated.

- Yeah, so now understanding and being in background, understanding speech-in-noise, trying to have a conversation in background noise without being annoyed and taking your hearing aids out. You can identify those people before you fit them with the QuickSIN.

- Yeah.

- And if you have time, do the ANL. But that's really another, another model you have to create.

- Yeah. See, well, it's a good thing we got a big toolbox.

- Exactly.

- It's only a half full so far.

- It's expandable.

- All right. That's good.

- All right Gus, we'll see you next time for number three in this series.

- Okay, sounds good to me. See you then.

- See you.

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## Getting the Maximum Output Right

- Hi, everyone. And welcome back to another episode of Research Quick Takes. I'm Brian Taylor. And in Volume 6.3, we're gonna be talking about how to get the maximum output right on your hearing aid fittings. And joining us today to talk about all the details on MPO is Gus Mueller. Gus, welcome back.

- Yeah, yeah, good to be here, Brian. We're sort of going a step-by-step thing here. And sometime ago when we recorded, geez, I don't remember, maybe it was Volume 3, we talked about a lot of different items that are part of best practice. We talked about why they're part of best practice. And what we didn't really talk about how to implement them. So we're sort of going through these. And so this is gonna be about if you wanna wake up tomorrow morning, and start really implementing, and getting the maximum output correct, this is at least the way you and I think it should be done. So the first concept is very simple, just like Goldilocks. Not too hot and not too cold.

You wanna just place it right nicely, comfortably, peacefully under the LDL. So you say, "How do I do that?" There are three options. And I actually know people and clinics that use all three of these. So let's talk about them in a particular order that I think makes sense. The first option is to say, "You know what? I think the manufacturer knows how to do this best. And I'm just going to sit back, and ignore it, and not even worry about programming the MPO because after all, they should know." Well, how does that work? My experience has been that it can be very risky. This is a study that I did with the folks from University of Iowa a couple years ago, published in hearing instruments.

And we wanted to ask that very question that I just posed. And that is, if you take a typical audiogram, what do manufacturers do when they're setting the MPO? And so what you see there is what I would consider a very typical audiogram, easy to fit. Down below, the red triangles are, if you go to the NAL-NL2, this is what NL2 would predict this person's LDLs would be. And I suspect it's probably what any one of you would

probably predict too with that degree of cochlear pathology. You'd predict their LDLs to be around 100. That's an HL, of course. So what we then did is we just simply measured to see what the output really was when we went into the software of each major manufacturer and programmed.

We didn't enter in LDLs because rumor has it, there are some people out there who don't enter in LDLs. So all we did was went in, put in that audiogram to see what the manufacturer would pick. Here is now the MPO. So this is the maximum output that's available from six different manufacturers. Now, interestingly, the top one, Mr. Orange, is almost exactly what we would want. Look at that. It's running five dB below the expected LDL. The peak out there at three K is a little too high. I'd go to that frequency, move the AGCo knee point down about five to eight dB. And that would be a beautiful fit. That's if I'm doing the programming, but look at these other ones.

In particular, look at the three or four of them that are grouped in this area. The MPO, the maximum output is no higher than about 80 dB for the mid frequencies, no higher than 80. That's like putting the ceiling on, you know? That if like you asked LeBron James to come in, and you're gonna measure his vertical jump, and you put him in a room where the ceiling is seven feet. His vertical jump isn't gonna be very big, I can tell you. Well, how does this relate to the real world? Not good. So here's a fairly typical example. These four women are out having a good time in their favorite little pub. The woman over here on the right is wearing a hearing aid.

The output to her hearing aid is, is she's wearing one of those four. She went to somebody who didn't believe in programming the output. And she ended up with an output of around 75 to 78, basically the same as the background noise. And the woman over here is talking to her. She knows she has a hearing loss, plus people just naturally try to raise their voice above the background noise. So this woman is raising her voice to 80 to 82. So she is delivering at the ear for this person, her friend at a plus



five SNR. That's at the ear, at the microphone of the hearing aid. At plus five, people usually can follow the conversation. And all would be well, except this poor woman on the right has a ceiling of 75; And therefore, 80 and 82 are 75, just like the background noise because there's no room for the speech to go above the noise.

And so rather than an SNR of plus five, she has an SNR of zero dB. Now, when she comes walking into your office on Monday morning and tells you that on Saturday night she was having this problem in the bar, my question is, how many of you would immediately raise the MPO? I'm thinking not many. And that's the problem that we have, which is why we can eliminate, "Let the manufacturer do it," 'cause they don't do it very well. That takes us to option number two, "Use average values based on degree of hearing loss." Here's a chart that I've been showing for quite a few years from Ruth Bentler and her colleague, Laura Cooley, I think her name is from a while ago.

But that doesn't make it, it's not anything that goes out of date. This is LDLs of 508 years, people with confirmed hearing loss. Notice that if you take a typical hearing loss of around 50 dB and their study LDLs ranged from about 75 to 128. So if somebody says, "Joe is walking into your clinic. He has a hearing loss of 50 dB, what do you think his LDL is?" You could say with confidence, "I think it's somewhere between about 75 and 125. I'm pretty certain of that. I'm pretty certain it's gonna fall in that range." And importantly here, only 32% were within plus or minus five of average. So what does that tell you? You can't use average values 'cause people are all over the place and you're gonna make serious mistakes.

So that takes us to option three, measure and apply. All of these are, we have a lot of rules and step-by-step. And I need to mention that all of this is laid out in the paper version of this, which you all have access to. And so I'm gonna go through it fairly quickly, but we wanted to make sure that we did a step-by-step to avoid questions. And so this is something that you could start doing tomorrow morning if you want to,

and I hope you do. So the first thing then what you need to do is measure actually LDLs. This is using pulsed pure-tones. You would use an ascending method. Normally, two frequencies per ear is enough, unless there was some really unusual thing.

And you normally would use, do two runs to give you reliability. It's very common that on the second ascending method you end up five dB higher than you did on the first one. The patient initially is a little scared that you're gonna blast them with something really loud. And then when they realize that's not gonna happen, they usually go up a little bit. We certainly recommend the work of Robyn Cox. These are her loudness anchors to the left, which is critical, the use for all patients. And going with them are the instructions on the right. Forget about terms like what you can tolerate and those sort of things. Look at the last paragraph here on the right that says, "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."

In other words, what is first uncomfortable? It's not about what you can tolerate for five seconds, or 10 seconds, or anything like that. Here's an example of a retired audiology professor from Iowa whose name I don't remember right at the moment, but there he is taking the test in the booth. What I like to do is, I actually always use the chart even bigger than what he's doing. I would always have the patients point to it because I think it gives you a little more idea of how close they are, how certain they are. I can tell you, when something is in number seven, it doesn't take them long to point to number seven. They don't sit and think about it very long.

So, and then, you're looking through the window, you see where they're pointing. Most people just have them call out the number. That's fine too. Over there is actually my worksheet that I use. You do, as you see, I use two runs on that. If you go to the far left at 500, the patient went from 90 on the first run and then went to a hundred on the second run. If the difference is 10 dB, I would normally do a third run, then just take an

average. And so what you see on top are the averages. What do you do once you have that? Well, it's a very simple procedure. And that is you need to talk to the hearing aid.

To talk to the hearing aid, you need to have all these values in 2-cc coupler. So what I'm showing here is how you would add the RETSPL. And these RETSPLs are published many places, including on this slide. This is going from insert earphone. We're assuming that you all use insert earphones. And if you look on the second bullet at the end, there's the RETSPLs for 500, 1,000, 2,000, 3,000 and 4,000. If you didn't wanna keep the chart that handy, if you simply remembered three or four dB, you're gonna be very close adding the RETSPLs 'cause usually, we're using those mid frequencies. So just to give us some practice here, we have a hypothetical patient. And with the, that this patient had started off with, I used two dB steps.

He had a 92 dB-HL. I added the RETSPL and I got 95. At three K, he had an HL of 104. I added the REDSPL and got 107. So now, I'm in 2-cc land. So now, when I go to the fitting software, I can talk to the fitting software, which is what we're gonna do right now. All fitting software has a screen where you program the output. It's a screen that you should be very familiar with 'cause it's a screen that you will use as often or nearly as often as when you're programming gain. So you see, we already have these numbers. You simply go to that screen. This is for Signia. And the screen will look like this.

So what I simply did for this patient is I went to the bars down below of which you simply pull down to reach the values. What I did, I reached, I pulled for 500, I adjusted it. So I get 95. Then I went over to three K and adjusted it. So I get 107. And then I just smoothed out in between. It sort of smooths out on its own, but you may have to adjust a few. LDLs don't jump around. So you just make a nice smooth output curve. And now, you've taken the, you've actually fit the hearing aid. And notice that these are considerably different than what you would get is if you'd let the manufacturer do it.

Next you do the real-ear verification. We've talked about this in previous episodes of this little show. But when you're, after you finished programming and fit your hearing aids to NL2 or DSL, what you then do is you do a swept tone at 85 dB and you look to see the real-ear output. Now, if you did your LDLs correctly and you did your programming correctly, there should be no surprises here. By the way, I should mention that you enter your measured LDLs into the fitting software. The probe-mic equipment then automatically corrects them to ear canal SPL LDLs. And that then becomes your fitting target. And so you want the output, what is called the REAR85, you want that to fall directly below the LDLs.

Here's an example that is close, but not quite as good as we'd like. So I wanted to show you that here out in the two K area, we're just a little high. And I would now go to the AGCo knee point for the three K area and I'd pull that down about five dB. So I'm sitting right under the measured LDL. Now, you say, "Well, what about 500?" You wanna move that up a little? What you see a lot is that there's not a lot of gain at 500. So that probably is the maximum. It's being limited by gain, not by MPO. Number five. You're finished with your REAR. REAR are measured. Before you let the patient leave, however you no doubt fit them bilaterally.

And you need to make sure that bilateral summation does not have effect. So what you do is you have them sitting back in front of your probe-mic equipment. Actually, they were still sitting there when you did the test that we just left, number four. And you simply present some speech babble. Different probe-mic equipment has different noises. A vacuum cleaner noise is real common. Some type of, a relatively obnoxious noise is okay. You present that at a loud level and you see if indeed they give you a rating number six. You go back and give them the same chart that they had for the unaided. And if they give you a number seven, I would usually repeat it a couple times.

And if they're really sticking with that number seven, well, then you just need to pull the output down a little bit, play the noise again, and make sure that everything is okay. This is a behavioral verification. You could almost call this a validation; although you will get more validation once they go out in the real world. There's my mom, Mrs. Mueller, who was fit just fantastically by her son. And as you can see, aided. She's pointing to, "Loud, but okay," as you would expect. My mom started started wearing hearing aids when she was 50 and lived to be 91. I fit her with, think, about six pairs of hearing aids. And of course, she always went, "Oh, that's so nice." But she said that about everything in the world. So Brian, what do you have to say about all this?

- No, I think this outputted. What's interesting to me about output, a couple things. Number one, I think it was, people started, and rightly so paying attention to it because they were afraid they were gonna provide too much output cause problems with making the hearing loss worse or just making it intolerable to wear. But in reality, the opposite is what we have to be concerned about where we're more often than not... And this goes back to one of the first slides you showed with all of, most of the manufacturers being well below the MPO target. We have a tendency now to under fit MPO and not give the people, shortchanged people when it comes to providing them with enough headroom. And I also wanna just interject that I think this is a really stable, easy to do measure. Once you go in and set the MPO the way that you described, I don't think you have very often have to go back and redo it. So to me, it's-

- Yeah, the LDLs really, even when hearing loss changes, LDLs change very little.

- Exactly. So-

- And they're the same year after year.

- So why not do this, take five minutes out of the fitting time, and do it, and get it outta the way, and make sure people have adequate headroom in their hearing aids?

- And just to add one more thing to what you're saying about everybody is concerned about, well, at one time, 20, 30 years ago, we were concerned about things being too loud. The, and that was a big concern when OTCs were being evaluated, and discussed, and all that. My my concern now with OTCs is they're gonna be too soft, not too loud. Because the OTC manufacturers are just like our major manufacturers. And their initial first fits are way too soft.

- Right, and people-

- And so the output is actually going to be limited not by the MPO, not by the AGCo. It's gonna be limited by the gain 'cause it can only get so high.

- Yeah, exactly. And I think the issue here, and why you need a fitter involved in this process, is because patients will come back and tell you if it's too loud. But in my experience, patients don't come back and tell you, "It's too soft." They don't know.-

- No, they're sometimes they're happy because they don't know any better.

- Exactly. So they require it I mean, we've all had porridge. And you have to get it just right. It can't be too hot and it can't be too cold. It has to be just right. And people should complain more about cold porridge, but they tend not to. They just complain about hot porridge. I don't know what the deal is.

- Well, on that note, I think that's a good place to end it here on MPO and why it should be done right. Thanks again for your expertise, Gus.

- All righty.
- Appreciate it. We'll see you next time for episode four.
- All right, looking forward to it.

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## Pre-Fitting Needs Assessment



- Welcome back, everybody. I'm Brian Taylor, and we are on volume 6.4 of Research Quick Takes, and with me, as usual, Dr. Gus Mueller, and welcome back to the broadcast, Gus.

- Thank you, thank you, thank you.

- You know, this whole thing has been about how to different parts of fitting hearing aids and today we're gonna be talking about pre-fitting assessment tools. What are your thoughts on those kinds of tools, Gus?

- Yeah, well, you know, we, we've sort of done step-by-step of, and of course, not necessarily in a chronological manner, but this is sort of the last thing that we'll talk about relative to what you do before the fitting. And of course, today, it has become more and more emphasized to have a patient-centered kind of approach. And there's no better way to be patient-centered than to collect information from the patient before you start doing the testing. So that's the kind of thing that I think we'll talk about.

- Mm-hmm.

- So with that said, there's all kinds of reasons why you would want to use these scales. And I should mention there's probably 12 or 15 of 'em available. And Brian, you and I sat down and came up with three that we'll go through today. So you might wanna do it just because to determine if a person's a candidate or not, Larry Humes has a ton of data showing that the HHIE just might be better than an audiogram to determine who's going to use and benefit from hearing aids. You could use it for counseling. It's a good way to see if there's, if the patient has realistic expectations and if their results are consistent with audiology findings. And it's great.

One of the scales we're gonna talk about is the COSI where you get to know the patient and you get to know exactly what they're looking for, what they're hoping for. Some of these scales, you also use down the road after the patient's had the hearing aids for a few weeks. So you need a baseline because if you don't have a baseline, you can't assess benefit. So they work as a baseline. The APHAB is a good example of that. It might help you in prioritizing technology. If your pre-fitting shows you this patient has just an inordinate amount of trouble and background noise, that could help determine what type of technology you might be steering them toward.

And also these scales can be used for quality assurance where you can compare one provider to another, one office to another. Or you can compare yourself to national norms and say are my patients like the ones that are average across the US. When you select these assessments, as we did, there's all kinds of things you want to look at. Reliability, validity, they have, you need, for sure, you need to have norms except for the COSI. That's a little different because each person is sort of their own control. You do wanna look at different domains. Where a good example of that is the APHAB where you're looking at speech understanding and quiet, but also speech understanding and background noise.

HHI, obviously by the name, is looking at handicap. We're all busy. You need something that's easy to administer and score, and you need something that's relatable to the patient. So let's start with one of the oldest ones. This goes back I'm thinking to the mid 1980s, the HHIE, which is the Hearing Handicap Inventory for the Elderly. Back then, they thought old was age 65. We all know that 65 is just a spry young chicken, spring chicken, that's the word I'm looking for. A spring chicken, not an old rooster or hen. And so who knows what's the right cutoff because there is another version, the HHIA, which is for adults. So I guess once you hit 65, you're no longer an adult.

I know some who are like that. Anyway, you can use your own judgment on the cutoff. Obviously if somebody's 70 and they're still very active, you probably would give them the HHIA, not the HIE. There's only two questions that are different on the 10 item version. Not a big deal, but usually, people try to give the right one. The original versions of both are 25 questions. We recommend using the 10 item version. So how do you do this? It does not take long at all to complete. Ideally, the HCP actually reads it to the patient when they first come into your office. You can sit down and read it to them. You could have them fill it out in the waiting room while they're waiting for you, or you could mail it to them.

You have a lot of options. It's a paper pencil thing usually. And I'll show you an example of that shortly. Questions are simply scored four points, two points or zero. Low scores are good, you add them together. And a 40 would be the worst score on the 10 item version. And I have the norms there down on the bottom. Zero to eight is normal, 10 to 22 mild to moderate, and greater than 22, greater perception. Here's an example of the 10 item score. The person on this would be scored a 14. That would be judged as mild. You know, I'd encourage you to take this yourself. If you have normal hearing, I think you'll find there's a couple questions on here where you would answer "sometimes," and which is why anything up to eight is considered normal.

So remember, four for a yes, two for sometimes, and zero for nos. Second test we'd like to talk about is the APHAB Abbreviated Profile Hearing Aid Benefit. This is called abbreviated because once upon a time, there was a test called the PHAB, which is twice as long, the APHAB, but developed by Robin Cox. It can also be used as an outcome measure, but as I mentioned earlier, it's nice to do it as a pretest. It tells you a lot about the patient, what problems they're having. And then you also have the baseline measures for when the patient comes back and you measure the outcome. There's four different scales, six questions to each scale. And I gave you an example

here of each one of these having listening and Ease of Communication, sort of a strange name because really, it's just listening in quiet.

So just think of that as listening in quiet. Have difficulty in a conversation when I'm with one of my family members at home, then Reverberation when I'm talking with someone across a large empty room. And I can tell you, the scores for Reverberation and Background Noise almost always turn out very, very similar. If you wanted to shorten the test, you could maybe leave out the Reverberation questions, but they're all mixed in with the others. And so I wouldn't do that. Anyway, Background Noise when I'm listening to news on the car radio, family members are talking. And the last one is sort of interesting. It's Aversiveness, and that is how is the patient bothered by unpleasant sounds?

This is the one that people leave out the most often. There's six questions because a lot of, I mean, one of the examples is the screeching of tires. Well, you know, patients will say, you know, "Fortunately I haven't heard screeching tires for a long time." It's like, ah, it's okay. But it does sometimes show up, people who have loudness problems. You can use it as a pencil and paper test, which isn't too bad. I would highly recommend doing the computer scoring. And you can do this in a couple ways. There are some hearing aid manufacturers that have the APHAB as part of their software, but APHAB is also part of the, it's in the questionnaire section of the NOAH module.

So I would suggest using that and let because the scoring is a little cumbersome. As you see there, depending on what answer the patient gives, you're adding numbers like 87% versus 50 versus 12% and so on. The test, one of the things I like about it is because I've given a lot of these scales where people answer and they sort of, a lot of 'em aren't excited about doing it and they just mark the same answer for everything. C, C, C, C or D, D or A, A, A. Robin Cox was clever when she designed this so you can't

get away with that. So I thought I'd show you how that sort of works. "I have trouble understanding dialogue in a movie or at the theater."

So the answer is G, which means, G would mean that you never have that problem. And then you look down here. When I'm talking with someone across at lunch, I understand all the words, and then if you answer G, so you should be saying A for that. But if you're just saying the same answer all the time, the test will pick up on that. And you'll see that on the printout. You'll see if somebody is giving the same letter answer for everything. And if they do, you know, it's not a valid test. Here's the norms. The fact that this goes back to 2005 I don't think really matters because first of all, for the unaided, it certainly doesn't, that's on top.

Down on the bottom is aided. Somebody, you know, said to me, "Well, geez, technology has improved so much. Shouldn't we be using norms from today?" I don't think it matters that much. Though these were all well-fitted, wide dynamic range compression hearing aids, and I don't know of any study that's given us new norms. The other thing that we have that I like to use is for patient counseling, we can compare a person's performance for on the left is elderly with fewer, no norms. And on the right is young and normal hearing individuals. So it's sort of nice at times to say, you know, for listening and quiet, you really are doing essentially as well as a young person with normal hearing if you see where that X is at around 15%.

So these are also things that you can use. You could have this printed out and, or you have it set up on your laptop to show people. This isn't very clear, but it's the best I could find. This is a screenshot of the APHAB scored in the module of NOAH. And so you see there the plot of all the scores for the different situations that I had just mentioned to you. And there's more down below where you see the, all the different, actually, the 24 answers that you can make comparisons. And finally, the test called the COSI. Interestingly enough, just, you know, a bit of information that you can

remember from this presentation. The COSI was developed in Australia, and in Australia, cossie is what people call their swimsuit.

I don't know why I thought of that, but it just seems important, short for costume called the cossie. Anyway, but the COSI people like to use the COSI. It's a fun word to say. And the COSI is very different. And that is, it starts with a blank sheet of paper and you allow the patient to identify and rank order their listening goals. You want at least two or three, no more than five. Here's the blank form. And you see we have room there for five different things that they can identify. Now, the patient sometimes will wanna identify something that just happened the night before, or they'll wanna identify five different situations where they did terrible. So what you need to do is you need to help them along and say, "Okay, Mildred, you've now told me about your granddaughter's wedding, and you are talking about that band playing during Bridge Club."

And you know, I said, "But what do you do? What do you, you've told me things that are like, 1% of your life. What do you do all the rest of the time?" And then you start getting into the average situations that Mildred is experiencing on a regular basis. That's the things you want on the COSI. And you, sometimes, you have to work for the person to get them there because if you're fitting with them with hearing aids, they probably have problems in a lot of different situations, not just the ones that stick in their mind. After you identify the situations, you can go back and review and have them rank order them. It's very common. In fact, almost every time that the order that they first listed is not their rank order.

Because what they list is something very recent, and when they have stepped back and take a look, it may be the least important. So you want them to rank order it. And this now is pre-fitting. We do the COSI again post-fitting. But in the pre-fitting, what we also recommend is you then have them mark down their expectations. So later on, we'll talk about their benefit. That actually will be another one of these episodes. But

you have them mark their motivation. Now, one thing to remember, this is from our friends, Elaine Morner and Catherine Palmer from University of Pittsburgh. They did an interesting study where they had people after they'd used their hearing aids for three weeks, they sat down with them and had them list things again.

Like they'd never done the COSI in the first place. And what they found is 96% recommended two of the same things, 64% nominated three, but no one nominated four of the same items. So what that tells you is if you can just get three good items, that's probably good enough because they, the other ones are gonna change from month to month. Here's a filled out COSI where we got this gentleman to come up with five different things. Notice the very first thing he mentioned was hearing his friends while shooting pool in the Ryder Bar, which had just happened a couple days before he came into the clinic. But then as we started working with him, we came up with these other issues.

You know, when you see then, look at the priority, after sitting and thinking about it, although understanding the voices of his grandchildren was the last thing he came up with. It turned out being ranked number one when we actually then went back and had him prioritize them. And then we had him list his expectations, and they're relatively high. He wants to do better. He really wants to hear well in the bar. And so you sit and talk. In fact, the first thing I would do is say that probably isn't gonna happen because I've been in that bar and I couldn't hear people playing. Brian, I don't know if you've been in there, but it looks sort of like this. This is, you might say this is the Ryder Bar, the pool table's just on the right when you walk in. Have you been there, Brian? I can't remember.

- I have not been there.

- No, not been there. Well, it almost looks like it's not open, but it is. You can see one of its main customers is trying to bring in some other customers, letting them know that yes, indeed, it is open. The old Ryder Star.

- Yeah, looks like a shed.

- Anyway, yeah, so, but you know, the beauty of the COSI is you really, it's like a contract. It's like a contract with a person where they name these things, and, you know, you sit and you say, you know what? I'm gonna do my best to get every one of those right. 'Cause those are the important things. That's what makes it so much better than some of the other forms where you're asking them questions that, "Do you think you'll do better in church?" And the guy says, "Well, I haven't been to church since I was 16." Well, that isn't a very relative question for that particular person, where with the COSI, they design their own questionnaire, and that's why it's so popular. And we'll talk about it again when we get to episode eight, I think it is, when we'll get back to the COSI. So here's what we come up with, three different ones. Each one is different in its own way, and each one gives useful information. And Brian, anything to add to all this?

- No, I think the sensible approach is to pick two out of those three and use it with every patient. I think the COSI is great because it's personalized to the individual, as you mentioned. I also think that, we talked about the Quick Send a couple of episodes ago, and knowing the Quick Send scores and the unaided condition really helps when you're developing a COSI and setting up those expectations.

- Yeah, yeah, oh, you're absolutely right. And in almost all cases, you would have the Quick Send scored before you sit down with the COSI.

- Exactly.



- And so if a person's Quick Send is 12DB, and they want to say they want to score, you know, they want to do 100% in the the neighborhood Wisconsin bar, they're in trouble.

- Right, so hopefully everybody that's watching these episodes are starting to see how things fit together.

- Absolutely.

- All right, well, next time, we'll be on our fifth episode for volume six, and can't wait to see what that is.

- All right, yeah, you never know. They're always, it's always a surprise. Alright, well, see you then.

- Alright, take care, bye.