Cognition and Hearing Health: Research and Clinical Application Part 2

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Welcome to part two of Cognition and Hearing Health. I'm Laurel Christensen, I am the Chief Audiology Officer at GN Hearing and I'm joined by Hannah Fehlberg, who is a field training audiologist for Resound as well. So on Monday we did part one of this seminar and mainly Hannah went through a lot of the research around cognition and hearing loss and a lot of clinical aspects around testing as well. So I encour you to watch part one if you haven't, if you haven't done that, but you don't need to have part one in order to join today for part two.

All right, so the learning outcomes today are. After this course, participants will be able to identify important hearing aid features to consider for patients with cognitive decline. So we're going to talk about, you know, what are the things you should consider in your hearing aid fitting. After this course, you'll be able to discuss how untreated hearing loss impacts the safety of patients. And finally after this course, participants will be able to explain how to navigate through SmartFit 2.0 software to make common adjustments for patients with cognitive decline.

The agenda today is going to be mainly around signal to noise ratio loss and how we talk about that. How does directionality improve signal to noise ratio loss? What are the different ways we can do it? What's the difference between a two microphone solution and a four microphone solution? So a lot of important things around the biggest problem that people have with hearing loss and that's hearing and noise.

We'll also talk about the relationship between untreated hearing loss and safety, things like falling and then again the software considerations at the end.

So I hope that many of you have already digested this article from Lancet. It was published the last day of July and it's the follow up report to the one that came out in 2020. And so the title is Dementia Prevention, intervention and care 2024 report of the Lancet Standing Commission. So this is really that germinal research that started to look at, you know, what is the amount of risk that untreated hearing

loss has on cognition and dementia. And like I said before, it came out in 2020 first, and I think many of you will be very familiar with this graphic that you're seeing.

And it shows 14 modifiable risk factors. And in 2020 there were 12 modifiable risk factors. So you can see that two more have been added in 2024. And what's broken up here is when these modifiable risk factors take place, so many of them in midlife one of them in your earlier days or your earlier life. But I think education would be part of all of your life and then what happens in later life.

And so these are, you know, these are really interesting. I'm going to blow up though the middle part. So these are the risk factors, and they're modifiable risk factors. So these are things we can do or anyone can do to try to stay healthy and really keep your cognition healthy. And if you add all of these up, 45% of the variance in that, or basically 45% of the modifiable risk is in these 14 risk factors.

So 7% you can see right there is hearing loss. And that was also 7% in the 2020 report. And then if you look down the rest of those risk factors, you'll see high cholesterol. That is a new one. That one was added just in 2024.

You see depression, you see traumatic brain injury, physical inactivity, diabetes, smoking, high blood pressure, often also called hypertension, obesity, and excessive alcohol consumption. Those are the midlife ones. The ones in early life are education level. And as you get into later life, it's about social isolation, it's about air pollution and visual loss. And visual loss is also a risk factor that was just added in 2024.

I like to talk about the hearing loss. 1. Hearing loss is that large modifiable risk factor at 7%. But also look at the things that really come with hearing loss. We talked about this in part one.

Hearing loss is also often accompanied by depression and by social isolation. And if you look at those three together, that's about 15% of the modifiable risk. So, like I said, I think it'd be great idea for everyone to digest this entire report. It really is good. But just because it's interesting and you may not all get there in the course of your busy lives, here are these specific actions to reduce dementia risk across the life course.

So 14 risk factors. And you can see, you know, ensure good quality education is available, make hearing aids accessible for people, treat depression effectively. Encourage the use of helmets in head protection in contact sports. It's always a good one, especially skiing out here in Colorado, where I live, encourage exercise because people who participate in sport are less likely to have dementia. Reduce cigarette smoking, prevent or reduce hypertension.

So keep your blood pressure under control, detect and treat high LDL cholesterol, maintain a healthy weight and treat obesity as early as possible. Reduce alcohol consumption. I actually had to look this one up. I thought, oh, no, what is that? Alcohol consumption.

But it's quite a lot of alcohol consumption that they're talking about here. Prioritize age friendly and supportive community environments and make screening and treatment for vision loss available for all. And finally, reduce exposure to air pollution. So I think it's just nice for anyone who's listening to this to kind of look at these, you know, what can we do to help keep our cognition and our brain healthy? But now I'm going to jump back into hearing loss, since that's why you're here.

And I think one of the most important things that came out of this report, at least for me, is the report specifically highlights that speech in noise hearing loss, and so many of you will know that as signal to noise ratio loss. So your ability to hear in noise kind of separate from audibility, separate from making the sound louder, but something that continues even when we make the sound audible for people. So again, it's specifically highlighted and it says that speech in noise hearing loss is associated with 1.91

times higher odds of developing dementia. And this is the first time that SNR loss has ever been called out in this report. And I think we all think about, yep, we do need to amplify.

We certainly need good amplification for patients. We need that as early as possible for dementia and cognition prevention. But do we really think about solving that hearing and noise problem as much as we should? And I'm going to talk a little bit more about that as we go. So I want to ask you, how many of you, do you complete speech and noise testings in your clinic?

And so remember, you found those reaction buttons, if you always use them, use those clapped hands. And so you got, you, you have, occasionally you have some nevers. I'm not seeing a lot of clapping. If you, if you take even one or two things away from this talk today, I hope it will be the motivation to test speech and noise in every single evaluation. And I'm talking about signal to noise ratio loss very specifically.

And if you will start to do that on every single patient, you will not only be able to help them better, select technology better, prescribe accessories better, but you will be able to do counseling better as well. So hopefully I'm going to convince you of that before I'm done today. Yesterday, Hannah brought you, brought you these three patients. So she introduced you to these three patients. Peter, who's a new hearing aid user, Greta, who is an experienced user, and Sam, who is a new user.

And we're going to use these patients again to talk through speech and noise. Peter is A restaurant consultant. He has trouble hearing in restaurants, which is not terribly convenient for his occupation. He also has difficulty in conference rooms. He's having difficulty on teams.

His hearing loss is a sloping to severe, or it's a normal in the lows and then sloping to severe in the high frequency. So there's a very common hearing loss that all of you see. It's normal in the lows, sloping, just like we see aging hearing loss often. So that's Peter. And again, he doesn't wear a hearing aid right

now.

Greta is a social worker. She has 18 years of hearing aid experience, but she is having some trouble. She needs to hear every word in her job. It's really important that she hears her clients. She has difficulty in both quiet and noise.

She's having difficulty on the phone and in meetings. Her family is complaining of her TV volume. Her hearing loss is a flat, severe hearing loss. So you, you all will know what kind of trouble that she's having. Sam, get another new user.

He has an active lifestyle. He's a retired pilot. He loves to travel. He loves music. He has trouble understanding noise.

He's having specific trouble understanding the guides. When he goes on tours on his travels, he has trouble hearing. But he has a new Samsung tv. And you'll know why that's important as I go along here. His hearing loss is very much like Peter's.

He has normal lows, they slope to severe high frequency hearing loss. So Peter and Sam, these new users, really have the same hearing loss. But there are better ways to differentiate Peter and Sam if we actually do some hearing and noise testing. So there are, you know, there are different hearing in noise tests on the market today. I am a huge advocate and you'll have to do a lot of convincing me that the quicksand is not the best way to go.

And there's a lot of reasons for that. It takes one minute. Your patient will repeat back sentences. The sentences start at a really high signal to noise ratio. So 25dB above the noise, the speech starts and then with every sentence it decreases 5 dB.

And then there's a very simple math calculation to give you the patient's signal to noise ratio loss. And this is separate from audibility. So remember that this is a completely separate thing than doing a hearing test that's hearing loss. This is your ability to understand speech and noise. And when you start to do testing like this, your patients will actually say to you, oh my gosh, this is the first time that someone ever tested my problem.

Because these patients come in not able to hear in background noise. And we put those hearing aids on and we hope we're helping them, but this is their real problem. And like I say, there are other tests out there. And some tests might have the advantage of being language independent, but when they're language independent, you aren't testing their problem, at least from their perspective. And so again, you'd have to do a lot of convincing me that the quick send isn't the way to go here.

Just to give you some examples of the sentences, these are just the five quicksand sentences from the test. And you can get this test in a couple of different places.

It's easy to find, it's escaping me right now, the names of those places. But I will tell you, by the time this is over, these sentences start out at plus 25. So you're going to hear to have is better than to wait and hope. And then the sentence level will decrease and you will hear the scream before the fire kept in the sparks. And so what you're scoring as the hearing healthcare professional is the number of words correct in each sentence and you're scoring the underlined words.

And so if they get the whole sentence, you get five correct. And so if you look at the example I have here, this particular example, the patient was able to repeat the first sentence, the second sentence got one word wrong in sentences three and four, was only able to repeat a couple of them in sentence five, and then was not able to hear them in sentence six. And sentence six is very difficult. It's the noise and the sentence are exactly the same signal to noise ratio loss. So to get their signal, or I should say the same signal to noise, sorry, not loss, but to get the same signal or to get the signal to noise ratio loss

for that patient, you're going to take 25 and a half, minus 20, which is the total they got correct.

And that's the SNR loss. So just doing that, this loss is 5.5 dB. So the person who did this is 5.5 dB. So what does that mean? So if you have under three db.

And really Mead Killian, who developed this test with Patty McQuette at Automotive Research, really felt 2dB was normal. So 3dB and above, really a hearing, or you have a signal to noise ratio last. If you have patients like this, these are going to be your favorite patients, your patients that come in and all you have to do is make it loud enough and they will hear really well. And when I was at LSU Medical center many, many years ago, and I always tell the story about a patient who. He was my favorite patient in all the years I saw him there.

And he was an older gentleman, and he always brought his wife in, and she was lovely, but she always put up with him flirting with me. And one day he even brought me in this little fake Kubrick zirconia ring and asked me to marry him. And I just said, I don't think your wife is really going to like this. And she laughed. And we had all become pretty good friends at that time.

But he referred me so many patients. He told everyone that I was the best audiologist and you had to go see me. And I always laughed about it. But at the time that I was really getting to know him well, Etymotic Research was putting out this test and Mead Killian sent me a test just to try it before it was even released. And I had this patient come in and he scored 2dB on this test.

He had completely normal hearing and noise. No wonder he loved his hearing aids. No wonder everything worked perfectly for him because all I had to do was make things audible and he was good to go. So let's look at what happens as you go up. So a mild signal to noise ratio loss is three and a half DB of loss up to seven.

So this is that patient on that slide before five and a half. Those are, you know, that's a person with mild loss. So what do you do with a person like that? Well, directional microphones in the hearing aids for sure. This particular patient will probably do okay with a system that works separately with two microphones on one hearing aid and two microphones on the other hearing aid.

So just a very standard basic directional system in a hearing aid, they'll get about 3 to 4dB of improvement, do pretty well. So what about patients that have moderate signal to noise ratio loss? Patients that score above seven or score score at seven and a half or above. These patients really need hearing aids that have four microphone beamformers. And like I said, if there's one thing I want you to take home, it's to do this kind of testing.

And if there's a second thing I want you to take home, it's that there is a huge difference between hearing aids that use four microphone beamformers and those that use two. And I'm going to show you that as we go along here. So these patients really need four microphone beamformers. They also need accessories to solve their hearing and noise problem. And then you will see patients that have severe hearing, hearing and noise deficits.

So signal to Noise ratio last is greater than 15 dB. And you know, I tell the story of another patient of mine again when I was at lsu, she really was never satisfied with her hearing aid. She came often in to get readjusted. She really complained that these just really weren't doing anything for her. And again, at the time that this quicksim came out, I tested her and she had a 17dB SNR loss.

And so there was not a lot more I could do for her. There were no accessories on the market. You could have bought an FM system. But again, that's the price of another hearing aid. And you know, those are expensive.

We didn't have small, you know, companion microphones like we have today. So this test really can get you to look at what those, you know, what the scores are. It will tell you what kind of directionality they should have. And you can also give your patient very realistic expectations about what they can expect. Because knowing that I couldn't really solve all the problems of that last patient I talked about, I could counsel her about those things.

So let's get back to our three patients. Peter has a 9dB SNR loss, Greta has a 16dB SNR loss, and Sam has a 4dB SNR loss. So the patient that you actually really want is Sam, because you're going to be able to solve all his problems and he's going to love you. Peter, you can actually solve all his problems with good hearing aids today as well. Greta.

Greta is going to have to have some more help. So let's take a look a little bit more about this. I would imagine it's news to many of you that SNR improvement, at least in our technology with Resound, is different at different price points. So at our 5 level price point we used a 2 microphone system and it gives about 3,4 db depending upon the environment of benefit. So let's go back to that first patient with 5 1/2 DBSNR loss.

This would bring that patient to about normal. Look at Peter, who was our patient? No, I guess it was Sam. Sam, who's our patient that has 4dB loss. If we can give him 3dB of benefit, he's going to love his hearing aids.

If you go up to our seven level products, you get a four microphone beamformer. And that four microphone beamformer is going to give more like four, four to five depending upon the environment. The worse the signal to noise ratio loss is, the further the speaker is, the less benefit you get. If the speaker is within 10ft, it's not as much noise, you're going to get more benefit. So you can't put exact values on benefits because it also has to do with the environment in which they're in.

But a beamformer is going to give you more SNR benefit. That is, simply because a beamformer can give you a much narrower beam. And when you have a narrow beam, you're just taking out that much more sound around the patient. In our premium technology, we give about 8.6dB of benefit. This is a lot of benefit.

We have a really, really beamformer here, four microphone beamformer, but with a very high resolution, where we are sampling the noise at a very high resolution. And we were able to cancel more noise effectively because of that. So our premium technology will really give you a really good benefit for SNR. Laughs let's look at accessories. You know, 16 decibels is a pretty good estimate of what a companion microphone ours is called the multimic or our TV streamer.

Plus those types of accessories are going to give you FM like improvement. 16dB is a number. It can go up to 25dB. If you're in a very quiet environment and you're just directly streaming the TV signal right to the ears, you can get even more SNR benefit than 16dB, but a good estimate about 16dB. So think about those numbers with regard to those three patients and I will get back to the three patients, I promise.

But I also want to talk a little bit more about these two microphone systems versus four microphone systems. And what I want you to see really is the beam. And so if you are looking at the slide in front of you, look at the polar plot looking part over on the left and you have a patient there and the red is the very, very narrow beam. And you can test this? I mean, I shouldn't say you can.

I mean, you could if you wanted to set all of this up. But as audiologists, we have tested this in our labs by just putting white noise out of a speaker so you can see right in front of that Kemar mannequin there. All we're doing is putting white noise out of the speaker and the right hearing aid is on, and then we're going to turn the mannequ can 360 degrees and we're going to chart essentially where is the sound getting in through the beamformer and where is the sound being attenuated by the beamformer. And so

put your attention back over to the polar plot looking and you'll see red, yellow and blue. You'll See that all over the chart, the red is what's getting through.

That's the noise that's actually coming in. And just like a beamformer or any directional microphone that is facing zero degrees, that that's where the sound is coming in. So you're seeing a very small beam of sound here and then you're seeing the sound above 5,000 spread out a little bit more. And let me, let me orient you to the frequency response. So toward the head is the high frequencies.

And so you can see this on this frequency plot right here. Toward the head would be a 10K. And all the way out to the end of the circle it'd be 125. So that really tight area there is the speech frequencies, that's the really narrow beam. And above that 5,000 in resound hearing aids, we actually open the beam up wider to give the good localization cues that people need.

So now I want to show you the difference between doing that exact exercise on the hearing aid that I just showed, which is on the screen, versus some other hearing aids on the market. So here are two other hearing aids that are on the market today. Both have four microphone beamformers. And again, I'm really just measuring the right ear so you can see the beam and the beam is the red. So just look at that red.

You can see that beam off to the right. You are getting some of that noise in through the left. But that's okay because if you had two hearing aids on, you would just, you know, you just see the left beam kind of right in this area. If you go to brand B, you see even narrower beam, quite a nice beam. But you can just see that everything else, there's no sound getting in.

The directional microphones are attenuating all of that sound. And then if you look at two microphone systems, you're going to see a huge difference. When you look at those two, those two microphone systems, there is so much more red plotted that noise getting through the beam and getting to the

person. You can just tell that you're going to get, you know, you're going to get so much more attenuation of the noise around if you have a narrower beam. And again, these are just the beams.

And it's very easy to see that you don't want to fit a two mic system on people who have really severe problems hearing in noise. And that really includes anything today where noise reduction is concerned, even where AI technologies are concerned, those technologies can do an enormous amount for comfort. New AI technology really can do a lot for comfort, but it does less for SNR improvement than directional microphones. Today, directional microphones are still the way that you're going to hear in noise. So let's go back to our three patients, Peter and Greta and Sam.

So what am I going to do with Peter? Peter has that 90B SNR loss. So hopefully you guys are all thinking he probably needs premium technology. If he doesn't get premium technology, he will need some accessories. So he'll do best in a resound hearing aid.

He'll do best in Annexion 9 that has 8.6 DB of SNR benefit. He's going to hear really well in noise with Annexi 9. But let's say he doesn't choose a Nexia 9, then the counseling really should be around. He will probably need a multi mic. He will probably need an accessory.

And remember, with our multi mic you can plug in really any input into that multi mic and stream to the hearing aid. So it's not just a companion mic. It also even has a T coil in there. So it can do an awful lot for Peter. He can even put that multi mic in conference rooms and use it as a table mic because it has omnidirectional microphones when it is put flat on the table.

So the last thing is that he would have in Anexia at any price level. He'll have Bluetooth low energy audio. And today Bluetooth low energy audio can connect directly to PCs that have an Evo intel processor and Windows 11. If those things are all true and he has that, he can stream from his computer directly to his hearing aids. And that is a huge benefit that Bluetooth Low Energy audio

already has today.

So having Bluetooth low energy audio turned on and being able to connect to his computer is going to really help him for teams and for work. So let's talk about Greta. Greta, she's got a 16 DB SNR loss. Greta is going to have problems no matter what hearing aid she selects in our price points. You know, the two microphone solution is not going to help her too much in noise.

Even the premium technology is not going to solve all her problems in noise. She really needs a multi mic. She probably needs to be using a multi mic, you know, on every conversation that she has. She needs to be hooking that into anyone that she's meeting with. She needs to be streaming to her hearing aids from her computer.

Her TV streamer should help solve the problems that she's having where her family doesn't like how loud the computer is. But Greta is somebody who needs to take advantage of absolutely everything that is available to her to help to help her hear better. And then you have Sam, he's got that four DBs in our loss. Sam's going to do great. In any hearing aid you give him.

There are always benefits of going with higher level technology. In our hearing aids you'll get more noise reduction. You'll get our environmental optimizer where you can do noise reduction per environment and other things. So there, there are things in higher level technologies we all know that would benefit him. But from a directionality point of view he will do well if you fit him with, you know, a basic, more basic technology in R5 or R7 or R9.

So you know he is going to be the patient that is not going to return their hearing aids for credit. It's going to solve his problems. But he also should be recommended a multi mic. You know that you can plug the multi mic into the audio on an airplane and then, and then everything from when he's, when he's off because he likes to travel. When he's on that plane he can have all the movies come straight to

his hearing aid.

And that's a huge problem. I mean we have all the retired people going on these great trips. They get on the airplane and they cannot hear with those headphones that are provided. They would really have to have their hearing aids in many cases. And so if you can just plug it in, it's a great accessory for that.

It's a perfect accessory for him to hand to the tour guide. And so all of these things are good for him. He also, and I told you he had a Samsung TV. Samsung now has all of their new TVs out have Bluetooth low energy audio so he can stream directly from his TV to his hearing aids without any accessory. So he really doesn't need the TV streamer.

Plus he just needs Bluetooth low energy audio today. So these are all things that you can do with the patients. Just to give you a little bit, just a look. This is the TV streamer. Plus this is really simple to set up and it's for TVs that don't have Bluetooth low energy audio.

And again I've talked a lot about the remote microphone. This is oracast compatible. Today when oracast assistants are available on the market, someone will be able to wear this. And Anyone who has AuraCast compatible devices will be able to pick up the signal or whatever the sound is usually clipped to somebody doing the speaking. That again though has a lot of Big benefits to including that line in the battery life's 15 to 20 hours.

It has a really long range, 25 meters of streaming range, and it's simple to pair. You hit one button on this and one button on the hearing aid and it appears.

I also wanted to remind you about Bluetooth Low energy audio, but not spend a lot of time here. You know, Bluetooth low energy audio is the future. Classic Bluetooth will be discontinued. The Bluetooth Special Interest Group has said classic Bluetooth is going to go away over some years. Both of them

will coexist at first, but Bluetooth SIG has decided that Bluetooth Low energy audio is a better Bluetooth than Bluetooth Classic.

It has better sound quality, it has very low latency. That's great for our patients. They don't get a delay in that sound getting to their ears, especially in open fitting where that really matters and has very low power consumption. If you're not aware, it was the hearing industry that asked Bluetooth to create this. So all of the European hearing aid manufacturers and Starkey all approached Bluetooth SIG and asked if we could get a Bluetooth that would work in a hearing aid.

Because even though we have hearing aids with classic Bluetooth, when you, when you have to use 90% of your power to deal with the Bluetooth, you can't do the signal processing in the hearing aid that you really need to do. So it is not a good way to have Bluetooth in a hearing aid using classic Bluetooth. So Bluetooth low energy audio with that power consumption is going to make things different. But we also ask them that we wanted to be able to have multiple streams so that you can connect simultaneously to devices. And that will be coming.

And we wanted to have aurcast, which is the broadcast audio. That broadcast audio is going to start coming really quickly. Just last month we did a demo at Lincoln center with some hearing impaired people able to stream directly from the soundboard in the auditorium right to their hearing aids for a concert at Lincoln Center. So absolutely amazing. This stuff is right on the cusp.

And you definitely shouldn't fit a hearing aid today that won't have oracast capability later. I think I'm going to skip that slide. And then I want to just summarize for you. We started in the beginning talking about the Lancet report and how important not just hearing loss, but your ability to hear in noise is to dementia prevention. It's not good enough to fit a hearing aid.

You also have to take into account the hearing in noise and it Just makes sense. Hannah went through on the first day different hypotheses as to why hearing loss and cognitive decline are related or so closely correlated. And one of the hypotheses is on cognitive load. And if you can't hear noise and you are still having to use all your cognitive load in order to hear noise, we haven't solved their problem. So, you know, really take care to not only solve the hearing loss, but to solve the signal to noise ratio loss as well.

So all of that really is around directionality and hearing and hearing noise and signal to noise ratio loss. But there are other things in a hearing aid we can start to consider and I think there'll be even more research coming out on this topic as time goes on. But you know, consider other things like the environmental classifier. I say consider the environmental classifier because environmental classifiers really are the driving force behind these hearing aids. If your hearing, if your patient's hearing aid doesn't know that it's in a restaurant situation where you want to hear what's in front of you and it thinks that you're in a concert instead, your hearing aid is not going to do all of the things that you want it to do.

So, oops. Let me just go to the next slide. So this is just some research that's published, it's been out there for a while on different hearing aid classifiers. I think the best reference for this is an article by Yellum seti. If you just type into Google Yellum SETI hearing aid classifier, you will find the article.

I can't remember where it's published, but it's a very independent author who looked at the accuracy of environmental classification systems. And then we've done some of our own internal work. As a matter of fact, it's one of my colleagues internal work that inspired yellow studies work. And, and it was really a pretty simple thing to do. You can, in a test box actually present a hearing aid with all kinds of different files.

So you could, you could say for the next 48 hours it's going to listen to traffic noise and then we're going to have it listen to a restaurant and we're going to have it listen in a grocery store, we're going to have it listen in a concert. And then if you just take the hearing aids out and read out the data logging, you'll be able to tell did was the data logging accurate? If the data logging doesn't say you're in a noisy environment or is it, sorry, not just a noisy environment But a speech and noisy environment in a restaurant, then your hearing aids are probably not changing to that environment when you think it is. And unfortunately, all hearing aid environmental classification systems are not created equally. That's Austin White.

That's awful. That's. That's also is the word I'm looking for. That's also why we put program two often as a hearing in noise program and a hearing aid. Because your patient needs to be able to switch to it if your hearing aids aren't aren't switching to directional microphones at that time.

One of the reasons why these environmental classifiers are not terribly accurate is music. Let's say you go to dinner tonight and there's a band playing and you're there with your friend and you want to have a conversation and listen to music, but you're mainly there to have a conversation and enjoy your friend. Is that a music environment or is that a speech in noise environment? I say it's a speech and noise environment. And if your hearing aid thinks it's a music environment, it will do everything opposite of what you need it to do in order to hear a noise.

So be very careful about hearing aids that classify music in their environmental classifier because when they do classify music, and this is all the work of Yellum Seti in that article, he points out that it is the hearing aid getting confused between speech and noise and music environments that really makes the classification inaccurate. So this is really important because if you have a patient who needs to hear a noise and the directionality doesn't turn on, you won't be able to help them then. Another thing that's very automatic and is good for people with cognitive decline is our environmental optimizer. Here is it's

basically an automatic volume control that you can adjust and it'll turn down or up the hearing aid in different environments. And it's often the things that patients will do anyway if they get into a really loud environment that's a lot of noise, they'll get to turn the hearing aid down.

So our environmental optimizer just turns it down for them. And it's just one of those things that people don't have to worry about, which is really good for the automation. And Hannah talked a lot about this. You know, the automated in your hearing aids is the best for someone who has cognitive decline. Noise Tracker 2 also another thing that you know is really needed.

Noise reduction is for comfort. And the more comfort you can provide to someone who's having trouble with listening. Effort is good in our hearing aids. You Know, we actually use spectral subtraction, and we do a really good job of being able to decrease the background noise when it's speech, as well as when it's all noise or white noise. This is something you can instantly do in your clinic.

If you have a test box, just put it in there, give it white noise, and you'll watch the noise tracker turn in or turn on, and it will decrease that noise. If you give it speech babble, you should also be able to watch it decrease the noise and not stay at the same level. So it's really easy for you to test noise reduction in a test box, and I encourage you to do that. Noise tracker by environment is also another feature that we have that's great for people with cognitive decline because it will increase the noise reduction when they get into a more noisy environment instead of keeping the same noise reduction setting for every environment.

All right, this is the screen or the. This is basically what it looks like for noise tracker 2. Hannah's going to even show you this a little bit more. And then for time constants, this is definitely one you want to think about for people who may have some cognitive decl decline and time constants resound. Our company, we are known for that syllabic fast time constants.

And we do it because that's for speech understanding and noise, that you get better clarity of speech with fast time constants. So if somebody doesn't have cognitive decline, you want them to have fast time constants. But if they do have some cognitive decline, slower time constraints do prioritize comfort and can make things a little less confusing for people who might have some cognitive decline. So think about those things as you are fitting patients. So I have a couple of slides just to talk about the negative consequences on safety with hearing loss.

And there's one particular study. Well, there's actually two that are in this slide, but the first one was from the US National Health and Nutrition Survey in the early 2000s. And what they found found was people with a 25dB hearing loss were nearly three times more likely to have a history of falling. And every additional 10dB of hearing loss meant a 1.4 fold risk of falling, an additional 1.4 fold risk of falling. So, you know, falling and hearing loss are also something that are correlated.

In 2012, John Hopkins also did a study on this where people with mild hearing loss were three times more likely likely to have a history of falling. We've actually done some of our own work, and I don't have a slide on it right now, but we did a study out of South Korea where we looked at our different kinds of receivers and showed that we were looking at it. We were looking at our Marie receiver versus our standard receiver. But what we found is that patients without the hearing aid or unaided were more likely to fall in our study than patients that had either of the receivers on base. Basically telling you that if you wear a hearing aid you are less likely to fall.

So safety is really a part of cognition. And I would say it's really more. It's also about hearing everything around you. And so when people are walking, you know, you probably want them to be able to hear everything around them. They need to be able to monitor the environment.

You know, that's one thing at Resound that we do is we try to, even with our directional microphones in our all around program, we try to. Well, we always keep one hearing aid on Omni so that you can get a

wide sound mapping. You can hear everything around and the directional microphone being on so that you can get the speech and noise benefit. Research will show you you don't need more than one directional microphone on unless it's really the worst of environments. And in those environments we will turn two directional microphones on and create that beam.

This is just a study that we did kind of talking, not kind of, but actually evaluating how do you hear from behind when you are in a hearing aid with a beamformer on. And so better is lower in this test because what this means is I had to turn up the sound that was in back 5dB for resound hearing aid in order for the patient to hear it when they are facing front. But if I'm in brand a hearing aid, this is a four microphone, really nice beamformer hearing aid. I had to turn up 10dB and again another beamformer hearing aid, 11dB. And this is just another hearing aid on the market, 9dB, showing that if you have have two microphones that are directional and you're looking forward, it's going to be very hard for you to hear what is in the back.

And when you think about that in terms of safety, that's probably not the best thing for a patient. So the last thing I'm going to just mention really quickly is our Marie microphone or our Marie receiver. It has a microphone in the receiver and it's got got lots and lots of benefits. And this talk isn't about the Marie. And the Marie is a receiver that is really for people with, you know, no more than moderate high frequency hearing loss.

Because There are feedback issues when you put a receiver and a microphone together. So it's not for everyone, but for the people that it's for. There is nothing better on the market. It allows for distance of sound instead of hearing sound in your head. It's better localization, it's better sound quality, it's better hearing in noise, and it's less listening effort when they have to listen in noise.

Again, another thing for cognition or someone who's having problems, giving less effort to listen is always a good thing. So, you know, I want to, I want to point out that, you know, if you have the patient

with no more than a moderate high frequency hearing loss, it will also work for someone who's got a flat loss that you can actually occlude because you won't have any feedback problems. The Marie receiver is absolutely fantastic for those patients. So it's something you should also keep in mind for cognitive considerations. So I'm going to hand over now to Hannah, who's going to take you through some of the software and some of those features that I've already talked about.

Awesome. Thank you, Laurel. I'm actually going to take over screen sharing here.

See?

Okay, so we are now going to talk through some of the software considerations, taking into account some of the those features that Laurel just talked about.

So one of the first things I want to highlight actually is speech scores. So Laurel talked about the importance of speech scores, especially for your patients with cognitive impairment. And I'm going to actually argue that this is an important thing to consider for everybody. So we highly encourage you to actually enter your patient speech score into our software when you're programming their hearing aids. And the main reason we recommend that is because entering speech scores into the system affects how Resound's directionality works.

So it takes a patient's hearing loss, especially if they're asymmetric, into account when the directionality system is changing. And this is especially important for noisy environment. So to enter your speech scores within the software, you actually click on the top right hamburger menu. And when you click on that, the very first option there in the menu is speech scores. So with that on the left side, you are going to have access to enter your patients Quicksin scores, your ear specific quicksand scores.

The right side is where you can enter their word recognition. If you have a system that automatically is integrating audiometry information, it might be integrating this, but I would double check it and add it if it's not already being pulled in. The next feature is actually time constants or These are actually the attack and release times that Laurel was just talking about. So as a reminder, generally a fast attack and release time is what we want to prioritize clarity. But for patients who have poor cognition, they actually do a little better with slower attack and release times.

So you can adjust that within the software so you can really customize for your patients. So you're going to be able to find the attack and release times, or we call them time constants under Advanced features and then under the Speech tab. And how I remember that that's where it's found is you just have to keep in mind that time constants are affecting speech clarity. Speech tab has all the features for speech clarity there. Okay, so time constants then are going to be the second or third feature down, depending on technology level.

You'll notice it defaults to syllabic. But if we have a patient who has poor cognition, we can just simply slow those time constants down all the way to slow. And then you just set it and forget it. Forget it.

The next feature Laurel had talked about was Noise Tracker to per Environment. So this just allows you to adjust how much noise reduction your patient is receiving in their various environments. And it's one of the best features to help improve the automation of the hearing aids, reduce the chances of your patients having to utilize a secondary, secondary program. So you're going to be able to find Noise Tracker again under Advanced features, but this actually lives under the Comfort tab. And again, how I remember what's where is the Comfort tab is where all of our noise features live, because noise is what causes the most comfort complaints.

Okay, so you're going to click on the Comfort tab and you'll see the option for noise tracker 2. This slider bar is going to vary depending on what technology you have. But in a nine level device, there's a

setting called per environment. And when you're selected in per environment, you even have a settings icon you can click on and it opens up how much noise reduction your patient is going to have applied in all those different environments. So, so these seven environments you see are the same seven environments we use for our environmental classification system, the one that is accurate, as Laurel was talking about.

So you can feel pretty confident that if you're going to be making an adjustment in here for a specific environment, it is going to actually kick in and apply in the appropriate environment for your patient. Now, when looking at the screen, you can see for each environment there are little gray circles, circles with numbers inside of them. That is just telling you how much noise reduction is being applied and you can adjust these as you want. So let's use an example of a patient coming into you and saying background noise is too loud. When I'm at Texas Roadhouse with my wife, I think we've probably all heard that complaint before.

Because this is very specific environmental complaint about noise, it should automatically point you to go to noise tracker per environment. Okay. And because this is speech and noise situation they're complaining of, and I think we can all verify that Texas Roadhouse is loud noise, we would adjust for this patient the amount of noise reduction in speech in loud noise environment. So right now our default setting is at 4dB of noise reduction. And I'm just going to move that slider bar to the right to increase the noise reduction just one to two, two steps.

So now when the patient goes into that environment, they have 6dB of noise reduction. Okay. So this is just a great way to customize and automate your patient's hearing aids. A very similar feature here that relies on environmental classification is environmental optimizer. So this is a environmental gain control or volume control.

And because it's simply a volume feature, you're going to find it under gain adjustments and it has its own tab there. So when you see this same seven environments for this, again, we've got our default settings listed in the gray circle. So for example, for soft speech, we're automatically increasing overall volume or gain 2dB. Now an example of a patient complaint where you might want to adjust this would be I like my hearing aids, but I'm struggling to hear my soft spoken granddaughter. That one's pretty easy.

I'd say that qualifies as a soft speech environment. So what we can do is we can take this default setting and move it up to the right. So we're going to increase the gain. So now in that environment they're going to have an extra DB volume boost.

And because we're working with patients who may not be reliable reporters, I want to highlight data logging. Okay, you're going to rely on this much more with patients who have cognitive impairments for software, you can find that under the patient tab. And data logging, you can see how long they're wearing their hearing aids and what situations they're wearing their hearing aids. At the bottom you can actually toggle through how they're adjusting them. And the feature that I like the most for this is actually this volume per environment tab.

So when you click on volume per environment, it's showing you again those same seven environments. The patient is going into, but it's showing you what their typical volume adjustment patterns are for that we can apply this directly to their environmental optimum. So for example, this patient is turning down their volume 2dB on average when they're in a moderately noisy environment. We can just go into environmental optimizer and now make that the default and the patient will no longer need to do that on their own. So just another way you can take all of this and integrate it into these automated processes going on behind the scenes.

So how I wanted to end here, I know we just have a few minutes, is I wanted to come back to Peter, Greta and Sam and we're going to actually talk through how you might use some of these features within the software to address their concerns. So Peter, the restaurant consultant, he ultimately decided to go with the Resound Nexia 7 and a multi mic since he needs a little extra assistance. He's coming in for follow up and he says that he finds he has to adjust his hearing aid volume when he's in noise and he would like these adjustments to happen automatically. So my question for you is, which software solution should you consider adjusting for Peter's complaint? Hand clap if you think it would be environmental optimizer, a heart if you think it would be noise tracker per environment, and then a thumbs up if you think it would be time constants.

Awesome. And I love that I'm seeing hand claps and hearts. The reason being is you can really make an argument for either one and it kind of depends on the technology level he's in. So Peter here is in seven level technology. He actually doesn't have access to that noise tracker per environment.

So we're going to use environmental optimizer for him. It's kind of an easy way for us to address his concerns is just to lower the volume or the gain when he's in a noisy environment. However, if Peter had nine level devices, we would have access to noise tracker per environment and could make those adjustments within that setting. Okay, so going to Greta now, she ended up being fit with nine level devices, a multimod streamer. So she's got all the stuff going on here and she is complaining that speech in general is unclear.

So which software solution would you consider adjusting for Greta? Hand clap for environmental optimizer, heart for noise tracker per environment or a thumbs up for time constants?

Awesome. I'm seeing quite a few thumbs ups. Time constants is the correct answer. So when it's this general complaint that all speeches is unclear, time constants and slowing them down is really the next move. It's more beneficial for these people with cognitive impairment to have a basically have that

temporal envelope maintained.

And that's what we get from having a slow attack and release time. And last one is our buddy Sam, the retired pilot. So he ended up being fit with Nexia nines and a multi mic. And he reports that he's having. He's hearing speech much better but that background noise is too loud when he's hanging out at his local bar.

And I love that I'm already seeing hearts. So, yep, hand clap for environmental optimizer, heart for noise tracker and thumb up for time constants. Fantastic. Because it's a noise related complaint. He's got nine level devices.

We definitely want to look at that noise tracker per environment. Fantastic. So that takes us to the end of our presentation. We really appreciate you guys joining.

I'm not sure that we have time for questions, but we can go through and answer these questions in the chat. I think we've hit most of them in the chat and in the Q and A, so I think we've gotten them all.

Great.

All right, well, we are at the top of the hour, so I will go ahead and end the meeting and thank everybody for attending today and see you back in another event at any time. Thank you.