Optimizing Fittings for Older Adults

Presenter: Erika Porter, AuD

Welcome everyone. Thank you for joining us today. Good morning, good afternoon, depending on where you're coming to us from. As we talk about ways that we can optimize fitting for older adults, I am Erika Porter. I am a senior audiology manager at Phonak and really looking forward to spending the next hour with you digging into how aging affects auditory processing and then getting into the nitty gritty of practicalities.

of what should we consider when we're working with these patients and what technology is available to help you in that processing. This course is part of our, what we call our ECHO series. ECHO stands for Enhancing Cognitive Health with Hearing Optimization. You may have listened or watched one of our prior recordings as part of this series that is also here on AO, that is Foundations of Cognition and Hearing Loss. and that if you haven't watched that one, that's a great one for really setting some of the foundation of what do we know is going on with cognition in relation to hearing?

What does the research show us? And what are practical things that we can do in clinic when we're helping those that may have some of those cognitive declines? This is a topic that gets it certainly is very important for us in our field because it's something we deal with every day. When we take a look at the population growth and put it a little bit in perspective, here are some numbers from the World Health Organization. Over the next 25 years or so, both the percentage of older adults as well as just the absolute number is showing very significant rise.

So going from 10% of the population to 16% that are over the age of 65. And the ones that the numbers that I find even more striking are these two lower ones. So adults that are over the age of 65 is the number of adults is expected to double by 2050. And adults over the age of 80, that number of adults is expected to triple. So you may hear things being referred to as aging societies.

This is what we mean. So the aging population is growing at a very rapid pace due to longer life expectancies. So we have advancements in technology and healthcare. We have healthier living. And

so there's going to be more and more people that fall within this category that we know is something that we that we are, this is our population when we're working with adults for the most part, obviously hearing loss across all ages, but we know that a hugely significant number over the age of 65 have hearing loss.

Now, in addition to just hearing loss, one of the things that we take a look at or that it's good to understand has to do with cognition. and cognitive changes over that course of time. We know that aging is different for everyone. And in this graph, it's simplified, but it's taking a look at normal aging versus pathological aging. Pathological means caused by a disease.

So normal aging, we expect there to be some cognitive decline. This is as a person gets older, there's some diminishing cognitive functions, And so we see some changes in what patients are able to do. Maybe it takes them a little bit longer to process things. Maybe they can't switch between inputs quite as quickly. But with normal aging, those cognitive declines generally do not affect the patient's ability to function, to live independently, to do those higher order functions like learning and feeding themselves, dressing themselves, things like that.

Dementia on the other hand is what we call pathological aging. So this is when cognitive function that decline occurs much more rapidly and to a greater extent. And in this case, it does affect those cognitive functions. It does affect that independent living, as the disease progresses. The faster decline is linked to accumulating pathology in the brain.

And unfortunately, if you look back at the very start of this graph, you'll notice it's hard to tell which line is which, right? It's not always black and white between what is normal aging and what is pathological aging. Sometimes we're not able to tell until things get a little bit further along. And in between those lines is what can be called mild cognitive impairment. This is the gray area, for lack of a better term.

And mild cognitive impairment involves cognitive difficulties more than what would be expected for just normal aging. but not significant enough yet to interfere with the ability to independently perform daily tasks. With MCI or mild cognitive impairment, sometimes it's a precursor to dementia, but not always. That again makes it a little bit of a gray area. Maybe what they're seeing is reversible.

Maybe it's due to medication or sleep deprivation, things like that, where once that is addressed, then those symptoms can resolve and we can see some improvement there in those symptoms. So different levels of cognitive performance that are seen in the adult population. But what I want to highlight here is you'll notice that all of those lines show some decline. So what we're talking about today when we're talking about programming changes and programming considerations, for patients is we're really looking, grouping it as just older adults. Because whether they are adults with a more rapid cognitive decline due to pathological processes or whether they are adults that are just experiencing normal aging with its associated decline, there's some decline either way.

And so the same principles can come into play. And that's what we're going to focus on today. So we are going to talk a little bit about what happens in the brain with those changes and then what is guidance that you can use as you're working with those patients. So let's get started.

What do we know about how sound is processed in the brain? Well, we know it's a very complex process. If you go back and think about in school when you were learning anatomy and you were learning the auditory pathway, we know that it starts peripherally, but then as it works its way up into the brain, it passes through several different regions ending up at the cortex. And with the brain, when it comes to processing sound, There are different dimensions that are needing to be encoded and different parts of the brain can be responsible for those various coding processes. So the brain is looking at things like loudness.

Some places may look at rhythm or patterns. That information helps feed into the ability to tell that sounds are different. that it's not just all one sound, but there are different components or different complexities to it. And then when you add in not just hearing that the sound is there, but identifying and putting meaning to that sound, that also, again, very complex for understanding the words and the phrases, for grasping the grammar and the meaning. So a very complex process that requires complex connections.

The brain is all about those neural connections there. Well, when it comes to aging, one of the just underlying facts that we know is that there is physiological change in the brain. And as a result of aging, the brain has fewer connections. So with those fewer connections, it can affect things like processing the timing information, gap detection, which is looking at the spacing between sounds or words, localization, which comes from frequency perception.

Having effects for those things makes it harder to pick out a specific sound or to focus on just one thing and ignore some of the others. So challenging situations, especially like hearing speech and background noise, are kind of get an extra challenge that the patient gets to work with.

When we think about acoustics, again, we're going really far back here, but we think about temporal information and we know that different areas are responsible for supporting the identification of different types of things. So below 50 Hertz, we have our speech envelope. This is helping with just the overall amplification or things up or down. We have voicing and periodicity. And then we have above 500 Hertz, we have those temporal fine structures.

And that's really what provides the granular detail of speech sounds like pitch and formants and are so critical or identifying and distinguishing between sounds. Hearing loss challenges our ability to make use of these spectral and timing cues, which makes it more difficult to understand the speech. What we're going to be looking at today is based on a review of Windle et al. who took a look at the different

studies, the different literature available to really craft some recommendations for these older adults. And within their article, they talk about three different theories that could come into play when we're talking about changes in cognitive abilities.

Because when we think about it, We know that the auditory system processes sound. It brings in the sound, it provides that audibility, but the cognitive process is what interprets those sounds. That's what gives the meaning. That's what provides the content information there. So three theories.

The first is processing speed theory. And this just suggests that as individuals age, that the mental processing slows down. And with that slow down, it takes more energy to think about things, to work through things. And so that uses up more of those resources, which can make it a person need to stay very much in the present, making it harder to start something new or to think about things more in the past. So things just working a little bit slower as we age.

We know certainly physically we're a little bit slower. This is saying that mentally that slowdown can also have an effect.

The second theory has to do with working memory. Working memory is what stores and processes information relevant to the current task. And there's a limited amount of resources available. If you think about your computer, your laptop, this is like the RAM, your RAM to access memory. Just as RAM temporarily stores data that the computer is currently using to run programs and perform tasks, working memory holds that information for us as individuals.

When the RAM is full, the computer may slow down or struggle to perform those tasks. Similar to if working memory is overloaded, then again, we don't have as many resources to do those functions.

The third theory ties into that and has to do with inhibition. So this is saying that as we age, that we lose some of our ability to filter out the irrelevant information. So our working memory may become cluttered for lack of a better term because we're not as good at ignoring things that we don't need to give attention to right at this moment. Now, these are three theories like many things when it comes to cognition, there is not a clear cut, it is this or that. And in all honesty, it's probably has some additive or combined effects.

When we look at a meta-analysis of data, it shows correlations between speech and noise performance and these various cognitive functions. So we know that there are some relationships there, things like processing memory, inhibition, working memory, episodic memory. We just talked about those. So there are strong links between some of those. And the truth is with those theories, it's probably going to be a combination of some sort.

One of the topics that we also focus on when we're looking in this area of looking at cognitive function and hearing is increased listening effort.

Listening effort we know is again looking at a finite set of resources. We have a certain amount of energy or attention to put towards listening. And when things become more difficult, then which can happen when we don't have as many cognitive resources to put towards something, then it increases our listening effort. We have to work harder to hear.

Our rate of listening effort can vary depending on the environment. So is it more challenging? Is it supporting the patient and making things a little bit easier? Also the individual's motivation. to overcoming.

If I am at a, maybe I'm with friends in a noisy place and I wanna hear that conversation, my friend's telling a story and I don't wanna miss out on anything, I'm willing to expend more energy and more

listening effort to really tune into that. If it's a topic that I don't care about, then maybe I don't have that same motivation. And so I don't, it's, to me, it's not worth expending that effort. When we think about listening effort and hearing, It is an important topic because we know it's something that our patients deal with. And we know that its effects are worth evaluating because if we can reduce someone's listening effort, if when they put on their hearing aids, they don't have to strain as hard to hear in those situations, they're not as fatigued at the end of the day, that can absolutely Affect motivation in a positive way.

I want to wear my hearing aids because it's helping me with listening effort. We also know that with reduced listening effort, then me as a patient, I'm willing to be in those noisier situations. I can handle that noise better. I have more willingness to be engaged socially. And we know that connections, social connections are so critical.

to us as adults, but especially as we're aging for healthy aging, that social emotional well-being very much tied to connections.

So the great thing is, is that we as providers can help with this. Now, you and I both know hearing aids are not perfect. We know that hearing aids can't put people back to 2020 hearing. We're not going to cure that hearing loss. But they absolutely, 100% no doubt, can make a difference and be very beneficial.

Hearing aids help with audibility, looking to address some of that peripheral sensitivity loss. They have ways to enhance the signal to noise ratio and reduce some of that distracting or background noise, which we know can reduce listening fatigue. So hearing aids, when they're programmed appropriately can make a huge difference in a patient's quality of life. Now at this point, unfortunately, just like we have with our patients, we talk about realistic expectations. I do need to do one quick realistic expectation with you as you're listening.

And that is, wouldn't it be lovely if there was an exact formula that said, if your patient scored this on this test and this on this test, this is exactly how you need to set their hearing aids. Unfortunately, that one-to-one relationship, we don't have that. When we take a look at cognitive tests, we know that they can be very beneficial for identifying cognitive levels or maybe monitoring, But they can sometimes be influenced, especially if verbal instruction is needed, if there's a hearing loss. And their clinical utility hasn't, again, we don't have that. If you do this, do this specifically outlined for everything.

And same thing when it comes to our standard speech audiometry. There's nothing that says X equals why. They again are helpful, they give us insights, but what we're really going to be talking about today are principles because each patient may be a little different. Perhaps like me, you've had a really old 60 year old and a really young 90 year old. There's lots of variability between patients, especially in that aging process.

So we're going to be looking at principles, The primary one is we want that sound to be as clear as possible so that it can support that cognitive processing for our patients. To do that, you are going to need to take into account the patient that's sitting in front of you at the moment. So you're going to want to incorporate their patient input to know what might you need to change, which direction might you need to go? But these are evidence-based principles that will arm you with that knowledge so that as you're working with patients, you have that background and foundation to work with.

So let's talk about practical guidance. I'm all about what can we do once we know the information. And we're going to look at it today in layers. So we're going to look at just the foundation of sound in general, and then we're going to progress into more specific programming and settings that are tools available to you as you're working with your patients.

So the first, again, the first principles that we're looking at are we want to make speech audible with minimal distortion of the envelope, maintaining those gaps between the elements of speech. So again, looking to represent it as realistically as possible. And this comes down to compression, everybody's favorite topic. In regards to compression, today we are going to look at two facets of it. We're going to look at compression speed and we're going to look at compression ratios.

So here we have We're going to start with fast acting compression. And here we have a little snippet of sound. So in our input on the YX, on the vertical axis, time on the horizontal axis. And what you'll see is over this little snippet of sound, we've got a door slamming and then somebody starts talking and then maybe a little bit of speech later on. With fast acting compression, it is based on short attack and release times.

So you'll see here with this green line that we get that door slamming with that really fast attack. So it brings down that sound and then we get the fast release immediately after it.

Fast acting compression can be beneficial. It's good for preserving the audibility of speech signals. So it allows that fast recovery allows for those soft sounds. to come in maybe a little bit more.

And that can sometimes provide additional clarity for speech, especially for those soft inputs. But you'll notice that that fast release with that door slamming, there are reflections to that sound. There's a little reverberation, which is the sound that reflects off surfaces and comes back. And so with that quick release, it allows more of that reverberation in. So because it's so fast acting, when we think about speech, sometimes it can amplify the noise within the gaps.

So makes the gaps less harder, makes the gaps harder to hear because there's other sounds that fill that in. This can distort the speech envelope and cues. It also reduces some of that modulation detection because again, we've got things filling in and so there's not as much definition between those

sounds.

The effects of that reverberation and some of that fast acting oppression also can impact localization. So fast acting oppression, straight fast acting oppression, really not the way to go. Okay, so let's talk about slow acting compression. Slow acting compression is based on longer attack and release times. We've got our same snippet of sound with slow compression when the door slams, they're still a relatively fast decrease in gain, not as fast as fast, but the biggest difference between them has to do with the recovery time.

So you'll see when it comes to the release that there's a very slow and gradual increase of that gain kind of back to the default. What this does is this provides great comfort. Slow acting compression is great for providing comfort, especially in noisy situations. But again, there's some side effects. You'll notice with that slow release, when that speech comes in, we may miss out on some of that, especially the very soft speech.

so it's not 100% the way to go either.

Gatehouse et al did a series of studies looking to look at cognitive function and how it interacts with compression speeds and hearing performance. And so they did a series of studies looking at fast acting compression, slow acting compression, and then a mix of both. And what you're seeing here on the screen is a little bit of the summary of those results. So what they found was that fast acting compression, as we mentioned before, is great for speech intelligibility, especially under ideal conditions. Slow acting compression, is great for comfort and was what was preferred by users.

For all of them, this isn't going to be a big surprise, but for both fast and slow acting compression, when things got more challenging, the benefit declined. So it got harder overall when the situation got harder, whether that was poor signal to noise ratios, higher input levels. But the one that I find most interesting

is when they were looking at Specifically looking at the cognitive performance of an individual. So different levels of cognitive functioning, how did they do with the different types of compression? And what they found was that when cognition was good, fast acting compression was good.

But when cognition got poorer, fast acting compression, they kind of fell apart. So slow acting compression was more consistent across all cognitive levels. So at this point in time, you've probably come to the conclusion yourself, it's again, a little bit of a spoiler alert, but I imagine that you have also determined, okay, really what's going to be best for a patient is a mix of fast and slow compression. Now, in the Phonak software, this is built in automatically for you. So we call it adaptive compression.

And so here you'll see our snippet of sound. And when the door slams, we've got that fast attack. So we've got that comfort there. And then it's going to be a relatively slow release until that speech comes. And then the system's going to recognize, oh, we need to let that speech through.

And so this mix of fast and slow compression is going to provide patients with more dynamic range, reduced perception of reverberation, more comfort in noise, and also comfort for those impulse sounds. Now, not only are we adaptive with compression speeds, but we're also adaptive about when we implement it. Again, really looking to be evidence-based, taking a look at what the research shows us. In those quiet situations, we use the adaptive compression so that we can get the maximum benefit of those audibility cues. But when things are noisier, so for those noisy situations, then we use a mix of adaptive compression 40% of the time and the rest is slow compression.

So this is really to provide the benefits of that slow compression and noise while giving the maximum temporal cues. Now, as I mentioned, all of your Phonak patients, adaptive Phonak Digital is your default for adult fittings. So they're getting this benefit, they're getting this optimized compression, regardless of technology level, regardless of style. And this adaptive compression has been in place since APD 2.0, so everything since Paradise. So this is a great way that we really set your patients up

for success without you having to think or do anything.

Now, I want to show you an additional tool that you have in the software. As mentioned by Gatehouse and their crew, they found that individuals with the reduced cognitive abilities performed better with slow acting compression in the challenging listening situations. So we actually give you an alternative that's even slower. So within your Global Tuning tab, if you go to the fitting formula drop down, you'll see it defaults to APD Adaptive Phonak Digital 3.0, But below that, you'll see an option that is Adaptive Phonak Digital Contrast 3.0. This is again a proprietary prescriptive option that is going to use that slow compression in all environments.

So it just slows everything down a little bit more to give more of those temporal cues and envelope cues for the patients that need it most. This is not something that will ever turn on by default. This is always a choice that you make as the provider. but it's there for any of your target fittings. And again, just a simple click that you can do there within Global Tuning.

So that is talking about compression speed. Now let's talk a little bit about compression ratios. Compression ratios, as we know, has to do with the relationship between soft inputs, average inputs, and loud inputs. and how much gain is given to those and that relationship between them. We know that compression can be extremely useful in making sure that sounds are audible, keeping them within that dynamic range without becoming uncomfortably loud.

But we also know that compression ratios, if things get too high, it can affect those speech envelope cues. Speech can get a little mushy, highly technical term, I know. And so we really want to pay attention to compression ratios as well. And again, Wendell and his team found in looking at the literature that listeners preferred a compression ratio about 2.0 or less, especially in noisy environments. Now in the target software, in the begin and NPO screen, so when it first pulls up and you're seeing the table view, you'll see your compression ratios right under that in the gray numbers

there.

And you'll see that they tend to fall within this range. Again, tools in your toolbox, I want to show you an additional tool that you have if you have a patient that you want to just do an overall compression, an overall change to make things a little bit more linear. Again, in global tuning, you can see that little compression drop down. So it defaults to prescribed compression and this is, the system is going to determine what that is based on the hearing loss, based on the feedback test, the acoustics, it looks at all of that great information. But if you have a patient where you just want to make things overall a little bit more linear, you can come in here and you can choose semi-linear.

I honestly never goes to complete linear, but semi-linear can be helpful. And when you choose that, it keeps your G65, your gain for average sounds or speech sounds the same, and then changes G50 and G80 in relation to that. So again, another tool in your toolbox if you need that for the patient.

Another behind the scenes change that are behind the scenes benefit that's going on that you have available also came when we introduced Adaptive Phonak Digital 2.0. And this is we added an additional knee point for loud sounds. so again, this is happening automatically. It's not something that you have to make. And what that did by adding that additional knee point, it provides still we get that comfort for the high input levels, but it gives us more speech intelligibility, especially for loud speech and noise, and a little bit more freedom to fine tune the input levels more easily because we're able to have that knee point of more range here before this knee point kicks in.

So peeling back the curtain a little bit, showing you what is happening already in the hearing aids automatically to set your patients up for success. It is taking those compression settings into account. So using adaptive compression algorithms with adaptive Phonak digital, giving you the option to slow things down even more with APD contrast, giving you a quick and easy way that you can change compression ratios if you want to make things a little bit more linear overall. So that is our foundation of

ways that we really look to make speech audible, but without distorting the envelope, without losing that gap detection that is so critical here.

Next, what we're going to take a look at has to do with binaural processing and what the brain is doing and what the hearing aids have available to help with changes in that regard. And the first is we know that as we age, our ability to process sound declines. We talked about that, and sometimes this decline can impact the ability to make use and detect some of those interaural time differences, interaural level differences. And so this can make it again, harder to separate things from background noise. So when the hearing aid is able to supply some of that binaural processing, and binaural processing is where the two hearing aids can share that audio signal to provide and integrate some of those timing cues, those level cues, we know that this can make a big difference for patients.

One of the tools that is available in Phonak products that help supply this is StereoZoom. So with StereoZoom, we are again sharing that signal to help focus in on what they need to listen to so that they're not as, they don't, aren't fighting the signal to noise ratio as much. This binaural processing is a great way to improve the signal to noise ratio, reduce the effect of an impact of some of those masking sounds, and reduce cognitive effort. Again, with this binaural processing, we're reducing listening effort, bringing up additional resources. And so using StereoZoom is a great way to set your patients up for success and provide those benefits when patients do have impaired interaural time or level differences.

Now for some patients, most patients are able to adapt to changes with that processing, especially with the support of hearing aids to provide that binaural processing. but you may come across a patient occasionally where they experience binaural interference. Binaural interference is where processing sounds from both ears simultaneously makes things more challenging. So they're not able to adapt to some of that binaural hearing aid use. In these rare cases, you may get better performance with only one hearing aid.

versus a binaural fitting. And this we know goes so against the grain with everything that we learn of the benefits of using two ears, getting that boost. But some patients do experience this. Now you can tell by doing some testing. So if you feel like this is the case, if your patient is coming in and saying, I really do better when I just wear one of my hearing aids, then do a little bit of additional testing.

Beyond standard speech audiometry, you can do aided speech testing and noise to determine if binaural interference is a concern with the performance of this patient. So you will test bilaterally, so test with both ears together, and then test with just the left hearing aid, just the right hearing aid, and look at what those results tell you.

This can be done in sound field testing. You can use speech and noise materials like the HINT, Hearing in Noise Test, or the Connected Speech Test with the standard speech and noise setup of speech from the front, noise from the back. If that performance drops with binaural hearing aids and is better with a monaural fit, then it may be worth considering that for for your patient.

So that is our kind of our second level. Is the patient, can we support that binaural processing for the patient? Or is this one of those rare patients where they really are going to do better with just a unilateral fitting?

The third level where we want to spend the balance of our time is really looking at what tools you have available to help with signal to noise management. Phonak provides multiple features to help with this. And we look at this because we know that when we can reduce or when we can improve that signal to noise ratio, reducing listening effort, that it really can free up cognitive resources. Phonak has a long history of developing technologies aimed at improving the signal to noise ratio, really looking to combat speech understanding precisely in these challenging situations. Smart speech technology is the collection of features that are adaptively activated in a seamless way to support this.

So really looking to optimize conversations and a variety of environments. Today we're going to highlight just some of the members of this collection. We're going to take a look at Speech Enhancer, Stereo Zoom, Spheric Speech Clarity, and Roger.

When we take a look at where patients spend the most time, so looking at data logging of where do patients spend the majority of their time, we know that it's generally in calm or quieter situations. Speech Enhancer is one of my favorite features because in those situations, let's give patients some extra help where they spend the most time. Speech Enhancer gives an extra boost to soft voices in quiet. And when you think about Well, why would that even matter? Why would we need to give a boost in quiet?

Well, think for a moment about where your patient might struggle to hear a soft voice in quiet. Have you ever had a patient that says, I have a hard time hearing my soft grandkids. Or I go to a study group and voices are soft and I have a hard time with that. My spouse starts talking before they get into the room, that distance speech, or maybe it is a companion who has a medical condition where they just can't project like they could before. If we didn't have Speech Enhancer, what would we do?

We'd turn up the gain for soft sounds, which might help with those soft voices, but it's gonna have some side effects. Now they're hearing their footsteps more, they're hearing the air conditioner, and you then have to play the game of, counseling or compromise. With speech enhancer, you don't have to worry about that because speech enhancer is specifically going to look at soft voices in quiet and just provide a boost to those. This is one of our most tested features. We've tested it with mild to moderate hearing loss, severe to profound hearing loss, pediatrics, and all of the groups experience benefit.

So Speech Enhancer has less listening effort. For 34% less listening effort, speech from a distance, 45% less effort with speech from a room. We know that has different acoustic characteristics than just same room further away. That reduction in listening effort, we know that Speech Enhancer also

reduces fatigue. so less fatigue at the end of the day, bring up cognitive resources for improved memory and comprehension.

This is a great way that we can support patients in bring up cognitive resources for where they're at the majority of the time. And this is a great feature. This is in 90 level technology here. Speech and answer comes into play where patients are the most, but we know that the situation where patients often complain about the most is in noisy environments. When we talk about noisy environments, we know that every dB counts when it comes to signal to noise ratio improvement.

We know that when there is hearing loss, For about every 10 dB of hearing loss, wearers need an additional 1-3 dB SNR to maintain their unaided intelligibility. So patients need more help in noise when they have a hearing loss than just someone with normal hearing. Not the biggest news in the world, but a good reminder to keep in mind.

We know one of our best tools that we've had historically speaking in noisy environments to help with that is directional microphone technology. So this is one of the, some of the practical advice for fitting older patients is let them take advantage of directional microphones. Directional microphones improve the signal to noise ratio, It's been shown to improve speech intelligibility in that typical speech and noise situation when speech is from the front, noise is from the back.

And so this is a great foundation and starting point for helping with that signal to noise ratio. This is this number, the 26% is really just looking even at fixed directionality, but we can take it one step further. And again, taking advantage of stereo zoom, this is using binaural processing to create that narrower beam. So we're sharing the signal between the two ears, so it's functioning as a four microphone system. And with stereo zoom 2.0 with its smooth activation, it's smart in knowing how narrow and when it needs to provide that narrowing.

On the screen are some of the benefits that patients see. So 3D be better SNR compared to even just regular fixed directionality. But with Stereo Zoom and its partner speech sensor, so in 90 level technology where Stereo Zoom is being activated automatically as part of AutoSense, Speech sensor is the perfect complement to that to be aware of when sound is coming from the back or the sides, and we'll adjust the beam forming, relax that directionality accordingly so that patients can get better SNR with speech from the side, better SNR with speech from behind. Patients have the ability within the app to even control it a little bit more and make it even more focused for an additional 2.5 better SNR benefit at that maximum strength. So really, this is again happening automatically for your patients to provide them access to sound, reduce listening effort from regardless of where that sound is coming from.

In addition to directional microphones, We also have noise reduction, things like noise block that you've seen. You'll see that in the software. Some of the guidance that Wendell at all recommend or provide is that it's really great to keep that at a moderate level or at least start with that at a moderate level. They talk about how if that noise reduction is too aggressive that it can provide, it can, people have to work harder because it's cutting down more, it's distorting that sound, distorting in the loose term, but it's changing that sound maybe more than they need to where they have to work harder to process what's coming through. Stronger levels of noise reduction can be fine when individuals have higher cognitive scores, but working memory for those with lower cognitive abilities, again, it's finding that balance of lessening the demands for working memory, but not changing it so much that they feel like they have to work harder for that.

So we don't want to affect speech intelligibility, which can sometimes happen if we're being too aggressive cutting down the noise. Sometimes there's little bits of speech components that may fall within those same channels. So start with Edit Moderate and then see where you need to go from there.

Now, one of our features that I am most excited for the difference that it can make with listening effort and freeing up cognitive resources comes with our new Infiniti sphere devices. And this is how new ways of using AI is allowing us to support patient function. So this comes with our deep sonic chip. This is a completely separate chip than what does AutoSense. And so because it's a separate chip, it really we're allowed to use those full resources.

It allows it to be a large DNN, 53 times more processing power, Develop proprietary to Phonak using 4.3 million parameters. And all of this supports the feature that we have called Spheric Speech Clarity. Spheric Speech Clarity is processing the sound scene all around the user in real time. So what it does is it extracts the speech signal enhances it relative to the background noise, and then integrates it into that speech or into that back into the signal that's going out to the patient. And it does it instantaneously, and it does it in every direction.

So here we have our patient. This illustration is showing our patient with all these different noise sources around it. So those are the black, the band, the conversation, the noise, and different speakers. You can see that the speakers, it's harder to pick them out. The noise is definitely there, but it's harder to pull the voices out.

What Spheric Speech Clarity does is it reinforces that speech. It enhances that speech so that the speech really pops and it reduces that background noise. so now as we're talking here, we're able to hear those voices without having to work so hard.

As great as directional microphones are, this really can free up the patient in having a conversation, especially with multiple people. They don't have to work so hard to be sure that they're looking at who they're talking to. It is fantastic. If you haven't had a chance to listen to Spheric Speech Clarity, reach out to your Phonak rep so that they can demonstrate that to you. When we take a look at the difference between what Spheric Speech Clarity can do compared to other brands and what they have available

with their limited DNNs or just directional microphones, what we see is that sphere is up to 3.7 dB more SNR benefit over what anybody else can do.

And this testing was done in a realistic sound environment. So sound all around speech coming concurrent same direction as the noise.

And it really is just a way to set your patients up for success.

So thanks to spheric speech Clarity, patients can benefit from a 10db SNR benefit.

The results also show that patients are two times more likely to hear and understand every word from any direction, which is up to 36.6% 27% more than with other brands. So the significant improvement in speech understanding, again, the reason that we pay so much attention to this is reducing that listening effort. One of my favorite study results just for thinking about the difference it makes to patients' lives is they found that with SpheriQ speech clarity, that patients could withstand almost 3 dB poorer SNR without feeling like things got harder. So without that corresponding increase in subjective listening effort. My friend was telling me about her dad, just to put this in real world terms, my friend was telling me about her dad and she said with his last hearing aids, we would go out to a family dinner at a restaurant and he would fatigue out at about two hours where that was just, that was as much like that was all the energy he had.

She said when he got SPHERE and they went out to the restaurant with family, she said he was still the life of the party four hours in. That's the difference that listening effort and spheric sweeps clarity can make for patients.

Feature levels, as you know, can easily be controlled within the target fitting software. For SPHERE, you'll see it under the program of spheric speech and loud noise. And there's the slider for spheric

speech clarity. The system, again, setting you up for success will automatically determine that starting point. Generally, it's going to start somewhere in the moderate range, again, as a good starting point for your patients.

Now, for those patients with a greater need, to improve the signal to noise ratio. Maybe this is in higher noise environments or over distance. We know that remote microphones should be considered and can really provide a help for that. Roger provides exceptional speech understanding in group conversations and over distance thanks to the adaptive gain. So Roger technology is again automatically looking to say, as that noise increases, I'm gonna increase the Roger signal to keep that positive signal to noise ratio.

So this is a great way that you can, again, set your patients up for success. And Roger On is my favorite Roger microphone because it is so flexible and so easy to use for patients. So patients, even patients with cognitive decline, as they're aging, Roger is still easy to use. You're sitting at a table, put it on a table. Somebody, you're one-on-one, have that person clip it on.

You're talking to maybe a doctor's appointment or shopping, just point it at who you're talking to. So this is a great way to again, set your patients up for success in a way that's practical and easy. Utilizing Phonak's advanced features is a valuable way to ensure that clients have access to the clearest signal possible with the aim of reducing listening effort and fatigue, bringing up those cognitive resources. And again, it's happening automatically at every level from the foundation to individual features. In summary, when we take a look at the body of knowledge around the links between hearing loss and cognitive decline, we know that that's just going to continue to grow.

It's an area where we're definitely putting time and attention for a better understanding. It's important to remember that most adults may not experience dementia, but will experience changes that are a normal course of aging. And so when we are working with these patients, regardless of if it's

pathological decline or just normal aging, we really want to provide the clearest possible sound, to set those patients up for success. And Phonak provides that for you with evidence-based features, evidence-proven benefits to your patients. Now, as you move forward, as you're talking with patients, as you're working with patients in the office, we have tools to help you with that.

So there are brochures that can help support that hearing and cognition conversation. They're available in both English and Spanish. There's also a nice little desktop display where you can put those brochures. That is a great conversation starter. The QR code will take you to the article by Wendell and his team.

If you want to read through all the nitty gritty of what we have talked about today, that is a great resource to have for you as well. We also have resources on just phonak.com/cognition. If you go there in addition to these resources, then you can have, there's also a couple of handouts that are available for you to support your conversations with patients. So there's a conversation starter and FAQ where it takes some regular, questions that your patient may have, some common questions, and provides some additional answers as a starting point for you that you can use as a springboard there. With that being said, we thank you so much for your time and attention today and really appreciate the work that you do in working with patients to help them be successful and help them not only hear better, but also live better.

Thank you so much and have a great afternoon.