The Evidence Behind Infinio Ultra

Presenter: Jenna Valania

Good afternoon or Good morning everybody. My name is Jenna Valenia and I am one of the clinical trainers with Phonak. I currently reside over in Alexandria, Virginia. So I may be one of your local representative. But in case you need additional information after the course, please feel free to reach out to your local Phonak rep, whether that's your account manager or your clinical trainer.

We are so happy to have you joining us today for our evidence behind Infineo Ultra. And really, when we look at evidence, evidence is so important, research is so important. But also how do we apply that research for your patient? Every day your patients come to you as the expert in hearing care. They come in asking questions like, well, what is the best hearing aid for me?

What type of difference will this make? And as providers, we have the responsibility to help them make those informed decisions in the best interest of of the patient. And so how do we do that? Phonak is dedicated to providing you with clinically relevant research so you can be confident in your recommendations to patients. And today that is our focus.

We will be digging into some of the evidence behind Infineo Ultra and what it means for you and also what does it mean for your patients. As I mentioned, I currently am a clinical trainer with Phonak and I do not have any non financial disclosures.

Today we will go through the advancements in AI powered features. We know AI is such a buzzword these days. Describe the importance of that realistic test setup and we will also have the opportunity to walk through how Spheric speech clarity benefits your patients in daily life, not only when they're in background noise. And we're going to do this by following these agenda items. We're going to start with a quick reminder about integrity of research and then we will get into improvements that come with the Ultra performance upgrade and look at the new AutoSense 7.0 and how that performance stacks up in the industry.

We will then build on AutoSense by exploring additional benefits available with Spheric Speech Clarity 2.0. And then finally we'll take the opportunity to move beyond device performances. This is especially important for these results as most patients don't just want to understand a higher percentage of words. We know they want to improve their lifestyle. And so we'll highlight some brand new research that explores the difference Phonak technology makes for reducing listening effort and fatigue, supporting your patient's cognitive fitness and most importantly, improving their overall quality of life.

Get started. So the first one that we're going to talk about today is our integrity in research design, Phonak's evidence labs are set up to demonstrate our commitments to reflecting realistic situations because we want to provide you with evidence that is based on real world scenarios that your patients are likely to encounter in their day to day lives. When you are consuming research, it is important to think critically about the acoustic setup, how it relates to the study objective and how realistic it is for what your patients may encounter. For example, using a single loudspeaker positioned at 0 degrees relative to the listener so right in front of them and presenting co located speech and noise is a setup that is required for some clinical tests, but would not be representative for assessing real world complex noise situations. So looking at your screen here, we see a comparison of two different types of acoustic setups to measure speech and noise.

Feature of a hearing aid that's designed to tackle that specific type of sound scene. Speech and noise, the gray circles. And I'm going to get my laser pointer here. The gray circles represented in Figure 1 and Figure 2 here are around a person in the center of each setup to represent the sensitivity of directional microphones. That's inclusive of that pinna effect.

So your pinna effect is going to be where these little notches are in here. And that's designed to preserve the naturalist because it includes the null points that would be there when listening without hearing AIDS in Figure 1. So on the left side of your screen you see a diffuse noise scene where noise

is coming from all, all around, including right in front where the speech source is. So this setup is designed to stimulate a typical noisy environment where the noise is pretty much everywhere instead of just in one or two static locations. So we are really challenging our technology and we do that so that we can understand the full potential of our hearing aids to provide you with realistic expectations supported by evidence, and also most importantly, what your users are going to experience.

So that's what's going on in Figure 1. We have the speech and noise coming from the front, and then we have noise coming from all around the patient that's sitting in the middle. Now we're going to talk about Figure 2. So on the other hand, this figure shows a lab setup that you might see within the larger field of audiology that represents a situation that is probably less likely to be encountered in the real world. Again, speech is coming from the front, so same as in Figure 1, but this time there's only two noise sources and they're pretty much aimed directly at those null points.

So intentionally, there's not a lot of amplification that's happening at those null points because of the directional microphone. So this physical setup is probably yielding a big perform, big improvement in performance. But what does that mean in real life for your patients? So this is where we encourage you to consider the parameters of the study design and why they may have been selected when you are evaluating research.

So now when we're putting the sound setup into context here, let's put this into action. So here we have setups from Phonak studies. We have three different setups, A, B and C. So over here in image A we have a setup from a test of speech enhancer where soft speech is presented at a distance of 4 meters. Feel free to pop in the chat. Feel free to put in the Q and A.

Tell me about what situations there might be where a patient might want to hear a slight soft or distant voice.

So we have some answers coming in. Maybe they're sitting at a library. Maybe it's a soft spoken spouse. Absolutely. Another one of receptionist.

And those are all great examples here. In this specific setup for this test patient, we see an example of a teacher needing to hear a student or vice versa. Thank you all so much for sharing Setup B. Now here we have the listener in the middle. So this green head in the middle here, we can call him John.

We have John sitting in the middle with the speech coming 0 degrees right in front of John and then at an angle to the right and left. So we have our 0 degrees and we have about 60 to 70 degrees on each side. When might this arrangement appear in your patient's daily life?

Taking a look at our chat here. This is great. It honestly could even be a situation that your patients might be sitting in in your office when we're sitting around a table with others, getting coffee, going to that family dinner. This a cafe. Exactly.

So this is where John is sitting in the middle and he has conversationalists on either side kind of at that 60 to 70 as well as right up front. And then finally we have setup C. So here the listener still, John, is hearing speech from only one side. What real world situation might this represent?

A car. Exactly. And I'm going along those travel lines. We have an airplane. Whispers at meetings.

Absolutely. Now when I was working in clinic, I would always have people be like, okay, well I can hear in front of me now, but what's going to happen when my co worker whispers right to the side? A drive through window. Thank you all so much for your thoughts on here because this is a really common situation. We have people that are sitting next to each other in quiet environments, or maybe in loud environments too.

And all three of these situations, A, B and C, paint a very different patient experience for that patient, depending on what they're doing. And so this is where, when we look at Phonak studies, this is what you're going to see. Research isn't as impactful if it's not going to show you and your patients how the technology is beneficial. And because that's our ultimate desired outcome, not just looking good on paper.

And another thing that we consider with Phonak and our research, and that I really do appreciate, I was actually just talking to a university about this the other day, is we make an effort to leverage as much of the hard work and innovation that happens within the broader field of hearing science as we can. So, for example, here, background noise was kind of the same for a really long time. You either use some kind of static going on or even a multitalker babble if you want to take it to the next level. But recently, all of our labs have began to integrate ambisonic recordings into our studies. And ambisonic recordings are complex and realistic sound scenes that are housed in an open source database called the Art database.

It's ambisonic recordings of typical environments. And that's exactly what they are meant to simulate, real world listening experiences. So in contrast to polar plots of traditional microphones that are rendered in two dimensions, the ambisonic microphone, so that's this one that's pictured right here, looks pretty funky, looks kind of like a sphere. This is able to capture the 3D sound field. And these recordings can be decoded in a way that allows the patient and allows the sounds to come through and be routed through a variety of different transducers.

So whether the patient is listening through headphones, listening through a loudspeaker away, the sounds are still heard in that 3D, like, environment. And it's able to produce that sphere or a bubble of sound, regardless of the setup. So this tool has allowed us to up the ante in terms of how realistic we can make these listening situations in a lab setting. These are also used for independent labs like

HearAdvisor. This is what they do when they do their benchmark studies.

And this is also publicly available, meaning if you wanted to recreate research in your clinic, you could utilize this as well. So some examples of these recordings that we have used in studies include the cafe scene, it includes a dinner party, a food court scene. So some of the situations that you all talked about that your patients would find themselves in when we're looking at our study data. So this means that these patients are able to get not only the wild sound scene of a food court, but they're also able to get transient noises like utensils clattering, somebody coughing and somebody laughing. So in contrast to static background noise stimulus, so think like white or pink noise, which at this point is honestly fairly easy for hearing aids to identify and reduce.

These recordings have a lot of dynamic aspects to them, speech, non speech, which is really going to challenge your patients and challenge those that are in our studies. These more challenging scenes are the ones that we use to put our hearing aids to the test so that we can feel more confident and then you can feel more confident recommending our technology to your patients.

Let's talk about what's new with our research and how it's been applied to Infineo and Infinio Ultra. Phonak has a 25 year history of leveraging artificial intelligence and hearing instruments. So while AI has been such a buzzword, this is not new to us. Since its introduction, AutoSense has undergone continuous improvements, further enhancing its capabilities by increasing sound classification accuracy and adding access to even more features to maximize the user benefit and their satisfaction regardless of the environment. So let's Talk about AutoSense 7.0.

One of the key innovations in Infineo Ultra, so this came out the end of October 2025, was improving the accuracy of AutoSense OS. Leveraging the database of sounds that we used during the development of Deep Sonic, which was part of Sphere, we took the opportunity to train autosense on 18 times more sound environments than the previous generation, making this one the most precise

implementation of Autosense to date, with a 24% increase in classification accuracy according to our technical measurements. Think of this like going from an HDTV to an ultra HD or 4K TV with more precise experience. And the next thing that we wanted to know is if we are improving by 24%, do patients even notice a difference in accuracy? And we wanted to know how this number translated to the patient experience.

So the next couple slides that we're going to be talking about here is looking specific to Infinio. So the purpose of this first investigation here was to highlight the importance of accurate sound classification by autosense. So in noisy environments, the classifier could identify the input as noise only with no discernible target and select the comfort and noise program in which global gain reduction is applied in order to improve listening comfort. So comfort in noise is there for your patients when there is no speech detected. So no discernible target means no speech was detected, only noise.

On the other hand, if speech was detected or is detected by the study participant, AutoSense would select the speech in loud noise program which applies more adaptive features, including a binaural beamformer which is our Stereozoom 2.0 or if it's available, the selected program would be the spheric speech in loud noise, which noise reduction is driven by the DNN or that deep neural network spheric speech clarity. So in this particular study we wanted to better understand if a speech and noise scene was mistakenly classified as just noise, how does that impact speech understanding and sound quality. So to assess this speech understanding, participants listened to and repeated AZ bio sentences in each of those three programs. So comfort and noise speech and loud noise or that spheric speech and loud noise noises diffuse presented from all 12 speakers in an array at a summited level of 70 DBA, while the presentation level of the speech was individualized based on the participant's SNR50. So the signal to noise ratio at which the participant scores 50% correct on single words.

In summary, this is a very challenging listening environment for these patients here.

So as expected, speech understanding was poorest in the comfort and noise program. So that's going to be that purple column on the left here. The speech and loud noise program with Stereozoom 2.0 is going to be your dark blue and improved the performance significantly by 8 percentage points on average. And when spheric speech and loud noise was in the mix, we observed an even larger improvement, 22 percentage points over comfort and noise. And not only was the improvement over comfort and noise statistically significant, it also was statistically significant over the improvement in the stereozoom program.

This data illustrates the benefit of high classification accuracy. The signal processing feature is activated automatically by Autosense 7.0 to improve speech intelligibility in challenging environments. By ensuring autosense is as accurate as possible, we have also ensured patients are able to enjoy these benefits to performance without needing manual programs. This meant we were doing what the hearing aids needed to do. So more accurate classification of speech and loud noise and spheric speech and loud noise resulted in better speech intelligibility.

During that same study, participants indicated their sound quality preferences. So not only how were they objectively doing, how were they performing the most accurately, but what did they like the best when they were listening? In speech and noise, they compared spheric speech and loud noise, the accurate classification condition to comfort in noise the misclassified condition so accurately the patient should be in spheric speech and loud noise. But which one did they prefer? Sound quality preferences were collected using an AB comparison tool and the listeners were blinded to which program was which.

Participants used a tablet to toggle between the hearing aid programs while listening to speech and noise. So this is self paced. They could toggle back and forth as many times as they wanted and listen to as much as the sample as needed. And then they indicated their preferences on a number of

dimensions.

So they rated the clarity, the naturalness, the volume of the speech as well as noise intrusion. So how much was that noise coming through their perceived listening effort? Sound quality and finally, overall preference. And across every single one of these dimensions, participants preferred ferric speech in loud noise, including a 100% preference for the accurate classification ferric speech and loud noise over the inaccurate classification comfort and noise. Taken together, these findings emphasize the importance of correct sound classification by AutoSense.

That 24% increase in accuracy yields tangible correct clinical benefits. Listeners experience improved speech intelligibility and exceptional sound quality.

Speech understanding in noise is also a critical aspect to human communication, significantly influencing social interactions, emotional well being and most importantly, overall quality of life. The ability to discern speech amidst competing sounds is not only a convenience, it's essential for effective communication, particularly in environments characterized by high ambient noise levels. So your restaurants, social gatherings, public spaces, things like that. Recent advancements in hearing aid technology have significantly improved the way users experience sound, especially in noisy environments. Different manufacturers have different approaches to how they process sound and there's lots of interest in how the different systems compare.

Let's get into this. So this first study here we're going to examine the performance in real world scenarios. So this was just a systemic technical study, meaning no human subjects were involved. Instead, we wanted to utilize KEMAR purely on a technical level. How our DAOR and video performs in challenging listening environments when compared to premium devices of four key competitors.

We are emphasizing here that this test was on Audeo r Infineo, not on the sphere program. To provide an accurate representation of hearing aid performance in real world scenarios. All hearing aids were programmed using proprietary fitting formulas with default feature settings and were evaluated using their automatic programs. So those are three keys. Here everybody is programmed proprietary fitting, default features are the way that they are and they only had an automatic program.

However, there's one exception and that's going to be with manufacturer A. Here it's not possible to access all these features in an automatic program. So there is an Additional condition that was included for Brand A to have that dedicated manual program so we could level the playing field. The speech signal that was used was the ISTs. So that international Speech test signal, which was presented consecutively from zero, so right in front, 60 degrees and 90 degree azimuth.

The noise that was used was the ambisonic cafeteria scene and was presented from all 12 speakers in the array and was co located with the speech. So as a brief refresher, all 12 of these had noise coming out and then also co located with where the speech was present as well.

The outcome measure that was used to assess and compare performance across manufacturers was an SNR improvement. So in other words, the DB change from the input, the SNR that would reach the ears in the unaided condition, which was 0 dB to the output SNR of the hearing aid after all of the signal processing has been applied. The higher the SNR here, the better the hearing aid is at separating speech from noise, resulting in clearer speech from the patient. So this first one here is when speech was presented directly in front, Audeo R and Finio achieved an SNR improvement at least 2.9 dB over the closest competitor devices. Automatic programs.

The manual program in Device A does a little better in terms of SNR improvement, but it's still outperformed by the automaticity in Infinio. This result highlights two primary advantages of Audeo R Infineo. It offered the largest SNR improvement when processing speech originating from the front and

noisy environment. So when you're facing a conversation partner in a loud restaurant, and it does so automatically through autosense os.

Next part here. Even when we move the speech slightly off access, so on access right in front, zero right in front of the patient, slightly off access about 60 degrees off that patient. The performance of Audio R and Finio demonstrates a significant advantage, achieving an SNR improvement of 7.8 dB, exceeding the performance of the automatic programs of each of the competitor's devices, all of which demonstrate smaller SNR improvements, as well as that manual program offered by Device A.

And lastly, let's look at the performance of Audeo, our Infineo, when processing speech directly from the side. And remember, this is our traditional Infineo. This is not inclusive of spear. You can see that across all manufacturers, the SNR improvement is smaller than in the other conditions in which speech was closer to the center of that front hemifield. So clearly this is a really difficult condition.

Some of you brought up the whispers, the meetings, the cafe, things like that. And so the SNR improvement is smaller than in those other conditions in which speech was closer to the front. But this is also where speech sensor really shines for speech oriented at 90 degrees. So right next to the patient who's listening here, speech sensor will automatically change the microphone directionality from stereozoom 2.0 to fixed directional. It's going to open up that beam, resulting in enhanced access to speech that is not coming from the front.

In a seamless listening experience. Audeo r Infineo once again is demonstrating that clear advantage, achieving an SNR improvement larger than all of the other test devices.

And those are pretty clear results that Aldeo r Infineo provided the largest SNR improvements across all tested devices as well as all sound field orientations, providing beneficial outcomes for patients thanks to the combination of precise classification and the capabilities of sophisticated processing

features. This study shows that just having a DNN doesn't make a product superior. It's what you do with it. Other manufacturers use their DNN for steering traditional noise reduction. But we didn't want to just do program steering.

We wanted to make a difference for your patients in speech and noise. And so we created our own DNN to be able to take performance to the next level. And we're going to introduce this with spheric speech clarity 2.0. As we shift to talk about infinioultra sphere, keep in mind that the only reason Infineo R isn't the very best on the market today is because of the introduction of a completely new way of dealing with noise, our Spheric Speech clarity.

Spheric Speech Clarity works on our dedicated DNN chip. And that dedicated DNN chip is called our deepsonic. It extracts the speech, so it takes the speech, it enhances it relative to the background noise, and it integrates it back into the signal for instantaneous separation of speech from noise in any direction. With Infineo Ultra, we created an entirely new DNN architecture that is 30% more efficient so patients can take advantage of the sound processing whenever the situation demands it. In this next section here, we're going to look at how this new processing benefits your patients.

We wanted to specifically focus on the measures that would relate to the especially difficult situation of a dynamic multi speaker conversation. Think about sitting at a wedding table, for example. So let's start with test number one here. One characteristic of a dynamic conversation that occurs in real life is the lack of clear turn taking. Conversation partners don't always wait for one person to finish speaking before jumping in.

I'm thinking of my son's daycare class, for example. He's 2. And I can assure you turn taking is still a work in progress. We wanted to understand how spheric speech clarity contributes to speech understanding when multiple talkers are overlapping with one another. We've done several studies now with Sphere, in which we've examined this very scenario.

But the one that we'll highlight today was completed in Oldenburg, Germany, and is the objective of this was to compare speech understanding performance with spheric speech clarity versus directional microphones. So this is infinioultra sphere just against infineo ultra here. So phonak to phonak is what we're looking at. We assess speech intelligibility for sentences presented at random through three different loudspeakers, one directly in front and one at about 67 and a half degrees to the right. And the left noise was presented from all 16 speakers in the array.

Additionally, there was a short overlap between adjacent sentences, which further added to the complexity. Participants were instructed to listen for sentences starting with the name Kirsten. When they heard this target sentence, their task was to focus their attention on that talker and repeat the last word of each sentence spoken by that talker until one of the other talkers said the name Kirsten, at which point they would shift their attention to the new talker. Anytime I read all of these studies, I honestly wonder how I would do in this situation, even with normal hearing here. This sounds very challenging.

We compared Stereozoom 2.0 versus Spheric Speech Clarity. The left panel of this graph shows the distribution of scores in the percent correct for each condition collapsed across the speaker location. And then the panel on the right side of the screen shows the distribution of the different scores. Anything above the dotted line at zero. So I'll put my laser pointer here, means that means better performance with ferric speech clarity.

As a group, these participants were performing significantly better, almost 20 percentage points better with spheric speech clarity than they were with speech and loud noise. As a reminder, that's going to be your directional microphone. And if we consider speech and loud noise in the reference condition, the median performance there was about 40%. So a difference of 20 percentage points is a 50% relative performance improvement. These results demonstrate that in group conversations and noise, listeners

can expect to understand more of the speech they're trying to hear with that spheric speech clarity.

And the second characteristic of dynamic conversations that we have investigated has to do with speech location. So the first one was that overlapping speech. The second one is going to Be that speech location. In a real life situation, like a cocktail party, a happy hour, cocktail hour at a wedding, you can all think of these situations that you probably may have found yourselves in this most recent month. You can't really predict with certainty where the next thing you want to listen to is going to be coming from.

So in the same study, the sentence were presented from five loudspeakers spaced equally across the front hemi field. So that's going to be pretty much everything from your shoulders moving forward. And the background noise was presented from all 16 speakers. This was an adaptive path, so the level of the noise was all fixed, meaning that level stayed the exact same, but the level of the sentences decreased and increased to reach SNR50. So that's SNR ratio where 50% of the speech can be understood.

Once again, in summary, really challenging listening environment. Also, this study has a unique twist to the methodology. Instead of presenting the entire sentence from one speaker and then the next full sentence from a different speaker, each word of the sentence would be presented at random from a different speaker. And it was the participant's task to repeat the entire sentence. And while you're trying to picture what that actually looks like in your head, we're going to give you a little taste of what this sounded like to participants and afterwards put in the chat what you've noticed here.

There is sound on the next video. And if the sound is not as loud as I am talking through my microphone, you might need to boost your. Your microphone just a little bit to hear this next one.

For this first test, you're going to hear some speech from any of these speakers in front of you. So keep facing forward, but be ready to hear anything from anywhere. Okay? Okay.

Hey, Jenna. I'm not hearing any audio on that. I'm not sure if your settings need to be bumped up or. But yeah, it was. It was quiet.

Are you getting anything now? Yes, I think I'm starting to hear it now. Thank you. Nina kept 15 red beds, sees three old windows. William has 60 green sofas.

Alan ordered 19 white houses. Steven wants two dark spoons. Kathy prefers nine pretty flowers. Nina kept 15 red desks. Doris sees three old windows.

William has sixty green sofas.

And if you did have any trouble hearing that, I will talk with my management team and see if we can get this clip downloaded so that we can send it to the participants that are on this webinar as well. So that first one was when you had the advantage of that stereozoom 2.0. So you had that really narrow Beam form, but sounds were coming from all around you. And then that second scenario was that spheric speech clarity. So even though the sounds were coming from all around you, it was easier for that patient to follow along.

While I found that to be easier when there was just more clarity with that spheric speech clarity. Think about what results are coming from the actual study here. So we're looking at the spatial speech intelligibility here. So again, the panel on the left is showing the distribution of scores. And since we are using a threshold measure here, lower is actually better, so the opposite of what we were looking at before because it means that the listeners were able to understand sentences at more challenging SNRs and by that same logic, anything below the dotted line of zero.

So once again, here's our dotted line. Anything below this here indicates a better performance with spheric speech clarity. And indeed, the SNR 50s were significantly lower compared to the speech and loud noise condition with stereozoom, which is a relative performance change of 44%. Now, it's not necessarily representative of a real world situation that you would need to be able to understand a sentence spoken one word at a time from five different locations. That would be really challenging for anybody.

But it is realistic to not know where the next thing you want to hear is going to come from and to still want to be able to hear that and respond appropriately and also timely. And these data speak exactly to the ability of spheric speech clarity to support patients in performing that specific task. So generally, the results of these two measures in this study tell us that in a fast paced environment, steric speech clarity helps patients to hear more of the conversation.

And so far we've discussed these studies around audibility, around sound quality, and around speech intelligibility.

There are useful device performance measures that provide a solid foundation. But we know for your patients, they're not the end all, be all. And at Phonak, we recognize that for participants to achieve our vision of a world where every, everyone is able to live a life without limitations, we need to look at the patient holistically. Ultimately, our goal is not just a high speech intelligibility score, but a better quality of life. And with this next set of studies, we'll start working our way up this pyramid of health benefits.

So a lot of times with studies, we're really stopping here. Maybe we're stopping here. So audibility, but also speech intelligibility. This is where a lot of manufacturers are really locking in, maybe moving into some ease of listening. But we are going to take all of these to the next level here.

So with our ease of listening we are going to start working our way up the pyramid. As providers, we intuitively know that with hearing loss individuals have to expend more effort to listen and follow auditory signals, especially in these challenging environments. Feel free to pop in the chat or think as we talk here. How does increased listening effort manifest in your patients lives? What are the outcomes of increased listening effort?

Taking a look at our chat here, Absolutely. Fatigue, ignoring people. Lots of votes for fatigue coming in. I'm sure some of you, even if you have normal hearing, being able to follow along those sentences in really challenging environments can be very, very tiring. We also notice that people are withdrawing from those social situations so not even going there to begin with.

And we really can all agree that this is a critical area of focus for improving patients lives in the real world. And Phonak technology reduces listening effort for your patients. We have two outcomes to show this. So these were all part of that study in Oldenburg. And so it was the same cohort in the same conditions tested the stereozoom 2.0 and our spheric speech and loud noise program and Spheric speech clarity.

And one of these outcomes was perceived listening effort measured using the adaptive categorical listening effort scale or the test that we have our A Kali's test. The way this works is when the participant is in this environment, they have a tablet or a computer touchscreen in front of them and they have this vertical scale on it. They'll listen to three short sentences presented one after the other. They don't need to repeat anything. They just need to rate their listening effort for that group of sentences on this scale from effortless, so easy to understand to extremely effortful.

After each rating the level of speech then adapts. So then they hear more than three sentences, they make their ratings and it adapts again. When the testing is complete you have a function that shows the SNR that resulted in each level of rating of listening effort across the scale. So pretty cool looking at

kind of on average how much SNR is required for different amounts of efforts for these patients. And here we were interested in listening effort for off access speech so presented from the loudspeaker directly at the side so that 90 degree angle indechi background noise, background noise is coming from all around the patient.

And this relates to those examples you gave at the start of the presentation as someone sitting beside you, the car, the drive thru window, whispering at meetings, things like that.

And to make this figure Somewhat more readable so that we weren't trying to look across all different levels of effort. Here we have collapsed these across categories representing low effort, moderate effort and extreme levels of effort. For each of those broader categories, we were looking at the SNR that resulted in rating of listening effort. So for example, listeners perceived little to no effort at SNRs above plus 5, whereas at the negative SNRs they reported extreme levels of listening effort. Makes sense, right?

When you see that in each category the green boxes are for spheric speech clarity are at that lower snr. So with each of those three broad categories, the participants could tolerate a more challenging situation without having to work harder. So as an example, if we're looking at our extreme side over here, so this last one in Table A. With stereozoom, participants reported extreme listening effort at approximately minus 2 db SNR. But with spheric speech clarity, the effort didn't feel extreme until the SNR was at negative 5 dB.

This study showed that spheric speech clarity reduced listening effort by 37%. For off access speech, participants could listen with even more background noise relative to the speech without an increase in effort when they were using spheric speech clarity. And taking this a step further, remember the task with the overlapping talkers? That setup was used again here. So really challenging setup.

0 degrees and about 67 and a half left and right side. However, instead of using a fixed overlap time between the sentences, the duration of the overlap between adjacent sentences was adapted. So it wasn't always like, all right, you're going to get five sentence five seconds from over here, five in the front, five to the side. It adapted throughout the test until the response accuracy for the participant was 50% correct. The resultant score was the threshold overlap time, which is considered the marker for cognitive load.

The more overlap of the sentences, the higher the cognitive load, meaning more cognitive capacity was available to be used up to complete the task. This test was performed at the beginning and then towards the end of a time compressed auditory day when the participant was expected to be fatigued. A time compressed auditory day is designed to simulate a typical listening day, condensed down to two and a half hours of intense auditory testing in the lab. The effect of listening fatigue in each condition. So therazoom 2.0 versus spheric speech clarity was quantified by comparing performance of the initial test to the retest at the end of their listening day.

And we'll start by looking at the results of that overlap time threshold measure which are shown in the figure at the center of this Screen here. So I'm looking right at this figure here. With SSC or spheric speech clarity, the overlap of target speech and the interfering talkers is significantly longer than when stereo zoom is activated. In fact, it's almost half a second longer, which corresponds to 31% more words per minute that could be understood. The higher overlap time indicates that listeners were able to take on a larger cognitive load, so maintaining that 50% performance in those more difficult situations, suggesting that the effort of steric speech clarity may free up cognitive resources that may otherwise have been used to just try to understand speech and noise.

In other words, with spheric speech clarity, listeners appeared to experience less cognitive load from the speech and noise itself, which enabled them to better navigate this added complexity of overlapping

speech. The figure on the right here. I'll bring my laser pointer up here. We're looking at this figure on the right. Shows the results of the test retest comparison at the start and end of that time compressed auditory day.

So that's meant to simulate an entire day's worth of listening eventually shoved into two and a half hours. A higher number means overlap time got longer from test to retest. And the longer overlap time means better performance. And when we do the same test multiple times, especially in the same study session, there are two things we need to think about. One is the effective training so participants might get better at a task after some practice.

And the effect of fatigue participants performance gets worse as they get tired. Those are two things that we're keeping in mind here. With sphero speech clarity, there was a significant increase in performance from test to retest, evidence that there was significant training effect with this task. However, in the stereozoom condition, performance was slightly worse at the end of the time compressed auditory day compared to at the beginning, indicating that the effective fatigue washed out any improvement that would have come from the training effect. Pretty cool.

These results suggest that the use of spheric speech clarity can reduce the amount of fatigue that patients experience over the course of an entire day.

When we're considering the results from your patient's perspective, feel free to pop in the chat or think about as we go on. What would it mean for your patients to not be as fatigued from listening? I can provide an example here as well. While some things are coming in. So I've worked with a variety of patients across my territory here, and one in particular stood out because she was a young mom and with her she was like, I used to just not be able to participate in bedtime, used to not be able to participate in bath time, not because they were necessarily noisy experiences.

There weren't a lot of people talking. But by the end of the day, she simply could not listen even in quiet anymore. With her new devices, being able to bring back bath time and bedtime and simply reading a story with your kids has been an invaluable experience for her. Some of you have mentioned in the chat that your patients are able to be more engaged in conversations. Kids are able to come home at the end of the school day and have the energy to go play outside or go play with friends at their sports games.

Listening fatigue is so real for everyone. By providing solutions that reduce listening fatigue, you really can be a hero to your patients as well as their families. So finally, in that last study, we started talking about cognitive load and what that means for your patients. And let's keep heading down that road and touch on evidence on how Infinio Ultra supports our cognitive fitness. This is an area of growing interest as more research emerges on the relationship between addressing hearing loss and reducing the risks of cognitive decline.

I'm sure your patients have received something, probably not from you, but something as a mailer talking about hearing loss and changes in cognition and the detrimental effects it can have on dementia. You know, the situations can go on and on. And so we wanted to look at this from a couple different angles to give your patients real world data for how hearing aids can improve that cognitive fitness. This first angle we're going to look at is working memory capacity and noise. So working memory is a cognitive system that temporarily holds and manipulates information needed for complex tasks like reasoning, learning and problem solving.

Unlike short term memory, which passively stores information like what did you have for lunch? Working memory actively processes and coordinates information. It is essential for everyday functions such as following multi step instruction, doing mental math, and comprehending conversations in real time. So in this exploratory study, we tested the ability to perform a test of working memory capacity in

a noisy environment. In this example, it's going to be +5 DBSNR.

The task was an auditory backward digit span task. Once again, another one that I'm like, how good would I really do in this situation too? Participants heard a sequence of two to nine digits presented one at a time, which they were instructed to then enter in backwards order on a computer keyboard. There were two trials per sequence length. If the participant correctly recalled the sequence in at least one of the two trials, the length of the digit sequence was increased by one digit.

The backward digit span was the measure of working memory capacity, and it was defined as the longest sequence the participant could correctly repeat once out of a maximum of two trials per sequence length. So we're going to do this here too. Obviously, not a lot of background noise, hopefully in your environment with me, but I'm going to give you a chance to experience this. So I'm going to say a string of digits when I say go. You can type them into the chat or write them down on your own notebook in backwards order.

Here are the digits. 3, 6, 4, 9, go.

If you wrote 9, 4, 6, 3, you would be correct. And that's your working memory in action. Now imagine doing that with more background noise coming at you from all angles here.

The backward digit spans were significantly longer when sparing speech clarity was on. So that's that green across all these studies is going to be green here compared to real ear sound, which is going to be our light gray. And that's going to be reflecting on improved performance and working memory capacity and noise. So when backward digit spans were longer, that meant patients were correctly responding for a longer amount of time. So here again, one way to interpret these results is that the reduction in noise offered by spheric speech clarity reduces the cognitive load for listening to the digits.

And the reduction in cognitive load frees up resources for the participants to do something else. So in this case, committing these digits to memory and repeating them back in reverse order, the noise didn't impact them as much as it did in other situations. Now, we of course, in Phonak Land recognize that this does not sound like an especially real world sort of task, but we all face these types of challenges. What are day to day situations where you have to keep information in your working memory?

I know my working memory is not as strong and if it's not written down, it does not exist. But maybe it's hearing specials at a restaurant because they might not be written down. You have to listen to them. Remembering appointment times that you need to go to, remembering what to get at the grocery store after you looked in the refrigerator. And maybe you didn't write it down because you're going to remember what you need.

Passwords is another great example that came in through the chat. Exactly. Especially as we have to change them as much as we do now. Our working memory is working hard for us every single day. Now imagine you had to pull that password in the middle of a crowded reception.

And then also while you're in the middle of meeting new people and remembering their names, if you're in a group of these new People hearing these names in noise and then remembering them and then maybe even repeating them back to show that you heard them correctly can be very challenging. And while it's not digits, it's the same sort of skill that was involved in this study here.

And finally, one study that was actually just published at the end of 2025. So truly state of the art here shows how these differences in cognitive load can be inferred from brain activity. We don't have to rely only on the results that come out of behavioral testing and subjective questionnaires. We can also see these results reflected in physiological measurement. So this study really cool looked at functional near infrared spectroscopy.

So fnirfield to investigate the neural basis of listening effort in experienced hearing aid users. So these patients have worn hearing aids before. This type of study is a way to use light to measure the flow of oxygenated blood throughout different areas of the brain. When a particular area of the brain is more active and consuming more energy, we expect it to show a higher flow of oxygenated blood. So similar to how a muscle has more blood flow when you're using it for working out.

So we would expect that any technology that makes listening easier and reduces the amount of work the brain has to do, it should result in a reduction in the oxygenated blood flow to the areas of the brain responsible for this effortful listening. And this study evaluated the impact of spheric speech clarity compared to a standard CALM hearing aid program. Participants listened to sentences presented in noise and repeated the last word of each sentence. And they did this while wearing this really cool looking device here. So the full cap is pictured, but participants just wore a headband version of this device so that cerebral oxy oxygen oxygenation, excuse me, can be measured simultaneously while they're doing that task.

The band was positioned over the prefrontal cortex because the activity in the left lateral prefrontal cortex in particular has been found to be correlated with subjective reports of listening effort. So we want to look at that specific region to see if oxygenated blood flow differed between these two aided conditions. I love this study. I think this one is super cool. In the graph on the left here.

So on our left here. And just orienting you, less blood flow means less and less effortful energy is being spent. In the graph on the left, we can see that while listening with spheric speech clarity, there is significant reduction in oxygenated blood flow in this area of the brain compared to the calm program, suggesting that the left lateral prefrontal cortex isn't having to work as hard and that means it's a reduction in listening effort. Further, the change in oxidization is specific to this area. The reduction was not seen in the right lateral or lower medial regions of the prefrontal cortex, which gives us confidence

that this does reflect a reduction in listening effort.

So up until this point, all of these benefits that have been that we've been talking about related to cognitive performance and effortful listening have been behavioral measures where we ask people to repeat things back when they're challenging, we ask them to rate subjective listening, et cetera. But for this particular task, we can see brain activity showing physiological evidence of lower effort with spheric speech clarity in this program here. Previous studies that have used this technology have examined the effects of amplification compared to an unaided condition. But to the best of our knowledge, this is the first study to show that a specific hearing aid feature can make a difference for listening effort using this type of testing. Listening effort is a thing that we know people do experience.

Of course we all experience too, but it is actually rather difficult to adopt assess systematically. So it's reassuring to see that we see these results are consistent with what we're seeing behaviorally. And all of this brings us to the top of our pyramid. Our quality of life, our social well being and ways that different things, different goals, different rewards can mean so much to different people. When have you heard your patients describe their hearing aids as a way that it helps them to reduce their fatigue, increase confidence, have better energy, and most importantly feel less stress?

All of this helps your patients to have that improvement in the cognitive well being and significant others are able to observe this as well. We know that hearing loss is a third party disability affecting family and loved ones and sometimes those family members are the first to notice a change and so we wanted to hear their experiences as well. Most importantly, their family members and loved ones are super happy that that patient is more themselves. I'm so grateful for the opportunity that you were able to join us today. Whether you're watching live or you're watching the recording.

This brings us to the end of our content. Today we discussed the importance of critically evaluating research. We reviewed the importance and the improvements of AutoSense Operating System 7.0 and

how that performance stacks up. We've been able to build on Autosense with Spheric Speech Clarity 2.0 and we highlighted how brand new research is really helping patients to have that reduced listening effort and fatigue support cognitive fitness and improve overall quality of life. Infineo Ultra is the very best for you and your patients.

Our goal today was to reinforce your expertise as hearing care providers, arming you with the confidence that you need to help your patients be fit with the best solution for them. I don't see any additional questions coming through on the Q and A. And so we are so grateful for all of you joining today for all of your participation in the chat and with Phonak. Together we change lives. Thank you so much for joining.