Beyond the Audiogram: Understanding the Role of Cognitive Screening, Speech in Noise (and more) in Amplification

Recorded January 18, 2023

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- And welcome, everyone, to today's webinar presented by Cognivue, Beyond the Audiogram, understanding the role of cognitive screening, speech, noise, and amplification. We are so pleased to welcome with us Dr. Doug Beck and Dr. Lori Adams. If you'd like to learn more about our presenters, please visit the course registration page on AudiologyOnline to view their bios. And with that, Lori, I'm gonna hand things over to you.

- Great, and I think we're gonna get started here with Doug first, so I'll let him start this for us. Actually, I'll run through our learning objectives really quick. You know, after this course, we hope they're gonna be able to name three cognitive screeners that you're gonna be able to name two symptoms, complaints, which overlap between cognitive disorders and listening disorders, and defined minor neurocognitive disorder versus major neurocognitive disorder. And then, of course, we have Doug Beck here, and he'll go over his relevant financial relationships and everything else. Here you go, Doug.

- All right, welcome. So glad you guys are here. You know, AudiologyOnline always a great venue. We started it, I was part of that original team 23 years ago, 24 years ago, and still amazing, so bill the call, aim your call, thank you for all you do. So my relevant financial relationships, I'm a full-time employee at Cognivue. I still consult for Oticon, Senior Editor at Hearing Review. My irrelevant financials are that I'm still a clinical professor, adjunct clinical professor, State University of New York, Buffalo, and a peer reviewer for many different publications. Next slide please. And there's Lori. So Lori, you want to, well, I guess I'll just, okay. So Lori is also a full-time employee at Cognivue, and that's her only financial relationship that needs to be disclosed.

Other than that, she is a multi-builder, just so we know. Publications and articles. I'm happy to tell you that most of what we're gonna talk about today, we have already published. And that's a great thing because you can look these up. Now, they are included, as you heard earlier, when you are within your account at AudiologyOnline, as

Kimberly was saying, you have access to all of these papers. So we'll just show you briefly. This one's from April. This is the emerging relationship between cognition and audition. This is peer review of Journal of Otolaryngology-ENT Research. Next, cognitive screenings in otolaryngology. This is Jed Grisel and myself. Jed is a ENT doctor. And we were reaching out, trying to get all health professionals involved.

This is not something that audiology can save the world with just our own resources. This is something that we feel very, very important. But the entire medical community, anybody with a license in healthcare needs to be aware and involved in cognitive issues. Very much like Catherine Palmer. As you know, at Pittsburgh, Catherine said many years ago when Sheila's president of AAA, that all audiologists need to be aware of, you know, and be part of the suicide watch, which doesn't mean you're gonna counsel patients who are suicidal. It means you should recognize those signs and symptoms, particularly when people are helpless or they feel there's no reason to go on. And their hearing loss has really just altered their life in a very negative way.

When you see suicidal ideations and other trouble spots, you should certainly refer immediately for management of that. And I feel this is very, very similar with cognitive decline and with mild cognitive impairment. And we'll talk about why. So next article, this is a deeper dive into cognition and audiology. This is hearing review, I believe this one came out in September of '22. And this one, one of my favorites because it goes into biomarkers, which are different things that we can look into chemical analysis or in PET scan, or we can look at alleles and we can look at all sorts of different things that might indicate you have a higher risk than everybody else for mild cognitive impairment or perhaps dementia of some sort.

Next slide please. This is still battling turf wars. So ASHA asked me to write an op-ed a while ago, and this is in the November, December. ASHA no, this is not the one in ASHA. That's my mistake. This was one that was in here will be later in the year, I think

this was November, December. Looking at, you know, is it our responsibility or not to be involved in these things? And we've heard that for the last 50 or 60 years in the otolaryngology and neuro-oncology and audiology. And I give a lot of examples about when it's not expansion of scope of practice, these things are in our scope of practice. If you go to ASHA 2018, it's very clear.

They say, yes, cognitive screenings are within the practice area of oncology. And right now, if you're, and I hope you're aware that the AAA is revising their best practice models and stuff like that. And they circulated to the membership of the American Academy of Audiology. Their latest thoughts on this, which includes that cognitive screening is part of the best practices, scope of practice of audiology. So we're not expanding practice. What we're trying to do is do a better job practicing and to practice more thoroughly. Whole-brain, hearing, and listening. This is beyond the audiogram, this is the ASHA up that I wrote. And basically what I talk about here is the importance of, you know, I'm not a fan of screenings.

The only screening that I endorse is newborn infant screening. I think when anybody has a reason that they should get a hearing screening, they need a comprehensive evaluation. I think we really damaged ourselves as professionals by doing three screenings and probably by doing screenings. You don't see OB-GYN doing screenings. You don't see neurosurgeons, you don't see family practitioners, you don't see pediatricians. When somebody comes in because they have an issue, they get a full evaluation for whatever you, so you get the right answer 'cause all of medicine is diagnosis first, treatment second. And what we tend to do, unfortunately, is we see something that looks like a mild to moderate sensory neural high frequency loss.

And we stop testing right about there unless we have a real good reason. But most of us don't go much deeper than that. And, you know, the numbers are that there are 37 to 38 million people in the USA with hearing loss on an audiogram. But there's another

26 million in the USA who have no hearing loss on an audiogram whatsoever. But they have Supra, S-U-P-R-A, Suprathreshold listening disorders, 26 million people. So these would be people who have ADD, ADHD, dyslexia, Auditory Neuropathy Spectrum Disorder, Auditory Processing Disorder, traumatic brain injury, mild cognitive impair, you know, I could go on and off, right? Dyslexia, all these things. And they will not necessarily have any hearing loss. And when you and I go through, and we do everybody in speech, we say, well the good news is your hearing's normal.

Well, that's not the good news. The bad news is we didn't test thoroughly enough to actually come up with the right diagnosis. And that's true for 26 million. And the fact that you have mild to moderate sensory neural loss does not protect you from ADD, ADHD dyslexia, mild cognitive impairment, dementia, Alzheimer's disease, frontotemporal disorders, you know, Parkinson's with dementia, Lewy body disorders. It doesn't protect you from auditory neuropathy spectrum disorder or auditory processing disorders. These things can and do exist in tandem. And so that's why I'm telling you about all these articles 'cause all of that stuff, all of those references are there. So hopefully you'll grab these. Let's go to the next slide. This is the brand new paper that we just published last week at hearing review cognition and additional perspectives and review 2023.

In this paper, I tried to do things a little differently. I think I referenced about 40 or 45 different papers here that are not mainstream. I mean, I'm hoping that you're all familiar with Hannah Glick and Anu Sharma's excellent work that came out in Frontiers that's about two years old showing the benefits of amplification for many people and how brains can rewire anatomically and physiologically. And I'm pretty sure most of you're familiar with the 2015 paper by Amieva, so I didn't go into those in this paper. I just want to give you some new perspectives and almost every day now, we're in the position where new papers are coming out that are showing the relationship between hearing loss and cognitive decline.

So I feel very comfortable, as you see in this lead sentence here. The evidence indicates that untreated hearing loss does exacerbate cognitive decline. And so I feel very comfortable saying that the bigger question that most of us are unclear on, do hearing aids slow the progression of cognitive decline or reverse it or any such thing. And the answer to that will become apparent over the next few years. Certainly in some cases it has been very successful or appears to be very successful in others, not at all. And what we have to do is we have to keep digging and we have to keep exploring so we can define who are the best candidates for change if we catch it early.

So here's kind of where most of us left off about two or three years ago. The Lancet 2020 came out, and that's what Dr. Gill Livingston and his colleagues wrote this amazing article on, what are your risks for dementia? And turns out 60% of your risk is due to aging and DNA, deoxy nucleic acids. So you can't do much about that. You're gonna get older and your DNA is your DNA, but then he said, you know, 40% of your risk is due to the 12 modifiable risk factors. Now this is what most of us heard about. So the 12 modifiable risk factors, I'm not gonna run through them all, but number one is hearing loss, which has an 8.2 per PAF, which is population attributable factor.

So if you have hearing loss, your risk of dementia increases by up to about 8.2%. Then you have things like depression, social isolation, air pollution, alcoholism, drug abuse, lesser education, all these things that add to that, that combine to make the 40% of potentially modifiable risk factors. So that's kind of where we are in all of this stuff. But what I wanted to do today is let's go to the next slide, and this will be just, what I'm going to do is, is just talk to you. So in an effort to avoid death by PowerPoint, we'll have just a conversation about these topics. And I'll speak for about, oh, I don't know, six or seven hours. Oh no, no, that won't work.

About 20 minutes. And then I'll introduce my colleague, Dr. Lori Adams. And I don't use notes or any such thing, so I'll try to keep it through exactly 20 minutes. My phone says I'm at 2:10 in central, which is where I live in San Antonio. So I'm gonna speak until about 2:30. So hearing versus listening, very important concept to get, hearing listening are not synonyms. And when people make them synonymous, they are wrong. Hearing is just perceiving or detecting sound, that's it. Listening is comprehending sound. Listening is making sense of sound. Listening is, you know, decoding that neural signal so it makes sense so that you can use memory and executive function and visuals, spatial and all of these other brainiac things going on to make sense out of cells.

So when people say, oh, I don't know what somebody just said, well it could be that they missed it 'cause of hearing, could be that they heard it just fine, but they couldn't make sense of it, that would be listening. It's important to understand that when you look at the best practice guidelines for AAA, for ASHA, for IHS, they all say exactly the same thing. Pretty much, pretty much. And what they say is you should absolutely be doing your diagnostic stuff, air bonus speech, right? Reflexes, temps, OES, all that stuff. Absolutely that stuff's very important because that helps a lot. But then they also, all three of them say you should do a communication and listening assessment, that would be the COSI, client-oriented skill of intervention.

The HHIE, Hearing Healthcare Inventory for Elderly, HHIA for adults, the IOI, International Outcomes Inventory, the APHAB, Abbreviated Profile of Hearing Aid Benefit, but something, SSQ, Speech, Spatial and Qualities one of those, you have to do one of those to really understand what the patient is going through. Pure tones do not tell you any of that. Communication and listening assessments should be done by communication and listening examinations or questionnaires or evaluations. And we certainly have a plethora of them, but most of us don't use them. It's a big problem. And then they also, all three say, AAA, ASHA, ISH, they all say you should be doing a

speech and noise test. And I know a lot of hearing care professionals say, "Oh, everybody has difficulty with speech and noise.

Why would I do that?" You would do that so that you can quantify it 'cause if you quantify it, that tells you exactly what type of amplification they need. And I do mean seriously that if you're not doing a speech and noise test, you really have no idea what they're going through. And the fact that they get a 100% in a TDH 39 or an in C2 earphones situation or an insert earphone. The speech and quiet and speech and noise, almost a zero relationship, somebody can have a 100% word recognition under headphones in a booth at a 30 DB presentation level, right? 30 dBSL, 40 dBSL. And that tells you nothing about how they're going to do in noise. Tells you nothing.

And this is a big problem in audiology and hearing aid dispensing and otolaryngology, we all tend to look at their word recognition score for 25 words and we say, "Oh, a 100%, they should do fine in noise." Oh, just pay more attention, better lighting, sit close. But we have no idea what their actual ability is to untangle the neurologic code in a real world listening situation. That's a functional listening assessment. So what I would really recommend is do what AAA and ASHA and IHS say and do a speech and noise test. Now so happens, I wrote one with Dr. Lauren Benitez. If you're using the Quicksend, if you're using the hint, if you're using the BKBs, if you're using 'em and you like 'em, don't change, keep doing it.

If you looked at those and somehow you weren't happy with them and so you're not doing it, you want a quicker test that's free, go to Google, put in Beck Benitez, B-E-N-I-T-E-Z, or you could find it at, it was published by AAA in 2019. Or you can go to my website, which is douglaslbeck.com and go to links and PDFs, and they're arranged chronologically go down to 2019, you'll get it, it's free. And I wish I had an hour to tell you how to do a two minute speech and noise test because that's the one

that Lauren and I wrote. And it's very, very simple. But what it does is it gives you an answer in terms of SNR-50.

Now that comes from decades of research. And the best I can tell you on this is get the 2001 seminars in hearing that Mead Killion wrote. That is to me, you know, the guideline, the encyclopedia of how to do speech and noise testing. And what Mead points out is this, people with normal brains, normal hearings should have an SNR-50 of two or three. That's the signal to noise ratio to get 50% of the words correct. People with a mild to moderate loss need eight. So you can see there's quite a bit of disparity. People don't need things. People with hearing loss don't need things just to be louder. They need it to be substantially louder than the background noise.

That's the SNR-50, the signals noise ratio to get 50% of the words correct. I'm not gonna go into SNR-50 'cause everybody watching this tape is a audiologist or hearing aid dispenser or ENT. So you guys know what signals noise ratio is, not gonna discuss that, but I want to tell you, it's very important to quantify. Why is it important? Well, because we know that as hearing loss increases, you need an ever increasing signal to noise ratio. So if somebody has an SNR-50 of two or three, you could actually fit 'em with directional mics. They probably do pretty well, because directional mics with the dome can improve the signal to noise ratio about two or three dB. But if somebody's SNR-50 is seven or eight, they're going to tell you, gee, I did great with you in quiet, but when I went to a restaurant with my significant other, I couldn't understand what they were saying.

That's because they probably needed seven, eight, or nine dB improvement in signal to noise ratio. Your dome fitting directionals or beam formers gave two or three, maybe four, but that wasn't nearly enough for them to understand clearly. They need a better SNR. So I want to underscore the importance of speech and noise testing. I think I've already done that. I'm gonna move, that's my dog, trying to jump up in my lap and I

think it's so important. We should all be doing it. It's two minutes. It costs you nothing. So look up the Beck Benitez, and again, if you're doing one of the other tests and you like it, keep doing it. Absolutely. So let's talk a little bit about mild cognitive impairment, dementia, Alzheimer's disease, mild and major neurocognitive disorders.

So again, this is just an overview and we've given you all of those papers because it's important to have a good depth of understanding of these things. So when we talk about MCI, mild cognitive impairment, turns out about 22% of Americans over age 65 have mild cognitive impairment. Mild cognitive impairment mostly shows up as memory problems. And it's not that, you know, I could show you this is a pen, right? And you wouldn't know what a pen is, or you don't know where you're putting your pen. That's not what we're talking about. We're talking about when you have a task to do and you totally blanked on it and it's happening on a regular and repeating basis and it's getting worse.

Mild cognitive impairment has been in the literature since about the mid-70s. And what we know about MCI is that that's a terrible term. And the DSM five now recommends we should call it MINCD, which is mild neurocognitive disorder. And I like that. I think it's much less derogatory. Same is true with dementias. The most common of which, of course is Alzheimer's. Now why do you know Alzheimer's and your less familiar with frontal temporal or Lewy body disorders? That's what Robin Williams had. Or why are we less familiar with things like Parkinson's with dementia? Well, the reason that we're less familiar is 65% of all dementias happen to be Alzheimer's. So it's the most common. And the numbers on Alzheimer's are startling.

By the time you hit age 85 in the USA, your chance of having Alzheimer's is 1/3. It's ridiculously high. So it's very, very important. And the thing about when we look at mild cognitive impairment or MiNCD and we look at major neurocognitive disorders like Alzheimer's or Lewy body disorders or frontotemporal or any of these things, what's

the difference? Well, the difference turns out to be something called ADL, activities of daily living. When a patient or a person, I should say, when a person can no longer toilet themselves, can no longer bathe themselves, cannot ambulate, cannot feed themselves, this is when most physicians are gonna start to get very serious about there could be a neurocognitive disorder that going on here.

What tests will they order? Well, there's no conclusive test at this moment. These are called biomarkers, as I mentioned earlier today. And there are some that are better than others. There's an allele test that's really good, just look apoE, apoE-4 is what it's called. And you can look that up and learn more. And in my articles, I mentioned a few paragraphs on that, probably the most conclusive. And if your mom and dad both transfer that, to you genetically, that's a real, you know, significant probability that dementia is possible for you. So these are tests that are important, but it doesn't mean you're gonna have it. Many people who go through mild cognitive impairment never develop dementia, but a lot do.

The numbers on that are also about 20 to 22% of the people with mild cognitive impairment convert to dementia every year. One of the things that we look for in dementia patients is we try to look at plaques and proteins such as amyloid plaques and tau proteins. Amyloid plaques exist in most of us. And there are certainly the more you have, the more suspect you are that you might be a candidate for dementia of some sort or mild cognitive impairments. But it's not a one-to-one correlation by any means. There are certainly people who have abnormal amounts of amyloid plaques or tau proteins who have no signs or symptoms of dementia. So you can have significant amounts and not be a dementia patient.

And these things are, we're improving them every year, we learn more about the signs and symptoms of the disease. And I think that in five years, 10 years, we'll probably have biomarkers that are 85 or 90% on target. Right now, we don't. Some of them are

quite good and I don't mean to be negative, but we don't have perfect biomarkers at this moment. We also don't have any drugs that, that really make a substantial difference for most of the people who are taking the drugs. You know, you've probably heard about some of them, and I don't want to be, you know, dug down around this, but the reality is that the vast majority of patients with dementia don't get much results and some patients do.

And that's going to serve as a foundation for the next step. There's also a lot of talk about amyloid plaques and tau proteins as far as is that the end result or is there something else that caused that? Because we've been looking at these things for about 30 years, and we don't have a solution based on that as of yet, based on amyloid plaques. But there are some newer research models that are saying, well, the amyloid plants, the tau proteins are very, they're significant when you see them in a patient, but it could be like ribosomes and lysosomes that failed. And when those things failed molecularly, to clean up cells, that's why the plaquing occurred. So maybe what we're looking at in amyloid plaques tau proteins is the tail wagging the dog.

We're looking at the end of it and maybe we have to look sooner. So there's a lot of exciting and very substantial research going on and I'm happy to tell you Cognivue is a part of that. We're supporting a lot of different studies and we're involved in a lot of different studies out in this stuff and we don't have all the answers yet, but we're a lot closer to the answers than we were five years ago. So that's a little bit on MCI, about 22% of the population, dementia, that becomes an issue at activities of daily living as those are compromised. Alzheimer's disease we talked about, you should know that Alzheimer's takes as the most dementias. It takes about 20 to 30 years from the time you're starting to have changes until it manifests.

So this is why I don't think hearing aids are going to change anybody in 30 days. These are problems that have been there for 20 or 30 years and slowly but surely they start to

manifest. And as they do, that's when all of us getting involved and it's a little bit late in the game. That's why we want to discover it. Early mild cognitive impairment. As I was saying earlier with the 2020 Lancet study, if we intervene at that point, there's about a 40% chance that we might change the trajectory. So we talked about those things. Let's talk about signal to noise ratio and dementia. Remember, excuse me, just a few minutes ago, I was arguing you should do SNR on everybody.

Turns out, if you go to the UK Biobank study, which I think came out in '21, they looked at 85,000 people, 85,000 people. And they said the people who had worse than typical signal to noise ratio deficits, you know, maybe they had normal hearing, but their SNR-50 instead of being two or three was eight or 10 or 12, you know, those people had about a 65% hazard ratio for dementia. They were going to get dementia probably sooner and probably more severe. Now that doesn't mean that testing an SNR can tell you who's gonna get dementia. These are independent tests. They are not perfectly correlated at all. But there was about a six, I'm sorry, it was 61% hazard ratio between people who had a bad SNR score and people who later went on to have cognitive problems.

If we're not testing SNR, we're not gonna find those other 26 million people because their audios could be totally normal. And again, even having a mild to moderate sensory neural loss doesn't mean you don't also have mild cognitive impairment. So this becomes the issue is that when we see somebody that we expect mild to moderate sensory neural loss, their complaint is the can't understand speech noise, which is the most common complaint of all of our patients. How do we know how much of that complaint is due to their auditory system versus how much is due to other things like mild cognitive impairment, Alzheimer's, frontotemporal disease, could be Lewy body disorder, could be Parkinson's with dementia, could be a lot of things.

How do we know? And the answer to that question, how do we know is to do a cognitive screening really helps us point us in the right direction. Cognitive screenings are screenings, they're not diagnostic. I don't ever tell patients I'm doing cognitive screenings. I tell them I'm going to evaluate their information processing. That may sound weird to you, but David Pisoni at Indiana wrote this brilliant book in 2021, and he wasn't the first one to ever suggest this, but I'm just gonna promote his book, because I read the book I think it's brilliant, he talks about cognitive decline as far as those of us in communicative disorders are concerned is mostly represented by information processing. Now if you go to the Hearing Review January 23, this month, you'll see Dr.

Pisoni and his colleagues wrote a really nice article on information processing. So you have a reference for that as well. So what is information processing? I tell patients that I'm going to see how they remember, how they prioritize, how they think about the stimuli that we're offering, whether it's verbal, whether it's visual, you know, it helps me to understand how they retain information, how they prioritize what they're retaining and how they think through problem solving. That's one thing that I think is very, very important about, and I won't get commercial on you, but the Cognivue Thrive is very interesting to me, which is why I joined the company about a year ago. Because what happens is that's a, just about the only test out there in which you can set the hearing loss aside, so to speak.

Because when you're talking about like the mini mental state exam, when you're talking about the MOCA, when you're talking about the SLUMS, the St. Louis University test, when you're talking about any of those, those are all brilliant tests. I have nothing nasty to say about any of them, and I wouldn't even, I did. But the point is that those tests involve somebody speaking a set of questions or statements, and then the patient is listening and the patient has to perceive, you know, they have to hear it and they have to make sense of it, and then they have to speak their answer. And then the person giving the test has to write what they heard, right?

And there's a lot of interpretation. So with the Cognivue Thrive, it's all visual and motoric. So they sit in front of a dedicated computer, more or less a like a laptop thing and they have a cognitive will. So they visually watch things occur and they have to put them in order and they have to memorize things and they have to look for things and they have to move a wheel to keep up with the stimuli. So their hearing loss isn't a factor, because we don't give them any hearing stimuli. So that's why it's particularly good for audiologists. Now in other professions, other things are big factors as well, right? In optometry you would look for maybe a test that allows people with corrected vision to participate.

But you might have issues if you've chosen a really good test if the patient happens to be blind that they probably couldn't participate in that, they would need an oral test or a verbal test. Anyway, you get the idea. So I talked about the relationship between signals, noise ratio and dementia. And I think this is a big miss in audiology. I have been writing for many years and as have many other people that probably only 15 or 20% of all hearing care providers bother to do a speech and noise test. And I think that's a huge miss and a shame on us. And I think that this is a really important area for us, particularly now in the age of OTC, where we can offer better services and we can be more holistic and we can offer patient-centered care.

It's not just about, you know, your hearing loss, it's about what does your brain do with the information perceived and this is something that I feel we should be doing all along. In fact, Jack Katz was the first one that I ever heard say that he was defining auditory processing disorders when I was one of his students, oh gosh, back in the late 70s. And Jack said, you know, auditory processing disorders, that's what you do with what you hear. And I still think that's universally the very best definition I've ever heard of APT. So I think that when we're dealing with dementia, when we're dealing with mild cognitive impairment, when dealing with sensory neural loss or we're dealing with

signal to noise ratio, these things all come together with what did you do with the sounds that you perceived?

And Patricia Kricos back, you know, 15 years ago was saying that auditory and cognitive problems masquerade as each other. And, you know, if you're not testing deeper and trying to figure out which one it is, the likelihood of you presuming it's one and being incorrect goes up. So now we have these tools that allow us to test very, very rapidly within five, six, seven minutes we can do a cognitive screening. And that gives us an idea that the patient is performing normatively or non-normative. And if they're non normative, I would simply refer them back to their GP, I would refer 'em back to whoever sent the patient to me. I wouldn't necessarily send 'em to neuropsych or anything like that.

You know, I definitely would not skip the GP and our test at when you get in the Cognivue Thrive, it spits out a report that's very detailed. How did the patient do visuals spatial, how did they do with their memory, how did they do with executive function? And it's color coded and it's normative or non-normative. And it indicates, yes, this is a screening, it's not at all diagnostic, but your patient didn't do well on screening. So we're referring back to the GP or the family doctor or the internal medicine, whoever the patient is being taken care of by, and saying, you know, these are the results. And so we're referring to you for further guidance.

I don't pretend to be a psychologist. I don't wanna be one. Cognitive screening. So one of the things to be aware of is there's quite a few out there. The Thrive is the one by Cognivue, that's five, six, seven minutes. Just depends on the patient, you know, because it is adaptive if the patient is very competent and very quick and they're gonna go through it rapidly. If not, it might take a little longer. MMSE is the mini mental state exam. The MOCA is the Montreal Cognitive Assessment, the Mini-Cog, Barbara

Weinstein, Mike Harvey, and I wrote about that in Hearing Review. You can find about that one there from 2016, I think we wrote that, and SLUMS is the St.

Louis University evaluation screening evaluation for cognitive ability. We have some really exciting results looking at test retest. And what we did with those is we compared it to SLUMS, which is the go-to St. Louis University Mental scale, I think is what it stands for. It's funny 'cause I was at St. Louis University for eight years and all of that was developed by John Morley and his group. But I always forget exactly what that stands for. Nonetheless, I think that you, you would be very impressed to see the test, retest as compared to SLUMS, which is what we used on our original FDA applications. And I think we're gonna be publishing that. I think probably by March, I can tell you that we just had a statistician who went through all of that data from fellow, from Rochester Institute of Technology, PhD in the stat.

He looked at all that raw data and he said, "You got a lot of good stuff here." So we're gonna be publishing that soon. I hope to publish it March or April whenever we have time. So that's the deal about cognitive screeners that don't depend on audition. Carol Flexer and I wrote an article, must have been 12, 13, 14 years ago, and we were making this argument that, you know, when people are going for a cognitive evaluation, it's very important that before that, you know, we have a complete audiometric evaluation. Not a screener, not a hearing test. Complete audiometric evaluation to see how is the patient doing? What are they doing with what they hear? Are they able to perceive it correctly?

If they have hearing loss, let's do something to improve their hearing. If they have listening disorders, let's do something like improve the signal to noise ratio to give them a better listening opportunity. And all of these things matter quite a bit. And it's not new. I mean, gosh, Carol and I think wrote that "Listening is Where Hearing Meets Brain." I think we wrote that in 2011, or no, that was 2009. Anyway, you know, I'm old,

sorry, I forget this stuff. And referral criteria. Anytime somebody is non-normative, I think you need to refer, 'cause if you're not gonna refer for a non-normative result, then why do the test, right? Okay, so I have used up my 20 minutes and I am delighted to introduce my colleague, Dr. Lori Adams, and she's gonna take you through the rest of this. And then I will be around for questions if needed. But Lori knows all this stuff anyway.

- Thank you, Doug. Thank you, Doug.

- You're welcome.

- So, you know, Doug's given you great foundation here of why we should be doing it, but I wanna talk about it more from a clinical perspective, right? Prior to joining Doug and our clinical sciences team, I was, you know, in there, in the trenches with Cognivue doing a lot of trainings and seeing what my colleagues were doing out there and, you know, the importance of why we should be doing those best practices. So why should we be doing that cognitive screening? First of all, our patients, right? It can give us more information for more rehabilitative protocol that could give them better outcomes, right? Education. Educating our patients about the ear to brain connection and how they hear and listen, that's how I always practice clinically.

If I had a 20-something in my chair just with some fluid in their ear from ENT, they were gonna get a little semi-lecture on how their hearing is and why it's important to have their, you know, hearing evaluated consistently throughout their life. It may increase our patient satisfaction, right? If they have an idea that it's more than the widget, more than that OTC thing that they can get at Walmart or wherever now, right? Why they should be doing it. And then, you know, it also empowers the patient with information to be proactive in their healthcare. Cognivue has a great Cogniwell report that we can give them along with their score report that talks about lifestyle related risk factors or

medical comorbidities that could be contributing to their scores and why they should start having that conversation with their GP.

And then, of course, our practices, right? More integrated role in the overall healthcare ecosystem, right? Differentiating our practices, you know, that doctor knows that when they're coming to us, they're getting that full evaluation and it can help manage clinic time spent with a patient too. When you have that patient that is scoring well on their cognitive results, right? Are they gonna be that patient that's gonna do very well very quickly? Are they gonna handle Bluetooth or are they gonna handle all those other things? Or does that patient need you to step back and have more frequent visits to get them started? More repetition of the, you know, of those instructions and obviously, should they have some family support?

And I do see, we do have a couple questions, but we'll do get to those in a few minutes. So, you know, this is a thing that we've been talking about for a long time. Dr. Beck already went over the difference between hearing and listening, which can be synonymous. But when I was starting to train our offices and asking, "Hey, what are your protocols?" And most of it was just a basic audiological workup. They're doing otoscopy. They're doing emittance measures, they're looking at that patient's pure tone and results and doing some word recognition and quiet and that's calling it a day. And I'd hear all the time, when I'd say, "Well, why aren't you doing speech and noise testing?"

You know, even, and they're like, "Well, they told me they were having trouble on noise." Well, sometimes they're there telling me they're having trouble with hearing, but we still wanna have an audiogram to have the results to understand what is the level of their hearing loss, right? But as Doug was saying, we need to have that comprehensive evaluation for really understanding their listening and communication needs, right? Those hearing handicapped questionnaires, doing a COSI, an AFAB, doing an HHIA, or

an HHIE, speech and noise testing, cognitive screening, and then additional audiological testing is needed, right? So that's really what I like to say is we're getting to the heart of what's going on with these patients and when we're not doing that information, we're missing out on some of what that patient's having, right?

Because that, again, let's go back to hearing, is just detecting and perceiving the sound. But listening is what we do with it, right? Assigning the meeting, decoding that information, comprehending. All of that information, we should be gathering that data on that patient. I'm gonna go through some patient examples, right? So here, we have somebody with, you can see a normal hearing here, right? 65 year old male, we'll call him Bill W. And his case history, he reports significantly difficulty hearing people around his office, having conversations with colleagues, especially when he is in meetings or when he is out in noise. He's had his hearing evaluated many times around the area with multiple providers. Everybody just keeps saying, "Your hearing's normal," right?

What is that number that we were just talking about? 26.7 million patients out there who have an audiogram like this. Initial evaluation was unremarkable with normal hearing, but if we'd gone that extra step, right? Investigating further, let's say his HHIE score was 40, pretty significant, right? Pretty moderate. Signal and noise ratio loss eight. If we did a cognitive screener using Thrive, right? Mostly normal, but he was outside of limits in memory and executive functioning,. What could we be dealing here with, right? A super threshold listening disorder. Could that patient benefit from having a low gain amplification trial? Should we be doing further testing, an APD avail? Where should we be going with this patient to help him with the symptoms that he is having?

Because as Doug has said before in many lectures, right? We can tell that people are wanting clearer sound. Apple has sold like 150 million units of AirPods and what do they get? They get great sound quality from them, right? They want that sound. They wanna be able to hear people speaking clearly. And what are we at for hearing aids in

2021? I think we sold 4.37 million units in the US, so we know that people are looking for good sound. Those 26.7 million people are looking for ways to hear better when they're struggling. So this is a patient that we, we should really shouldn't ignore. Something's going on at that brain level, how can we help them? Patient number two.

So this is a patient who is a 72 year old female during case history, again, just reports difficulty hearing in restaurants and in group settings. She feels people mumble all the time and she has difficulty understanding them, right? We hear that all the time from our patients. People just mumble, I'm fine, they're just mumbling. Never had her hearing evaluated until today. And then that audit, you know, that hearing healthcare professional just did that evaluation that was just basic, and otoscopy, immittance measures, pure tone air conduction, bone conduction and SRT and WRS, right? Checking that word recognition and quiet even though she complained of noise. And again, sad how many times of her from providers, right? Well, they already told me they had difficulty of noise, but how much, right?

Is it just something minor? Is it just that two to three SNR loss or is it 15 SNR loss, right? We really should be doing these to understand what levels these patients are at. This patient was counseled on the results and that she's a hearing aid candidate and she decides to pursue amplification that day. But how would that make that patient respond to amplification? She may rock it, right? She may do really well with amplification alum. You know, we didn't check her word recognition or cognition. So she may do just fine, but she may come back in and be struggling with the amplification. She's still struggling in noise and things of that nature. So again, if we had that signal to noise ratio and if we did that speech and noise, we have an SNR loss of eight, she may need that additional support of making sure we have instead of just open domes, how are we fit doing that fit?

Does she need a remote microphone? What does she need to support her? And if her cognition is normal and it's just a little bit of speech and noise difficulty, again just adding those in. But then we may have that patient who's really struggling so much that they're gonna almost wanna give up on amplification. I know we've all been there. They can't get used to it, right? They can't get used to the sound. If that patient has a pretty significant SNR loss, let's say 15, and they have cognition results in their memory and executive functioning in the poor ranges, that may be a patient that is gonna need that repetition of instruction. They're gonna need you to slowly work up at those levels, right?

We can't just, you know, be doing, getting them right rock and rolling and trying to complicate things for them. So she may seem like she's with it, but when you're looking at those and actually having a screening and you're having more information on that patient. So I think that's why it's really important to do all those things, all those tools in our tool baskets that we have as audiologists. Let's understand that patient and where they're coming from so that we could lead them down the path to success. So that they're not just giving up and saying, "Why did I do this or why didn't I just get an over the counter," right? This is what we're here for.

There's a great article that was published in ASHA in 2022, and it looked at 129 audiologists in Holland who were working with patients who had cognition concerns. Correct? And what they found was that they could do different settings to help that patient adapt better, right? Set noise reductions strongly. Use identical directional mics in each listening situation. The patient's preferred slow amplitude compression. Rarely use frequency compression. Built up gains slowly. So again, that patient might not be able to take on everything all at once. So we might have to ramp them up. We might need to see them on a weekly basis during that hearing aid fitting, right? We're not just gonna set them off for two weeks and see how they do.

They might be frustrated. How many times have you had a patient come back and they can't even remember how to put them in their ears, right? Again, if you're having some of this information, you're gonna bring that patient in a lot sooner. See if a family member can be involved so that we can get them going in the right direction. Do we have any questions coming up? I know that we did have one question. I'm gonna start taking some questions here. I think that Alex asked when, let's see. Okay, so Alex had asked, when you say refer for non-normative results, we always send back the Thrive report and write up portion included in the Audiometric report. In your opinion, is it sufficient to do, is that sufficient or do you think it requires a separate touchpoint? So I would say, Doug, do you wanna come on off of mute too as well?

- Yeah, I think generally speaking, you know, the report is sufficient. I mean they're special cases when you have unusual patients who have special circumstances that you need to, phone call is probably the most important thing and you know, but chart notes are really spelled out very well in the report. They're written very briefly but very succinctly. And so I think the report, speaks for itself. Again, there are certainly times when I would make a phone call and say, "Hey listen, I'm a little concerned about this patient because," and I think that's totally appropriate. I don't feel you have to do that every time. It just depends. One of the things that I wrote in I think 2014 was everything depends on everything.

There aren't necessarily hard and fast rules for these things. So with it, go with your gut if you think that you should call, 'cause this is an unusual patient, I would definitely call. I would definitely add a little bit more to the chart notes, but it's all written pretty well in those chart notes in the printout.

- And speaking with us too, with this Holland, I know that you have some specific opinions on some of these as well, that you usually talk about that I didn't add in here as a slide, but.

- Yeah, one of the things here is slow acting compression and I know a lot of audiologists have very strong feelings on this. I do too. my feeling goes back to Robin Cox's paper in 2010 where she said it absolutely made no difference. There are patients who prefer one or the other slower or fast, but they didn't necessarily do better with it. She said there was statistically no difference in the results. So that's important to know. And the other thing that's important to know about, and I apologize, my dogs are buzzing while we're doing this, the other thing that's important to know is that you do have adaptive compression now, and adaptive compression changes slow to fast release times based on the acoustics of the environment. So I would most often pick a circuit that has adaptive compression and then you don't have to deal with the slow versus fast release time issue.

- Absolutely. And some people have talked about too with those patients who are really on the poor side, potentially even having it be more linear.

- Yeah.

- Isn't on this side?

- Linear sound. Linear sound is always the very best sound you can get. Right now you're listening probably essentially through a linear system. And when you listen to your music at home through your sound system, that's fairly linear. I mean, it's being compressed on whatever the format is, but when you think about a CD or a DVD, they have about a 90, 95 dB, dynamic range. So things have to get pretty darn loud before you're going to notice the compression and think of compression also as distortion. So if you have a choice for people who have MCI or dementia, you're gonna be better off keeping the signal as linear as possible, as long as possible. You can't always do it. I agree, but if you can, it's a really good option.

- Absolutely. Looks like we may have another, let's see. So I have another question from Alex. So there has been some comments over time with hearing aid fitting that higher end hearing aids offer more noise reduction, however can then distort the sound more with increasing processing. Do you have a recommendation for more mid-level versus high level hearing aids for those?

- Yeah, so this is a major question. That noise reduction in most hearing aids works on amplitude modulation. And you have to understand how this stuff works and most of the people watching this, you have books on this on your shelf, behind you probably. Amplitude compression, speech has about a 30 dB dynamic range, right? When I'm speaking right now, the loudest sound I make to the quietest sounds about 30 decibels. Amplitude compression means that it's looking for that amplitude changes, right? For the amplitude changes in a signal. And when you're at a restaurant, you're at a cocktail party, you've got four or five people, you know, just jammering on at a coffee house or something. Everything's changing very quickly as far as the sound levels.

So the hearing aid is not going to be able to do very much because the amplitude is changing all the time. When you think about hearing aids, the noise reduction works maximally with steady state noise. So you're going to have fan noises, fluorescent light noises, HVAC systems, you know, it's something that's going, it can knock that down two or three dB. So that's great. But that's why these guys in this study, these 129 people said, you know, we would set noise reduction on strong. Now people think that might take away some of the speech signal, but it really won't in most systems. And, of course, the best thing is to always just do a functional analysis, and a speech and noise test as we said earlier and see how the patient is doing with speech and noise.

If you're not making any change, if you go from aided to unaided and there's no change in their SNR response, then the hearing aids aren't helping them. If by the

same token they enter your clinic and their SNR-50 as Lori said earlier, as eight or nine, and you fit them with hearing aids and their SNR-50 goes down to two or three, you've made a remarkable difference. But you wouldn't know any of that if you didn't do a speech and noise test. We think this is time very, very well spent. We think, you know, Carhart and Tillman in 1970, Ray Carhart, the father of audiology said, in 1970, all comprehensive evaluation should have a speech and noise test. And you know, that was 53 years ago and he was right then.

And I think it's correct now and that's why AAA, ASHA and IHS all say best practice includes a speech and noise test, that really does quantify things for you. there're gonna be some people who have an SNR-50 or 12 or 13 or 14 and hearing aids can't reach that. They can't, so what do you do? Well, we have FM systems that can improve it 12 to 15 easily. We have digital remote mics that can improve the signal to noise ratio by 12 to 15 easily. Oh, my patient won't stop. You don't know. And what we do know is they're gonna need a lot of handholding. We're gonna have to try things, we're gonna have to experiment. We're gonna have to see how they do well, and everything depends on everything.

You can't just say my patient has an SNR-50 of 12, so I'm gonna give 'em a digital remote mic. May not work. You may wind up with a Pocketalker, you may wind up with a Telecoil, you may wind up with another assistive listening device. That's fine. 'Cause each patient is unique and you should have a system that you know, if they are a hearing aid candidate, that makes it easy because you know how that works and you can fit that and you can improve their signal to noise ratio. Some hearing aids, you're gonna improve the signal to noise ratio with domes by two to three dB. That's kind of typical. If now there was an article that came out, I think it was 2015, that was Tom Powers and Harvey Dillon and they were saying, you could take a standard hearing aid and improve the SNR by simply closing the ear canal.

Now I know you patients don't wanna close the ear canal, of course, they don't. Nobody does. But it's very important that if you do, now the hearing aid is gonna do a much better job processing because the noise isn't leaking in through the dome, right? So that makes a world difference. You can take a hearing aid that with domes, you get two or three dB SNR improvement and you put a skeleton with a vent or a half shell, now maybe you're gonna improve it to four, five, or six, and there are some premium hearing aids that can give you six, seven, or eight. You know, there are. And so that's remarkably important. All hearing aids are not the same.

I know everybody likes to think they are, oh, I just used brand X, or I just used brand Y, oh my patients, you know, it's just not a good way to go. I mean, you have to be open-minded. You have all these tools, you have all these patients and the reason that we're doctors right, is to find what the exact problem is for the patient, refer if needed or handle it. And if we're gonna handle it, we have to know the degree of dysfunction so that we know what our target is to overcome. So that was probably way too much that you.

- Yeah, it's okay.

- Thought we had wanted to know.

- We have a follow up with that, right? So the SNR-50 tests you created is sensitive to aided testing in the sound booth with AIDS, with speech and noise coming from a physically close source, sound field speakers, not all of the speech and noise tests are as sensitive to changes based on presentation in their experience.

- Yeah, I think that's probably true. We go, in two minutes. If you do the two minute speech and noise test. Again, it was published AAA audiology today, I think it was called in 2019. We started a 15 dB SNR, then ten five, three, two, one. And we actually

get it down to one or two dB SNR-50 as very, very quick. And by the way, you don't need a sound booth because this test is being done in 70 dB SPL. So that's about how loud I'm speaking now, right? And so you don't really care about the HVAC and the fluorescent light hums and all that stuff, because you're presenting way over that 70 dB SPL. And if somebody has significant hearing loss, mild, moderate, I'm sorry, moderate, severe profound loss, you're gonna do it at, you know, their MCL or MCL plus four or five dB to make sure it's, it's audible before you start making it more difficult. So yes, to everything you said, but you don't need a sound booth, you can do this. In fact, the paper that Dr. Benitez and I wrote, we didn't use a sound booth. We did it outside of the booth, but in the office.

- So I'm gonna ask a question that I know, you know, Cognivue providers that we're using Thrive, always asked me, right?

- Sure.

- And that is, you know, when should they rescreen this patient, not only for cognition, right? You know, but should they rescreen their hearing handicap? how is that patient who's never had hearing aids doing, are they doing better? And could they repeat those measures in six months to judge how their patients are doing?

- Yeah, so there's a paper by Gaeta, G-A-E-T-A et all came out in 2022, I think in August. And they looked at personal listening devices versus hearing aids. And so Lori's point, I'm gonna take it a little bit sideways. If you were to take a standard traditional patient, mild, moderate sensorineural, or take a patient who is not doing well with speech and noise and you do a cognitive test and they perform non-normative natively, so they have a positive cognitive screening test, if you put hearing aids on 'em and you test 'em again in 30 days, they're probably gonna do better on the cognitive screening test, why would that be? Well, because you have improved their sensory

perception, you're making more information available to their brain so they can sort through it more easily.

Assuming that we fit using real ear, verifying with speech noise or other verification or validation measures. If we've done a good job fitting them in 30 days, they're going to do better or there's no point in fitting them, right? You get this impression if you test too soon that, oh, they did better. So now their cognitive screening scores have improved. So that's great. To me, those early changes are primarily sensory changes. If you're going to say that there's a probability that you've altered the cognitive course of that patient, I don't think you can see that for three to six months. And that's why we usually recommend retested six months. Brian Taylor back in 2009 did a brilliant study where he looked at, well, how long does it take to adapt to hearing aids?

And the answer is 30 to 45 days. So the first 30 to 45 days that says your brain, which is plastic, right? It changes based on the stimuli. That's your brain getting used to a new sound and learning to use it. And you know, we all have seen patients who do well and rapidly, they adapt to hearing aids and others are slow. And some people used to say years ago, oh well it, it takes some six months to adapt to hearing aids. Well, no, it doesn't, it really doesn't. If it takes six months, something's wrong. So you can, you can look that up, but, but I think that it's very important that we, we don't overread a cognitive screening and we don't unread it.

It's a screening. So what you don't wanna do is say, "Oh look, there's a cognitive change based on the screener." It's not diagnostic. If you wanna say there's been a cognitive change, you have to do a diagnostic test. So I would say if the screening improves in three to six months and if they had a baseline cognitive diagnostic test, then maybe you could do that again or refer for that, right? And see that there's been a cognitive change. But you can't tell a cognitive change diagnostically objectively with the screener, 'cause screeners are not diagnostic screeners are.

- Right, and so that's why I was talking about also adding in repeating that HHIA or HHIE or repeating even speech noise just to see how that patient's doing.

- Right, and then.

- I think that's a good measure of kind of understanding, especially for our normative patients that we're doing low gain amplification on, right? See-

- Right.

- If it's helping.

- And this is such an important point. How much time do I have here? I got about one minute. Okay, so Lori mentioned this in passing, but those patients with normal hearing have suprathreshold listening disorders, that's 26 million of them. We generally, as hearing care professionals have said, "Well, good news, your hearing's normal, we'll see you in a year." Yeah, but 110 million of them bought AirPods. Now do I know that they all had normal hearing? No, I don't, but I'm gonna guess that a lot of them did. So why would they buy AirPods? And by the way, AirPod is only one of the excellent Bluetooth type connectors, right? Because they're getting noise reduction 'cause they're getting better signal to noise ratio and they can focus on the sound they wanna pay attention to.

So I think that patients clearly want a better sound quality and they want a better signal to noise ratio and they want noise reduction. And when you think that all five major manufacturers combined sold about 5 million hearing aids, but Apple sold 110 million AirPods, you can see that 20 times more people are buying those technologies than maybe we would take care of. And I'm not saying fit everybody with normal hearing,

with hearing aids. Nobody's saying that. I'm saying look for hearing loss. Look for suprathreshold listening disorders. Look for mild cognitive impairment. If those people are improved by a better signal to noise ratio, which I think is gonna happen the majority of the time, then maybe that's a good option for them. So thank you Lori, that's a, I'm so glad you said that.

- All right, any last questions? I know that certainly you can feel free to outside of this webinar, email questions to doug@cognivue.com or myself ladams@cognivue.com. We'd certainly, you know, love to hear your feedback. Any questions you have that were not answered today, certainly don't hesitate to reach out to us.

- Get copies of those papers. 'Cause I think they're gonna answer a lot of your questions. I'm really proud of the team effort that goes into that stuff because as you know, writing papers is not fun and it's very, you know, nose to the grindstone. But the reason that we do that is because these are really important things to understand at a deep level. And we don't want anybody going off without, you know, full information and without full instruction and really understanding what we're doing when we are doing cognitive screening, why we're doing it, and what it means. So I hope this has been useful for you. I wanna thank Kimberly and then certainly Lori for participating. And our emails are open, and I promise you we'll get back to you within a day or two if you send us an email. Other than that, have a joyous afternoon and thanks for paying attention.

- Thank you, everyone. Thank you, everyone. Good night.