Back to Basics:
Practical Aspects of Auditory Processing Disorders
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- [Amy] Welcome to our webinar today, Back to Basics: Practical Aspects of Auditory Processing Disorders. Our presenter today is Dr. Gail Whitelaw. She is the Director of the Speech Language Hearing Clinic and a Clinical Associate Professor in the Doctor of Audiology Program at The Ohio State University. She teaches coursework in pediatric audiology, tinnitus, ethics and leadership, and serves as a preceptor to audiology student and provides audiology services. She finds that one of the most rewarding aspects of her job is working with children, adults with auditory processing disorders. So Gail, you are just the one to be here to talk to us today, welcome. I'm gonna turn over the floor to you.

- [Gail] Thanks so much, Amy. I see there's a lot of people on today. And I'm really excited about that. And I've given in my career probably a zillion talks on auditory processing. But we're gonna take it a little bit different direction today. And I want you to think, I want me to think, I want us to share some ideas because as an audiologist, my best partners and working with auditory processing patients, whether they be children or adults, our speech language pathologists, and hopefully, you will see me and my colleagues as a really good partner after this. I may say some things today that will annoy you, or make you mad, and I hope I do because I want this to be a call to action for us. Let me go through my slides and talk about that a little bit. Here's my disclosures. I'm getting an honorarium for this presentation. But most of my disclosures are non-financial, based on the organizations with which I belong. And then today, what I hope you will accomplish by the end of the time that we spend together is that you'll be able to think about characteristics of children with auditory processing disorders, and how those disorders might relate to speech and language skills or academic skills, or cognitive skills. We'll touch on all of that. Listen tests that I might use for assessment, and how they differ from what you might use for assessment. I'm gonna tell you I have some biases up front. I have loved auditory processing disorders

for the 36 years plus that I've been an audiologist. I worked with kids with auditory processing disorders as an undergrad at the wonderful Bowling Green State University where I had a ton of speech language pathology opportunities. I accrued 430 hours before I graduated as an undergrad, which I know is unheard of today and I use those skills all the time. And then I would like for us to spend some time looking at what are appropriate accommodations? And what are inappropriate accommodations for kids with auditory processing disorders?

I got a whole lot and I don't wanna go too fast. But I also wanna be able to get in all the information that you might want to have, and some of it's redundant because I think there are certain take-home messages about APD or auditory processing disorders that are really, really critical. So here's our scenario. We have a nine-year-old child that's referred to your clinic with concerns about hearing and listening. She's passed all our hearing screenings at school. She has difficulty hearing in noisy environments. You've seen that, I've seen that based on some forms that the parents completed and the teachers completed. I see it based on what the child is telling me. The teachers completed a behavioral questionnaire.

One of the ones that we'll talk about today is a screening inventory for targeting educational risk, and have significant concerns about the child's listening skills. So here's the question. A medical adage is when you hear hoof beats, you think horses. So if a child were referred to my clinic like that by one of you, I would wanna do a hearing evaluation first because a hearing screening might not tell me the whole big picture. And two things I'm gonna be really redundant on today, one of which is hearing evaluation precludes anything related to auditory processing. I will say this and say this and say this, and I will tell you all the reasons why. The second thing is that a traditional audiogram doesn't really help us very much. A traditional audiogram really only gives us information about detection of sound, about, I hear a beep, and I can raise my hand. It doesn't give us anything further. And with a child like this, we would also do some

speech-in-noise testing. But now that we've done that hearing evaluation, and the results are normal, what do we do? So as I mentioned, for me, this is gonna be a different type of APD talk. And I wanna encourage you guys to think about, these are not always cases that hit you over the head. Sometimes there's subtleties. We're looking for functional hearing difficulties, not just kids who have abnormal audiograms. So I wanna talk about some of that and some recent things. There's years of information on auditory processing disorders, and I've given you a nice long list of references. So you don't have to go back and we don't have to say, "Oh, you know do auditory processing disorders exist?"

I'm tired of that question. They exist, just like stuttering, just like language processing, just like swallowing disorders, just like everything else that you do. These kids exist. And I wanna talk specifically about who they are, and how we might be able to better identify them. But for me, this is a call-to-action talk. I hope that I get each and everyone of you motivated to think about who these kids might be on your caseload, in your clinic, in your elevator speech, when you say to somebody, "I'm a speech language pathologist," and that person says, "Oh, my kid has this issue with listening." I want us all to get on that page because we're missing kids. We're spending a lot of time debating things that have already been debated.

And I'm gonna talk about that today as we move on. And then I wanna talk about how we address these issues. So my very favorite thing that is in every talk I ever give no matter what the topic, is this Erber's Hierarchy. Norm Erber is an audiologist/speech pathologist in Australia, and Erber created this hierarchy to talk about listening, and really, it was designed to look at a lot of things related to cochlear implantation, but it's so global, and if you haven't learned from any student that I've ever worked with, knows my love of this. This is on my bucket list a million times over. Hopefully some of you today will see the benefit of this. And I said I wasn't gonna use the pointer but I find myself using the pointer, so hold on just a sec. Let me get it. Let me get it. Well, I

thought, there it is. Come on down pointer. When you ask about someone's hearing, I'm gonna talk to you about this very bottom of the pyramid, the detection, which is how do you do when you hear a tone or a sound, and you're able to repeat it? The next part of that is and that's a basic audiogram. Audiograms are fine. They're ancient, and we've used them for a million years or is around as long as audiology has been around since the 1940s. But they don't tell us very much of the story that you wanna hear about your school-age kids.

And I wanna tell you about your school-aged kids. Discrimination is how well are you able to tell the difference between two sounds? Whether it be a drum, and a rattle, or whether it be an S and an sh, s and a sh, which we know is really difficult for a lot of kids with hearing loss, but it's also true for kids on this spectrum. Identification. When you hear a sound, do what it is? And then comprehension. When you hear a sound, what does it mean to you? Do you comprehend the meaning of that information? Whether it be phonological or morphological, or all the other logicals that you guys all work with. So we're gonna use Erber's Hierarchy as our kind of guide for today, not as kind of, as our guide for today.

So I wanna redefine hearing in this talk. When we talk about hearing, we talk about the World Health Organization, and its changes and challenges to us to see hearing as functional communication. I work with a lot of adults and this is relevant to the topic today, because many of the adults I work with have had traumatic brain injuries. And those traumatic brain injuries are really turning points for them, which is kind of where we came from, where APD came out of initially, but it came out of brain tumors and pathology. These folks will come in and many of them have had hearing test after hearing test after hearing test and complain to the audiologist that they can't hear. And the audiologists will do an audiogram and say that they hear just fine, and all of this is just in their head. We're learning about a new concept that's partially relevant today called hidden hearing loss. But there's also people who have things called auditory

neuropathy. And there are also people who have auditory processing disorders, and they have functional communication difficulties. And these have been found in research labs that do bench-to-practice type of research, like Walter Reed National Medical Military Medical Center. The National Center for Rehabilitative Audiology Research, NCRAR, and at our lab at Ohio State University. Environments that support all listeners provide redundancy and predictability. And by the way, I don't think mine all turn out the same size. But when you're looking, there's a little Q1 down here. This would be a place where you might wanna look for a answer to one of your questions. So recommendations for speech language pathologists related to auditory processing disorders. If I can ask you anything today, if you and I can be partners in something, please consider that this is a thing.

Don't keep asking, "Is this a thing?" It is a thing. It's got peer-reviewed research to say it's a thing. And for people who don't believe it, they either haven't had very much experience either research-wise or clinically with this patient population, or they don't hear the actual anecdotal stories that are repeated over and over and over again, and I will talk about some of that today. James Jaeger, the father of Audiology, tells us there are at least two distinct entities in auditory processing deficits. Listening-in-noise, which includes dichotic listening. And that means how do your two ears work together as a team? You know most audiologists, when we do hearing testing, we test the right ear, we test the left ear, that's probably how you do your screening. So I'm gonna get to that in a minute.

But what we really care about is those two ears have to work together as a team. They can't be your right ear hears this way, and your left ear hears this way. And developmentally, that dichotic or two-ear or binary listening, we can call it any of those things, developed to about age 15 to 16. So it's not unusual for kids to have some developmental issues in this area, particularly if they have a history of otitis media or a lot of ear infections. So Jaeger says we should look at two things. We should look at

dichotic listening, or listening-in-noise, speech-in-noise as some people call, which is also on this slide. And then temporal processing retiming. And why timing of the auditory system is so critical to each and everyone of you, somebody is telling you my sound is distorted. Let's see if this sounds better. I've got one sounds good and one doesn't sound good. So hopefully we can clear that up. Okay, thank you. The other thing is that temporal processing timing is so critical to things that you are all interested in like reading and following directions, and see if those things are important. So the three things we want you to look at are speech-in-noise, which is what we call hidden hearing loss, is the newer term.

Dichotic listening, how the two ears work together, and temporal processing or timing of auditory information. Those are the foundations of what auditory processing is. ASHA as long ago, as 15 years ago, said that the quality and quantity of scientific evidence is sufficient to support the existence of APD as a diagnostic entity to guide the diagnosis and assessment of the disorder, and to inform the development of more customized deficit-focused treatment plans and management plans. A lot of speech pathologists will tell me that they're afraid of this area because it's controversial. And a lot of audiologists aren't interested in it for whatever reason, and it drives me crazy because I teach this, and every year my goal is to get a couple of students who love this area and want to do more.

I have a student right now who's fantastic and she loves it. And she's really great at it. She's better at it than a lot of audiologists who've had years of experience. And that's because she's committed to it. And I see some questions coming up, and I'm gonna try to keep going and catch up with you. Evidence for APD is a disorder, also comes from the American Academy of Audiology from 10 years ago. They have clinical practice guidelines. By the way, you can access any of these clinical practice guidelines online. And the definition of APD through the American Academy of Audiology, is that there are two different areas that are abnormal in the test battery. And

that's where we get into some controversy about what constitutes abnormal. Audiologists can't agree on a test battery, just a speech language pathologist can't in many areas, if you ask people what their batteries are, they differ. And so I think it's important to challenge your audiology colleagues to tell you what their battery looks like, what they're testing, and we're gonna talk about some of that right now. Another definition I said I wasn't gonna go into many definitions, is a breakdown in auditory abilities, resulting in diminished learning or comprehension. Remember on the Erber's Hierarchy through hearing, even though peripheral hearing sensitivity might be considered as normal. So if you have someone who has a hearing loss, we know they're gonna have difficulty processing auditory information. That's part of the definition of the hearing loss.

However, you are gonna see a lot of people who come through your doors or come through my door, I see a lot of these people who have normal audiograms, but boy, did they have difficulty with comprehension? And I can tell you story after story after story. And if we had another three hours I would because I think that good teaching is storytelling. And you remember those things and they influence you. So I will try to tell you a couple of stories today. The other thing is this is a low-incidence population. I think people get really worried about if they start to diagnose auditory processing disorders, it's gonna be a floodgate.

Like every classroom is gonna have 50 of these kids. Well, first of all, you shouldn't have 50 kids in the classroom, but secondly, it's not gonna be the majority of kids. If you're working with people who know how to do differential diagnosis. If you're working with audiologists who understand this population, and if you're working in an environment where we appropriately identify these kids. The other research says that, and this has been a couple decades of research, says that two to 5% of the school-age population has auditory processing disorder, very low incidence. Hearing loss, 10 to 12% of school-aged kids. But if you wanna talk to people about this, these

kids are on the same continuum, as kids who have hearing loss. One of the things I wanna point out to you and encourage you to believe and preach to your choir hopefully, is that many of these kids have more difficulties than children that I work with in school who have peripheral hearing loss. Many of these kids have never had services. Many of them have been ignored or told they have things like ADHD, when they don't have ADHD. It is a myth if you don't know that it is impossible to separate APD from ADHD. It is not. And there's research articles on that too. And it's a pretty easy thing for those of us who have experience. It is not also not difficult to separate kids who have language processing disorders from kids with auditory processing disorders. So I wanna say that aspect too.

So some more recommendations. If I were going to give the biggest recommendation, it's the need to work on a team. I've worked on teams for auditory processing disorders for my entire 36 years of my career. I love getting to work with other professionals. And it's a very hot topic right now with IPE, Interprofessional Education and IPP, Interprofessional Practice. Those are hot topics right now in training and education of our professionals.

And of all the research says that IPP, interprofessional practice provides a better outcome for patients and their families than practicing in silos. I do wanna say though, that auditory processing disorders is the scope of practice of the audiologist. It is not the scope of practice of OTs. I'm gonna tell you a little story about that in a moment. Hopefully it's a story you'll remember. And it is not in the speech language pathology scope of practice, although we are a team, and we support each other. This is my wheelhouse. And I wanna tell you why. And just because a test has auditory processing in the name, does not mean it assesses auditory processing. I don't wanna offend any of you, but the test of auditory processing skills really doesn't look at auditory processing in a way that is a bottom-up way of looking at auditory processing. So the reason that auditory processing is in my wheelhouse and not yours, is 'cause I can

control the stimulus. You can't control your voice to be consistent all the time. You can't control your presentation levels. You can't know your presentation levels are specifically, you cannot be that consistent. When we present information on a calibrated audiometer either through the audiometer or through CD, and it is calibrated. It is not like pulling out a little CD player and putting headphones on a patient. We are able to control the stimuli. That control is critical, critical, critical, critical in the diagnosis of APD. Next is we can control the listening environment. You can't control the noise in your treatment room unless you have a bank vault like some of my kids call the booth. I can control the listening environment. I can control the stimuli that's coming through the headphones. I can control the level of signal-to-noise ratio, which you can't do.

And presumably my expertise is in hearing and listening skills. I wanna work with you partner. Better evaluation tools are definitely needed. And they're not coming quickly enough. But there are strong tools that are providing control and consistency. And lots of people are looking at these tools right now. So there's going to be better tools coming out. But the tools we have right now are perfectly acceptable to make a diagnosis of auditory processing disorder that should be made by an audiologist. This information helps us to make a differential diagnosis. APD isn't a type of autism. It's not ADHD, it is different than a language disorder, although there can be some comorbidities.

So there was an article that came out five years ago, and it was by a gentleman named DeBonis, and it got a lot of attention. A bunch of school districts that I consult to, asked if I would come out and talk about this article to their SLPs. And there's a lot of things that are really beneficial in the article. The thing that I don't think is beneficial is he kinda throws out the baby with the bathwater, and I don't like that. So one of the big issues that I am here to implore on you today, and if I don't get through any other slides, this is the most important one. Whenever you suspect an auditory processing

disorder, you cannot guess or guesstimate hearing, we must have a hearing evaluation. If you know anything about universal newborn hearing screening, one of the main things that still exists today and existed 20 years ago, was that parental or teacher concern are the main foci of looking at kids in school with potential hearing losses. That means that that child needs a hearing evaluation. If they've been screened, the screening might not be enough, you have such a critical role here. Please, please, please, please, please, refer children for audiologic evaluations. All kids who were concerned as raised should have speech-in-noise testing. This is his general listening issue. And there are some great tests that we can use. There's a test for children that starts as young as five, and goes up to 14, called the Bamford Kowel Bench-Speech-in-Noise test, the BKB-SIN. It is well-normed. It takes a very short time to administer.

It is a great starting point for looking at APD, if we're looking in auditory processing, or if we're just sending somebody for an evaluation for their hearing, this should be done. We know that language is related to cognition and attention, and the same concerns may be raised there. And so knowing the status of hearing, so critical. And there was an article in the ASHA Leader about hidden hearing loss, and I brought up that topic a couple of times. And I just wanna tell you that this is a person who can ace a standardized test, a standard hearing test, but they still struggle to hear in a noisy room.

And most audiologists, well, I shouldn't say most, it's less than 50% of us, do not practice best practices because we do not do speech-in-noise testing on any patient that we see. This should be a standard of care. If you yourself get your hearing evaluated, you should be saying, "Where is my speech-in-noise test?" If you send a child, you should say, "I need a speech-in-noise test." All of this is critical. And the reasons are so important because listening to speech-in-quiet, and hearing speech-in-noise are not related to each other. They're not related skills. So someone

can do perfectly well under headphones. And not do well when they're listening in a noisy environment. And I don't wanna go into too much detail on hidden hearing loss. But I do wanna bring your attention to that. So some more recommendations, I need for us to be collegial, but I need for you to help push my colleagues too. Many audiologists are reluctant to do APD. I love getting to teach audiology to people, whether it be you guys or graduate students in audiology, or audiologists who've been out in the field who come to me and say, "I wanna learn to do APD, I'd a little bit of a class in this in college and I think there might be a need, but help me." And I am more than happy to help.

And my email is on the first slide for me today. If you have questions we don't get to today or you wanna talk about how to connect with audiologists in your area or whatever, please, please please email me. I wanted you to tell them the need that you see, and encourage them to do it well. I've read some really ridiculous auditory processing reports. And you might read one of mine and think it's ridiculous. So be it. We'll go from there. But we have to ask them to write reports that state what they did, and how it relates to what you need to know. How does this impact a kid in the classroom?

Dichotic listening, if you can't localize appropriately to speech, you're gonna have a terrible time listening in noisy environments. And there's so much research and I took some of my slides out, but there's a ton of research on room acoustics that says that most kids don't spend their day in optimal listening environments. They spend their day in noisy classrooms, whether you think it's noisy or not as a teacher, you can't just ear that. You've got to think about what's going on between the HVAC system and traffic going by and kids talking and sharing, all of that. And I also realized that audiologists can't be wishy-washy with their interpretations. That's not gonna work. They have to be very direct. And it can't be, well, maybe you should try this, and maybe you should try that. We owe these kids really good recommendations. I owe

you really good recommendations. I get some amazing speech pathology reports, I got a speech pathology report from a kid that I see from DC. They fly to Columbus for auditory processing stuff. And the report from the speech pathologists was the most amazing report I think I've ever seen in any way, and I work with some fantastic speech pathologists at my facility, and I took that report around to them and said, "Oh, this is so great." I owe her the same. She deserves to have as much information on that kid as is a kid in the family. And we need to provide how you access the recommendations, not just "Try an FM system." You need to know how you try an FM system. How this is handled in school districts? There is absolutely no consistency. Some districts classify kids on the IEP as hearing-impaired, some is language-impaired, some as other health-impaired, some automatically go to a 504 Plan.

And some say it's a figment of the audiologists imagination. And that's that. So how is it handled in the school district? One of the things we have to look about is how is this functional deficit impacting listening in the classroom? And I already mentioned that is a continuum. And some kids with APD have much greater difficulty hearing and listening than kids who have peripheral hearing loss. I know it's hard to believe, but it's very, very true. So I'm gonna tell you a little bit Connor. I saw Connor during our COVID closed.

Our clinic just opened up last Monday. And I was doing a lot of virtual consults and got a contact from this mom, who has an 18-year-old son, and said he had been diagnosed as having APD. And he was a little guy around three or four, wasn't diagnosed then, we'll talk about that in a second. But Connor had different language. He had expressive and receptive language issues. They were messing around with diagnoses on him and they never got a full diagnosis of autism or ADHD. The speech pathologist, he went to public school through third grade, the speech pathologist said he had expressive and receptive language issues, but there was nothing else that

could be done. And granted, this is often the parents' perspective. But I read some of the reports that I was sent and it pretty much corroborate what the mom was told. She pulled Connor out of school to homeschool him. And he got an auditory processing evaluation at age 12. And they confirmed that he had auditory processing deficits, primarily in speech-in-noise and in dichotic listening. It was repeated again, but none of the recommendations were followed through. The audiologist didn't really give them anything to do. So I was fortunate to come in contact with this family, because they read an article that I had written that happened to be on audiology, an audiology online and so they wanted to talk about how do you fit hearing aids to kids with hearing loss? And they found an audiologist in their community who was willing to do this, they live quite a distance from us.

And at 18, he's finally getting help. It was life-changing to him. He's preparing to go to college. I can tell you from meeting this young man, he probably has less autism than I do. And he's definitely less-ADHD than I am. So I think that they missed the boat with him. What he has is APD, and I believe he still has receptive and expressive language processing. He believes that he described his language in detail and we've got him hooked up with a speech pathologist who works with adolescents and young adults, and it's really exciting right now.

So I think it takes a village but Connor is, and I have permission to talk about his case, there's no violation of HIPAA. Connor is an example of someone who was kinda failed by the system. And mom kept asking for information from all the professionals she worked with. My profession, your profession, OT's profession, and nobody was able to really point her in a direction that got Connor to where he is today. I think she must have been an amazing homeschooler. And by the way, she has five kids, so... Okay, so let's talk about things that go back to Erber. By virtue of childhood, children need a more favorable listening environment than adults. And we're gonna try to create a welcoming environment for looking at auditory processing disorders, and moving away

from what the audiogram says. I have a little slide on here that talks about the ear bone and the brain bone have always been connected. And we're gonna skip a little bit of this because I wanna make sure we get to what I think is critical at the end, which is recommendations. There's a lot of auditory processes. They include localizing to sound, discrimination, as Erber talks about. Timing, as I mentioned earlier, the timing aspects of auditory processing. What happens when there's competing background noise, or competing signals? And what happens with degraded speech? And this is all from an article from ASHA in 1996.

And all of these components are components that are included in auditory processing evaluation by audiologists. So let's talk about assessment. Auditory processing, assessment and management, again, is in the scope of Audiology. Audiologists cannot relegate or abdicate this responsibility to other professions. And I wanna tell you a story that you will remember. Had a family who brought their child to us once, who the diagnosis was auditory processing disorder that was done by an occupational therapist. And the Occupational Therapist had spent a lot of time with his family. We took the child into the booth, and that they were doing an expensive auditory processing, and I have quotes or air quotes around that treatment for the child. We took the child into the booth, we tested their hearing, they had had a lot of ear infections.

And mom reported a lot of fluctuations in hearing. Hearing was normal at that time and the kid basically aced all the APD stuff, did really, really well. And we came out of the booth, we were talking to the mom, and the mom said that the Occupational Therapist had told them that the child had auditory processing, because of all the ear infections had interfered with the connection, developing between the ear and the bowel. And a lot of people believe that if kids have a lot of middle ear pathology, because they take a lot of antibiotics, or at least they used to, they would have issues with their guts, they'd have bowel issues. And I remember saying to her that would be a really circuitous

pathway to get from the ear to the large intestines, and she laughed and realized how ridiculous it was. And again the TAPS is also not a test of auditory processing. So I wanna remind you about that, that you need to push my colleagues to do this testing. Audiologists are gonna tax the auditory system, we're gonna make it work. And that's the idea behind this. And we also vary linguistic loading. So if there's a child that you've got linguistic concerns about, we can also get information on them. Age seven is standard for testing. There's value for age seven, because that's when kids become more consistent in their auditory processing skills.

They're not as scattered. However, as I said before, critical, critical, critical. If you have a family who's pushing you and saying, "I think my kid has an auditory processing disorders," there's a lot of stuff on the internet about this. And they're concerned about the child's hearing and listening skills. It is very important that they have that evaluated. There's a test that you can use on children between the ages of three and seven called the auditory skills analysis. It's not one of my favorites, but we have used it. And also speech-in-noise testing is available for younger kids.

And so it's really important that we measure some of those things that we know, some of those things. I have identified so many kids where the parents thought the kid had an auditory processing disorder, and they had a peripheral hearing loss. And that should not happen in 2020. And we know that there's tremendous variability in the auditory system development, and I've talked to lots of parents about how to capitalize on auditory system development and how to maximize that, even if the child has normal hearing. So a pre-appointment screening is in order. One of the things that may disqualify in some places is the cognitive ability of the child. But I think it's really important to look at that cognitive ability and think about what does it mean? How do we get information about, is there scatter? Is their performance verbal split? Where the performance is much better than the verbal. We have a couple of psychologists who use the lighter three, which is a non-verbal, or less verbal IQ test, it was designed for

use with the deaf. But it is fantastic for looking at kids 'cause one thing we know is that cognitive testing is heavily language-biased. And if you're a poor user of language, your cognitive abilities may look poor than they actually are. Okay, next slide. If you wanna do some pre-screening, I think these things are fantastic tools and you can get them on the site. One is the SIFTER, which looks at preschool kids, elementary school kids and high school kids in terms of their listening skills and comparing it to others, and they can fill it out. Their families can fill it out. Teachers can fill it out, you as a speech pathologist could fill it out. The CHAPs is a standard central auditory screening. It is also available at this website.

So they're available to you for free. And I think they're really great for doing some screenings. The Educational Audiology Association has the Fishers Auditory Problems Checklist. It is a little bit older, but still very useful. And those things may really help you in determining what kids are the best to send for referrals. They always helped me, so I will tell you that that's a great thing to do. We call it authentic assessment. Prior to the APD evaluation, we have to know that the child has normal hearing, and for children that is 15 decibels.

And again, that speech-in-noise testing we wanna do that. So I wanna give you a quick overview on this. The tests that we might use are the SCAN-3, which has both screening and diagnostic subtests, it is very comprehensive. It can be used to look at the auditory processing criteria, diagnostic criteria put forth by AAA. There is one that's normed up through 12 years of age, there is one that's normed for adolescents and adults. The pitch pattern sequence tests looks at temporal processing as is GAPs in noise. The Multiple Auditory Processing Assessment version two is very similar to the SCAN. It uses those ASHA-based skills that I mentioned, the localization, the temporal processing, the degraded speech to look at auditory processing and kids. I really like this test too. We tend to use the SCAN more as a test battery and add other things to it. One of the things that you will hear about out there is a Buffalo Model, and they use

other tests that I tend not to use because I think they're a little bit older and not as well-normed and not as well-recorded. But many, many audiologists use that. So if somebody tells you I use the Buffalo Model, you'll know that that's a test battery model also. There's a newer test battery called Feather Squadron. If you wanna go and play with this, I would love feedback from some of you guys. I would love for you to go and play with it. It's at a website called Acoustic Pioneer. It was developed in Australia, and it's given on an iPad. And the iPad is calibrated with headphones, but you can give it with... I don't like the testing. And the reason I don't like it is because I think it's too heavily linguistically loaded. It has this big bird and a Feather Squadron, and he comes out and he says, "Ready recruits."

And I think about a lot of my kids and I've given this test to a lot of kids just to play with it. I think a lot of my kids who don't know what a recruit is, there's a lot of visual information in it, which as you all know, executive functioning is hard for a lot of kids. And so I worry about some aspects of this. And then there's some aspects that I totally love. So I would direct you to go if you've got any downtime, go play with Feather Squadron and see what you think about it, it's a lot of fun. I wanted to get to management and I've got a little over 15 minutes to talk about this. So what doesn't work? Doing nothing doesn't work and giving people a pre-printed list of recommendations does not work. We've moved away from that. I wanna ask you guys to help me with something else.

Preferential seating does not work. And I wish that audiologists would stop recommending this as a fix for auditory processing and hearing loss. First of all, it varies so much based on the environment. So there's no one seat in the room that's a preferential seat. We've had since 1991 evidence that says that there's really no acoustic benefit for the child from preferential seating. So acoustically, it doesn't do very much. School districts might like it because it's inexpensive. And teachers like it, and the kids like it, because it gives them better visual access to the teacher or to the

teaching situation. But if you ask kids and I asked a lot of teenagers with hearing loss this question, where their preferential seat is. Each one of them will tell you something different. So if you wanna say seating that allows the maximum ability to listen, or whatever, those things are fine. But to assume it's in the front and center of the classroom, and let's face it, most classrooms don't have front and centers anymore. So I want you to think about this as a recommendation for visual access, but not an acoustic or one-size-fits-all, let's put the kid in the front of the classroom and assume that works. Acoustic modifications in the classroom, I'm not a fan of these unless we measure it. You know that old adage that if you don't measure something, it doesn't happen.

A lot of people, a lot of audiologists like put tennis balls on the bottom of chairs, and that became really popular when we started getting more kids in school with cochlear implants. There is no evidence that that reduces classroom noise, unless we measure it. And it's got such a minimal impact on classroom noise that getting that exact, I've gotten an X-Acto knife out, I've done this you guys, and put tennis balls on the bottom of the chairs. Now teachers like it because they don't hear the chairs. Scooting and it's easier to keep the floor clean because sometimes the chairs make a mess on the floor, you know that they're sliding across the floor.

So for those reasons, it's not not a bad thing, but for the reason of acoustics doesn't work. And then some field FM systems, I have school districts tell me this all the time, "Oh, I have some field FM system." We don't really care. Because that's most likely not a good enough signal-to-noise ratio enhancement for kids with hearing loss or auditory processing disorders. They need more, and I'll talk about that in a second. And an FM system isn't a panacea for all kids. That's not gonna work because not all kids need an FM system. So the three things I want you to think about are compensatory strategies, improving the acoustic environment, and direct intervention. Compensatory strategies, you guys are good at. Increasing predictability and increasing redundancy. That's part

of how audiologists and speech pathologists are educated, I know that. So there's some compensatory strategies I wanna draw your attention to. And some of this might be teacher strategy development. I wanna talk specifically about this "Clear Speech" article that was published in 1994, that helps speakers to learn to speak in ways that enhance the comprehension of the listener. It's in the "Journal of the Acoustical Society of America". Don't let that scare you. It's got some great information about teaching teachers how to do this better. And using visual and other modality cues is of benefit for kids. So we know that those are good things. We know that auditory fatigue happens.

This is a huge topic in audiology right now, especially in educational audiology. And we know that there's significant research to support that listener fatigue is huge for a lot of these kids, so they go home, and they're pranky, and they can't concentrate and they're exhausted, and they talk about their listening exhaustion, and many of them are sitting doing homework because they didn't get it in school during the day, they didn't understand it. So their families are doing it with them again. So it adds to their auditory fatigue. Some technology tools. Some of the speech-to-text options are huge. One of the ones that I really like and I wanna bring your attention to, and I would encourage you to go take a look at it is something called the Livescribe pen. There are different options for this.

And it's not great for early elementary school, but later elementary school all the way through college works beautifully. It's a pen that you train, and it takes speech and it turns it to text, it can turn it into a Word document, it takes a little bit time. And it's a little bit of a financial investment. They range from about 140 to $400. But it's a great tool. So any of those technology tools would be good to enhance that. So we wanna talk about an evidence-based listening environment. We know that the central auditory nervous system or the CANs has a really complex developmental time course, that listening-in-noise has a progression and then extends well into adulthood. Remember I

said earlier that dichotic listening and speech-in-noise we know at least to age 12 improves, and dichotic listening or the pairing of two ears together, improves to 15 or 16, that's normal auditory development. Carroll-Johnson revealed that a more complex the noise listening situation, such as if there's more reverberation or decrease in linguistic redundancy of the stimulus, it results in a longer developmental trend for speech-in-noise performance. The typical child in school requires a plus six signal-to-noise ratio. That means how loud the speaker's voice is, in relation to the background noise. The average classroom has a plus five signal-to-noise ratio. The closer you are to zero, the worse it is.

A high-risk listener, which is the APD kids that you and I are talking, or that I'm talking about right now, and you're listening about right now require somewhere between a plus 12 to plus 20 signal-to-noise ratio. That is four to five times better than the typical classroom. Remember decibels or logarithmic. So it's not just like, "Hey, what's a few decibels among friends?" A few decibels among friends means that kids who are high-risk listeners need a much more favorable listening environment. These are kids with cochlear implants. These are English or second-language learner kids. These are kids with hearing losses, and these are the kids that we're talking about today. So there's two ways to improve the signal-to-noise ratio in listeners with APD. The first is the use of personal FM or now is called DM, Digital Modulating technology, and the use of mild gain hearing aids.

You're probably saying, "These kids have normal hearing, Gail." Yes, they do. But we'll talk about FM or DM first. DM technology that's worn on the ear. The personal system gives superior signal-to-noise ratio. The sound quality is amazing. If you listen to a current DM system, and one that I can give you an example of, designed for kids with normal hearing is the Phonak Focus. It's the Phonak Roger Focus. When you listen to it, you'll want one, it makes listening so much easier. It's easy to use. It's easy to fit. But someone in the school needs to be comfortable and trained with using it. These

things have little domes or little plastic pieces that go in the ear that have to be cleaned for wax, and I know you can't expect a second or third-grader to do that all on their own. And there's some really cool options for receivers and for transmitters at this time. It doesn't necessarily have to be something that's worn around the teacher's neck anymore. It can be something that sits on a desk really effectively. There's ways to authenticate this, such as the listening inventory for targeting, yeah, listening inventory for targeting educational risk, or for looking at risk and education. And it shows us how you can use this technology as a questionnaire to see the benefits the child has, the benefits that the teacher sees, because you can't just say, "Did you think it worked well?"

Many teachers don't wanna be bothered by this. They've told me that. So they aren't gonna say "Yes" or "No," but if you give them something very, very objective, that is what the life questionnaire does. It's really fantastic. Again, available for free. And remember, this is not providing amplification, but signal-to-noise ratio enhancement only. We have some children and many teens who are successful with hearing aids. And I was gonna tell you some stories about these. But you can fit current digital hearing aids to really produce signal-to-noise ratio and directional enhancement, without providing any kind of hearing loss to that child. This is very, very easy. There's been a number of studies that have done this as early as Francis Cook looking at APD kids in 2011.

Before we ever do this, we need to have caution in fitting these kids. We have to have medical clearance which you have to have for a hearing aid fitting on any child under the age of 18. So we need to be clear about what our physicians know, and that we're not gonna do anything to damage their hearing. We have to use something called real ear measures. We might do more authentic assessment, like we might put the kid in the booth. Or we might say, "Let's do some more questionnaires on this." We need to set it up in the booth. So we know how to do listening and noise testing. None of these

things are difficult. They are all in the wheelhouse of an audiologist and should be part of standard hearing aid fitting, no matter if it's an APD kid or kid with a hearing loss. So here's another way you can help my profession by insisting these are the things that we do and do them well. You can also put an FM or DM option directly on a hearing aid. Some of the kids will wear a little mic, a mini mic, with their hearing aids without a DM system or without an FM system, that is amazing to them. And it gets them so excited because they can hear so clearly.

You're not gonna put this on a kid 24 hours a day but the DM system, sometimes kids don't like it 'cause it calls attention to itself. Sometimes kids don't like it because they only have access to it in school. And I can tell you anecdotally, and we've published a number of things and a number of studies that are in your reference list. And I have even more studies to give you that I didn't put in your reference list to talk about how beneficial hearing aid use is in this situation. It's not just 'cause I wanna sell more hearing aids, 'cause I got news for you guys. I get paid a university-professor's salary, right? Whether I sell a hearing aid or not. So I'm there to do problem-solving and critical-thinking with patients. And this is an amazing option at least for some folks.

There are audiologists who haven't bought into this yet. But it's a really important option to think about. Every technology requires training. So there has to be somebody at the school who knows how to use this, the family have to be comfortable in using it. If you have a kid who comes in with a dead battery, you have to be comfortable in using it. So we know that when people know how to use this, the outcomes are better, duh, right? Okay, let's talk about some direct therapeutic approaches 'cause I really wanna get to this. If you want to do listening training with any of the kids, you're working with an APD, I have got some new and good things for you. Many of you might recommend hear builders and I don't have a problem with hear builders. I have a slide in here on that. But hear builders is a very top-down approach. It trains the brain from the top-down, which is great for a lot of people with auditory processing disorders. I

need to look at a bottom-up 'cause that's what audiologists do. I look at how the information gets from the ear to the brain. We don't know very, as much as we'd like to, but that he efferent auditory system, the part of the brain that controls the ear, and there are ways we can work on that and that's a couple of our talk for a different day. I wanna tell you about some things that my kids, that I work with, find beneficial. Angel Sound is one of those things. This is a great program for a patient who might be just at the beginning of some of this, and doesn't have very good listening skills. It is free. It's an interactive listening rehabilitation program that was designed for kids with cochlear implants. And I will tell you it is so much broader than that. Please take a look at this. I think it's fantastic.

And I have so many families who've used this, and the kids who thought it was fantastic. Listening And Communication Enhancement, or LACE. It was developed by Robert Sweetow. It's distributed by Neurotone. It was designed initially for adults with peripheral hearing loss, but it is great at looking at speech-in-noise issues. And I have effectively used it with many older kids and teens. It costs about $60. And it's based on adaptive listening principles.

So you've got to do it every day for a period like 40 out of 60 days. I know for a lot of families, they can't do that. They won't do that. And if they don't do it, they get kicked out of it, and they got to spend the 60 bucks again. 60 bucks isn't a very big investment in the therapeutic tool. But just to let up front and I always tell families that you know, this may be too much for a kid who's in school to do something every single day, doing their homework, doing other stuff, and being a kid, which I think is important is really critical. Then, Read my Quips is great for older kids. It's focused on speech comprehension and listening-in-noise, and it has an average improvement in speech-in-noise abilities of 30%. So this is also evidence-based. ListN and Learn is focused on dichotic listening and speech-in-noise. We also use this lisN-S test, which looks at dichotic listening and speech-in-noise and it looks at improving three skills,

localization, speech-in-noise and three-dimensional listening, dichotic listening. And it's a unique way to do this. And it's based on a new generation of testing, and a new generation of how we do remediation. Hear builder I already mentioned, most of you are probably familiar with that. And if you're not, you can go on and take a look. And it's got some great top-down information. Acoustic Pioneer is related to that Feather Squadron that I mentioned to you. The testing is here at this website. But the treatment programs are available through the website also. And one of them is great for dichotic listening and one is temporal processing. They're relatively inexpensive. They're also done on an iPad.

And I think all these things are probably best done... You guys can get feedback on them, but they're best done at home, working with parents as a home project and carrying it over. And here's one of the things that Acoustic Pioneer has, or two of the programs, one's called Zoo Caper Sky Scraper, and the other is called Insane Airplane. And they're listening games, evidence-based. I mentioned already, I have some issues with the testing.

But I think that the dichotic listening program, the Zoo Caper Sky Scraper, we've had some really great success with. Capdots is another program. It's three levels based on agent skills. And there are some speech pathologists who are doing this in their private practices. If you like working with families with APD, kids with APD, and you wanna have a more directed approach, Capdots is been successful for some of our patients. We do not do it in our clinic, but I have some facilities in our community who do it. So I'm at conclusions and I'm at 359. So I wanna stand for just a little bit to see if we can get some questions, and you will help me with that if she can. We need to stop debating if this exists, and start focusing how we move ahead for kids that have really auditory processing issues, while they're young and their brains are plastic. We need to get to this just like we do with hearing loss. I know that seven isn't an early age to start, but it's where a lot of people start. And seven is better than 18. That's for sure. I need

for you guys to refer appropriately and to encourage audiologists for us to do our best for you, and for the kids that you serve. We need to advocate for appropriate services, for appropriate testing, for appropriate classroom acoustics. We need to keep the mantra, that low-incidence population is there. And this is part of an interdisciplinary team. So if I roll out auditory processing, ADHD might be the next step. Or you know I don't wanna see a lot of kids with autism because we know that they have sensory processing issues that are separate from APD. And then we know that we need to listen and take action. If your first hypothesis doesn't work out, you think it's a language issue, and it doesn't prove that way. Or you think it's an ADHD issue, and it doesn't prove that way. Please consider APD. I'm sorry for the speed run through this. I do wanna answer a couple of questions. And my email is also on here. And then there's a whole bunch of references for you. And like I said, if you would like for me to be a reference for you, if I said something today that got you angry or got you excited or got you curious, I would love for us to talk further about that. So Amy, if you can help me, that would be great.

- [Amy] We'll do. Thank you so much, Gail. I wanted to just interject and let our participants know if you do need to leave, you will have credit for having been here for the whole time so, but if you're able to stick around for a bit of Q&A, that would be wonderful. So Gail, we have somebody who wanted to clarify if the programs you we're talking about there at the end, like Read my Quips and Listen and Learn and so on. Are those for an SLP to implement and monitor or are those things that the audiologist implements?

- [Gail] It could be done, if you like that and you wanna implement those, an SLP can implement them, I can implement them. And most audiologists don't do that. And that's a discussion for a whole other day about reimbursement or reimbursed for services, and my oral rehab isn't reimbursed for audiologists. But most of the time, we use this with families. I have families who do it. That's how we do it with our adult

patients. And I actually have a family who has a parent who's got auditory processing. She knows that she's been tested, and they've been doing some of these things together. I guess as their video games in the evenings. Some of them are kinda fun and they're definitely challenging, but they're kinda fun. So you could use it any way that you wanted to use it. If you had a family who wanted to pay you and come use it as part of your session, you certainly can do it that way-

- [Amy] Thank you, now, do if any of these programs that you were talking about or any others are available in a Spanish version?

- [Gail] That is a fantastic question. And I do not know the answer to that question. But I would be happy to look that up and post it somewhere on here if I could do that, because you know, there's a lot of issues with testing auditory perception on pre-processing in other languages. You know, for example, we use a lot of spondee words, and a language like Spanish doesn't necessarily have spondees, so it doesn't just translate. So that's a great question. I don't know the answer to that. But I would be more than happy to look into that 'cause I think it's a critical question.

- [Amy] Someone is asking how often do you recommend a reevaluation for auditory processing disorders?

- [Gail] For me, it depends on the severity and the age of the person that's being tested. I think it's felt mental, I usually check for the child every two years, unless there's something that's really radical that happens in the meantime, the parent notices a significant difference. I think it's important to remember that we don't always know why auditory processing disorders exist. And for some kids, it could be something neurological, some kind of a progressive disease. I've seen children with seizure disorders, who their auditory processing got worse. So it might also depend on what their cause is, but two years is great, on some older kids where we think auditory, the

development is already done, and they're pretty stable. I might not recommend a reevaluation. It really depends on the factors of the presenting person and their age.

- [Amy] So now Gail, I have sort of a compound question combined of several people's questions that relate to providing services in the schools. So someone first was noting that the speech therapists, at least in her district, are supposed to do some testing, and give an assessment in order to be able to refer the kid to an audiologist to test for auditory processing disorders. And so what would you recommend in that situation? And then, part two of that, there were a couple people mentioning the psychologists on the school team. One person mentioned that the school psychologist gives the TAPS to quote unquote, assess for auditory processing disorders in her school. And then someone else was asking, should that be the psychologist or the SLP, who does that initial assessment and then refers to the audiologist to get the actual APD testing? Is that too much all at one time?

- [Gail] If I were a school-based speech pathologist, I would use one of those authentic assessment tools and make sure that an appropriate hearing screening has been done. And if the child can't easily be screened, or there's you know, issues, I don't know that there's much else that you can do other than make a referral. Doing a great hearing screening is critical. And you know, I've been on hearing screening taskforce for this Ohio Department of Health, on and off for years. And I know how hard it is in the school environment to often do a good hearing screening. But that to me is critical. As for a psychologist, I have great working relationships with psychologists and refer to them all the time. This is not their wheelhouse. This does not belong to them. Most psychologists know so little about speech and language. And they know so little about hearing. I don't know how they would interpret the TAPS other than going and looking in the book. And the TAPS again, how do they know that it's a quiet listening environment where they're administering it? How do they know that their voice level's appropriate? You know, I have a big old voice that's born to be an audiologist. There

are some people that kids will complain about because the teacher is so quiet are so soft-spoken. So to me, there's no controls in that whatsoever. And just as I could say to a psychologist, I can't give the whisk 'cause I've seen it done many times and I've probably seen more WISP results. I think I could do that. I don't think they would be very happy with me, and think that was in the scope of my practice. And actually, I think that it's probably out of their license domain, they're license are domain. But manufacturers sell like the scan to speech pathologist, so you can just pop that CD in and test in the school. And it's so inappropriate, they sell the TAPS to anybody. And even though I don't like the test, I would much rather you all administer it than the psychologist administer it, because you are more likely to make some observations related to listening and things that are in your wheelhouse that helped me knowing this more effectively. It really helps me for psychologists to talk about executive functioning abilities, or verbal, nonverbal split, those things are critical to me. It does not help for me to give them, for them to get the TAPS and I don't think it helps the kid. I think it just wastes their time-

- [Amy] Okay, thank you. And just one more question. And then I do believe we're gonna have to wrap up. That someone was asking then, so if a child has been diagnosed with auditory processing disorder, what category would they qualify for special ed services under? Does that go under hearing impairment? Does that go under speech and language?

- [Gail] As I was saying, I don't think there's any consistency in how this is done. And you know, I see it as other health-impaired a lot here in Ohio. I also have when a district asked me, I say, "Oh, these kids are like kids with hearing loss, call it hearing impairment." But they're often reluctant to do so, because of the definition. But if we look at a functional definition, which is also in a lot of the IEP guidance, out in a lot of IDEA's guidance. And it does talk about how that you know, functionally impacts the child. I also see it under speech and language. And I see many school districts who

don't wanna give it a classification, but do give it a 504 Plan. So I think it really depends, and it depends on the severity of the kid also, to be really honest with you-

- [Amy] One of our participants-

- [Gail] We get kids who have such-

- [Amy] Sorry.

- [Gail] We have kids who do poorly in speech-in-noise, and they often are classified as hearing-impaired, so-

- [Amy] Okay, some couple people are noting, one person is noting that perhaps if it's under hearing impairment, you can get those DM systems easier through the schools and then someone else is saying, "In my district, it's usually classified as specific learning disability." So it does seem to vary all over the place depending on districts and states, perhaps. We had lots of other great questions. Thank you to our participants for that. As we mentioned earlier, Gail was kind enough to provide her email address. So if you didn't get your questions answered today, sorry, we ran out of time, but you can get in touch with Gail. Thank you, Gail, for a really wonderful comprehensive course. I think we could have given you hours and hours. And it's still not covered everything we'd love to cover, but I appreciate you being here with us today.

- [Gail] Thank you, I always have a great time talking about this topic, it's one of the things that I could take hours and hours to do, so-

- [Amy] We're good. Well, I will wrap up here. Thanks to everyone for being with us. Be safe out there, enjoy the holiday weekend, and we will see you next time, bye-bye.