>> It is 1:30 so we are going to get started so we have enough time for this session. My name is Brooke I am with Hands & Voices and I'm your room moderator for today. Your presenters are Jane Maydel and Joan Hewitt.

>> First we would like -- first let me tell you about us. I'm a pediatric audiologist, speech-language pathologist, and listening and spoken language specialist. I have been in this field for over 50 years, which means I'm old.

And I've done a lot of different things. And right now I'm retired from clinical practice, but I'm doing consulting with families and school districts, and clinics, and I travel giving talks, although I'm traveling less and Zooming more.

Joan is a teacher of the Deaf, initially. She has a sister who is Deaf and that's how she got interested. I have a cousin who is Deaf and this is how I got interested. She has -- Joan was a teacher of the Deaf and then became an audiologist. She's the Executive Director of Project Talk which is a center in California where she provides wonderful services.

Okay... any --

How many people in this room are teachers of the Deaf?

[Pause]

>> Speech language pathologists?.

Audiologists? Oh, that's unusual for EHDI. Thank you for coming. Parents of children for hearing loss? Thank you especially for coming.

And -- administrate others? I don't think all the hands went up. What did I leave out?

[Pause]

>> EHDI staff. Thank you. Okay. Um... all right. So, let's get started. We are talking about maximizing auditory access for children with hearing loss. We're a small enough group so if you have a question, raise your hand and we'll call on you, while we are you know -- unless we get really far behind, we'll just ask questions as we move along.

Joan and I frequently interrupt each other, so don't take that as a sign of anything, except we both feel like we have a lot to say.

Okay, it's not moving forward. How about that one? No, that's not moving....

>> There you go.

>> Okay, so why is auditory access like listening magic?

Language -- spoken language is learned by listening. If children do not hear, they will not learn spoken language. If they do not hear language, they won't learn phonics and if they don't learn phonics, they will have a hard time reading. So language learning requires hearing spoken language. And so, language learning requires hearing speech around you. So language is magic. It gives us access to so many things in the world. So, audiology is the foundation of providing auditory access. Hearing is the beginning of listening in spoken language development. And audiology is the foundation for understanding hearing and listening. Children need to use listening, in order to develop spoken language, and the only way to get tell is to fit them appropriately with technology. If we get the right technology on children, then they will hear the speech around them, and they will be able to use listening to develop spoken language.

Without appropriately fitting technology, the brain is compromised. The auditory portion of the brain will not develop and spoken language will be comprised and phonics and literacy and social skills will be compromised.

Social skills are based on language. A child who does not have good language, will not have good social skills. You can get away with not having great language, until maybe second grade. And then the language of play becomes more complicated. And if a child doesn't have good spoken language by that time, then we know there are going to be problems. So hearing equals auditory brain development. So we need to be sure that hearing is providing sufficient auditory access to reach the brain. Hearing is the first order -- the first order for developing spoken communication and literacy. So any time we say the word "hearing" we mean auditory brain development. Auditory --

It's not just enough to get sound in. The speech that gets in has to be intelligible. So you don't want to listen to things like this a because you may hear it but it's not clear and that's going to interfere with language, which is why the audiologist is the person whose responsible for making sure this works.

These slides are in the handout that is on the -- the EHDI website. So you can -- if you click on the -- on this session, there's a PDF that will come up, and you will find the handout.

Feel free to take pictures but I'm telling you, you've got access to the whole thing, except the videos.

So it's -- we want the speech to be intelligible and part of the important -- the important part of the intelligible speech is the signal to noise ratio. Signal to noise ratio means the difference between how loud the spoken language is and the background noise around the spoken language. We need to be sure that the spoken language is high enough above the background noise, so that a child can truly hear the spoken language. So... if the speech is at 50 decibels and the noise is at 40 decibels, then the speech is at a plus ten signal to noise ratio.

In the speech is at 50 decibels and the noise is at 55 decibels, then the speech is at a minus [off mic] signal to noise ratio and that child is going to have a very hard time hearing, unless we get the equipment so... so that we know that the child can have access.

I love this slide. This is a slide that Joan developed several years ago, and it's a very helpful slide in counseling family, because you can look at this slide and you know that you can help families understand, they have a child with a moderate hearing loss, why does that child need technology?

[Pause]

>> They need technology because... they -- their vowel articulation will be affected, their consonant articulation will be affected, they will have expressive language delays and their processing time will be awkwardly long. What does that mean? And we've all seen this in talking to our kids, when I saw: Go to the kitchen and get me a fork.

[Pause]

>> A fork. You want a fork. Does that seem familiar to everybody in this room? That processing time that it take as kid to get what you're saying. So it's really important that we -- when families are saying to us: But he seems okay.

This kind of information helps them understand why in the long run "okay" is not enough.

[Pause]

>> So the audiologists are the primary people responsible for the technology. The audiologists are responsible for evaluating hearing, for fitting and adjusting technology, for selecting the technology, and maybe most importantly, for monitoring the technology, to make sure it works. And it's -- make sure a child has sufficient auditory access, to develop speech and language. So, and the only way we know that is if the audiologist tests. You can't intuit it. If a plug the hearing aid into a real aid system and it does what the technology -- it doesn't tell me what is reaching the brain. And that is what I need to know. So, the -- so while the audiologist is the person primarily responsible for all aspects of technology, everybody else is working with the family, clinicians, teachers, parents, are all responsible for paying attention and reporting to each other, and to the audiologist, what the child is hearing and more importantly, what the child is not hearing.

[Pause]

>> So... we have five sections, and Joan is going to start with the brain.

[Pause]

>> So we're talking about maximizing auditory access to the brain and we have five different points, as Jane said. So, the first first is that the audiological testing must be thorough and accurate. You're going to hear us say this statement over and over again today, auditory access is the biggest problem, worldwide, for all degrees of hearing loss. And I don't think that is limited just to children. Any of you who has an adult in your life, who also wears hearing aids, or has an implant, auditory access is the biggest problem worldwide.

And as Jane said, the audiologist is the first line of defense on this. So, the audiological testing that we as audiologists do, must be accurate and it must be complete. Because if it's not accurate, or it's not complete, we can't ensure that everyone else, all the clinicians, the parents, anyone else can do their job, unless we have done our job well, first.

And I want to give you an example of this, this is a child I met just a couple of weeks ago. So, the parent told us that she had failed her AOE newborn hearing screening in one year. They had a follow-up ABR screening which she failed in both ears.

And then over the next year, they got what they called Inconsistent Diagnostic Results sometimes they had present OAEs at certain frequencies, sometimes they didn't.

They got ABRs that were inconsistent, tried to do VRA and they said fatigue to VRA and Jane and I always feel that this is not something that we as audiologists should be writing down, generally. It means -- if they really fall asleep on the table.

But if we can't get them to respond, then that's our fault. We did not set up the testing in the way that we could get the information from them. It was not the child's fault. It was our fault, which is a whole other talk.

So... after a year of getting all these inconsistent results, they decided that at age one this child had Otitis media. So she had bilateral PE tubes placed and then the parents said she is responding to sound. So everybody stopped doing everything. They did not even do a follow-up ABR or behavioral test. They just, when the parent said she's got tubes, she can hear, they were done.

And then at age two the parents came back and said she's not talking.

So they tested and they got this particular audiogram. So they got this flat severe hearing loss in 4 frequencies. They got bone conduction results that were better but she had functioning PE tubes. They had this history of all these inconsistent OAE and ABR results. And they got a speech awareness threshold at 10 decibels in the right ear and 25 in the left ear and soy that I had she has auditory neuroopty spectrum disorder.

And they fit her with hearing aids, she wouldn't tolerate them, and so they fit her with a mild hearing loss because they said well she does have speech awareness, kind of, in the milder minimal -- or in normal or minimal loss. And so we are going to give her mild hearing aids because she obviously has tolerance problems with her auditory neuropathy. So fast forward, she's 4 years old now, she is mainstreamed in a community preschool program, the family is using spoken language. Her voice quality is very poor.

Her articulation almost [off mic]. Her spoken language development, she's using single word utterances, which is residentially unintelligible. Despite the fact that everyone says she can hear. So, the conclusion is that she was not developing to her potential, because she has auditory neuropathy spectrum disorder, so the IEP team recommended she be enrolled in a TC prom and they they discontinue amplification since it's not helping her and they can't get much benefit.

So at that point the family came to us, we were the 4th opinion and this is the audiogram that we got.

So... only 4 frequencies had ever been tested. 250 is worse than those 4 frequencies. And at 6 and 8 thousand, she has near normal or normal hearing. She does not have auditory neuropathy spectrum disorder. She has an unusual hearing loss. And those of us who work with kids know if it's going to be unusual, we're going to get it. Right?

How these hearing losses happen? I don't know. When somebody figures it out, please let me know how you end up with a loss like this, but this is what she had. Why were her OAEs inconsistent, because she had normal hearing at some frequents.

What's happening in the cochlea when you're sending outside across a cochlea where that basal end is normal or near normal, it can affect your results. Why doesn't she tolerate hearing aids? Well, gosh... they are going to overamplify. So then we did speech perception testing. Although she has a speech awareness threshold, that's consistent with those high frequency, her unaided speech reception threshold was in that moderately severe range.

With her hearing aids on, because it really wasn't any better. Her unaided new chips and we do do open set, we'll talk more about that, but she has single words. I don't need to know that she can point to a picture because that gives her 25% chance of getting it right every time. I want to hear what she says.

Very, very poor. And with the hearing aids on, not doing well at all. We saw that there was these unusual bone conduction results that they had gotten all along and at these very soft levels at 250 and started to suspect that this child had cochlear malformations, they did imaging who was not done. She does not have auditory neuropathy disorder. And now she is 4, and we are recommending bilateral cochlear implantation ASAP.

As audiologists we have to aggressively manage the patients. I understand that those that don't make sense it's nice to say, come back in a while and maybe your child will mature. But we are putting off the inevitable and causing these children to lose time. Every day that we don't know what is going on is a lost day for that child. We have to aggressively manage them. We have to make sure that we can reconcile every inconsistent test that we get and we have to... put if our ENTs are not considering genetic testing and imaging when we have unusual results, even when we have usual results, we need to encourage them to do that.

>> I just want to add something, here. We know that there are times when you don't get a full audiogram or you don't -- I mean, it happens. We are not saying it doesn't happen. But when something like that happens, you can't say come back in 3 months or 6 months. You have to say come back tomorrow or the next day, even if that means, you know, we leave places in our schedule, or we see these kids at lunchtime. Because what it does to a family, first of all what it does to the child is -- this child is now 4 and has no language. That's not fair.

And what it does to the -- can you imagine the confusion that that gives to a family when we can't tell them what is going on. So we not saying you have to get it all on the first day you see the while, but you have to get it all in a very short time.

>> Thank you for clarifying that. Yes, I did not mean on the first day you need to get it. But we need to have them back. We need to reconcile it.

We need to make sure we can figure out why we have these inconsistencies.

And we need the SLPs, AVT, all of the clinician, we need your help, too. So, when things are not going right, when you're like: This child really does hear things but I don't see any difference with the hearing aids on and neither do the parents.

We need that and we need to listen to the parents because they know what is going on at home.

And if the results are inconsistent and the child is not progressing as expected, and we all have to be high expectation, we can't say well auditory neuropathy spectrum disorder, I guess we can't expect much.

We need to have high expectations for every child. Then if the child is not progressing and we have inconsistent results, then we do not have adequate or sufficient information to tell us what this child hears. And we need to keep finding time to test these children.

>> Jane is going to talk about point two.

>> So point two... auditory access to the brain. All day, every day. Children need to hear all the time. Um... you know, an extension of the example that Joan was just talking about, I was testing a family in another state, and it was a very young baby who failed screening at birth and came in with hearing aids on from another center but came to see me what was they were uncomfortable.

I said, what does she hear with her hearing aids on? Which is a question I ask every family, every time I see them. Not just the first time, not just when I'm thinking the equipment is good. But every time I see a family, I say "What is he hearing with his hearing aids?"

And they said they didn't know. That's a wrong answer. That's a red flag. If a child -- if a family -- or -- if a family doesn't know what a child is hearing or the therapist doesn't know what a child is hearing or SLP or TLD doesn't know, something is wrong.

The technology isn't doing its job or they would know. And what I did in this situation, was I changed the technology setting, they came back the next day, and I said: What is she hearing?

And they said: It's unbelievable, you walk into the room and she turns around. That's what I want to hear from families. Okay. Um... so access -- auditory access is the biggest problem -- all day every day and as Joan said, we are going to say this a lot. It's the biggest problem worldwide for technology, research, all over the world shows that everybody -- that hearing aids and cochlear implants are not always fit to provide sufficient auditory access. We also know that technology has to be worn all waking hours. The Boys Town Research has shown that children who wear technology more than 10 hours a day, do significantly better than children who wear technology less than 10 hours a day. We need to tell that information to families so that -- they understand why we are being pushy about how often you have to have the technology on. They have to understand, eyes open, ears on.

Um, I was doing volunteer work in Vietnam and I said to a family, eyes open and ears on. And the interpreter, I found this out through another interpreter, said: When the child is hears aids are on you have to hold her eyes open.

And the other interpreter said, she didn't get that. That's not what you meant. So, be careful about that. So um... at birth, a child's brain has about a hundred billion neuros and also have multiples synapses connecting the neurons but the synapses are not developed at birth, they only get developed when we stimulate the child's brain. If we talk to the child, if we tickle the child, if we sing to the child, if we just babble about what's going on in the world, what happens is synapse -- the neurons connect through the synapses, and a child's brain can develop 700-1000 new connections every second, if we are providing stimulation. So, the early years are the most critical, that's the most critical time for developing the brain, and as children grow, the unused synapses start to be pruned.

So that if we do not provide auditory stimulation early, the synapses are gone. You'll get some, but you don't get enough to have a really rich auditory program in the brain. So that's why we are a little pushy about technology early and always.

So how much practice to you need to make this complex neural structure, that's the auditory part of the brain. It takes ten thousand hours of practice to learn a new skill.

It takes 46 -- a child hears 46 billion words by the time they are 4.

It takes 20,000 hours of listening as the bases for reading... require 3 times the exposure to new words and concepts because of the reduced acoustic bandwidth that is caused by the hearing loss and we know that children with cochlear implants can develop speech and language skills similar to peers if they have good auditory access.

So what does this mean to the kids we care about? It means we have to figure out a way to provide them with that kind of auditory access. We have to make sure that they are able to hear. These are two references for full-time use of technology. Children who are fit with hearing aids before 6 months of age, that had better language than children fit after 12 months. Children who had more than 10 hours of hearing -- a day of hearing aid use had more positive language trajectory. And even adults, adults experienced an average of a 7% increase in speech perception, for every hour of additional wear.

I'm not good at that. I have to confess. The adult part, I just... [chuckles]. Don't point at me. They don't have to know it's really me.

Okay, so first you need appropriate technology with good acoustic accessibility, it's not enough to have the technology on, it has to be appropriately set. Then we need enriched auditory exposure. The child needs to have -- people need to be talking to the child. If we get great technology on the child, and the child is living in a closet and no one is talking to them, that child is not going to have good brain development. If people are talking to a child all day long and they don't have good technology settings, that child is not going to have brain development. So for a child to have good auditory brain development, they need appropriate technology, which is providing good acoustic accessibility and an enriched auditory exposure.

So... typical children have access to sound 24 hours a day. Children with hearing loss do not. If a child wears technology 4 hours a day, it will take that child 6 years to hear what a typical hearing child hears in one year.

I'm going to say that again because I think it's really important. If a child wears technology 4 hours a day, it will take that child 6 years to hear what a typical child hears in one year.

That's why -- this is another thing that's helpful to tell parents, because then they understand why we are so pushy about making them wear the technology. So... we need to also help families understand why we need to keep the technology on a child's head. Um, everybody needs to understand the typical development of what happens. People say he keeps pulling the hearing aids off. Well... a 4-7 month old is exploring his body and parts of his body and so he will occasionally pull the hearing aid out, that's typical. And we just take it and put it back in the kid's ear.

By 6-12 months they are really investigating things, examining the world and they are going to start putting stuff in their mouth and shaking it and banging it and transferring it from hand to hand. And that's important. We need -- they need to do that and we need to know they are doing it.

And then... you know, so those are things that are typical and if a child what as problem with that, we need to just, you know, help everybody understand why.

>> I just want to say the biggest thing we hear parents say is well they don't like them, they keep taking them off.

But I let the picture where the child, I think it's that picture, pulling their hair. I remember my own daughter getting ahold of her hair and yanking and crying and then letting go and then pulling again.

It's not really a like or dislike. We need to help. Just because they take it off doesn't mean they don't like it, they are just exploring, they are just finding "Look what is on my head."

It's in the a like or dislike.

>> That's why they take off their sock, it's not different than taking off their socks. One of the ways to find out how many hours a day a child is really wearing their technology, is to review the data logging. And the data logging will tell us how many hours the technology is on. Um... you could take -- turn it on and put it on the table and it will look like it's on, but that's you know, most parents don't do that. They are not trying to trick us. But parents often think the children are wearing their technology more hours than they really are. So we need to help them understand, 10 hours means 10 hours.

So, this is something that you can find on Karen Anderson's website, success For Kids With Hearing Loss, it's a sudden did we did in 2013 in which we looked at different ways of keeping technology on, because when a family says we can't get -- she won't keep the technology on.

We talked about what the -- we asked families and teachers what they thoughtworked well and what did not work well.

Everybody uses thing like critter clips, but they only keep them from getting lost. That's a good thing, but it's not solving the big problem of keeping the hearing aid, the sound going into the kids ear.

We found that Ear Gear worked best at that time. [Coughs].

I think --

[Pause]

>> This is a -- I think this is a really good slide. It tells -- helps everybody understand the available hours of listening by age. Children under 3 months [coughs]... are -- can hear about 9 hours, 9.5 hours which they could be listening if we worked on the technology.

By the time a child a two or three, it's 12 hours. [Coughs].

Sorry about this. So if a child has the -- if a child is using their hearing aids appropriately, this is what we expect them to do, and where we expect them to be listening. [Coughs]

[Pause]

>> Hold on a second.

[Pause]

>> I'm sorry. [Coughs].

My voice gets horse when I talk too much.

Okay, so now we are going to talk about child B.

26 months of age, and a boy, he came for a hearing test, and he wasn't wearing his technology. Now, in my clinic... if a child didn't have their technology on when they walked in the door, one of the secretaries would say, Dr. Mendel is not going to see him if the hearing aids aren't on.

So this didn't happen with this family, and mom said, they are in my purse. And I said, does your purse have a hearing loss? And she laughed. I was making a joke. Um... and I said you put them on. I wanted to see how comfortable she was putting hearing aids on this baby.

And she was not very comfortable doing it. She was really having trouble doing it. So he started crying and swinging his arms and she said, one minute and she came back with the biggest chocolate donut I had ever seen in my life. And she offered him the chocolate donut in exchange for wearing the hearing aids. I do not think that's something we should ever do.

[Pause]

>> We should not be bribing kids to do something they have to do that's just part of your life. Life is not fair, you have to wear technology. That's just what's. Life's not fair, I have to wear eyeglasses and hearing aids, that's really not fair. So, I mean, I think that you know, parents just, what I would say to parents, okay, would you let your child throw down the lamp in the living room?

Would you let your child run in traffic?

And obviously they say "no" to that. Although one mother did tell me that her son had just thrown down the lamp in the living room the day before.

But I mean, so parents need to understand that there are limits and hearing aids is a limit. You have to wear your technology, and that's not debatable. And you don't get a special reward for doing it.

And if a child pulls it out, the parents need to be firm but kind, and put it right back in.

So... auditory access is the biggest problem worldwide, technology is often not programmed to what we expect, and what is possible. And if the technology is not appropriately programmed the child will not develop speech perception skills and if they don't develop speech perception, they won't develop speech production, they won't have literacy and all that stuff.

So technology has to be checked every day. Every morning, somebody needs to make sure that that technology is working. And if it's not working, somebody needs to arrange to get it fixed. And for kids who are in school all day, I think somebody needs to check, especially young children, needs to check the technology twice a day because if it's not working you have all those hours when a child is not learning.

So if a child is not making the progress we expect them to make and if everyone has high expectations, we will guarantee you the problem is the technology.

[Pause]

>> Okay?.

>> Number 3. So if we know what the hearing loss is and we've got the hearing aids on, all the waking hours or the cochlear implants, then we need access across the speech spectrum. The child needs to hear the entire frequency range. Low frequencies contain about 90% of the power of speech but only 10% of the intelligibility. Whereas high frequencies carry 10% of the power, but 90% of the intelligibility.

If I talked to you using vowels, you can't understand anything I'm saying. But if I whisper to you only using voiced conns ninetys you can understand everything I say.

The intelligibility is dependent upon those high frequencies. And 6 and 8 thousand hertz really do matter. When we look at the count the dots audiogram done by Muller and Kiln we can see how much information is in the mid and high frequencies. And not that much in the low. Each of those dots represents one percent of our speech information. So if you miss this high frequency information you're going to miss grammatical markers, you're going to miss plurals and tenses, you're going to miss those little tiny things like prepositions and articles. Um... that we don't really stress in conversations. We have a lot of research to tell us that children with poor 4 thousand hertz thresholds are going to have poorer speech perception on tests.

We need to consider it carefully, especially with hearing aids. Cochlear implants are pretty good, they give us a frequency range, usually we don't need to change that. But with hearing aids, that hearing aid manufacturer, that style, and that level of technology is going to dictate what this child hears. And just as an example, I picked out probably the most popular pediatric hearing aid that is fit these days in most places and I picked out one model of it but looked at the different levels. We have level one where you don't pay much and you don't get a lot. Level two and then we have the top of the range. I don't know, I'm in California, but often those who get -- those children where have state insurance get this low level over here.

But I also see parents who private pay, are offered only this level over here. And the difference between this one and that one was a cut off of 5,000 hertz versus 8,000 hertz. So just by choosing that lower level of technology on that hearing aid, we were sacrificing the high frequency information that that child was going to get. How do we evaluate across the speech spectrum? With hearing aids we can use real measurements but we have to remember that that is the information reaching the tympanic membrane, that is not the information reaching the auditory brain.

And all of the real ear measurements and the programming from hearing aid manufacturers are algorithms for the average person. How many of you think that you're average?

[Pause]

>> How many of you think the kids you see are average?

Sometimes we have to adjust away from average. Because just because the average amount of sound is getting to the tympanic membrane doesn't mean the child needs the average amount to hear.

We can look at some field thresholds and we can do LMH testing. We are going to do a brief pit stop here and talk about the LMH test. How many of you have heard of it? Some.

So LMH, Lig may dell Hewit other low, mid, high and we first published this test in 2021. Why did we come up with the LMH. As the number of cochlear implant patients increased we started to see apparent trends. We saw patients who were super stars and patients who were not super stars and the blame that we would hear was placed on the CIses, just don't work for everybody and this is a kid they don't work for.

The child. That one makes me really angry. Well you know... their implantation, this happened, they've don't have a full insertion, or they had this surgeon or they picked this brand. Oh, well they have oral motor issues, we hear that one all the time.

>> Or they're not ready to listen.

>> Yeah, love that one. They have other issues, which we haven't found any of -- I mean, we have seen children with those things, but it's not typically the problem. And the third place that also makes us angry is parents. Well they just need to do more. They are not doing enough and that's why that child is not making progress. But there was one common thread that we saw. And that was that children who didn't hear well, didn't do well.

And so... we would ask the clinicians, so tell me what you know about what the child would hear? And we would get pages and pages and pages of testing on these kids. And when we look through this, I would see that some kids who had every little check mark on the Lings were doing great, super starts. And some kids were still struggling. And those who didn't have the check marks, on all the Lings, they were struggling or made little to no progress. And those that didn't have any good check marks on the Lings, they were not making much progress at all. So we saw that clearly the Lings were not telling us the information that we needed.

They did not tell us, below the surface, what the children needed to be hearing. So we did a study of 230 plus subjects, phoneme perception errors before and after programming. And what we already knew was that the Lings were being overused, almost like a curriculum. And we would ask somebody and they would say we did the Lings every day and this is what we got.

And they were being used well beyond applicable ages. Why are we asking a middle school or high school student to repeep thelings?

Before you say anything, the child goes, Ahh. Uhh. Eee.

Shh.

They are just memorized. And the kids see them as boring. One of the kids who came in with all their Ling things from the school, and I saw that everything was fine and then they were awful. And I said... I checked the technology and everything is working fine so I said to the kid: What happened here?

And he said: You know I can get to class faster if I just say something.

So, I said the same thing in the same order every day and I got it wrong but I didn't care because I got to go.

Well, there you have it. It's boring. So, what we found, in looking at this reprospective study was that the Lings did to the predict speech perception of all phonemes and indicated there were significant global speech errors and the Lings did not identify the most common errors. So in our study here were the most common errors that we found, here's the occurrence, how often they occurred.

And then here is the correction. So within that cochlear implant programming session, here is how often we could actually correct it, right then and there. And if you look at the Lings, really number 3, so the S, okay, the Lings might show us that and the last one on the bottom. But other than that the Lings is not going to tell us anything of those, and if you look also, M-N confusion was one of the biggest issues, and people said well the Lings will tell us that. No, it's only going to tell us that the child hears M, it's not going to tell us there's that confusion.

Is what was missing from the test? As we looked at it we saw that in those 6 sounds like the Ling uses there was good information in the low frequencies and in the high frequencies. But the mid frequency, which is where almost all consonants are differentiated, was very limited and all in the same bans.

Well, why are those mid frequencies so important? Well it comes back to what I said about the power and the intelligibility. Right in those mid frequencies, is that cross over point, where we go from power to intelligibility. The mid frequencies are essential, to telling voicing, manner and place differentiation.

If you look at the consonant energy bans you will see that almost every consonant has information in those mid frequencies. Which the Ling test was not differentiating for us.

So, we added some extra phonemes to the Ling test. We added N... and so many people have said to us "They can't tell the difference between M and N."

Exactly. That's the problem. And we need to know that. Because there's a -- that is huge. We all have kids who say Mo, Mo.

It's No. It's not Mo.

H covers that mid frequency well. And then we have two heavyweight phonemes, the Jjjj which has low frequency and mid frequency information and the Zzz which has low and high frequency information. These two are heavyweight because if I said Zzzz, and the child hears as we saw the most common error, Mmmmm. Then I know the child is hearing low frequency information and maybe too much low frequency information, and they're not hearing the high frequency information. I don't know if that low frequency is masking out the high or I don't know if there's not enough high frequency information, but I have now gotten information on the low and the high frequency ends of the spectrum. But the LMH test is a battery of tests. It is meant to grow with the child. We can start a detection of the ten sounds, we can move to identification,Aaaa is the airplane. You can move to imitation. As soon as kids can start to imitate those ten sounds, we are going to move to imitation of all phonemes. All phonemes are important. And from there, we are going to move to immediate consonants. So that our... bigger kids are doing something that actually challenges their speech perception.

So we do have a little form, it's available in a number of places, that show you the ten sounds on the quick test for beginning listeners.

When we are starting with detection for very young children, you're going to repeat the sound 3 times because we want to minimize the Qs.

One thing we saw is that parents or clinicians would go AhhAhhAhh.

Shh. Well... that's not hard. You don't have to hear very much to know okay, that long one is probably the airplane with the intonation and the shorter one is going to be the Shh.

We also found that people, like, Shh Shh Shh.

No. We say Shh.

So Shh Shh Shh forces you to use those short bursts.

We only have one little change from the way the picture shows it when you're doing detection, and that is instead of saying ma ma, ma, you say MM, MM.

Because we want to make sure the children can hear the difference between UUU and MMM.

It's possible they are hearing the UU part and not the M. And the same with the N.

Identification and imitation, you're going to say them like the picture. Ma, ma, ma, repeating them 3 times. And it is important to repeat them 3 times. When you move to all phonemes, again you're going to repeat them 3 times to minimize any cues.

Voice consonants are going to have a natural vowel, you can't really release it without having a vowel. But your voiceless consonants are not going to. Ttt, Ttt. Because we don't want -- we want to make sure they hear that voiceless consonant, we don't want to add voicing into it to confuse it. And immediate consonants are vowel consonant, vowel combination. Ba, Asa, Ada.

And we want to do random presentation. So, I have some short video clips of doing this so here is a 12 month old. She was implanted at 7 months. So he is 7 months post CI and you're going to see just a little bit of detection. Here. I don't do the whole test because you know with babies it takes a long time and throwing things on the floor, picking them up. So just a few to see how we can check for detection.

[Video].

>> Here you'll see there's a quick sound test which can be used for identification, if children are not, if they are detecting but not imitating yet so we can make sure they are hearing the differences by pointing to the picture or they can use objects. If they have objects. But we have found that children can move from detection to imitation, very, very quickly. We just need to have that expectation. So this is an 11 month old, two months post bilateral implantation. I did not show she could imitate. But we have to give the children opportunity, children take a longer time to process than we do just by the nature of not knowing the information yet. And you'll see she stops... and I started to think, she's thinking about something here. Let's see what she will do.

[Video].

>> Sometimes if we just wait, they'll start imitating which is going to give us even more information than identifying. Once I move to individual phonemes, we are going to do all the phonemes and really focus on consonants, um, this little girl is to show you it can be done with anybody, is a 3-year-old. She was diagnosed with cochlear nerve deficiency on both sides. One ear they did not even want to implant because they said there was no auditory nerve at all but her parents pushed and she got bilateral implantation at 12 months. At the age of 3 she was only starting -- she could detect Ahh, that was it. She had no other responses to sound. We reprogrammed everything, and this is 4 months after the new program and this is the ear that she supposedly has no cochlear nerve and only one surgeon would implant this ear.

[Video].

>> So if you're a clinician, you can do more than one on a time, if you're playing with a toy, to keep them engaged to two or three. Um, here is a copy of the medial consonant test.

All are on the handouts.

>> But they are also on [off mic]

>> Oh, on Jane's website. Jane Maydel dot com. We have um... Mary and Fernanda have worked together to do a Spanish version for those of you who have Spanish-speaking patients.

I use the short list, so here is my short list that I go through that are um... presented from lowest frequency to highest frequency. We have a Spanish list. The same way. And then we get to... medial consonants and this was a 4-year-old, am aright Jane? One year both CI?

>> 14 months but she -- [off mic] and she... she came from another [off mic] -- she came from another country where there were no services for children with hearing loss and her family, um... brought her to the United States to get help. And she got bilaterally implanted, and this was about 13 months later.

>> Yep so late identified, late implanted and doing medial consonants 14 months after implantation.

[Video].

>> I'm not going to play the whole thing, but you get the idea. So some notes about the LMH. You -- in the beginning, especially with implants children, you want to be testing a variety of vowels, and consonants. I have so many clinicians who tell me they don't have these vowels yet and we have not moved any further.

But developmental progress, especially with cochlear implants, varies. We have always seen the child that make it is SH child and not too many vowels, but if we are only looking at vowels, we will never know all the other things that they are developing. So it's so important to be looking at consonant, too. Once there's differentiation of vowels and they seem clear, focus on consonants.

Continued problems with vowel perception generally indicates global programming issues.

How long does it take the test? Oh, this is a lot?

It's not a lot at all. So I have a 3-year-old charge patient, she has cochlear nerve deficiency in one ear and um... just atypical anatomy in the other ear. And doing individual phonemes and using a toy, so keeping her motivated and involved with two or three sounds per piece of toy. Her better ear two one minute and 15 seconds. Her poorer ear, two minutes and 12 seconds. This doesn't take a lot of time. Medial consonants, about 30 seconds per year to go through all of it.

And we have kids as young as 18 months who are doing medial consonants. If you follow the progression, in purpose is audiologist.

In purple is the clinician and in blue is the parent. Clinicians when the child has first gotten their hearing aids or implants they are going to be looking for detection of the sounds. As soon as you see that they are seeing they know what to do, you are going to pass them to the parents. When the child wakes up and you put the hearing aids on and when you're in the highchair and cooking, see what they detect. Try the multiple times throughout the day. And at that point the clinician is going to start working on identification, picking the right picture or imitation if the child is already imitating. As soon as the child can do that, we are handing it back off to the parents. As soon as they can identify or they can imitate, we are going to tell parents, I don't want you sitting in the highchair and looking at you, I want them to imitate you with the sounds.

Then we move to imitation of all phonemes of isolation. As soon as the kids can do that, we have pass it on to the parents and we are going to start encouraging imitation of immediate consonants.

Um, so that very early on, with kids who are doing well, we are going to see this, like I said 18 months, I have 18 month olds who are imitating immediate consonants.

And at the same time, we are giving information to the audiologist so the audiologist can start speech perception testing, as soon as the child can do it.

>> And so the audiologist can adjust the settings of the technology, that's the real purpose of doing this. So, the audiologist can adjust -- see what the child is not perceiving, go back to the consonant format chart, figure out what frequencies need to be adjusted, and adjust those frequencies in the hearing aids or the cochlear implants so that the child will be hearing more.

>> And that's really an important point. To come back to the beginning of this topic, when I got pages and pages of Lings, I didn't know what to do to adjust. So they missed Ahh on two days and M on five days, I didn't know what to adjust. But... when you send me -- and it's not going to make sense to you, but if you send me something that says: I don't get it but they confuse M and N, they don't have a CH, their SH is slushy and they interchange B and G.

Those look like they are not related at all, but when you go to the frequency format charts you will see there is a very specific overlap of each of those consonants, and okay, here it is. I'm going to start right here, and having parents come in and say "I don't know but they lost their H, their H is gone," and they will say "I don't know it's silly."

You're not silly, it's exactly right. And when we change it, it's back. So that information is so important, and the more detailed you can get it, even if it doesn't make sense, the more precise we can be in helping the perception through the programming.

>> Okay, does anybody have any questions or are we -- there's usually a lot of questions related to this. Okay? Wait.

>> AUDIENCE: Thank you. I had a question about the... M and N distinction. So... because we have been trying it out a little bit in our clinic and we found the same thing that we find it really hard to hear the difference between MM and NN. And so yeah, so we were wondering if we needed to add the vowel because then we could here the distinction. Um, but --

>> So yes, so only for detection are you taking the vowel out. Only for detection. If it's imitation, you've got the vowel in there. Because I mean, listen MMM, NNN, I can't tell the difference either. So ma, ma, ma, nah, nah, nah.

>> AUDIENCE: So detection only, there's no vowel. But identification....

>> And I want was another clinic that pointed out to us, if I say ma, ma, ma and you hear the AhAhAh we don't know what they heard. So with detection, MM, MM, MM, NN, NN.

Hopefully we are moving past detection so quickly and getting to imitation. Exactly like it's written on the paper.

And often it's mid frequencies, not low frequencies that need to be adjusted there. Or lows need to come down, mids up to hear those differences.

>> AUDIENCE: Thank you.

>> You're welcome. Any other questions?

[Pause]

>> Okay. Either we are very boring or very clear, those are the two possibilities. Okay, auditory access to the brain, number 4. Access to soft speech. So... as we have said, at least five times, auditory access is the biggest problem, worldwide, for all degrees of hearing loss and that's because technology is often not programmed appropriately. So children definitely need to hear normal conversation, we know that that's clear, but they also need to be able to hear soft conversation. Because if -- soft conversation is frequently overlooked and not assessed. That's in therapy, and in audiology. Soft speech is at about 30-35 decibels. Normal conversation is 45-50 decibels. Soft speech measures what you hear at a distance. Or what you hear when it's very quiet.

Overhearing or incidental learning is critical. Because at least 80% of what young children learn, they learn incidentally. They learn by overhearing. So children learn language, I mean, all of us have had the experience where you say something to someone and the child who was playing on the side doing something else, turns around and says, "Why did you tell so-and-so that?"

And it's like... you weren't supposed to have heard that, I wasn't talking to you. But in fact, that information provides -- that provides a lot of information about language learning. So over 80% of what children learn, they learn incidentally and also what they learn in a classroom, if a teacher asks a question, and another child answers it, if that child doesn't have a pass around mic, then this child is missing that information. And that is critical information for language.

And for academic information. I was doing a school visit and this -- it was a 5th grade class and talking about the World Series, this was a number of years ago and one of the teams was a Minnesota Twins and the teacher asked why they were twins and kids are calling out all the answers and the teacher was not repeating anything.

And hearing impaired kid doesn't hear anything that anybody is saying and at the end, when the teacher said "That's the right answer" the kid said could you tell me what the right answer is?

And I was proud that he was able to advocate and say: I didn't hear. But the teacher wasn't doing a good job before that.

So if a child doesn't hear soft speech, they won't hear their peers, they won't hear in the classroom or on the playground and they will have reduced language and literacy skills. Some of the research from Boys Town in 2011 study reported that they did a multisensor study, 5 centers all good centers, 40% of the children fit with hearing aids were under fit. They were not fit, even according to really the targets. But we don't want hearing aids at -- that kids are hearing at 0 because they are going to get a lot of distortion, but they should be able to hear so they can hear soft speech and they -- so that children with both CIs and hearing aids can hear soft speech. And they are capable of hearing it. And the technology can be adjusted independently. Normal conversation and soft conversation. And it needs to happen.

So, this is the audiology fruit. If you look at the top line... there we go. The B line, if you're hearing at the B line, you're going to hear 90% of what is said. If you're hearing at the C line, you're only going to hear 10% of what is said.

So my goal is not to have a child hear in the speech banana, it's to have the child be hearing at the top of the speech banana. So that they get all the information they need to get. And so I'm suggesting that we give up the banana, and call it a string bean because that's really where I want to child to hear, at the top of the banana so that they are really getting -- we know they are going to be getting what they need to get. So here I think this slide is helpful. The blue line is normal conversation. At about 50 dB and the red line is soft conversation, 30-35.

If a child has aided thresholds of 40 decibels, they are going to hear normal conversation very softly. [Off mic] at all.

They will have no soft access to soft conversation. So by knowing what a child is hearing, with their technology, we know whether they have access to soft speech. Thresholds are not going to tell us how a child hears to loud speech, but they are going to tell us how well a child hears soft speech and I think that's very important.

So here is child C. Am I doing this kid?

A two-year-old whose language was developing slowly.

They are parenting -- parenting issues, was it a compliance issue? Well parents said we didn't see much difference with the hearing aids on. Red flag. If you don't see a lot -- if you -- if you don't see anything happening with the hearing aid on, that's a problem. Or they would say he listens when he wants to. And after increasing the speech, and making it louder, he is saying so many things that I didn't teach him, because he overheard them, he got incidental learning.

His unaiding was 50 and 45.

His aided SRT was 40 and 35, not good.

But his word recognition at normal conversation was fair, fair at 72% and good at 80% in the left ear. But look at his word recognition for soft speech. There's no reason for a childhood hearing this way. If you look at the A's on this audiogram, what is he hearing? He is missing all of soft speech. So we need to know.

>> Which would be my the parents are reporting, he seems to hear some things but not other things, why they are saying we don't see a lot of difference.

And speech and language was slow the develop, he had no access to incidental learning. As soon as he could hear that soft speech, there wasn't that -- there was just a little change to normal conversation. But as soon as he had access to soft speech, his parents saw this huge difference, now he is getting input, many more hours a day because she's not just hearing the people talking to him. He's hearing all the people talking around him.

I mean, I can't tell you how many kids I've seen like that.

The number is astounding. So, when I say to a parent, what is he hearing?

I want to know the answer to that because that's going to tell me a lot.

Normally we put a little initials on these slides so we know who is talking but we never got around to it on this talk. So we are fudging.

>> [Off mic]

>> We knew what we were doing, then Joan changed her mind. Auditory access to brain number five, access to intelligible speech in all environments. So, again auditory access is the biggest problem worldwide and technology is often not programmed optimally and children learn language by hearing it.

So every sound needs to be audible. If you have the low end technology and only hearing through 5,000. Are you going to hear S? No. Are you going to be able to distinguish between S and SH?

No.

Does S matter? Pronouns? Possession? You know, pluralization. Yeah, S matters.

So the goal of technology is to provide access to intelligible speech and language, in quiet, in noise, up close, and at a distance. And here is the string bean with a whole bunch of consonants on it. And you can see that it goes all over the place. But look at what happens. Here is MMM. Which has energy at about 270. At about 1200. And at about... 3000.

So, if you're only hearing the low frequencies, no wonder you can't distinguish between M and N. And also between M and D.

Except that Mmm is longer. So -- if you look at what happens here, you can see that phonemes are -- phonemes have energy in a lot of places and we need to know them. So... oh...

What happened? There was another slide here. How do I go backwards?

[Pause]

>> It's not...

It's not moving. Okay. Right? Wait, it's not even going forward.

>> No, it's not going at all. Let me undo it. I might have to close....

>> So what does the audiogram tell us, why Joan is trying to figure this out, I'll talk to you.

>> Will this affection the captioning if I shut it down?

>> Is the captioner in this room?

>> Captioner we have to shut this down for a minute.

[Pause]

[ Captioner standing by ].

>> Sorry, everybody.

[Pause]

>> There should be one, the blue -- okay, there's a slide missing.

All right. I had another example of other sounds, but okay.

>> Captioning is there.

>> Okay. Um... thank you.

So what does the audiogram tell us? It tells us the degree and type of hearing loss, it tells us the quantity of the hearing loss, but it doesn't tell us quality. It doesn't tell us what we can expect a child to understand. It gives us suggestions about the type of technology. And we can make an estimate, you can use something like the... the... count the dots audiogram, and get an estimate of what speech perception might be, but unless we test speech perception, we do not know, really, what the child's speech perception is. So, the audiogram doesn't tell us their speech perception skills, what their speech production is going to be, what their language is going to be or whether there are other auditory problems that the child has.

So we should never assume. Without testing we will not know what a child is hearing and what they are able to understand. What is their auditory perception for words, and for phonemes and for sentences and in quiet and in noise?

When I do a word recognition test for words, I record, not just whether they got it right, but what was the error. If I say "books" and the kid says, "Book" I record that they missed the "S."

If I they but, and they say boot, that's a vowel perception error and I record what the error is. Because that's the information I use to go into the speech perception testing -- into the phoneme chart, and figure out what I have to change in the technology settings. So for me, that information is very important. We don't use -- the ABbio sentence testing is the first that we have that are providing us reasonable information about what a child is hearing. But there are still clues in there. So I'm not going to get enough information about the specific perception errors that I need, to change the technology settings. So while that is going to give me important information, it's not all the information I need. So, I have to use word recognition testing, using phoneme scoring, in order for me to really understand what the child's perception is. And I want to do that in quiet and in noise, so that I know what is happening. So speech acoustics can help us understand how a child is receiving the sounds of speech, are they hearing all of them? Can help us understand what a child is perceiving, and you know, Damling said what they hear is what they say. And that's something that I remember all the time. So if a child is not putting an S in when there should be an S, I know that means the child is not hearing it.

When the child is confusing "boot" for "boots", then the child has a perception error, and the production will show that perception error. Does that make sense?

[Pause]

>> So I want to evaluate the missing phonemes and the distorted phonemes and we would do additional testing and see what the child repeats, but if the kid doesn't have it they are not hearing it.

So... and they we also want to know what their ability is to hear close up and far. Because a lot of language they don't learn with someone sitting in front of them and talking to them. So -- and Joan talked about this, one of us talked about this a little bit earlier, speech may be audible but not intelligible. You can hear it, I'm talking to you now and you hear it, you can hear me now, [off mic] that you understand what I'm saying, but it's not really audible. So, the speech has to really sound good if we are going to have a child who is going to learn to use it.

So can you tell the difference between words? Even words that are subtle. Now a child may be able to tell the difference between sleep and sleeping, because it's one versus two syllables, but they can tail the difference between sleep and sleeps?

That's important to know. So here is some information from Arthur that is in Maydel, Flexer, Wolf and Shafer from the third edition Of Pediatric Audiology and you can see this area is the most intense for important information. There's a little less information here and here, but there's still information in the high frequency and in the low frequencies, that provide very significant perception information. So if a child isn't hearing up here, they are going to be hissing a lot. If they are not hearing over here, they are missing a lot. Um, here is a checklist for the tests that should be done, when you're doing technology settings on kids at different ages. This is in your handout.

And now, some recommendations. Are you --

[Pause]

>> This is where I through her off and changed it.

I think before you test for speech perception, it's important to think about what is the goal of the evaluation and we see that a lot of audiologists and always parents and teachers and clinicians want the highest score possible. So that's the goal to get the highest score possible.

We don't really think the highest score possible, yes, we want them to do the best they can, but the highest score possible doesn't necessarily give us the information that we want.

We want to compare them to their peers, so we need to know what are age appropriate tests. We want to monitor the technology benefit and find out if they are not doing well.

So that score doesn't tell us if there are places we need to re-adjust.

We want to make sure that they have everything that they need for their intervention, they can hear everything and we want to identification specific speech perception errors. We want the most realistic picture possible and I tell parents in my office, they will come in and say: You know, at my other audiologist my child always got 100%.

My goal is never to get your child to 100%, because I had a 12-year-old that came in one time that they needed a new chips finger pointing task, she was fully mainstreamed, 100% and then the school district said we are going to discontinue his services because he got 100% that they did not understand was for two and 3-year-olds, a finger pointing test. When we did age appropriate material, his scores were very low and I tell parents, my goal is never to get your child to 100%. There are always going to be more difficult listening environments for your child, and so as soon as your child is doing well, that means the testing material is not hard enough and we are going to move to the next level because what I want you to be able to take back to your IEP team is to say this is where my child is going to have defectty. These are the problems they are going to have. How many of you have the families that say, I asked the teacher how they are doing and the teacher said great, they don't miss anything. If we don't quantify what they are missing, who is going to do it?

So we need to make sure that tests are linguistically appropriate, not too easy, not a finger pointing preschool test for a 12-year-old, and not too hard, I don't want to do adult testing with a two-year-old.

We need to have the appropriate level of complexity to get the information that we need. So sentence testing allows us to use context and fill in the blanks. And so it may not necessarily be the most accurate measure for those patients, especially who have really, really good language. And for those, let's say, who have had a progressive hearing loss and looking at CI candidacy, it may not be appropriate for them because they may be able to fill in more blanks, and the score might look too high. But I do think there is an important place for sentence testing, and especially with young children, or children we see who are struggling with language, it's going to provide data about what is being processed in connected language. So... we did the pediatric AZBio on a kid and he did not use a single article in the entire test. And they were getting ready to dismiss him from speech in school, because they said he is fully intelligible.

But... every single sentence there was not an article included in it. So it gave me information that... well, it gave me information that maybe he doesn't hear the articles or he has not learned that yet. But he is not hearing and using everything that he should. So we can compare it to their single word scores and their language.

Mono syllabic words are going to be more accurate of auditory perception. Phoneme testing is going to tell us even more specifically.

And nonsense syllables, it's going to be an excellent measure because there's no context that can be used for that test.

Open set versus closed set. Obviously there are times that we need to use closed set measures where there are limited number of possibilities. They are useful for children with limited vocabulary. Um, or who are very difficult to understand because of their articulation. But we have to remember that it can inflate their performance. When you have a horse, a horse, a cow, milk, and a dog, those words don't sound alike at all. And if you can hear a little bit of the word, if you hear Aww you know it's not 3 of them and it has to be dog, even though you didn't hear anything else.

And it's important that we don't use them as soon as children can really start repeating for us. We want the move to open set measures. Because they are going to be more challenging, they are unlimited number of possibilities. I love those kids who when we do CNC words and it's ready, chair and the kids say, could be bear, hair, stair, pear.

They list them all. Okay, you do not hear it as well as you need to, but you know all of it -- you know there are a number of possibilities here. And it's going to be more representative of what is happening in every day life and very little kids can do it.

We start open set speech perception testing, again, we have done it as young as kids as 18 months to two years old. And clinician, that's where you can help us to get the kids to repeat early on, imitate, we can get so much information. So here are the protocols by age. Um, that's really important that kids do them by age. Um, it's also important to realize that you can do like the new chips open set, you don't have to do it closed set or the WIPY. Pediatric AZBIO down to age 5. But if children are doing well, if they have typically developing language, typically developing kids can do the test at 3. We can start much younger. And sometimes we have to move them up to the AZBIO to the adult sentence test before they turn 8, if they have great language. And I just had a school audiologist call and said he is 7, why did you do this? Because he missed a lot and when you did the pediatric, he got 90-something percent.

Exactly. I don't think his second grade teacher is only talking to him in kid sentence, they are using adult sentences and vocabulary. So yes, not all the sentences are quite appropriate but we try and pick lists that are pretty appropriate.

When we evaluate, like Jane said, we can do word scoring but we also need to do phoneme scoring because word scoring is just a small part of the picture. We really need to see what the child is miss perceiving. I love when we can move them up to the CNCs because it's super easy and they actually even help you with the scoring. Um, so we need to know, what are they misperceiving? Is it all high frequency errors or are there certain mid frequency or low frequency errors? Which frequencies have the errors? Vowels, are they okay? What are the confusions? Like Jane was talking about. And then what can we do to change the response of the technology, to improve that. And we can change the technology, put them right back in the booth and we can see the changes right then and there. It's not a go home and adjust.

If they can hear better, if the intelligibility is better, it should be automatic. So we should use our technology, to work on improving the perception and then therapy, if there are still issues going on.

This is a study that Jane did, looking at with typically hearing kids,ing um, what test or -- yeah, yeah, here is the test. Sorry, I was looking in the wrong --

Here is the tests, the conditions.

>> These are -- these are the results of speech perception testing, because people frequently don't believe it's possible to do this on little kids so we did, a bunch of years ago, we did this study and we presented it at the Academy of Audiology and we did a group of kids -- where is the --

There it is. We did quiet -- so normal conversation, quiet, soft conversation, quiet, normal conversation, plus five. Normal conversation, 0. Soft conversation, 0.

We did a group of kids who were 3 to 5, 6 to 8, and 9 to 16.

And the important thing to look at is... um, this column, underneath male or female. This was the percent of the word recognition scores and you can see that everybody is in the -- oops.

Everybody is in the 90s, you know. So it's possible, on typical hearing children, to get them to hear these tests well. So if our goal is to have our hearing impaired kids do the same thing... I'm showing you what is possible.

>> And look at the standard deviation, too. 98% with a standard deviation of 3.7. Kids did well, all in the 90s. Which, so Jane suggested scoring is excellent, 90-100%. Good, 80-89.

So when we report an a child, if that child's score is 68%, we need to say they have poor speech perception. If it's 82%, they have good speech perception. We need to use the same standard that we would use for typically hearing children.

>> And if we don't say that a child -- if we say the child has got 74% or 68% has good speech perception, the message we giving to the parents and kid and therapist is speech perception is good you don't have to do any work.

That's not the message we want to give.

>> And when they are sitting in the classroom and the teacher says, they get everything, yeah, 76%, they are getting everything.

They're not.

>> They're missing 24% of what is happening in that classroom.

>> So I want you to meet child D. Who is going to eliminate some of this. So he was a fully mainstreamed kindergartner, had gotten hearing aids at 2 years old, and a right cochlear implant at 2.5.

He moved, he had moved away, had been our patient, moved away and started at a new center during his kinder year. And he saw the new audiologist for the first time, she did a bunch of reprogramming and she was fine. He sat there fine and when it was time to leave he stood up and burst into tears and said I can't leave, I can't hear.

And he kept insisting he couldn't hear.

All right, let's put him in the booth.

So she did a speech awareness threshold, 15 decibels, new chips closed set finger pointer test, he got 96%.

He still said he didn't hear. Threshold detection, 15 to 25.

Detection of Lings, everything looked okay. But he insisted. So she said, I want you to go home, give him 3 weeks to adapt and everything should be fine. But come back in 3 weeks, if he hasn't adapted.

>> What is missing? What should she have done that she didn't do?

[Pause]

>> That would have given her some information about what was wrong?

[Pause]

>> AUDIENCE: They did detection, but I don't think they did repetition? Or imitation?

>> Yep, no recognition, so just detection, so he's just saying it's audible, not that it's intelligible. Right?

>> They did speech perception at 50 but they could have done a soft speech level too.

>> Yeah, no soft speech.

>> AUDIENCE: It would be interesting to know exactly -- maybe ask him more questions, what do you feel like you're not hearing? If I say a sentence, what do you feel like you're missing in the sentence? Beginning in? Middle? End.

>> That's a great point and he couldn't quantify. It is hard to describe our hearing. You know. The other thing too is they did the new chips, closed set, so this is a 2 and 3-year-old finger pointing task. So he could hear enough to finger point to an easy word but he is a fully mainstreamed 5-year-old so this test was way too easy.

>> The test was inappropriate.

>> The test was inappropriate. So 3 weeks later, he continued to report that he could not hear. The teacher and the parents reporting he was overly sensitive, he was crying at the drop of a hat, he had become disruptive in school which he had never been disruptive before and his mother said she has chewed the front of every shirt that he has worn to school since this and his pencils are awful, has chewed them too.

So they came back, okay, let's put him in the booth and see what is going on, but let's do appropriate testing. So we did a speech reception threshold. So he couldn't repeat words, until they were at 40 decibels, despite the fact that he was aware he could detect speech at 15 but it was audible at 15, not intelligible. It does not intelligible until 40.

We did kindergarten words, at 50 dB and he got 40%. At 35 dB he didn't get any right.

And when we asked him to imitate the Ling sounds he couldn't imitate them until these thresholds here.

So even though he -- things were audible, he was correct. He just didn't know how the say it's not intelligible. I can hear but I can't understand what is happening. Reprogrammed, put him right back in the booth, so he didn't have to get used to it. And his SRT was at 25. His PDK at 50 was 80% and at 35 was 68%.

Audible does not ensure intelligibility. So, let's review. We are going to give you a case to review everything.

So, this child had an unremarkal birth history. Testing revealed absent OAEs. ABR thresholds in the minimal to mild moderate loss range. These were the ABR thresholds that they got. He was referred to ENT for review of everything and med cat clearance. The ENT there is no middle ear abnormalities, cleared the patient for hearing aids and recommended there was no need for additional follow-up because mild to moderate hearing loss, you don't need to do anything else. So he was fit with hearing aids at 3 months of age. And the audiologist recommended um, follow-up testing at 12 months, 18 months and 24 months.

They had a DHH auditory specialist who came two hours per month that first year. And the second year. Actually, the first year and then was coming out every week the second year. Anybody see any problems here?

[Pause]

>> AUDIENCE: No follow up until 12 months.

>> Really? One ABR is sufficient?

Anybody else?

>> AUDIENCE: They only looked at the 4 frequencies they didn't low at the lower and higher.

>> Exactly. We don't have a full picture here, we only have 4 frequencies.

>> AUDIENCE: The ENT not suggesting any follow-up, potential genetic testing or imaging.

>> That mild to moderate hearing loss doesn't need anything but detection, I guess? That we just need to find it and then we good.

Excellent. So mom kept saying, this was her second child and she kept telling everyone, no, he's just not doing what I would expect. He's not like his brother. And everybody everybody she said and at 24 months she decided to put her foot down and said I don't see any difference. He doesn't care if they are on or off. And he is not developing much speech and language. When she told it to the audiologist, the audiologist said well you know, your child fatigues when we try to do testing and he's really difficult to test so I think now that he is two we should sedate him and do an ABR. Mom was not happy to hear that now we were going to sedate him and all this time her child had been difficult to test.

The specialist who was coming into the home said, well, I didn't want to mention to you, but his rate of progress has been really concerning.

As clinicians, it's our job to be honest, our parents don't know what they don't know. And actually, this mom said she kept saying it and it was never validated. And then the clinician said I didn't want to tell you, but you're not really going to the best pediatric center.

>> That's a hard thing to say.

>> Well, you know, I know it's hard and I know the school district people worry they are going to flip the bill. But there are so many ways that you can say, you know, there are other places, if you don't feel like you're getting the information that you need, there are some other places that you could go.

So... listen number one to review. We must, as audiologists, be thorough and accurate and one ABR is not thorough and accurate.

And brains should want technology all day every day. A child who doesn't care if the hearing aids are on, he didn't fight, but he didn't care and parents who don't see a difference with them on, something is wrong. Huge reflags. So they went to the next center. And the audiologist said let's teach him conditioned play. So my plea to all of you teachers of the Deaf and speech-language pathologists, start teaching conditioned play early, start teaching babies at 12 months, conditioned play.

We have 18 months old who can do it. The faster you teach them, the faster we can get good testing. And you can have them hold it up and go behind them and go Ahh or Shh. Whatever you want. And put it in. You just have to teach them to wait and that's the part they don't want to do. You just have to say nope, you didn't hear it yet. Wait.

So please teach it. Taught them conditioned play. And then the audiologist said we will test him every 6 months, one ear at a time until we get a full audiogram.

>> [Off mic] 11.

>> [Chuckles]. That's about it. He will be 11, his parents will be dead, I think, by then. So um... again, why? When we are already at this point, why are we delaying things. We have to be aggressive. So, they did 3 audiograms, he's now 3 years two months old and they got the second audiogram, which is not a mild to moderate hearing loss but now moderate to profound sleeping hearing loss. But his hearing aids had been programmed to mild to moderate hearing loss.

So the second opinion center recommended increasing gain. And he started using words quickly, combining them into some simple sentences, but his articulation was so poor that they said they couldn't do speech perception testing.

For frequencies, it's not the entire speech spectrum. And hearing can change. We always say that test is a snapshot, it is a snapshot of that day, so that hearing test from before, was a snapshot of his ABR when he was 3 months old. It was not what his hearing was now.

>> What would you do if a child had speech perception, if a child had articulation, that was very poor?

>> So what could you do if they had articulation that was very poor and you're worried about understanding speech perception.

We can do a finger pointing task to see what they understand. But we might not want to use -- I mean, if it's developmentally appropriate and language wise to use the new chips, do it, maybe we can use the WIPY, which is going to be harder.

>> That's 4 to 6-year-olds, but Ruth Latufski around I are working on a new picture pointing test that's on a computer and will be harder.

But there's a test available now, called the Alphabet Test. Has anyone in this -- any of the audiologists in this room heard of this test? I happen to love this test. For kids who you really can't understand. You get a and it has all of the letters of the alphabet and you have a scoring sheet. You say A, W.

And the kid points to two sounds and you score, if you got -- if you say W and the kid says Q, they are -- they are too far apart. If you say W and the kid says V, they are closer. It's a good test for older kids who are really unintelligible. It was developed for profound hearing loss.

>> Good to know. I didn't know about it either. So we saw him as a third opinion. He was not quite 3 -- he was a little -- not quite 3 and a half at this point. I think we are right on time. We are good.

So this is the audiogram that we got. And you can see speech perception very poor at the limits of the audiometer. And with the hearing aids he was getting little to nothing.

And we had suggested to mom when she called to make this appointment that she also talked to her ENT about imaging. And she received a call when she got off the freeway, to come to office that there was bilateral EVA.

That ENT doesn't need anything else, mild to moderate hearing loss can still need imaging, because we may not have a stable mild to moderate hearing loss. We recommended bilateral cochlear implants, then the decision became -- was it sequential implants? So he could still hear something with a hearing aid. Um... while he was adjusting to one, or was it simultaneous cochlear implants. His parents decided on simultaneous, they said it's what he needs, we've lost so much time, let's do it.

So he was simultaneously, bilaterally implanted at not quite 4 years of age. [Clears throat].

And I will tell you that those first 6 weeks were incredibly difficult. I can't tell you how many points I had with them and I'm sure that the clinicians working with them had many more, because it was a huge adjust. For him. But... I can tell you the first time that they knew that he heard something, and again, this is where CI development can be so different, they called me and said, he doesn't respond to his name. But [clears throat] mom [clears throat] -- excuse me.

He was playing on the floor, mom and dad were having a conversation about going out for ice cream after dinner and he popped up and said, we are going to go for ice cream?

So... you never know how they are going to develop it. So we can't just be stuck on one thing. 6 months post implant, so with the hearing aids we couldn't really do an SRT. With the CI, he was now down 30, 35 dB and still developing.

We couldn't do new chips open set, we couldn't do a closed set with the hearing aids. But he was getting 64 and 76% open set and starting to do the hint and quiet.

We saw him make double the progress, so by 12 months post-implant he had made 24 months of language growth. The school district said he was ready for kinder. He said this poor child lost almost 4 years of his life. Why would you put him in kindergarten because in one year he has made this much progress? I'm a big proponent for letting our kids have that developmental language time to catch up. So we said do everything you can to put the brakes on. Spend another year talking to him, let him go to regular preschool, find out what it's like to talk to kids and he is now a successful second grader.

Access to soft speech fosters incidental learning. He did not have that with his hearing aids and as soon as he got that, his language flew.

And it has to be access to intelligible speech, to grow his language and grow his brain.

[Pause]

>> Okay, so... summary... everyone with a hearing loss has the right the hear optimally. And let me say, we believe that virtually everyone with a hearing loss, if you have an auditory nerve, even if it's not that big an auditory nerve, you have to right to hear optimally. Perception is more than listening to the Ling6 or the MLH10.

And assessment of perception should grow with the child. There's no such thing as good enough. It's not good enough, unless it's excellent. And that means that we all continually have work to do. If a child is not hearing wonderfully, something is the matter. Don't accept it. Technology is most likely the problem. Perception can be improved by programming changes, just do it.

And only after you've ruled out technology as the problem, can you start to look at therapy and the family. Everyone on the team including the family, needs to work together to achieve success. So, thank you for listening. And... this is our new textbook, which came out a few months ago. August. Um, it's a book for -- comprehensive Intervention, to Maximize Learning for children And Adults With Hearing Loss.

You can see at the bottom, is the foundation, the basics of the foundation of language, audition, the basics of strengthening the foundation speech acoustics, and then it's a house that we are building level by level. There's lots of reference stuff at the end of it, From Listening to Language and it's Maydel and Hewitt and here is the 3rd edition of the pediatrician audiology textbook and the case book.

And the slide, with the bridge is the Brooklyn Bridge where I live. And Joan wants me to feel bad and she's showing a beach where she lives. So questions?

[Pause]

>> AUDIENCE: Thank you. You had given an example of a client who was bilaterally implanted and on the one side they had no nerve? Or was reported no nerve? And they had to advocate for cochlear implant. Um... I've had clients say that before, unilateral, profound deafness and with the... they were reported no nerve. So we were told no CI would be an option for them. So, I didn't quite realize we could advocate for that kind of thing. How did you go about that?

>> So are those patient single sided deafness? Normal hearing on one side?

That child has it on both sides but the side that everyone wanted to implant she has the worse perception on. And the side that everyone said there was no nerve and they only did it as "Okay, we will do it" is the side that she has the best perception on.

And we have a number of kids who have bilateral cochlear nerve deficiency.

With union any lateral, I don't have a complete answer but the surgeon that I work with, we have kids that we are going to implant, there are places that say no but the parents say, we have done a cross hearing aid, a Baha and none of it helps my child. If we can do an implant and gives them something, is that better than nothing?

And until we do those patients and we find out what the kids say, I don't know that we know the answer. But I think the programming is going to be essential, and it comes back to with the cochlear nerve deficiency, they are going to hear the high frequencies better than the low frequencies and I see the programming, where everybody is focusing on blasting to get these low frequencies. But again, they can get the high frequencies, that's going to help them in noise. If they can get that high frequency information, if they know that there's an S, if that's what it's giving them, then that's better than not hearing. That may be enough on that side, to aid the good ear.

That's our hypothesis. We have about 4 kids in the pipeline, that we'll see what happens when we implant them. There are places that will not and we understand. We didn't implant auditory neuropathy spectrum disorder.

>> We didn't implant severe hearing loss. [Off mic] so things change.

>> I'm really interesting, like you, to see. Because it's so hard.

>> But I also think it's the bigger clinics that have enough population, that are doing it.

Okay, I think we are out of time.

>> Some of the bigger clinics are the ones saying "no" for that.

>> I'm sorry, but we have run out of time. But thank you very much for --

>> And we will be up here if you have a question.

>> Okay.

>> Thank you all.

[Applause]

>> If you did not sign in, the sign-up sheets are on the front table, please do that before you leave. Thank you.