

***This unedited transcript of a AudiologyOnline webinar is provided in order to facilitate communication accessibility for the viewer and may not be a totally verbatim record of the proceedings. This transcript may contain errors. Copying or distributing this transcript without the express written consent of AudiologyOnline is strictly prohibited. For any questions, please contact [customerservice@AudiologyOnline.com](mailto:customerservice@AudiologyOnline.com).***

## Teleaudiology: Improving Access to Hearing Healthcare

Recorded Mar 10, 2020

Presenter: Laura Prigge, AuD  
AudiologyOnline.com Course #34553  
Partner: Grason-Stadler - GSI

- [Laura] Hello and welcome to today's webinar, Teleaudiology: Improving Access to Hearing Healthcare. My name is Laura Prigge. I am one of the audiologists with Grason-Stadler. Just a little bit about me, I am actually on a team of three audiologists with GSI and we provide a lot of application support. So if anybody needs help with their equipment. We do training, we do R&D testing, just a whole bunch of stuff with this team of audiologists. I have been with Grason-Stadler for I just had my 10 year anniversary so I'm kind of proud of that. And it's a fun and exciting place to work. So thanks again for attending this morning. Today our course objectives are as follows. Number one after this course, the participant will be able to describe two methods of teleaudiology. Number two, after this course, the participant will be able to select a method of teleaudiology that is appropriate for specific needs of his or her area. And number three, after this course, the participant will be able to describe how teleaudiology improves access to hearing healthcare.

So today we are gonna spend the next 55 minutes or hour talking about teleaudiology. So I've just posted a little agenda here just sort of define how we're gonna do this. Teleaudiology is a really really hot topic right now. Telemedicine in general actually. So we're gonna talk about why we're using teleaudiology in our own profession. The different types, the challenges that we have, some requirements and then of course we're gonna talk about the research and the validation. Then we're gonna go a little deep dive into the methods of teleaudiology. We will focus on GSI AMTAS as part of the deep dive that we're doing. And then we're gonna talk about which teleaudiology is most appropriate in which scenarios. And then I have a whole list of questions that we get asked here at Grason-Stadler all time. So let's dive in. So I like to show this slide really to demonstrate that there is for sure a crisis in audiology. Now we all joke around that there's actually not ever a crisis in audiology but we really do have some sort of crisis here. What's happening is there is a growing need for hearing healthcare with all of the programs that are available. We have the screening programs for adults and childrens. We have followup if needed for screenings, for self referrals, for medical referrals on all ages. And of course we have that aging population which really

contributes to this growing need for hearing healthcare. The other thing that's happening is audiology is a flat or maybe even shrinking profession. There are not enough audiologists currently to meet the need of our patients right now and in the future. It seems as though we're going to still have that need and not be able to fit it. And it's not just in the United States that we're struggling to meet the needs of hearing healthcare. This is a situation that is happening globally. So let's dive in a little bit to that and talk about it. People have been predicting this crisis in audiology since 2009. Maybe before but it was published first in around 2009, the crisis is coming. So we had a bunch of different people all throughout the last I would say decade or so talking about how we're going to meet the needs of this crisis. How we're going to improve access to hearing healthcare for our patients.

So let's dive into that. Let's talk about this need for hearing healthcare, this need for access for our patients. These are things that we all know but it's a nice review I think. In 2015 the World Health Organization did report that there are about 360 million people worldwide who have hearing loss. About 328 million adults and about 32 million children. It's a lot of people. And we also know that about a third of people over age 65 have hearing loss. And then in the United States it was also reported. Again, statistics that we're familiar with and that we hear quite frequently I would say. But about two to three of every 1,000 children have some sort of hearing loss that requires intervention. And about 30 million people who are age 12 years or older have some sort of hearing loss that would require intervention and would really have a significant effect on communication and to society overall. So we know that there is a lot of people with hearing loss. We know that we are responsible for identifying, treating intervention for this hearing loss but let's talk about audiology. Now this is information from that study that Windmill and Freeman did. And it really describes I think in good detail the situation that audiologists are in. In this year, in 2013, there were about 16,000 licensed audiologists. But when you break it down, it looks like 20% of those audiologists are not impacting or participating in patient care. So that's 20% that are not even really practicing in the field. Of that remaining 12,800, there are only about 11,200 that

practice full-time. And then here's an interesting one too. About 600 audiologists graduate every year. It is estimated about 40% of those never even enter the field and we have 400 people retiring every year. So you can see as we progress in time we do have a very flat profession that's really impacting the growing need for hearing healthcare for our patients. So when I was at the Global Coalition for Global Hearing Healthcare in 2019 in October actually. And Margolis really presented some interesting information. He made some really cool assumptions or interesting assumptions about the increasing need for hearing tests in the United States. And so I thought it would be a really good time to help really illustrate how, I don't wanna say far behind but what the actual need for that access is. So according to state census data and Margolis' estimates, the population in 2020 is about 333 million people. In 2060 it's gonna increase to about 417 million people. We know that the prevalence of hearing impairment right now is about 17%. And in 2060 it will increase 1% to 18%. And of course I was thinking gosh, 1% is not really that big of a deal. But if you look at the number of people, that is 56 million people who are estimated to have hearing loss now in 2020. And in 2060 that's 75 million people. So it is a significant increase in actual people with hearing impairment.

So then we decided let's see how many hearing tests does that mean we need to do annually? So we figured the number of hearing tests per patient per year would probably, and again these are just random assumptions that are 80/20 rule. So probably people would get their hearing tested every bi-annually. So every other year people are gonna go in for their hearing evaluation to see if there's any change, to keep their normal. And then we also do have to subtract about 25% of those patients because they have normal hearing. So they are just one test and done. And using those numbers, the total number of hearing tests that we need every year in 2020 is about 35 million hearing evaluations. And in 2060 it increases to about 47 million. I mean that's a lot of hearing tests and this is just audiograms only. This doesn't include any of the ABRs, any of the balance stuff, any OAEs, things like that. This is just audiologists or hearing instrument specialists doing audiograms. So what does that

really mean for actual audiologists and hearing instrument specialists who are practicing in the field. Well first of all let's review? The number of full-time audiologists that we have currently in the United States, it's roughly about 12,019. Now remember that 2013 study said that we had about 11,200 audiologists practicing. So these numbers are pretty close to in line. It's a very slowly growing or flat profession. And so it is estimated with the flat movement that in 2060 there will still be about 12,019 audiologists. What about those hearing instrument specialists and hearing aid dispensers? This is an estimation from Margolis. But he is estimating that there are about 6,000 currently practicing hearing instrument specialists and hearing aid dispensers. And again their profession is also flat. And so we're looking at about 6,002. So the total number of hearing healthcare professionals that are doing audiograms in 2020 is 18,019. And then in 2060 it will still be about 18,000. So now we're going to continue to interpellate some numbers here. How many audiograms or how many hearing tests per year per tester are performed currently? These are tricky numbers but I think they work out.

So if we look at every single one of these full-time audiologists, we figure that they can probably average about three full audiograms per day. And that is because I mean I know many places are like yeah I do 15 a day every time. Well if you average out the times if you're working let's say in an ENT clinic, you're not doing audios all day everyday because the physician has surgery or because they're in a satellite clinic. So there are certain times that you don't do 10 or 15. And so we've averaged that out to about three audiograms per workday over 260 average workdays per year. So that is every tester is performing about 920 audiograms every year. I'm pretty impressed. I feel like that's a solid number and I'm pretty impressed with us. We're crushing it with our hearing test. It's almost 1,000 audiograms a year. So that means that we can do collectively between the audiologist and the hearing instrument specialist about 17 million audiograms a year. And that's this year and because of the flatness of our profession, that's also in 2060. So 17 million sounds like a pretty impressive number, pretty solid. But if we look to see about that growing population and the number of

people that need a hearing test, we can clearly see that we are unable to meet the demand. Here in 2020 there's our 17 million audiograms that we're able to do. And that stays flat over the next several decades. And then if you look up here on the top these are the demands for the hearing tests. And you can see that that's growing pretty steadily over time just like our population, just like the need for audiograms. So that shows a big separation between the number of audiograms that we're able to provide currently and in the very near future. And then the number of tests that are needed. And I think it's really interesting if you look at the graph at the right you can see that they've actually plotted the need or the shortfall. So we are looking at in 2060 we're gonna be 30 million audiograms short of the ones that are needed to be taken. So that's kind of a staggering number and that's kind of a staggering graph when you look at it. Because I feel like we're all pretty busy. I feel like we're all doing a great deal of testing and we're maximizing our time. But then you look at the actual numbers of people who need hearing tests and it's, I don't wanna say depressing. But it's shocking, it's eye-opening to see that we really are not able to reach all of the people that need hearing tests.

So recently in 2019 there was a grad student and she's in social services. And she decided that she wanted to figure out where audiologists are in relationship to the people who need tests. Because now we know they're all out there. So we need to figure out are we close to them? Are they able to get in to us? Is it because their schedules too busy? Is it because our schedule is too busy? Let's figure out where these audiologists are in relation to where these people are with hearing loss. And so this is one of the graphs that she posted and it's based on Asher data and census data. And it's pretty interesting. So you can see we have all the different states and they're color-coded. And it is color-coded by audiologists per 100,000 people. The good news is there's not a state where there's zero. So that is I think very comforting and actually refreshing. And then you look at this scale down here. All of the different colors of gray indicate how many audiologists there are per 100,000 people. And I was actually surprised when I looked at this map like California, Texas, Florida where

people are snowboarding maybe. Where there seems to be maybe a larger population of elderly adults. Those seemed a little light to me. But remember the populations are huge. So certainly we won't have a different number of audiologists per 100,000 there. But it's pretty refreshing. I actually enjoyed seeing this map. Well this grad student continued to dig into this issue. Because again, this hearing healthcare is quite a crisis. And so then what she did was she looked at some more data from the census. This is a really detailed map of the United States broken down into county. And the different colors indicate how many people who are 65 and older self reported difficulty in hearing. And so it was really interesting to look at this map. I think eye-opening actually. Because we can see in all of these different locations the darker the number, except for this very last one, the more people who are age 65 or older are self-reporting that they have difficulty hearing. So some of these dark black and this other gray over here, those are from 22 to 45% of people who are 65 and older who are reporting this difficulty. And to illustrate how difficult it is for these people who are self-reporting hearing loss to get actual help. To get to a service provider for hearing healthcare, she did a map that showed where audiologists are. Not just by state but by county per 100,000 people.

And again this is one of the two comparison graphs that I think is just staggering. Because look, you can see here in New Mexico and Nevada, there are not many audiologists per 100,000 people, especially per county. And if you go back to that graph where the people are, the people who are having trouble with their actual hearing, it doesn't look like they're very close to actual audiologists. And this is an eye-opening issue. I think that it's really really important to note that this is one of the best illustrations I think to demonstrate that there is a huge gap in the people who have the hearing loss and the people who can diagnose and treat the hearing loss. It's very difficult to meet the need of people with hearing loss if we're not close to them. You can also see in this interesting map where the audiologists are. We tend to be around populated areas. We tend to be around the bigger cities and the places where there are things and people. And the population is spread out all over the place. The other

interesting is is yes there is for sure a crisis in the United States. But this is a global situation. These graphs are from the World Health Organization. Again it's 2013 data and over here on the left side, this is where people are self-reporting disabling hearing loss. The darker the color, the more percentage of the population is talking about disabling hearing loss. And this is not based on people who are 65 and older, this is all ages. And if you look on the right, it's audiologists per million people globally and ENT per million globally. Now the audiologists, the white area is places that weren't actually, they didn't get data back from these countries. But we know about the United States, we just reviewed that. It's really interesting. I mean one of my friends is an audiologist and she's from Thailand and she always likes to say, "Well I'm one in a million". And I say, "What are you talking about?" And she says, "Well there's 85 million people in Thailand "and 85 total audiologists". And that is I think a daunting responsibility to know that she and her 84 colleagues are really responsible for managing hearing health in her country.

And it's not just hearing aids. It is newborn hearing screening and it is followup from screening. And it is fitting these children and adults and babies with hearing protection and getting them treatment for ear infections and all those different things. So you can see this is for sure a global shortage of hearing healthcare. And of course in the United States we have other things that are really influencing change in audiology. It's not just the growing population. We have the PSAPs that have been around for awhile. We have the new looming over the counter hearing aids that are going to disrupt our market. We have demands for efficiency, whether that is in our offices or from our patients. There are lots of hearing aid delivery models that are changing and the big box stores are selling hearing aids. Which again, all of these things are influencing change in our realm. It doesn't change the fact that we have all of these people to test and we don't have enough people to test them. But it really makes us sort of consider and think twice about what we need to do to help meet the demands and help improve access to hearing healthcare in the United States and globally. So now that we know how busy we're gonna be over the next several decades, let's talk about how we can

actually increase access to hearing healthcare. So of course I have this really fancy little list. I mean it looks easy. We can probably do all these things, let's dive in. The number one way we can address the need for more hearing healthcare professionals is to maybe increase the workforce. But we know from research that this is probably not the fastest or the easiest thing that's going to work. So we need to look into some different methods to really address the access to hearing healthcare. The thing that we're gonna focus on the most today is teleaudiology and telemedicine. It is becoming increasingly popular among many medical professions and audiology is certainly top on that list as well. So we will for sure talk about that. Other ways that we could address the crisis in audiology is we could be more efficient. We could use our workers and use our staff more efficiently. We could really up the use of technicians. We could introduce some automation and maybe even think about our alternative service delivery models. And so hopefully we'll cover those things as well.

So when we talk about telemedicine, we know just based on really just the title, telemedicine is solving a lot of issues that we're having. It is when the patients are in one location and the providers are in another location. And we're able to merge those two together so that we can have some communication and some sort of touchpoint for a medical consultation without having to be physically in the same location. Congress has actually defined four different types of telemedicine. So they have live video which is face to face. They have store and forward which is when the data is collected without a professional or without the licensed provider there and then forwarded to the licensed provider for interpretation. There is remote patient monitoring which is more like if you were monitoring a chronic illness or a chronic disease. And then they would take your measurements and then that would be somehow transmitted back to somewhere for interpretation. And then there's mobile health which is, we call it a clinic in a truck. So the mobile health is where the truck comes to you and you go into it and they have all the tools they need to perform the medical evaluation. When we talk about teleaudiology, we talk about mainly two different types. And so we talk about the live video, the face to face, we call that synchronous. And we

talk about store and forward and we call that the SFT or asynchronous. Certainly we do have mobile audiology. We might have the remote monitoring as well but the two that we're gonna talk about mainly today are the live video and the store and forward. When I think of telemedicine or teleaudiology, I instantly go to the live video. That is my first thought because it makes sense. I mean it's telecommuting, it's teleconferencing and it is going to be this live face to face sort of contact with the provider that is not in my location. And this is a fantastic way to bridge that gap of geography between patients and audiologists. So when we talk about the live video or the face to face teleaudiology, we're gonna talk about a couple different things. The personnel, the technology, the equipment and we'll go from there.

So when you have synchronous or live video or face to face teleaudiometry, you have some personnel requirements. First you need to have an audiologist online in one office with a camera. And then the second place, the remote place has to have a trained technician. Their in the other office physically with that patient. And their job, this trained technician, this audiology assistant or however they're set up. Their job is to be your hands. And so basically they will help you with your otoscopy, video otoscopy. They will help with transducer placement. And they will really facilitate that video conference call so that things go seamlessly just like the audiologist was there. For technology, because you are doing this, you're facilitating this appointment via videoconference, you do need to have an Internet connection that will support the videoconference. And you need to make sure that you're in a location that has reliable power for equipment. The testing that can be done with a live face to face teleaudiology is just a traditional live appointment. So you can pretty much do anything that can be connected to your computer. And it's fantastic because I can get everything I need to get done right there with my patient in a different city, in a different town or in a different office because I'm really there, just via video. So the equipment that is required for this live video, this face to face teleaudiometry, you need to have PC based equipment. So you have to have a PC based audiometer and you need a video otoscope so when the technician is viewing the ear canal and the tympanic

membrane, you the audiologist who's in a different town can see it on your screen and make some decisions about that. It's nice to have a room monitor so you know how loud the ambient noise is to ensure that your testing is gonna be valid. You can also do real-ear measurements. It's ideal for hearing aid programming. So all of the things that you would do in a normal live appointment can be achieved very seamlessly on face to face or live video or synchronous teleaudiology. You also wanna make sure that when we're doing these evaluations, I mean this is again, we're looking at sort of alternative delivery models. So we wanna make sure that we have the research and the validation to back this up. We are using proven tests and proven equipment for this synchronous appointment. We know from patient surveys that the patients actually feel like this is an effective way and a convenient way to meet with their audiologists. They don't feel like they were cheated. They don't feel like they didn't get enough time. And it's one of those things that's really refreshing because it really adds so much value to both the audiologist and the patient as far as time and stuff. It does require an audiologist to be present because you have to be on that video call. You're the one who's interacting with the patient at that time.

So some of the benefits that we like to talk about for the patient and for the provider. For the patient we are increasing access for sure. If you have a patient base that is three or four hours away, it's very difficult for those people to get to those appointments. Shoot, sometimes it's difficult for people to get to appointments if you're just two miles away across town. So we're for sure increasing access with synchronous teleaudiology. Additionally it will decrease cost for the patient. Potentially with the travel, if they have childcare that they need to arrange. If they have to take time off form work. This is going to really decrease the cost for the patient. And then also it gives them access to specialty care that maybe they don't have access to in their hometown or in their home location. The provider benefits, what do we get? What do I get out of this? It really helps me overcome geographic challenges because again, I might not make it out to my satellite clinics once every week or every other day or as often as I need to because it's far and I have patients at my main office. And so I'm

really able to overcome those geographic challenges and time challenges because if I have to drive three hours, I mean that's six hours in a day that I'm just driving. So that's a huge benefit for the providers. It will increase my patient reach because again I'm able to get to those patients who are a little bit more remote or far away. And it can increase the practice revenue. I'm not wasting time, I don't wanna say wasting time. I'm not using a lot of time driving when I could be seeing patients and really helping them. So the thing that we don't think about sometimes with teleaudiology, because our job is so personal and is so reliant on this patient interaction is using a store and forward method of teleaudiology with our patients. And so I wanted to talk a little bit about the store and forward method that GSI offers and it's called the AMTAS. So what I'll do is I'll just go over some of the different requirements. And then we'll dive in and talk a little bit more about the patients experience with this actual method of teleaudiology.

So store and forward is a little bit different because the audiologist is not required to be at the actual appointment. The audiologist is necessary for all the other stuff except for collecting the initial data. And so the personnel requirements when you're using a store and forward method for teleaudiology, you have to have a technician. And this technician again must like in the synchronous is the hands. They're the ones who are going to place the transducers. They are the ones that are going to email or fax or upload the results that you get from the evaluation. And then you do have to have an audiologist that's going to interpret the results. But it's not a scheduled time. You made scheduled time for your teleaudiology but it is not required to be there at the onset of the appointment. The technology required for a store and forward. You do need to have reliable power to power the audiometer and to power computer. But the Internet requirements are not quite as intense as with a live video chat. Because you're not doing a live video chat. And then you also have to have access to email or a fax or some sort of wifi to upload results to the audiologist when the evaluation is completed. As far as the telehealth portion of this, so there are several different ways that are being used currently with GSI AMTAS. So any telehealth appointment with the store and

forward, you are limited on some of the data that you get because there's not an audiologist there. But with AMTAS you can obtain masked air conduction and bone conduction thresholds. And you can also obtain masked speech reception thresholds and masked word recognition. And so these are basic diagnostic battery that will essentially allow you the audiologist upon interpretation to make decisions for the next step. The equipment that you need for this store and forward teleaudiometry with AMTAS, you do have to have a GSI audiometer that has the AMTAS license. You also need to have a computer that has the AMTAS software. And then just a quiet testing area. Now in my pictures they also have optional equipment. One of the reasons that the AMTAS was developed was for the military, for the VA, because there are so many patients who have a hard time getting to one of the VA medical centers. And so they have really implemented this optional equipment, the telehealth software and the video otoscope with an attachment to maximize the information that they're getting from this initial appointment.

And so you can see here in my picture at the top, there's a technician, he's sitting with the patient. He's performing the video otoscopy. So he will look in the ear, take a picture of each one of the tympanic membranes of the ear canal. And another thing that they do with this telehealth software and camera is they actually have a calibrated length and they can take a photograph of the external ear and do some measurements. And those measurements correspond with hearing aid receiver lengths for the receiver in the ear hearing aids. And then as an audiologist when I'm interpreting, I can actually make decisions. And of course this would be if the patient wants to upgrade their hearing aids. Or they wanna try a different brand or something like that. Then I would have those measurements available for me and I can make those decisions so that when I do see that patient, we'll be ready to go with a meaningful interaction. As far as the research and validation, of course we know that is really critical when we're obtaining audiometric data. I just wanted to mention briefly and show you briefly that there has been a lot of research and a lot of validation done on this automated hearing test that we are using for store and forward. It's been over 15 years they have been

working on this and implementing it and validating it and testing it. And we will talk about that I'm sure more as we move through the actual operation of patient experience. So some of the store and forward benefits for teleaudiometry. The patient benefits again, it increases access just like the goal with all teleaudiology. It does decrease the cost with the travel and with the childcare, the time off from work. And it does improve the access to specialty care. So again just like with the live, the face to face. Those patient benefits are consistent. The provider benefits are also consistent and different. So we of course can overcome the geographic challenges. So the patient location versus the provider location. We can overcome scheduling challenges and this is an added bonus with store and forward because as an audiologist, I don't have to be there when the patient is working through the basic audiometric evaluation. While they're doing air conduction, bone conduction and speech, I'm in my own office seeing other people. In fact, we have used this store and forward sometimes even in the same office where the audiologists are to really help maximize the time that they're using with their patients. Because we're not using some of that time for basic audiometric testing, we can increase the caseload.

So we can see more patients, we're not driving, we're not on a video conference for an hour so we are able to see more patients when we're using the store and forward for audiometric data. And of course we can increase the practice revenue because we're seeing more people. But I do wanna talk a little bit more about the AMTAS, this store and forward method for teleaudiology, the patient experience. So I'm positive that when I say the words oh it's automated audiometry, people have questions. I have questions and so it's one of those things that we really like to sort of dive into a little bit more because it's actually pretty cool. So AMTAS is just the software. It is the software that goes onto your PC and it runs the audiometer through the test that you decide. So basically when you get AMTAS you have a GSI audiometer, you have a computer sitting next to it. And then you the program manager, the audiologist can say okay, at satellite A I'm going to do air conduction and bone conduction and speech. We're gonna do a full evaluation because I need that data to move forward with these

patients, I only go there once a month. So with AMTAS like most GSI products, it does come with configuration application. And in this configuration application is where you set up the workflow. You decide how you want the instructions to be delivered, how much are you counting on your technician or your audiology assistant to instruct? And how much are you asking the software to do? Also you can set up for different test types so you can do pure-tone air, pure-tone rolling speech, any combination of those things. We also have a screening mode but it is super super basic and you probably wouldn't get a ton of diagnostic, zero diagnostic value from doing just a screening. And then it also talks about how it's going to generate the report. So once you have committed to your asynchronous or your store and forward teleaudiology, you set up the site and then you start seeing patients. So here's what happens when the patient comes into the office. So you have your technician who is trained.

Again if you're using the optional telehealth software, they would do otoscopy. But really there's nothing that's going inside the ears. So it's, I'm not gonna say not necessary but certainly it's not a show stopper for this particular test. So the patient setup from the actual technician is number one, we would put on the bone conduction. It's out of order, please forgive me. So the bone conduction oscillator will go on the forehead and we use a thing called the AMBAND. And it's just a stretchy sort of material with Velcro headband that you place around the head. And then you just slide that bone oscillator into the middle of the forehead. So we're gonna be using forehead bone placement for the bone conduction. Then the technician will put on the circumoral headphones. So they're called the DD450's. They are clones of the HDA200's so they're those big circumorals so you don't have the inclusion issue that you have with some of the other transducers. So we're really able to rely on and be confident in the results of the bone conduction. We isolate the test area using masking for bone conduction. And we do masking for air conduction and speech as well to ensure that we have the appropriate levels and responses. When the patient is all set up, then the technician will push start on the AMTAS software. There's a little button down there that says get started. And this is when the patient experience really gets

going. There are options when you're setting up the site. So you can have the technicians go through a headphone check to make sure that there isn't any error. So you can have them play a tone in the left ear or the right ear and the patient will actually press which ear they heard the tone in to make sure that the headphones are on correctly. Or there are video instructions also that I think are pretty nice. You can do text instructions instead of the video instructions. And these can be translated and have been translated into a number of different languages if you have any multilingual areas that you're using for some of your satellite services, for some of your teleaudiology services. And after the patient has heard the instructions, then we move into the actual evaluation. The first screen that the patient will see is listen for a tone. And then the patient listens and then it displays a second screen that says did you hear it? And the patient must make a selection yes or no. And so this goes on through the entire pure tone evaluation for air conduction and bone conduction. They listen for a tone, they make a choice. And then they listen for a tone, they make a choice.

The cool thing is because this is developed by audiologists for audiologists, we have different catch trials, we have a whole bunch of different rules. It's a modified Hughson Westlake process but there are lots of builtin features that make it reliable and very valid. If you have opted to do the speech testing, the speech testing also is the closed set. So instead of saying listen for a tone, the software says listen for a word and then it gives them choices. Now this is where things get interesting. With the SRT it's easy. The words get softer and softer and you just don't hear them anymore so you just don't select the correct one. So it's just like with pure tones. With the word recognition scores, this is an interesting one because if I presented word recognition at MCL in a closed set, every single person would get 100%. And then when I got the results I'd be like oh look, what a shock, I can't believe, this is so amazing. It seems like it's not a really good use of a speech test. And so based on research of word recognition scores at MCL, there was a study that was done and we have decided that we will present the word recognition levels about 22 decibels louder than SRT. And so when you listen to these tests, if you've ever done an AMTAS, if you've ever done a closed set word

recognition test, it's hard. It's designed to be hard. So even me with my wonderfully normal hearing and my fantastic word recognition, and I know the lists, I still struggle sometimes to hear some of those words on purpose because I need to know if it's at a reduced level, how do I do? Now on the scoring and we'll again of course talk about this a little bit later. But on the scoring, I don't expect that everybody's gonna get 100%. In fact, 88% is my actual cutoff for excellent. If you get 88% on your word recognition, you move on to the next evaluation. If you get less than 88% on the word recognition, then what happens is we increase the decibel value AdB and represent. And they still might not get 100%. But what we're looking for in that particular case is a PIPB improvement. When I turned up the volume, did they do better because that's what should happen.

And so those are the kinds of things you look for when you're looking at a closed set of word recognition scores. And AMTAS does a really good job of really documenting that and working out the presentation levels. When the patient is completely done with the test then it will give them a message thanks for completing, please press the button below to conclude the test. And then the administrator will come in and unhook them and tell them thank you. There is an option, I mean again this is all completely up to the program director, the audiologist if you want to have them give them the report or whatever. But it does create both a patient report and an audiologist report. With the report, remember this is what you're getting in your office when someone completes AMTAS in a different office. You get an automated report that has the usual suspects. So you'll have the patient information, the audiogram, the legend, the masking level table. But then you have a couple of other elements that really give you more confidence in what happened in that satellite office when you weren't there and someone was doing their own hearing test. So you get a quality assessment table. You get an audiogram classification table. Then you get the speech recognition scores as well. When this AMTAS was developed it was really interesting because that was I think one of the biggest, I don't wanna say, concerns. We'll say one of the biggest concerns is what do I do with this information that I'm getting from a diagnostic test?

We've been doing automated tests forever with occupational health, with screening. But I'm actually looking at air conduction, bone conduction and speech. How am I supposed to really trust and rely on this evaluation? Well we do have a patented method for determining the accuracy of the tests results. And what happens is from the minute that patient hits start, we start collecting data. And we look at all that different data so that when you the audiologist gets the report, you have your audiogram but you also have this thing called the quality assessment or the quality indicators. The quality indicators are what are going to help you believe or really envision what was happening during that test. So this particular evaluation, I see the audiogram. I see that it's normal to 1,000 followed by a slope in high frequency hearing loss. Pretty typical, but what was really going on? Well the accuracy was good and the quality indicators are really gonna give me the deep dive into this interpretation.

So the predicted difference, the predicted average difference. This is the difference in decibels of if I did this test manually versus this automated evaluation. It's different for every patient and it's based on some really good research and those papers have been referenced and I can certainly get copies of those. It also gonna tell me how long did it take for this patient to select an answer? When it said listen for a tone and display the yes or no, how long did it take them? So I can vision this. I can actually see what this patient was doing. If it took them a long time they're either thinking really hard maybe. Or maybe they dozed off a little bit. But we'll be able to tell by those other quality indicators. False alarm rate, how often did this patient press yes when there wasn't a tone being presented? So this is, in my mind, this is when the patient gets into their routine and they're pressing that patient response button every second and a half. In my office I would turn up the intensity a little bit and remind them what the target stimulus frequency is and then we would get back to the testing. In this case it actually displays a message that says hey, you pressed yes when there wasn't a tone available. Please listen carefully, continue with the test. But if there's a lot of these then I become concerned. And then this is the average test retest difference. And this is because we do test and retest 1,000 hertz and this gives me a good indication of the reliability. And

then the last one is I think one of my key ones that I look at and that is the quality control fail. So as we're collecting this data we get to what we consider is the threshold. AMTAS will present a tone 5 DB louder than the threshold. Your patient should hear that all the time. If they don't hear that, this becomes a red flag. And this becomes something that I am concerned with. Whether it is because my patient is a malinger or because my patient didn't understand the test. Or because my patient maybe has some failing cognitive abilities. But if I look at this test and I look at the quality indicators, I would say that this is a good one and I'm gonna make some decisions based on this evaluation. If I get a report that looks like this, I now become a little bit more concerned. So now you can see that these areas of concern have been ever so elegantly highlighted in red. And so I'm like wow this predicted accuracy is poor.

So this overall test was kind of a challenge, what was the big difference? Well the predicted difference between manual versus this automated audiometry was 11 over 11 decibels. And that's concerning, I don't want it to be that high. Time per trial was within reason. The false alarm rate, I wonder in my mind, were they just pushing yes every single time? Because we do have those catch trials in there and I need to figure out why this patient was doing that. Average test retest, it was a 12 DB difference when I tested 1,000 hertz. This is a concern. And then of course my favorite the QC fail. This is one where they should hear all of the responses that are presented by DB ladder. So this is a patient who I would say gosh, maybe this one isn't a good candidate for automated audiometry. Let's look at their patient history. Let's look at past evaluations. This just might not be a candidate. But this gives me the confidence to know that I am going to get accurate results and I'm gonna be able to make decisions based on these reports. The store and forward, the GSI AMTAS is ideal for the teleaudiology. It is nice because of all the other things that we said earlier. Improving the access, overcoming geography, overcoming scheduling. But as far as other factors, there's minimal training required for this facilitator or for this audiology assistant. They basically just have to be able to put the bone oscillator on the forehead

and put the headphones on red on the right side, blue on the left side. We have the proven reliability. We have all of the data and the research that backs up the scores and the method for testing and the results. And we do have our quality indicators that really increase the confidence when I'm interpreting. Because remember, somebody else is doing this evaluation. It's the patient with a software. And so I need to be very confident in these responses when I get the test back. And also improves access to quality basic diagnostic testing. We know this is not the end all test that we're doing to dismiss everyone. But certainly this is going to get us to the most appropriate next step. Additionally, it addresses some of those other things on the list that help us address the shortfall in audiologists versus demand for hearing test. We're able to have more efficient use of our workforce and of our staff. We're able to really implement the use of audiology assistants or technicians. With the automation, we're taking a very basic part of what we do that is still critical to our overall diagnosis and automate that in a very trustworthy way. And we're looking at these alternative service delivery models as well.

So the store and forward is a valuable addition to teleaudiology as it stands. So we have talked about the synchronous and we've talked about the store and forward so how do you choose when you have these great delivery models for teleaudiology? Which one is right for you? Well they're both right. Everybody should have all of the teleaudiology in their offices. Because with the store and forward, you get your basic air, bone, speech diagnostic evaluation. And you can really obtain that data from most adults and lots of older children. Of course we do a ton of testing here at Grason-Stadler and my children were I think eight and 10, normally developing children and they were able to take these tests and get pretty good quality indicators at that age. And so you're really able to reach a whole lot of patients that may be on a waiting list. Or maybe their audiogram isn't the most critical but you hate to wait for them to be able to get into your office or to just get on your schedule. And the live video is fantastic because you can perform basic audiometry. Maybe with some of those patients who gave you back all those red quality indicators. Maybe you can do that

basic audiometry there. But then you have the opportunity to have meaningful interactions face to face with these patients who are far away with your hearing aid fittings and your adjusting of hearing aids. The counseling and the followup care can be achieved very very seamlessly and very effectively with this live or this synchronous teleaudiology. So the big answer to the burning question is yes both teleaudiology is for everyone. So now that we're all convinced that we need to go and get our new teleaudiology equipment, we do want you to go into a few frequently asked questions that we get here at Grason-Stadler.. So as far as some of the questions we get on synchronous or face to face teleaudiology. One of the biggest questions is what speed Internet do you need for the synchronous live face to face. Now I'm not an Internet expert but it has to be high speed. It can't be dial up and of course this is a bigger issue in some of the very very rural issues but most of the places do have good access to Internet that is appropriate for synchronous or face to face video teleaudiology.

Another question that we get a lot is what happens if the Internet goes down during a synchronous session? Well, what happens if the Internet goes down during your regular session or your network? It's tricky but it's just like a regular appointment with technical difficulties. You wait for it, see if it comes back on and if it doesn't then it's one of those situations where you reschedule. And I don't think that it is actually much different than things that would happen in your regular office with a networked computer system. For the store and forward, how long does it take for an automated test to be completed? Average time for a test if you do all three modules, air conduction, bone conduction and speech is about 15 to 18 minutes depending on the patient. It is a self paced test. So if the patient is taking a very long time to decide whether he or she hears the tone and responds, it could take a little bit longer. I've seen people speed through it. It's impressive, sometimes it feels like a race. But average time is really about 15 to 18 minutes. Oh that's just what I said, how many tests and it is self-directed. Another question we get about this automated test for the store and forward is can everybody do the test? The answer is lots of them can. Research indicates more than 85% of the patients are for sure candidates for

automated audiometry. We know that the validation studies were done in a VA. And so the patient population that we were using to determine the candidacy was our patient population. It was people who are older adults. Sometimes they're totally with it, sometimes they're not. And we found that about 85% or more of the patients are candidates. And again as I said a little bit earlier, you can use this for children who are older and adults, they're all candidates. And if they start the test and it turns out that they're not able to complete it, then we reschedule and we will use they're not a good candidate for the automated, we move to the manual audiometry. Big question, huge question that we get at Grason-Stadler. is can you really trust the results of automated tests? I know that a lot of times we're leery about this and it's really funny. We always say oh basic audiometry, anybody can do that. It's one of those things, I bet my kids could do that. Until you say that you're gonna automate it and then everybody gets nervous because there is a little bit more to just a basic pure tone than we like to let on.

But the good news is yes, you can for sure trust the results of this automated test. It does assign those quality indicators. The examples that I showed you were the basic ones. If you had bone conduction then it does add some more quality indicators about the quality of the bone assessment as well. So it will tell you if you have air bone gaps or if there are masking dilemmas. And it really does indicate the quality of the test. And that really gives confidence to the results. It has been out there for a number of years. It says over 15 years, I think we're looking at 20 or more. It's really interesting. I think the reason that this test was developed. We all say oh we developed it for the VA. The brainchild of this test was really with Dr. Margolis was at the University of Minnesota Speech and Hearing Clinics. And yet all of these audiologists and audiologist students and they were going through their daily tests and seeing their patients. And he realized that they were spending an enormous amount of time on this basic pure tone stuff. And at that time when he was thinking about this, we had just started sort of automating reflex thresholds. And we had started automating some of the other tests that we do in audiometry. And he thought gosh, how much time are they actually spending on this basic pure tone? And he realized, he did some calculations and

realized that these students and these audiologists were spending almost 40% of their time doing basic pure tone evaluations. And he thought gosh, there is really a better use of time, like all the other stuff that audiologists need to do, like the otoscopy, like the counseling, like the middle ear evaluation. Other tests like the ABR's, the balance test and the hearing aids. So he really was looking for a way to help free up the time of his clinicians so that they could spend time doing some of those evaluations and procedures that required more knowledge the audiologists possess. So yes, the answer is yes you can trust these automated tests. They were made by research audiologists for audiologists to help really maximize their time.

So here's the next question obviously that we get every single time we bring up the store and forward. Once everybody's finally onboard with the fact that yes we can trust the automated test, the next question is can I bill for it? Now the answer currently is no. There is not a code that is available for this remote or automated audiometry in the way that we think of it. You can not bill the 92557. There are some T codes or temporary codes that are associated with automated hearing tests. I mean of course you should bill them if you're doing this but the chance of getting paid, I'm not really sure of the percentage of that. And we also know that efforts are being made right now to make this a reimbursable evaluation. I know that with at least the interpretation and the decisions made by the results are going to be something that will be billable at some point. It also brings up another interesting point. If you have more time in your day to do more advanced audiology procedures, that is going to bring in more revenue than billing the same 92557 with every single patient. There was a study done and they did, I call it the choose your own adventure audiology. They had two clinics and one clinic did their 92557 with every single patient and at the same time they did other stuff. And one of the offices did tests that they felt like they should do based on patient complaints. And so they weren't always doing air conduction, bone conduction, SRT, word recognition. They were choosing maybe reflex thresholds, maybe speech and noise, maybe some other different evaluations that really had more meaning to the patients complaints. And what they found was in both cases people were making

revenue. They were generating revenue. And in many cases the choose your own adventure audiologists were generating a little bit more revenue and their patient outcomes were a lot of times better because the tests were focused directly on the patient complaints. And I think that that's a really interesting thing that we can think about. Because sometimes we get into, you know we have to do air, bone and speech on every single person because that's what the billable code is. And we disrupt the market with the teleaudiology and with the store and forward and with some of those other things that we talked about earlier, it's something nice to consider is maybe we gather this test automated and we can't bill for it. But now we have some really good meaningful data and we can continue our testing and add value to their appointments that the time that they're with us by doing more reimbursable things.

And then of course one other question, just a teeny question that we get is is AMTAS, is this store and forward, is this automated audiology going to replace an audiologist? And the answer is a resounding no, absolutely not. There's no possible way that a basic hearing test run by a computer is going to replace a audiologist. AMTAS is just the hearing test. It is a very basic air conduction, bone conduction and speech that is valid and it's reliable and it's going to give you the information that you need to do all the other things that audiologists do. Audiologists do counseling, they do hearing aids, they preform tympanometry and OAEs, they do re-tests. They test the children and the adults that have more cognitive delays that we can't do with an automated test. And so we really are way more than the AMTAS hearing test so there's no possible way that AMTAS will replace an audiologist. So now that we've covered all of the things that we talked about today. So the crisis in audiology, the teleaudiology methods, the store and forward and the live and synchronous. And some of the ways that we're going to address it. I think it's really important to just review. We do have a crisis in audiology. There are not enough of us to go around. We're going to fail to meet the need of our hearing healthcare patients if we don't start doing something else, something very exciting, something that probably includes some sort of teleaudiology. And with teleaudiology we are not able to increase the workforce but we are able to address

these other things like using our workforce more efficiently. So we're able to really utilize those audiology technicians, the medical assistants in other areas where they weren't being utilized before and freeing up our time so that we can again practice more audiology. And the automation is really I think something to explore as far as teleaudiology to help us reach more of the patients that are really requiring and needing our services. And when we think about this all, it really fits into that alternative service delivery model for not only the video face to face where we're delivering via a technicians hands. But also how we're delivering the results to an audiologist for interpretation and determination of the next steps. And that concludes today's talk on teleaudiology, the basics of. If you have any questions you can feel free to type them into the pane. And if there are no questions then I will end the webinar and you can certainly always reach out to [audiology@grasonstadler.com](mailto:audiology@grasonstadler.com). Hold on we got a question.

Okay so the question is does the automated system perform word recognition testing? Is so, what word list does it use and how does it determine the level to present at? Great question, yes the GSI AMTAS does have an option for word recognition. It is a closed set, it's the MU six lists that we're using. We are using half lists. The presentation level is based off of either the pure tone average or the SRT and you can select that. It defaults to the pure tone average. And so the way that it works is we will present the speech list 22 decibels or higher or louder than your pure tone average. And then if you get 88% we consider that excellent. If you do not get 88% then we will raise it another AdB and present a different word list. And we're looking for PIPB improvement. And so one of the challenging things when you're looking at reports from AMTAS during the speech tables is you're not seeing 100% on every one. But doing a closed set speech test at MCL, everybody would get 100%, we're good guessers. Another question we have is what is recommended for infection control on the bone oscillator strap? They are tagged as single use. They have found a way to make them inexpensive enough that they are labeled as single use products, great questions. All right, again if there are additional questions I believe my contact information is on

audiology online. You can always email [audiology@grason-stadler.com](mailto:audiology@grason-stadler.com), G-R-A-S-O-N, hyphen stadler, S-T-A-D-L-E-R dot com.