Tele-Audiology Today: Research, Practical Demonstrations, and Fundamentals, presented in partnership with Salus University

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- [Samantha] I think that's my cue. I am excited to be here again, and thank you for everyone who came last week and is back for more this week. I have worked on the talk to try and incorporate a lot of the feedback I got and the questions in the areas that individuals seemed interested. Just to start off with disclosures. Am receiving honorarium. We'll talk a lot about equipment. I have no financial gain and don't endorse anything specifically. These are just suggestions. Okay, learning outcomes. This talk was probably gonna be long to begin with, but with COVID-19 and sort of this need for audiologists to better understand how to work from home and meet their patients' needs in their patients' home, I've geared a lot of the talk towards that. And so, it is long. Strap in. This is gonna be a big talk, but the slides are available to you and at the end I have my contact information that you can personally reach out to me with your specific ask because I don't think I'll be able to address all of it in the talk, but hope to float lots of ideas behind areas of things that you can do in your program. Before we get started, Kimberly, if we can put up that first polling question to give me a sense of what people are most interested in. Okay, looks like we're just in the back end.

Okay, so let's just keep going, and then when we're ready, basically it was a question to get a sense for what people are interested in. We can come back to that question. I'll come back to that. Okay, I would be remiss if I didn't start off this talk by reminding everyone about infection control. I think historically, audiologists, we are not great about wearing gloves and being mindful of infection control, and this is of the utmost importance during this timeframe. This is anything from if you have, let's say you do a drop-off program for broken hearing aids that you need to troubleshoot, and you're collecting them in a box. We need to be gloving for that. You need to be wiping everything down. If you're sending batteries out, if you are sending new tubes out, mailing patients, you just wanna be thinking about things that are coming in, both people and equipment, and what you're sending out and just ensuring that everything

you do, from equipment to microphones to seats to technology, all of that is available and taken care of and cleaned, cleaned, cleaned, cleaned. And so, as I talk about solutions where you may receive a hearing aid or mail it out or have equipment that you're sending out for people to borrow or do a test in the parking lot or do a test at home, that you're doing a really good job of wiping that equipment down, and just think about that through all of your practice. And then Asha did a really nice town hall. They had an infection control consultant on there, and she spent a lot of time talking about PPE and if you're seeing patients and who's vulnerable and how to best do it and what's the latest with CDC. And so just be referencing things like that. Okay. The poll is ready, so let's go ahead and do that poll before we get started in the different areas. I would love to know what areas within audiology you're most interested in learning to do telehealth.

So, is it diagnostics, is it hearings aids, newborn hearing screening? Could be all of them, could be other, don't wanna contribute. I have a guess for what people wanna hear about, but I just kind of wanted to poll before we started so I could tailor how much time I spend on things. Okay, perfect. Most people are telling me diagnostics and hearing aids. That's what I focused on. I will touch on other areas. But, that's great. I think you guys will find this helpful then. Thank you so much for putting in your vote and giving me a sense for interest. Okay, so, research in tele-audiology. It's pretty much in all aspects of what we do. Some of the research is a little bit more scarce, but it has been done. Some of it's a little bit dated, and models are a little bit old. But, there is evidence out there. There is example models we can build off of. And so I'll touch on these kind of major topic areas, and I'm gonna focus primarily on diagnostics in terms of hearing testing and then a little bit with amplification, and that seems to go well with the audience's interests. In terms of tele-audiology and cochlear implants, there's actually a pretty big set of evidence out there on it and showing its success. This is mostly done via remote access. So someone's dialing in to another computer that has the software and a facilitator with the equipment necessary to connect that implant. And they're doing everything from impedance testing to programming to speech

perception. And interestingly, speech perception kind of was a bug in the system. You know, they weren't really showing that you could get the same level of speech perception, results in the distant remote site as you could, say, in a sound booth, until this recent article right here, and the reference is at the end, started using direct audio input through remote connection and was getting the same results as it would be in a sound booth. So that's all really exciting, and for those of you doing cochlear implants, you know, how many appointments is that? That's a ton. And so, if you can really reduce how many in-person visits you need and do the rest of that follow-up on VTC, that's awesome. And I think from a direct to patient model, I know that some of the implant programs have the ability to kind of store programs that can be remotely added in and things like that.

So, it's a little, I mean, I think you do need that remote access option for a lot of this, but I think for quick program updates, something that we've done in Alaska is put additional programs, like increase the map, and then you can download that to the implant from a distance and not need to remote access. So, really cool ideas out there. I think there's a lot of potential here, and the evidence is pretty strong, particularly related to remote access. Okay, moving on. Aural habilitation and rehabilitation, there is a ton of evidence in this area. This is low-hanging fruit for converting to tele-audiology. You know, this is just a small sampling of some of the evidence out there in the different areas, but, you know, obviously video teleconference connection, and then what I'm seeing in evidence a little bit is that they do like some asynchronous store-and-forward type in between sessions. You know, maybe they're filling out handouts or questionnaires or doing home tasks and then, or using apps, so partnering between a VTC type of environment model partnered with a store-and-forward in between. But, you know, in many cases, it's either the same or somewhat better on VTCs, so I won't spend a lot of time here. There's a ton of stuff out there. There's a ton of resources. And if someone has some specific stuff, we can, you know, if you're looking for videos, you can do, or if you're looking for ways to screen share and things like that, we can walk through that specifically. Just reach out to me. But in general,

lots of evidence in this area and you should be able to take what you're doing in person and implement it on VTC relatively straightforward. On newborn hearing screening, there's also a lot of evidence in this area, and again, a lot of it is remote access in the sense that you have equipment on the remote end and an audiologist is dialing in to that computer and controlling that equipment. The studies listed here have talked about different types of connections for that remote access and what worked the best and then also how they've implemented that program so you can get a little bit on program details. In general, everything is shown to be the same in person versus not in person. Again, for the type of model we're trying to battle with, COVID boundaries in terms of testing at home, this doesn't quite get us there, but if you're thinking about how you flow healthy patients through, for example, I think the American Academy of Pediatrics is gonna come out with the idea that the 136 for eddy is essential and so wellness newborn screenings are gonna be essential, and so as we look through, as we handle COVID and do some of our essential areas of audiology, newborn hearing screening is gonna be one of them. But if you can float healthy children through a remote clinic, you can easily get your equipment out there and set up a remote access connection and work with a nurse, for example.

So I think that while you're maybe not looking at in-the-home testing for these types of things, there are ways to creatively use what you already have to potentially set up something for remote access to either a healthy spot where you're following patients through or remote areas, or maybe you're not going in to the newborn hearing screening area or you're not bringing a patient in to audiology, but you're setting up equipment where they're already being seen and doing it there. Anyway, just throwing some ideas out, trying to think creatively. I think there is some avenue for doing some even in the current timeframe, timeline. Okay, couple of slides on diagnostics. Biggest takeaway I want you guys to have is that automated audiometry is well researched and is well validated. This is a great, Mahomed et al. is a great meta-analysis of kind of what's out there is terms of automated threshold audiometry, and what they're finding is that the average difference between manual versus automated air conduction is

about 4D, 0.4 decibels with a standard deviation of six. Now, taking that into consideration, test-retest differences for manual is 1.3 decibels with a standard deviation of six, and then an automated is 0.3 decibels with 6.6 standard deviation. So it's right in line with what our test-retest is if they come in and they see you in the sound booth. And so I think people are scared of automated audiometry in some instances. We do a ton of it. I think it is something that you require some training. Sometimes it's a little bit more work on the front end as you walk someone through like how quickly they need to respond and hit the button, and it takes a little bit of kind of, some, kind of, you know, you just need to, you need to interpret with caution. You need to kind of walk people through how to do it well. But it can really open up the door in terms of what information you can get on a person. For sure, there's not as much evidence on bone conduction and this doesn't always apply to difficult to test, so I think someone asked about malingering last week.

You know, obviously if you have children or adults with developmental delays or you're even looking at like condition play, for example, automated audiometry's not gonna work here. I think there's still some ways you could potentially help to do some condition play with a facilitator, you know, in a dire situation where you need to get some results, but in general, for the bulk of the people you might be seeing on a general practice, automated audiometry's gonna give you some good information. Here's another review article that talks a little bit more on the implementation of evaluation side of automated audiometry. Say that 10 times fast. So they get into the software, the hardware, the smartphone, the tablet, how are you doing it. And so this is a great article to review. And again, they came, what they found was that there was no significant differences between automated versus traditional audiometry. Again, just a tip of the iceberg smattering of studies that have started to look into various aspects of diagnostic audiometry and doing it via OAEs or manual pure tone, and so this is someone who's remoting in to a computer and then automated, there's just a, you know, those review articles will give you a sense of what's out there, and these are a couple of really good, key articles on looking at automated, pure tone, air, and bone. I

got some questions on school, and so how do you do tele-audiology in like pre-school example for children, pre-school children for example. In terms of school, there's a bit of evidence out there. You know, there's this idea of automated testing, and so doing it via tablet or a smartphone. Something that we did in our big project up here was the hear screen. So this idea of it's an android cellphone-based technology that a lay person is doing a pure tone screening on. There is also evidence, oh, I didn't, I must have left the article off here. I'm sorry. There is some evidence on researchers dialing in to a computer and it screening children. Actually, I think at Crumb et al., maybe 2008, has an article, or 2007 has one where they dialed in and did synchronous otoscopy, so a facilitator's doing otoscopy, like maybe like a special ed teacher, and than tympanometry and then a pure tone screen. The pure tone screen was controlled by them, and then tympanometry and otoscopy were done by the facilitator and then kind of coached and interpreted in real time. So that's an option. I'm not sure how sustainable that is in terms of audiology ability to do that with kids. I think you could probably train, more easily you could train a school to do the screenings and then they're getting results to the audiology practice.

And then, again, oh, and then there's the Lancaster et al., 2008, and that's another example of this real time application and remoting in. So, in terms of pre-school kids, they're little littles, right? And so you're looking at kind of difficult to do pure tone screening. Hear screen does have evidence of kids down to three or four, and so that does get at your pre-school group and it is a really easy tool to use in terms of, you know, the lay person is just clicking a button. I think you've gotta incorporate some coaching for condition play to help get good responses. But that is a really viable option, and that's an asynchronous model, which I think is more viable. But I think you could potentially set someone up with an OAE and do some coaching. I think you could also potentially remote in if you have a small program and it was your responsibility to screen their kid's hearing, you could remote in and do that with an OAE on a laptop with the software installed, things like that. So lots of options there. Okay, so in general, diagnostic testing models to think about in terms of tele-

audiology, so in real time, the two options you have, obviously for gaining diagnostic results, you have remote access, so that's you're dialing in to someone's computer and you're controlling software that's on that computer. And then there's mobile audiometer. So like, this would be like the KUDUwave or hear test or something where you can actually, their system is connected to a laptop, you're dialing in to the laptop, so you're controlling that mobile audiometer on that person's head. Similarly, you can do that system more store-and-forward, so that system also has automated audiometry, so the person's just there clicking and they can send that result to you or you can view it via the cloud. And then of course for store-and-forward, you have the smartphone apps. So someone's doing a hearing test at home and then they're sending you either a screenshot of that or a lot of the times there's an export feature where they're sending it to you over email. It's just like a picture or a PDF of it. So less common in terms of getting diagnostic hearing results. When we think about mobile audiometers, obviously this is gonna be the best way to get more diagnostic information than an airline. KUDUwave has got a good bit of research behind it. This is a link to their webpage that lists all of their, the evidence behind their device and the development of it.

Oh, and speaking of links, I'm gonna work with audiology online and we'll either get you a PowerPoint that's linkable or we will get you, I'll make a sheet, a worksheet, that has all the links that you can either click or it's spelled out, and so I know that that was an issue with last week's talk, but we'll make sure we close the loop and get you all the links because I know it'd be helpful. And then, GSI has a system with automated air and bone, and then Shoebox is air, bone, and speech. And Kiary has air, and they're in bone development. And so all of these mobile audiometers for the most part have an automated component and then many of them have a diagnostic component with it. And then KUDUwave interestingly also has a tympanometer that interfaces with this headset. Little clunky, but I think that that's pretty neat in terms of mobile solutions. And so, my thought for this is, A, mobile audiometer's awesome. If you don't need a sound booth, even if your program is expanding, like I think about our Anchorage

program for audiology is growing so big. They're doing amazing stuff down there, but they're growing out of their space. And so if you have this ability to use office space that isn't a sound booth, for example, mobile audiometers are awesome and we should be starting to think about where we can go with these, period. But it just diversifies your ability to do more stuff, right? So like maybe you have someone in their car in the parking lot doing this test, and you're on a VTC walking them through it and you're on the hospital wifi. You know, things like that. Or maybe you're traveling with this to a local clinic where you're funneling healthy patients through, for example. Things like that.

Okay, cellphone-based also super cool. I think that's gonna be getting, you know, becoming more and more popular. Shawana Polsteen out of South Africa is doing the most work here, and they're doing amazing work. Their research is really strong. They've lots of different applications from hear test, which is diagnostic, so this is going through a full audiogram. They are close to having bone, I'm pretty sure, and then they also have an otoscope that interfaces with their phone. So a really nice solution that continues to grow that I think will be really valuable. We have several of these, and we're sending them, I mean, our community is small, but we're using these at home for people that don't have their own equipment or can't download an app, things like that. There is web-based. This is thinking outside the box a little bit, but lots of programs, you know, I think if you just Google like hearing test, you'll get a whole swath of information. But there are things like Listen Lively is geared towards sort of direct-to-consumer model and that's led by Harvey Abrams and consulted by Dr. Jay Hall. It's kind of a neat interface. This doesn't scare me in terms of replacing audiology. I think if you partner audiology with things like this, we're getting at the 20% of the population that has hearing loss, and so, but this is awesome, right? Because someone can do this from their home, and you can get a sense for their profile of hearing or they're doing intake questionnaires, things like that. You can really get a sense for what your patients' needs are and then potentially ship them something and work through fitting with them, and then maybe you bring them in when it's safe for

one follow-up appointment and things like that. But, anyway, I'm outside of the box thinking there, but that's, web-based diagnostics does exist. A home kit, so Edamolick has an example of one or iHear I think is another. I've got a slide that lists these. But, basically the idea's, you know, you're using calibrated headphones, you know, that you plug into your laptop's sound card and you can do an automated airline hearing test with these. I think the idea's that the headset's calibrated, but these are anywhere from like $60 to $100 or something and so, you know, you potentially, if your demographic has a lot of laptops or maybe you're trying to set up something in the small PCC area where you just wanna get a quick sense of hearing, this is a really cheap purchase that you could put on something that gives you a sense of hearing, especially if you have baseline tests already. So that's not off the table, and then of course you have smartphone technology.

And so, I did go over that review article by Bright. I think you should visit that. That's helpful in starting to even think about what apps are out there. And I'm gonna go over length on the hearing apps on a slide later, so don't think there's not, there's more to come. Hang tight. Otoscopy, I think a lot of people are like, how in the heck am I gonna see inside the ear? I mean, it is not a super easy solution in terms of like your patient's at home and that's your only option. But, don't just stop there. I think there is technology out there. CellScope is one of them. That's really quick, good, and validated. Tyto is another one that's really quite good. There's costs to these models, but they do have consumer advantage points. So like, the price in that not totally steep. I think that a small practice could buy these and loan them out to their high-risk population or, again, potentially have someone pick it up and take a picture and then, you know, I think that there's a ways to be creative in how you use this technology with a smart app or a cloud-based system to get an image of the ear that doesn't involve you getting close to them and putting the provider and the patient in jeopardy. So, options are out there. One thing that, we do have the CellScope. We are working with Tyto for a large project we might be doing across the state of Alaska. And so we currently have, you know, this system and we've worked with, mostly the model we've

done has had traveling providers who are going to the home use it to take images. And we've been working on integrating it into our EHR. So it's a little bit clunky, but I think there's options for development there and ways to do workarounds in the short term. Vestibular and balance. I won't go into a lot of it here because I don't know how much people are interested in it, but there are cool apps out there that are looking at balance and gait, both for diagnostics and for rehab. And I've included a couple of recent articles. Tinnitus is another one. I mean, there is like how many tinnitus apps? And so this article I really like because it reviews all the apps out there right now for tinnitus management, pros and cons, rankings, and then also like how you might use this in addition to like, say, VTC therapies. And I have questions. Someone was like, hey, what do we do? Like, we don't do a ton of hearing aids. You know, we mostly do diagnostics. Like, what's an option for us as we stay home? I think tinnitus is low-hanging fruit. Aural rehab. I mean, you could do some, get your patients that are already fit and do some rehab with them. You know, I think that there is a few things that you can consider, especially in the therapy side, that are easy to start engaging.

And then I love this idea of, you could do like a hybrid model of like your, for those of you that are doing tinnitus therapy, like CPT or some of those other types of tinnitus behavioral health kind of behavioral modification models, you could intersperse that with the apps that range from like white noise to, you know, masking and things like that. Okay. Let's talk hearing aids. This article right here, Paglione and, I can't even say that. So it was in '18. Awesome article. I love it. I think you'll find it really interesting, so I would dive in. I think it's an open access article. And so they essentially reviewed tele-audiology across the course of the adult hearing aid journey. So this does not talk pediatrics, which is a little different, but they do go into like, what's been done for the education information, what's been done for like pre-fitting, fitting, and post-fitting, and I have a little screenshot of it, one of their tables. But this is really helpful, you know. Like you can see what's been done, what their summary of that is, and also what might work for your practice, you know, in terms of what these other publications have done for their models. I think that the age-old question is like, well how do I do real ear

measures, right? Like that's our, that's one of the things that, you know, is a defining characteristic of going to an audiologist for the most part. People are doing real ear measures. What do I do if I'm not doing real ear measures, and booth testing. I don't know how many of you guys do booth testing, but something that we do. We do real ear measures and we do functional sound booth testing. Like you can't do either of those with doing remote fittings. But there is several articles that have looked at remote hearing aid fitting and programming. And so the idea here is mostly remote access. And so, in this case, someone is dialing. You have like basically your real ear equipment on the remote end where the patient is and you're dialing in and you're helping to guide a facilitator putting the probe mic in and getting those readings. I think for today's COVID dynamics, this isn't probably totally viable, but I think it's something to think about in terms of like as you set up and you partner with other local health entities. What you might be able to do to expand best practices for hearing aid fitting.

Another thought that I have that, for example, and I'll give an example later. Sometimes I think it's something I do when I see the person and patient in person and I'm getting that diagnostic audio and doing a hearing aid eval, I'll also get RSCDs, especially if I know I'm not gonna see them in person again if they're like a remote person. So, I think there's a couple of different ways to try and get the closest to best practice as possible, taking in the dynamic of like safety, patient care, safety, and like for me previously, the COVID like convenience or you know the burden of travel, things like that. I don't think it's unfathomable to see someone for an automated hearing test, especially if you've got a good baseline hearing test, in particular. Do some intake questionnaires. Get a sense of what's going on. And potentially do like an open fitting type of model. You know, we used to do for some humanitarian work, we used to do insta molds. I don't know. That's not off the table. I mean, a lot of the over-the-counter models have some take-home setups for ear mold impressions. I think we can look into those, so if this is your area, I think there's some cool things that we could potentially play around with and pilot and see how well it works. And then, I think the key ingredient in all of that is the audiologist. Like you're doing the guiding. You're

helping patients figure out what to do, what's the best technology for them, and I think audiologists will still be that integral ingredient to success for that. Even in self-fitting, right? Like there's a ton of self-fitting hearing aids. There's a lot of evidence that's starting to be generated around the success of self-fitting hearing aids and patients making their own adjustments. And the evidence is not all bad. I think it does take into account dynamics. But, for the most part, you know, I think with the right support and guidance from, say, audiologists or professional and then taking into account like really user-friendly materials, I think there's a lot of room here for meeting, for an audiologist to meet more patients' needs, both in the home potentially, but more than they even did when patients were coming in to the practice, because a lot of people that have hearing loss haven't been fit, and so I think there's an avenue here where audiologists can get on board with this and do some cool stuff.

So in summary, research in tele-audiology is, there's a lot of it, and I think if you were to put in like tele-audiology and whatever your area of interest is, you'd find a lot. In summary, you know, nearly all audiology services can be done over distance, especially with thoughtful modifications. And so that's my takeaway for you guys. And then this is just a cool quote from Dr. Northern. I think this was in like a hearing journal article. But, he's basically saying that, you know, we need to be, you know, technology has really opened up the door for us to be creative in how we provide services, and we're really gonna need to do that in order to meet our patients' needs. And he goes on to talk about like, I mean, think about how you consume stuff. Like, do you bank on your phone? Do you get groceries delivered to your house? Like, a lot of people do these more convenient ways in life. Like, no one wants to get in the car and like find the parking garage and find the office. You know, I think that we, like this COVID, we can make silver lining in this situation we're in right now where we're staying home by just starting to really create, think and create models that make consumption of hearing health care easier for the patient. And we should be at the front end of that. Okay. I digress. Oh, there's a couple questions on acronyms. Oh, I'm so sorry. PCC is primary care clinic. I'm terrible with acronyms. And VTC is video teleconference. So any time

you hear me say VTC, I'm talking about like someone's on, you know, you're on a video with, like right now, what we're doing is a VTC, but think patient care. Sorry about that. I'm terrible with acronyms. Okay, I said that I would dive into the Alaska program a little bit, more than I did last time, so this is a graphic from the same slide deck you guys saw last time. You know, obviously Alaska is large. We've just depended on telemedicine for so long. 75% of the state is not even on a road system. So, I mean, we're talking about boating and mostly small aircraft plane travel. It is really hard to get around, and it's really hard to get different levels of care to these most remote communities. So telehealth it is. This is just a zoomed in version of like the region that I work in and have lived in for quite some time, although I'm not there right now. I'm with family during this time. But yeah, so we basically we have a regional hub, Nome, that has about 3500 people, and we have a really state-of-the-art hospital there that's new in 2014.

And then we have these 15 sub-communities here that are all super beautiful. Some are in the trees, and some are on spits at the top of Norton Sound, and some are islands, you know. It's such a cool place to live and work, but you have to fly to all these, or boat. I've boated between like Teller and Brevig, and Wales and Teller, and Stebbins and Saint Michael. You can drive between, there's little like dirt roads. You can be in a four-wheeler, or in the winter you can snow machine, you know, between some of these communities. But travel is hard, essentially, is what I'm trying to say. And so telemedicine makes things really viable for us in terms of providing health care on the regular. I won't digress here. Looks like the slide formatting's a little off, but essentially, you know, telehealth in Alaska's been since the early 1900s. I mean, we've just had to depend upon it. And then AFHCAN, which is the network solution I've referenced last time and we'll talk more about today, is this network solution that we use that connects the state to different levels of specialty care. And again, on this kind of cart, this is in about 250 sites across the state of Alaska. It connects the community clinics to the regional hubs, and then the regional hubs to the state hospital. And everything is on there, right? So you can do vitals. You can do EKGs. You can take

pictures of the teeth. You can take pictures of the eyes. You can take pictures of the ears. You can do all kinds of cool stuff. One of the most creative things I had to do, I had a really weird nystagmus and a vestibular condition. I had no idea what was going on, and I did a bedside exam, and then I did a lot of digital camera video of the nystagmus and sent it to ENT and we were able to work that individual up, but I think that there's some outside-of-the-box uses, even for this, but in general, it's an amazing system that connects several specialties, from audiology, ENT, to cardiology, dermatology, optometry, dental, things like that, and of course general PCC care. I wanted to give some more concrete examples. It's a system that, again, I think you're gonna hear me use the term "user-friendly." Like it's gotta be user-friendly. Like we know in audiology, if it's not user-friendly we're not gonna use it, right? So, the same as with patients and the same as with facilitators or like your community health workers.

This is a big touchscreen. These are big buttons. Easy to review. I mean, those are things you're gonna think about when you're looking at different technologies you may pursue. But, you know, basically we have equipment integrated into the software, and it reads the results. Here's technology from the, it used to be Centerrial Path and now it's Natus Rebranded Biologic AuDX, I think it's called. But, you know, we can get screening OAEs. We can get diagnostic OAEs. And we can get a pure tone audiogram. This, on the bottom, this happened to be an individual who had a right perforation with sudden hearing loss, and obviously he's got some hunters high frequency hearing loss too. So, you know, this was, for me, this helped us in this particular individual who came in with sudden hearing loss. Otoscopy, tympanometry, and the audiogram helped us understand what might be going on. And so this was kind of, this is just a great example of the data we collect and use. When that information comes in, so I'll talk more about the model to give you a visual, but it comes in and the data's collected. It comes in in packets, and then I get an email that says, hey, something came into your group, or to you directly, and then I go into either the website or I go into the phone and I can pull up that case and review it. So the idea is that at the cart

side, so this would be like the local side, where the patient is. You're getting all this information. Usually we have community health aides, which is a really cool program up here. Just Google community health aide Alaska. You can read more about it, but it's a professional program that trains people from local communities to, you know, kind of serve as eyes and ears of providers in various specialties, and so it's just a really, really cool program. But anyway, so a community health aide would grab all this information, and then they would send it to the reviewer who gets pinged, and then you review all these documents, you look in the EHR, and then you type up a consult and send it back. Outcomes, and then I will go into models, I swear. You know, when... Before telemedicine, let's just talk ENT audiology for a second. The wait time to see an ENT, and we have a lot of otologic disease, which is why I'm focusing on this, was an average of about five months, a new patient had to wait for an ENT service. When telemedicine was implemented, which means a case is created, images, tymps, you know, audiology's triaging that, you know, figuring out what needs to go and then sending it to ENT. After telemedicine had been established for three years, this is the drop, so it went from five months to a two month wait, or less than two months. So it's pretty significant.

So this idea of like, essentially working your patients through telemedicine to kick them out of any unnecessary inpatient care if it can be done on telemedicine. So we see reduced wait time in services, and this is for cardiology, this is for ENT, this is for several of the specialties. We also see improved cost-effectiveness, right? So like you're not traveling patients as much. On the other hand, so long as you find things you wouldn't otherwise find, so sometimes someone's being traveled where they otherwise wouldn't have, but now they're gonna have a better health outcome. We also see reduced burden on family. You know, if they're only traveling once versus three times for something. That's been all great. And then, we see an improved antibiotic stewardship, and what I mean by that is when we compare encounters that were just seen by health aides or just primary care, so that's someone doing a, think about a regular, you go to see your, you know, your primary care PA or, you know, maybe you

see, you know, a health care worker or something like that. Like they're looking in your ears, they're doing a general exam on you, and you're getting a diagnosis and a treatment. In the case of otitis media, acute otitis media, when it was just that primary care visit versus a primary care visit linked to a telemedicine encounter, so they, during that visit they took images and tymps and they maybe did a hearing screening and they send it to audiology who then potentially counsel the ENT if needed. But we saw a significant reduction in antibiotic usage because you're basically, and I don't even know if it's the specialty consulting, but it's the fact that you're getting images of the ear versus a handheld otoscope and tympanometry, which is just incredible in terms of like determining whether or not there's actually an ear infection going on because there's a lot of over-prescription and over-diagnosis of AOM. So, all really exciting things coming out of telemedicine.

So again, I think I showed this last time, but we funnel everything through store-and-forward. What can't be done through store-and-forward, and then what needs to be done via VTC, so coaching a health aide on getting more accurate information or coaching a patient who's hesitant about care or you need a better case history. Anytime audiology counseling is necessary, VTC is great and sometimes it's a hybrid of both of those. And then our last resort is in-person if needed. And sometimes in-person is necessary. It's not that we don't need that, but I think you can do a lot of these things and get the same outcome as if you traveled that person in. I mentioned this before, but we handle a lot of otologic disease and then subsequently infection-mediated hearing loss, and so for us, images of the ear and tympanograms are absolutely crucial. And then we've tried to even take our telehealth model to the next level by doing a randomized control trial looking at if we could link an expedited telemedicine followup to a referred school hearing screening and get kids better access, and we're looking at things from screening program to how many kids got plugged in the health care system if they had that expedited telemedicine to academic performance, Hearing-related quality of life and everything like that. So, this trial just ended and we are in data analysis phase, so stay tuned for some of the data coming

out of this. It does look really good. We have a couple of protocol papers out if you wanted to read more about what our trial is and how we're trying to morph the telehealth models we already use to do more than what we've done it before. And I know, again, I have to mention other systems. I may not be familiar with these. I do know that the VA has done quite a bit with the, all the new metrics cart I think now owned by Natus. That's everything from diagnostics to hearing aid fitting, I think. If anyone's worked with, you know, the Oto Suite with any of the equipment like the old school oto flex, which is now like the Zodiac, I think. Things like that. That's all Bluetooth and run through their software, and so that's kind of neat. You can remote in and control any of that, if that was located somewhere. So you could put carts like this in places where you're following healthy patients through and dial in and help facilitate someone.

So I think they've done, they've published a ton. They've done a ton of cool stuff. So I think if you put in tele-audiology in the VA, you'd also get some really great examples, and they're definitely experts in pioneering through tele-audiology for us. And then during my stints at Mayo, they were just coming out with this HealthSpot platform. And so this is the idea of what you might, maybe it's at CVS and you're like going in there and you're, and you've got all your like vital machines here and then you've got your doc on the call. So, there are definitely lots of other solutions out there. These are, you know, I just didn't want to just mention AFHCAN, but there is some other cool network systems out there that you can use. Okay, so back to Alaska. Some telehealth work flows. I've alluded to some of it. One of our most common is the health aide to audiology ENT model in terms of the rate of otologic disease we have to deal with. We just do a ton of like kind of medical audiology, I guess you'd call it. But, you know, we're getting high-resolution images. We're getting tympanometry. We can do screening and diagnostic reflexes if we needed to. Automated audiometry, I showed you an example. We can get vitals, and we can get a history. And then we can capture this and triage it. Like, is this someone we already follow? You know, what is the, you know, is this a treatment issue? Is this something that needs to go to ENT for surgical

intervention potentially, for tubes or a T plasty that continues to drain or looks risky for a cholesteatoma. And then we also do a ton of audiology to ENT, and so like when you have, when you see someone in your practice and you're referring them, like, hey, you know, this is a concern. You need to go see an ENT for this. Here's a referral. We're doing that referral. CHA is community health aide. So like basically a community worker, but a trained professional in our state. And then, so we, instead of just giving someone a referral and saying go see ENT, we have them see ENT as part of our appointment. You know, so it's another encounter but it's a telemedicine appointment, and we're sending digital otoscopy. Again, all the same things. Full diagnostic audiogram, particularly because they're coming out of our sound booth. And then what happens there is just this incredible coordinated care where they're getting, you know, because a lot of our, we have hearing loss but we also have a lot of disease, so we're getting a plan.

So is it surgery intervention, and then audiology's coordinating, you know, hearing stuff related to that, pre- and post-followup with telemedicine. Is it a sudden hearing loss? Things like that. This is what the workflow may look like. Starts with a community health aide, who's positioned in the rural clinic. Could be as small as 50 people living in a small village. They'll take that information. They just send it through the system to the audiologist. We can send it on to ENT down in Anchorage if we think it needs some sort of surgical management or it's a complex treatment case. And then, otherwise we work with primary care. And then, this may come back to audiology. We'll help case manage it. We'll also help with intervention, so what kind of management are we doing? Is hearing aids or FM or some sort of system needed? And so then we have this circle and all that's documented in the system, everything from the encounter to the exchange and then also the care coordination. So it just makes it for a beautiful, well-managed patient. And... You know, I just don't think there's many systems out there like it, and you just have to think about that care and case management in there together, and it just really is quite a profound system. Okay, so great question from Priscilla. In terms of how this model works, I gave you that example of it coming in the

form of an email notification. So the way it works is, unless I'm in a patient appointment, I'm most likely responding to these immediately. So, you know, they take usually 15 minutes to review. Sometimes a little longer if it's a complex case and I need to dig into the chart more. But I'll get that notification. I'll get it on my phone, and I'll hop on my email, stop what I'm doing administratively and then I'll go to that and I'll do the consult and send it back. ENT, the same way. So in between patients in a clinic, you know, the nurse is rooming the next patient. They might grab a telemed quick consult on it and send it back. I would say we average about four hours turnaround time, and that's from the ENT back. And so if it goes healthy audiology for triage and then ENT and back, we're looking at less than four hours. We try for a same-day turnaround. And so, that's really, you know, essentially we, the on-call ENT, in particular, is the one that's focusing on taking these cases. But for audiology, we all just listen and take care of these cases. Okay, sorry for the background noise. Okay, problem resolved.

Okay, case examples. I listed this out last time. I'm gonna, and we talked a little bit about these. I'm gonna go into a couple more, more specifically, just to give you a few different examples. I do have like a recent telehealth article out with some of my colleagues that we go into more case examples and give more background, if you wanted to peruse that too, just because I'm breezing through here. This is a cholesteatoma case, and so I just wanna give you examples. So like again, I get that notification on my phone and I call out the case I'm reviewing. These little attachments, let me get my little mouse thing going here. I forget you guys can't see it unless I do. Here we go. So, you know, this is all the attachments. Each of these can be opened up and reviewed, enlarged. This happened to be a 19-year-old who came in for a right hearing loss and some pressure. I've obscured a lot of information here for privacy, but, you know, so what we've done here, you can see a consult done by me where I'm kind of going through this patient's chart. Interestingly, let me go to the next slide here. Here is his data, like, it's not the way it would look if you pull it up in the system, but I just wanted you to see it in all one fell swoop. But here is images. This right ear is very

sick. It's retracted TM against the ear drum. The left ear has a long-standing perforation. Obviously post-surgical. And then you can see this kind of cerumen trail that I don't like to see. Usually for me, this is like concern for cholesteatoma or something else is going on and I usually wanna get this to ENT for some sort of review, and potentially they'll wanna see this person for microscopic exam. But, this individual had some management done but had been totally lost in the system, and he came in just because his hearing had changed. And here's his audiogram. This is the one I'd shown you earlier. And so we were able to take this information and I worked to pretty aggressively get him back under surgery. A CT had been done a while ago. Like I alerted the ENT of that to review it, and then the ENT did review and then now he's being scheduled for surgery to get, I think, potentially in both ears, but they're starting with the right.

So this is just an example of how we used a case to triage. Let's see, I can, wait, I got my little things here. Here we go. Here's another case. This was a sudden hearing loss case from an older gentleman. The point that I wanna make again, so again, we get this case. Actually, this isn't, the last one was a health aide to an audiology and then ENT. This one is to an audiologist to an ENT, and so this person came in. They were living in Nome. They came in to the clinic and had some issues with sudden hearing loss. The audiogram showed, this was the audiogram from the initial encounter. Obviously, a decrease in hearing. Should have put a baseline audio on there, but I didn't think to do that. And then, this individual got a prednisone taper and then this was their hearing post-treatment. What I wanna point out to you is at, this case was sent, you know, 11/20 at 4 p.m. By 4:20, the ENT had confirmed they were gonna treat it like a sudden hearing loss and they're gonna do prednisone taper and gave a script. By 4:30, the script got put into pharmacy and the patient was able to pick it up. So, that's pretty cool. We don't have ENT in Nome, but this person was able to get a script for a prednisone taper within 30 minutes from, you know, a specialty consultation. And then subsequently, his hearing returned. So I think this is an example of really good outcome using telemedicine. Amplification is something I know a lot of people are like,

how the heck are we gonna do this. Here's this dye mead case I had shared with you guys before. I was able to see him in person initially, and I did the diagnostic hearing test and I did RSCDs with a portable veri fit on the front end. I could have done an ear mold. I didn't need it for his type of hearing loss. And so, I didn't do it, but I think we, obviously would have done ear molds here at this time too. I think post that and during COVID. I think there's a couple things you could think about doing for ear mold impressions, such as insta fits and things like that or, you know, temporary solutions. But, anyway, so then I got this in-person data. Offline I ordered the technology and the extra supplies. I pre-programmed the device, and then I shipped it via helicopter to the clinic and then I did a virtual fitting.

And so I had the RSCDs pre-programmed in there and then I did in situ audiogram and then I did a validation questionnaire. So I couldn't do real ear and I couldn't put him in a sound booth to verify, but I did as much as I could in that scenario. And then I saw him for hearing aid checks following that. So I looked at data logging. I did some programming adjustments. We increased his loudness a little bit. And then we double-checked on his validation questionnaires. How is he doing? Are we targeting the areas where he wants to hear better? So all of that, these are kind of the important ones. If you've had people you've already fit in person, these are ways you can follow up with them virtually now while you're at home and they're at home. And then just for your exam question. Here's the text here. Examples of tele-audiology and amplification include remote, you could do, I didn't do remote real ear measures here, but it does exist and it is possible. Hearing aid programming and then self-fitting hearing aids are all examples of ways you could do tele-audiology amplification. Okay, I need to speed up. Okay. Newborn hearing screening. Lots to be said here. I think it is an essential part of audiology, even during this COVID crisis. But something that we've done to help reduce loss to followup even before everything going on was hybrid models with audiology video teleconference and then store-and-forward with otoscopy, tympanometry, and OAEs for that initial appointment. This case, I've also mentioned it in that article, but it has a combination of different levels of telehealth models in it. So

we had a newborn, born at 36 weeks, no complications, no family history. Lots of ear infections, though. He referred the left ear, passed the right at newborn. Really had a hard time getting them to come back in. Dad was subsisting. Mom has three other kids at home. She was struggling with not being able to come back in. So I said, hey, we could do it there in the clinic. So I dialed in to the remote clinic and I did a VTC appointment, including otoscopy, tymps, OAEs, and counseling. He referred the left ear again.

So I stressed the importance. Now at that point, something that we're playing around with doing was sending the A, automated ABR out there and doing it out there. But actually, she had to come in for another child for a more emergent appointment, and so we just went ahead and did that AABR while they were there for another appointment at seven weeks, which ended up working out really nicely. Referred the left ear again. There was some concern that there might have been an effusion, so I did a telemed to ENT. We got them on an amoxicillin script and we went from there. Brought them back in post-treatment and found them to have a profound left hearing loss. I did an ENT telemed. And then they got scheduled, from that encounter, I got scheduled for obviously an ENT eval, genetics, and ophthalmology and potential CI consultation. Where we're at right now with this person is when they, this baby, when they flew back from doing this care set in Anchorage, we had them stop over in Nome a night and they were fit with a hearing aid. And then we've had two VTC followup appointments with them since, and I think they're still kind of in the queue for potential CI. But that's kind of an example of how we've tried to reduce loss to followup. These are just some examples in our program of how we're using telemedicine. I'll just point them out. Here, if the initial outpatient followup, we are playing around with right now piloting, sending out the AABR equipment and having the health aide do the ABR with us on VTC coaching. We are managing high-risk kids on VTC, so we're seeing them for OAEs and otoscopy and just monitoring them. And then obviously we do a lot of ENT on telemed. And then if you needed rehab, we're starting some, we do a little bit of rehab stuff but not a ton. But that's all telemed stuff, part of this. Okay, so couple

demonstrations. Can we play this video, Kimberly? Or get it loaded? Okay, perfect. Okay, so I'm gonna talk over this video. I wanted to basically show you guys what it may look like for me to connect with a local clinic to provide audiology support, or what I'm calling an audiology VTC. And there's no audio. I'm gonna talk kind of over this. So basically right now I'm in the patient's chart. You know, options, I'm gonna pause this. This is gonna go too fast. I could dial in through the virtual patient room. I'm choosing, I'm also showing you how I can dial in from a system. I just have a desktop application on the computer, so I've essentially called the clinic. You can also choose to meet in rooms. There's lots of different ways to use this technology to connect to people. So, this is me connecting. I'm joining, I happen to be calling in to Shishmaref, which I pointed out to you in the map. At the very, very top of our region, they live on a little land spit.

And so we're dialing in. You can see I'm gonna adjust my, it always makes me big. I don't wanna be big when I'm looking at myself here, so I'm gonna change my screen so that I'm seeing more of the exam room. You can see there's the health aide there. To shorten it, you'll see it cropped a little bit, but essentially this is my test patient that we have for the demonstration. And then I'm talking the health aide through what to do. So right now I'm talking her through how to share the screen with me. And so she's gonna share the screen, so now I can see everything that's going on in her end and I can coach her through every step. And so now I'm telling her she's gonna kind of load a test patient. Here's the profile. This is linked to our EHR, so when they search for people in here, it's pulling it from using HL7 from the EHR, and so then it will also drop this information into the EHR as well, as a PDF link. So all the images and the data from all of this and the exchange and everything, as it's final will port into our EHR. So I'm having her just kind of, this is right before the launch hour, so they gave me like five minutes. So I quickly got her to do just a tymp on one ear, so you can see it. I can coach her a little bit, so how she's holding the probe or if I'm getting a result that I don't think is accurate. I can't see the tymp because it's on that peripheral path machine I was telling you about. But I'll show you how she will download that data and

I can review it with her in real time, and we potentially repeat it if we need to. And then I also have her just do a quick OAE screening. And so as she's doing that, I'm being quiet because I don't wanna be loud during the test. And then she's getting the data. Sometimes with the OAEs, she's got a pretty steady hand. I'm not too worried about it. But like I will have them put the probe in and release. And I've sent little clips out to help with that. But you just come up with different techniques. This patient in particular has a hearing loss, so I know that they're gonna refer. But you can see how I can look at the data. The tymp here is normal. She left before we could get an otoscopy on her, but I have the health aide do otoscopy, and I'll show you what that looks like now. So I can see the data. We walk through it if the patient was there. I'm interpreting it and talking to them about what I'm seeing and what the plan would be. So right now, she's going to do otoscopy.

And so in this system, there's lots of video otoscopy out there, and some of them more expensive and some more affordable. Something that you guys can consider right off the bat is the oto cam is a huge one. The VA probably uses that a lot with their own metric system. But that's a great USB-powered one. There's several USB-powered ones, and there's a few that are run by smartphones now that are like 50 bucks you can get off of Amazon that aren't half bad. But anyway, so in terms of us getting like really high-quality images for like reviewing otologic disease, she's white balancing the camera and then she's also has a focus tool to put the camera in focus. And that just helps because a lot of times this is happening without us coaching them through it, and so the more we can get good standard images, the better. Now she's taking an image of her own ear, so we're not gonna get as good of an image as if she's in someone else's ear, but you can kind of see how I'm seeing her take that image in real time and I'm coaching her through what I wanna look at in terms of the sulcus or the attic, the prussic space or whatnot. So she'll save that image, and then again, I'm counseling the patient. They're there in the room. We might go into a hearing aid pre-programming session if we needed to, things like that. So, we're coming up with a care plan. If there was a lot of disease or we were looking at something surgical, if it was a

complex case, I may add in ENT right to this call. Let me pause this. Right to this call if they were available. We use TigerText to communicate between providers, and so sometimes we're like, hey, I've got a complex potential surgical case. Can you review and dial in? And so I would send this asynchronous information to that ENT. They would review it quickly and they'd chime in on this video call, and then we would get that all done right there in the spot, and that's helpful, right? We've saved so much travel and so much time. She's holding up the headphones that we have that go with the system, and I asked her to hold up the response button so you could see what that looks like. Mostly with the hearing tests, they know there's some embedded training, I'm sorry, instruction, on the screen. I didn't have her show all that. I probably should've just so that you guys could see it. But, there's a lot of stuff here that helps them understand. And then we have pocket talkers that we put near microphones. If we have someone with a lot of hearing loss or we direct connect the headset into like a jambar speaker so that they're getting the direct input.

So, that's not demonstrating everything, but I just wanted you to have a sense for the feel of what that looks like for us to dial in and work with that health aide and work with that patient and get that information. And she's gonna send this case to me, and then I have like Cerner on my computer. I've been typing the results and the findings. And then... And then I might, like I said, I'm coming up with that care plan. Is it going to ENT? What does it need? Are we ordering a hearing aid and sending it out? You know, kind of what's going on with that. So, that's the way that works for VTC. There was no audio in the video, so I think some people might have thought there might have been an audio but there wasn't one. So now, I would like, so that's an example of an audio VTC dialing in. I'd like to go now to the next slide. Okay, I've got a quick question. I'm gonna pause to answer it. It's from Rachel. She's asking, to clarify, when you call an ENT into appointment, you mention it being a separate encounter, but are you speaking to the ENT or is the ENT seeing the patient and are able to participate in the video call you are currently on, or do they have to connect to the patient separately? This is a great question. Basically the answer to all of this is yes. So we've had

examples of, in particular, complex surgical cases where I send that information to the ENT. I TigerText him and say, hey, got someone in I'd like you to take a look at your surgical case complex outcome. Can you take a look and dial in? Patient needs some guidance. And if they're available, they'll dial right in to that call, see the patient. The patient's talking to the ENT. This has worked for me in particular for surgical cases. So someone who's hesitant for surgery or not understanding why they're being recommended for surgery. So we've done it that way. And that becomes two encounters, so the ENT will end up billing for that exchange as well as the audiology billing from Norton Sound. But it's happening all in real time. So basically two appointments happening at once. It's like a patient went to two appointments in the same day. The other way that it's done is store-and-forward, and that is that you're sending it to the ENT for review and management, and then they might be going down for pre-op and then surgery the next day. And so then they would be seeing the ENT at a later time. But any time I want that instantaneous ENT exchange or counseling, we can dial them in and we usually can just hit up.

Our team is pretty close, and so there's three or four ENTs that all see who's available, right, or try and see who's on call and they easily will just dial in. So hope that answers your question, Rachel. Okay, good, we're on the next video. This is showing you a remote desktop connection. So the idea with this would be like programming from afar. Now, you can do this. This is on most PC computers, and so this is just automatically installed if you have Windows, and it's free. And so as long as you're dialing in to someone who has another Windows computer, they'll have this and then both computers have to be in the internet, and you just basically get the address to their computer and you connect, and then you would have control over their computer. So a lot of people do this, for example, like if you work from home and you wanna get your desktop, a lot of people will dial under their own desktop so that they can access what's on their desktop. So I don't know if people have done that, but this is kind of the same concept. For us, the system is networked, and so obviously like all of our communities are on the same kind of large network structure, and so in this case, I'm

dialing in to another computer on our network and so there's extra security privileges I need. We need to get permissions granted, so each, like I'm permitted to remote desktop reach to these computers, so there's extra layers of security and all of that, but I've logged in and now what you're seeing is me on this desktop. And I've called in to Savoonga, which is a community on a remote island. And so this is covering lots of miles, but I'm able to dial in to their computer. There's a little bit of a lag. But I can click on, we've just got phone ack standalone version installed. We piloted this a couple of years ago with phone ack and eye cubes. It was just kind of, phone ack was willing to give us eye cubes, free eye cubes. We launched them out to each of the clinics and set them up via USB hubs in, oh, let me pause so this I can walk you through.

But yeah, so we have that, and then we, since then, we've also put out Noah wireless units, and so we can do more softwares, or more companies such as like Resound and Oticon. We do have, we are integrating Noah. It's just a little bit complex with our server system, and so that is not off the ground yet but that is in process, so you could theoretically do the same thing through Noah, which would be better because then you're not on standalone systems. But, anyway, I mean, that's the kind of beauty of tele-audiology is it doesn't have to be perfect when you start, but just start something and try it and then you expand it into what the ideal model would be. Okay, so here, I'm demonstrating for you, normally I have two monitors, but I don't have that right now as I'm working, I left work to be with family during kind of this COVID crisis. But, essentially you would... Like I would dial in to the cart, and I'll do that through Cerner or through this desktop application, so I have video going, VTC video going on one screen, so imagine me dragging, now you're just gonna look at me right now because I didn't dial in to actually anybody for this one. I just was showing you how it works. And so you would move that screen over, and then I've got Cerner open, so I'm maybe noting what's going on, and then I'm toggling back and forth. Let me pause here. This is how you know you're in that other computer. So right now like I know I'm in the other computer right now because this bar is at the top and so anything I'm doing here is on the other computer. So, you would toggle back and forth between this screen and you

might have Cerner and your video on the other screen if you have this on one, so you can kind of see both computers technically at the same time. So yeah, that is kind of how we use remote desktop. It's relatively straightforward and pretty easy. And then I, a couple slides from here, I'll show you a couple other examples of like what you might use for remote desktop access type of stuff. And then I think I on the rest of this video I'm just kind of showing you how to go back and forth. I might look at the patient and do some orientation or some coaching on inserting, so I'm back to video. And then I'll go back to maybe I'm looking at whatever he's talking about, occlusion, or maybe I'm trying to raise the knee point because he's hearing the refrigerator too much or something.

So I'm going back and forth between programming it and looking at that person, and then when you're done, you just disconnect and you're out of the system, and you've disconnected from that computer. So remote access stuff is not scary. I think probably just the initial learning phase is hard, but it really kind of gives a lot of capabilities. So we can switch back to the main PowerPoint, and we'll keep going. There is a real question from Rebecca, and she's asking, are all providers part of the same health system? That is a great question. And that is, the answer to that is yes and no. So we are all Indian Health Service, so in some ways the system is connected and so our Cerners are connected, our EHRs are connected. Like it's two separate, or three separate health corporations, but we all belong to the same network of providers, and so that is helpful. It does kind of not generalizes well to like systems outside of that. But you, you know, we are looking at building network systems. There are telehealth solutions out there that have... So physicians who are part of organizations, insurance organizations and other kinds of organizations in states, you can get on board with some of those, or I think there are kind of cool ways we can look at networked provider telehealth systems in one of our, we have a grant application and that's looking at building, what that would look like to build something that's generalizable in terms of like a telehealth network provider access and specialty care. This is a great question, and it is a little bit easier for me to talk about it based on the models of care we have

with IHS. So that is a caveat. Thanks for the good question. Okay. So we went through our demonstrations. Hopefully that was helpful. Okay, so let's target what we know you guys are gonna care about, and that is, how do I see my patients in their home while I'm at home? And I can't reiterate enough a telephone check-in is really great. I also, you know, in many instances third-party insurances and Medicare will reimburse audiologists for that. I think there's a lot of push for Medicaid. I'm sorry, Medicare. To get that to happen, and Ash is working hard. I think that we're not far away from that happening. And that would be great because I think that that would be, like once that's, I mean, we've been working hard for that period and then I think once we're in the system, it'll be hard to take us out.

So I'm excited for what that means for us long term. But telephone phone calls and then turning that into potential consults if needed, where you're dealing with a problem-focused history and management. Other low-hanging fruit would be patient portals, like what is your current corporation already have, or messaging platforms. These are e-consults. Telling your patient, like putting blasts out to your patients like, hey, if you need us, we are here for you and you can reach us here, and this is how you do it, and you can put little screenshots in there and for how they log in. You can invite them to it. Something that we're doing right now is bringing on our heavy users, so people that are coming to the clinic a lot, we have encounter rates for how often they're coming in, can we get them on the portal. Can they be doing some of that on the patient portal, so lab, followup, and maybe giving images, things like that. Obviously hearing aid checks are also low-hanging fruit, especially if your under-warranty hearing aid checks for your no charging anyway. And then hearing aid manufacturers are doing a great job, I think including cochlear, of helping to push ways to do remote programming now, and remote access is another great one like I just showed you. Tons of things to do in automated audiometry. And I'll talk a little bit more about that at the very end. Let me highlight things to think about the VTC, so video teleconference. You gotta select your platform. I can't do that for you. There's lots of solutions out there. There's Zoom, there's video. I mentioned a few in the last talk.

Your corporation may have recommendations on what you're going for. But then you wanna learn the platforms, right? So like there can be a smartphone app. There can be a desktop app. You can get it on the web, or you can get it on an EHR integration. And so, there's just, and that's cool because that gives you a lot of flexibility on the provider side, but you'll wanna understand what options are available to you and how you're gonna do it. And then the same is true on the receiving side of that consult, and so if you're gonna do a smartphone app, like here's an example of a room code. You would give this to the person, and if they already had the app downloaded, you would just give them this like kind of airport code here and they would go into that meeting room and meet you there. And for us in our system, the same patient has the same room every time, so it's like they come to their own virtual waiting room, and there's no like HIPAA issues because it's all protected for each patient. And then on, if they don't have the app installed, they're gonna be guided to installing the app in the store or it's gonna open it up in the app. It's gonna say, do you wanna open this up in the app, and you'll say yes.

So that's just on the patient side. I mean, I think the phone is great. You can swivel the camera around. You can look at the hearing aid they're telling you about. When it's laying on their table and they're like, the tube is disconnected! And you're like, what are you talking about? And you flip the camera around. They can show you, things like that. Or how they're putting it in their ear, for example. But I think these are things you're gonna wanna think about with VTC. I think a caveat to that is kind of pre-screening for the technical side of it, so what devices do they have? Is it a smartphone, is it a laptop, is it desktop? What type of smartphone, and then more importantly, what's their connectivity. This is an issue that we have up in Alaska. For you guys, it may not be as much of an issue where 3G and 4G and 5G or whatever you guys have now is like really good. So, are they wired internet? Is it gonna be wifi? Is it gonna be cellular data? It's gonna help you understand kind of what your connectivity issues may be. Do they have unlimited or metered? Like in Alaska, we're all metered, and so that's something, a barrier we're tackling right now. And then, is the technology already

connected and do they know that their internet's working? And then is there any additional costs, right? So if it's a metered connection, are they gonna be charged more? And then, does the device have a functional microphone and speaker? Like have they tested it lately. And then a key is just to have them download the stuff in advance, and then I've got a link down here to AFHCAN, our group in AFHCAN who's down in Anchorage. They help us with a lot of this technical support, and this information comes from them, these next couple of slides. And then again, how you might technically troubleshoot. We'll kind of skip through that right now. Let's go to the apps. Okay, so in general, Apple has a lot more apps and is a little bit more researched, and that is because it's just a stable platform. Like we know what the sound card is. We know that the headphones that come with it.

And so in general, you're just seeing more versatility and availability here. There's lots of apps for Apple that you can do to get automated hearing testing. And then android, not as much just because it's a little less regulated, if you will. But there is a hearing test app that I played around with a little bit, it doesn't look too bad, that you could use. And then, wired headphones is probably the way to go. You wanna be going with the bundled headphones that come with the phone. It's like the best option you have for that. Otherwise, go for something more like Sennheiser or some like high-level headphone. And then they can be sending you screenshots of that information. It could be in the form of a text or an email or using the portal, and then what I would advise is that you combine this with intake assessments. Maybe you're doing CEDRA. Maybe you're doing HHIA or whatever kind of intakes you wanna do. Do the case history. You're walking them through doing that hearing test accurately. You may have them do it once or twice to check on reliability. Obviously anything below 500 hertz, or 500 hertz and below may be a little inflated, so I would definitely interpret the low frequencies with caution. Even the quietest of rooms, if you see something coming in at 40 or 50, I wouldn't be surprised. So, it's not gonna give you a ton of help there, but it will give you a ballpark. And then I think you can come up with a really good counseling and case management plan based on all of that. I think you could do the home hearing test

or the iHear, which are affordable solutions. You could potentially put this in remote primary care clinics. You could potentially have a few of these, they're not that expensive, and send them to patients. If they can't download software, you can use web-based solutions. Hearing testing using mobile audiometry, I've kind of talked a little bit about this. What you can do with hear screen and hear test, which is a pretty robust android solution, which is on the more affordable side but you're still going through like, and they have an officially calibrated headset with that so you know what you're getting is true and you know you can speak to that. Obviously a little bit more money for that system. It's something that you would get professionally versus like, or foreign organizations versus say like for individuals, and then same with the KUDUwave.

And then again, I would combine these. I think there's a couple different way you can use these, and I would combine them with intakes and case history. For remote access, I showed you a remote desktop connection, which comes with all Windows computers. There's also team viewer, which we use. I think there's actually, you can get like a non-commercial free version of this. But then also I think if you start using it for commercial purposes, they may have like a fee for a subscription plan. And then free conference call's another one. I mostly use free conference call for phone calls back in the day, but they've actually gone to video, a video model as well as screen sharing, and then they have the ability within their system to give someone controls to the computer. So remote controls, and so you could potentially do the same thing with this, and then now you're in a VTC and that now HIPAA is up for grabs. I haven't researched it right now. There's a lot of leniency there, but long term, you'd have to look into like what that is. But it is all free, and so it's something to like just say, let me try it and see what happens. It is a viable possibility if your corporation allows you. Okay, so trying to make sure I wrap up here so there's time for questions and I don't go over. This is kind of segueing into what are you gonna do if you build a program. I think that this is still valuable. I think it looks a little different in the time of COVID in trying to do some things really emergently. But I also think you should start thinking

bigger picture, like long-term solution. We're not sure how long this is gonna last. And, at the end of the day, I will tell you these systems are more efficient. They are more cost-effective. And I think we're gonna see a lot more evidence come out of it based on what's happening right now, and I think we'll see a lot more support and more reimbursement for it. And so, I would beg that, for you guys to consider more formalizing your programs in the current, but then in the long term to continue with these solutions after COVID. So again, a clinical assessment is obviously the way to go, and looking at your market potential, which right now we don't really need to do because it's there. You always wanna develop the model and the plan. That's like the who, what, when, where, and how. You're gonna lay that out. There's lots of resources to do this. So like things that walk you through step by step. They'll give you templates on what to, boxes to check.

Okay, I've done this, I've done this, I've done this. And they'll give you a lot of direction. I gave you some of those resources, I believe, in the last PowerPoint, and I'll make sure you guys get the links to that. But, to formalize this process, the blueprints for it are out there. And there's also consulting firms, too, that kind of make it easier for you. So training personnel is a huge step of it. Getting your personnel like on board and bought in and trained, and then obviously implementing the solution and then doing some monitoring. And then key components for telehealth. Obviously, appropriate equipment. That is the answer to the assessment question. You wanna be looking at M-health and mobile solutions. You really do. I mean, it makes you, it increases flexibility. We know it's more accessible in the home. We know you can do more with it, even in your own clinical space. It generally tends to be universal and user-friendly, and that's the kind of interfaces you wanna look for. And then you definitely wanna try and look for solutions that will integrate with your EHR just to make your life easier and make the solutions more sustainable. I can't reiterate enough how important the personnel is. I mean, it's all buy-in and relationship. I mean, if I didn't have, if our ENTs and our audiologists didn't get along as well as they did or if our health aides, you know, when a health aide needs help walking through something,

they wanna trust that they can call you and get that help, and so I can't tell you how pivotal this is in building this team, and that goes for a lot of work we do, but it's really key in successful services on telehealth. And then of course initial and on-going training. I can't, you know, not say this enough, because if you don't have people using it regularly, you know, it will just start to collect dust and people aren't gonna be comfortable with it and they're not gonna do it. Okay, so takeaways. And then I'll go to questions. You know, well-designed telehealth models are awesome for continuity of care and connected care. Think about how much more data, how many more appointments you could do or data you could collect. And you're not just looking at that person in the visit. You can just get so much more information. Accurate and timely diagnosis and management. For us in Alaska, in particular, like you can see patients sooner. You know, you can get to them sooner than having them wait to come in and see you, for example. And then the reduced health care cost and the burden. You know, burden on travel, burden on, you know, brick and mortar cost, you know, all kinds of stuff like that. And then I think what I didn't put on here is that like this is what, at the end of the day, this is what consumers want. Like this is the direction we're going in. Everyone does everything on their mobile phone, so we need to be meeting them there.

Okay, I will stop talking. I see questions. So I'm going to look at those. Are there specific VTC platforms that are known to be HIPAA compliant? The answer's yes. Video is one of them. Zoom is one of them. I can't speak to pay versus unpaid, but they do have encrypted video that is HIPAA compliant. There are several others, and... Once you're finding a solution that you want that you can afford, you can look to that. Right now, the, you know, HHS is turning kind of like a blind eye to like, if you need to meet a patient's need and you don't have a solution that you know is HIPAA compliant, they would rather you provide a service than not. So let's say you're trying to do a sudden hearing loss case history, and you can't get them to download a Zoom or video mobile or you don't have it up yet, but you need to talk to them, you can Facetime with them. You can talk to them on... You can talk to them on Google Duo.

You can talk to them on Facebook Messenger. I would come up with workflows so that you're not talking from your personal account, but that is something that you could do right in the now if you needed to. But yes, there are VTCs that are HIPAA compliant. I think Asher probably has some recommendations for that outside of what I just mentioned off the top of my head. Closed captioning available for those with a poor hearing, Kelly, this is a great question. So the question is, is there closed captioning available for those with very poor hearing during a VTC appointment? If so, how do we have a patient access this? The only thing that I have come up with so far is I had this happen for profound hearing loss. Cochlear implant candidate. And what we did, this was my fix, and so I don't know if it will work for everybody, our health aides have iPads and they have iPhones, and so I had them download, I think it's called Google Translate. It's the app that came out of development from Gallaudet University. I'll give you the name of the app, Kelly. But it's incredibly good.

And so what we had happen was the health aide propped up that phone with the app open in front of the screen, so the patient's looking at me. I also have the super aural headphones to try and give as much boost as I can, and then they're reading the closed captioning in real time. So that's what I did. It's a free app. It worked great for the scenario. I think that you could keep doing that. There are probably other more formal ways to do closed captioning in real time and video, but I don't have those researched. But that was what I did in a pinch. We are five minutes away, so I will keep doing the Q & A and then the session will officially be closed, and then I'll stay for maybe 10 extra minutes if there's more questions if I need to. Okay. Can we bill for those hearing tests? That is a good question. And that is probably a question I should not answer. Historically, when we are doing hearing tests in our system and interpreting them, we are doing a billing for that, but like whether someone's doing a smartphone automated hearing test at home and billing for that as like an audiogram, I'm not sure the answer to that. It's probably more reasonable to be billing for the e-consult or the telephone call, where you're actually billing for that appointment time versus like the actual procedure done. But I'm not the guru here, and unfortunately the

benefit of being in IHS is that some of the reimbursement pieces, they're important but some of them's less important for us, and so we can just kind of get started doing stuff. So I apologize. I'm probably not the best expert for that. I would turn to audiology, the academy, and Asha, who are putting guidelines out for that and what codes to bill for certain types of appointments. But again, I'd probably lean towards more the appointment type versus the actual procedure if you're not doing it. Do you think it's more risky for fake hearing loss? I think it's certainly harder to tell if someone's malingering, right? Because we all have like the audiology vibe, you know? Like we're testing and we kind of know what's going on, you know? Like you can do it blind with your eyes closed and still know that like you're getting a threshold that's not reliable. I think if you suspect, I think there's gonna be known cases where someone's gonna try and fake a hearing loss, and I think you should watch out for those.

You know, someone who's looking for an insurance claim, someone who's trying to blame somebody else for something. I think watch out for that, and I think beyond that, you can have them repeat the test a couple times and that would just be like, hey, I'm not getting a great result. Let's have you do it again, or this is inconsistent with other things that, other data I've got on you. Like maybe you're able to get otoscopy or like depending on your environment, you know, tymps. Your tymps and otoscopy and automated hearing and the hearing is just down and weird. I mean, there are times, I will tell you, like for example, I had an elder. He was probably like 75, and he, there's like a range where I know automated hearing testing's gonna work really well, and it's kind of like I don't really do a ton with condition play unless I have to, and I don't do a ton with like elderly because there's kind of a response time that someone needs to push that button either on the phone or in their hand, the response button in their hand. And so if they're outside of that, then sometimes, occasionally I'll get an audiogram where like no responses across the board, and that's just because every time they responded, it just was not in the timeframe with which the automated screener was expecting a result. And so, in that case, that was an example of automated hearing testing that did not work for me. We attempted again with me

dialing in and working with that elder, but I still, and I got better results but I still was questioning. So, that might be an example of like maybe you're fitting them with a pocket talker. Some intermittent solution to try and wait out until you can get them more accurate hearing, manual hearing, or maybe you can set up that remote connection situation. Or, you know, like send a device out where you can then have it on and you can control the audiometry on it and get better result. The question is, test question in Alaska, the following have been... Oh. The answer is B. Sandra, your question. She was asking for one of the questions on what type of store-and-forward telehealth has been done with the exception of, and we have not done B beyond telehealth. Done phone consults for it, for sure, but not really done telehealth for it.

Christine says, typically how much time do you allot for your schedule for a remote hearing test? This is a great question. Generally, a little bit longer. I do about 45 minutes to an hour, and that's with the idea of like that demo I gave you where we're doing otoscopy and OAEs and tympanometry, potentially reflexes, and then automated hearing. The hearing test can take on a normal person about six to seven minutes, and so you're probably looking at like 10 minutes on average for that hearing test, especially if they have hearing loss because it's gonna have to go through more testing, more bracketing, but I would do 45 minutes to an hour until you've mastered it and like you can walk someone through doing stuff quicker or you're walking the patient through it faster, and then you can kind of gear down how much time you need. But generally, like add on a little bit of time to get through it all. Do your remote health aides biologically calibrate the equipment daily or how are potential problems ? Great question. In terms of tympanometry, there is a calibrator, a 2 cc calibrator that we ask them to put, they basically do the 2 cc calibration every time before they do tymps. So it's a quick run. They do that, and then they do tymp tymp. And we only look at that, then we get a sense for when we see that 2 cc run and it looks normal, then we're okay. So then we look at a tracing. It looks funny, like, and even then, sometimes you get a funny tracing. You have to ask them to redo it because maybe the probe is against the canal wall or something wonky going on. For audiometry, we have not done

daily biologic checks with health aides. It is a good suggestion. What we do do is if I'm starting a hearing test and it's not looking normal or something's funny, or we're getting some weird prompts from the machine, if the machine sends us something funny, it's gonna prompt and the health aides say, okay, the machine is saying this. Then something I'll do is I'll have the health aides clean the headphones down, put them on, and have her listen and give me a sense for what she's hearing, much like what you do for biology check, you know? And then we go from there. But yeah, that's a really great point. We do calibrate the equipment and, just like we would with stuff in the clinic, and that always has its own challenges. Something that we've done is got extra probes, and so we're switching out probes. Sometimes to help with moving equipment around a lot. Stephanie asks if the hearing test app has been validated. I do not think the hearing test app has been validated yet. I think the caveats with that are just looking at the headphones, so I'd be careful. I would just try and use the bundled headphone that came with the android phone. Take results with caution, and then, you know, take that assumption that anytime we do automated hearing for the most part, it's reliable.

So it comes down a little bit to the technical capabilities of the app, but most of them work pretty well. And of the apps that have been researched, there's not a whole lot that has shown that we shouldn't be using them. But no, to my knowledge, in those articles I showed you, I don't think hearing test app has been looked at. I think that Hane, he's like dizzinessandbalance.com or something. I think Timothy Hane has looked at just kind of like anecdotally and kind of reported on their feedback, and he might have included the hearing test. So you can look at that website to see what, I think if you just put in like Hane and like smart app, something, I think it'll come up. So I'm getting a question. How would you initially introduce tele-audiology to ENT practices and defend its value in a language approach they will accept? This is a great question. Here is how I'd approach this, because I've done it. First, I would tell them like, what, especially if they're a surgeon practice. Let's say they do surgery. ENTs that are surgeons do not wanna see low-yield cases in clinic. That's not where the money's

made. That's not where they wanna be. And so if they're seeing these low-yield cases on telemedicine, I'm sorry, in the office, they're gonna be so frustrated because they'd rather be operating in the operating room. So what you could say is if they responded quickly, and we have ENTs that can do this in five minutes or less, in between patients, if they can triage out otologic cases like that don't need to come in person, then their in-person clinic time goes down and their OR time goes up because they are just seeing patients that need to go to OR. They're high-yield cases, and so that's the first approach I would take because like I said, ENTs don't want that. It's all billable. I mean, especially in Alaska. Any time the consulting person is seen, they can bill for that service, so this is something that they can be reimbursed for.

So it's getting them seeing more patients, so they could be still doing a full clinic and in between patients while someone's being roomed, they could take one or two telemeds. And then I think that they would like that, and then I think if, so I think that there's a business model there that, not that I've created one, but I think there's been a business model there that can be sold to them. And then I think that, you know, just increased efficiency and they're gonna get the right kind of referrals. They're not gonna be dealing with referrals that maybe didn't need to go there. Maybe you have a practice that doesn't look a lot of abnormal TMs, and so they don't know what they're looking at, and so if you can take a picture, send it to them and they consult on it, say, oh yeah, that's a post-surgical ear. I'm not worried about that at all, or, oh yeah, that needs to come back to us for revision. You know, you can triage that out. So that's the first approach I would take. And that is like when I wrote up building a program at Mayo where we were gonna float messages to, we were gonna float messages to the, I'm sorry, I got distracted, ear images over to ENT, that was something they were so on board with because like they can consult, they can teach, they can start getting better referrals, they can start maximizing their clinic days, and then they can maximize their OR time. So that would be the approach that I would take. And if they aren't doing surgery, then at least they're triaging out the in-person patients that they don't need to do a lot of time with, you know? So it's just about maximizing their practice, too, and

increasing a service and access to ENT. Okay, it is 1:35, so we are definitely over if anyone needs to leave. I'll finish these last couple questions that are coming in for the next five minutes. I do know that they are recording this, and so if you wanted to review back to this, you can. When you're doing remote testing, is there a remote way to perform word recognition? Oh, that's a great question. Yes, if you are like on the shoebox has a speech platform and on KUDUwave has a speech platform and... If you're using a system that you're remoting into a laptop that has the software to do it, so like Oto Suite, for example. You know, there's a couple other portable audiometers you could potentially remote that have PC-based, you know, you can connect to a PC like, it's not the Ostera. Itera maybe. Things like that.

So I think that if you have any of that type of technology that can be PC-based, you could remote in and control performances, word recognition remote. Now, if you're not in a sound booth, you have to take that in consideration. If you're not using a headset that's been validated outside of a sound booth, you know. You just need to monitor room noise. Many of these solutions have room noise monitoring on them, and so you can either have a sound level meter to gauge it, you can have them in a quiet office, you can have the app or the device tell you what the sound level is. What else? Or you can use a headset that's been validated for testing outside of the booth. And there's a couple of them. Like KUDUwave's out there. Hear Screen's done a bit. Shoebox has done a bit. Kiary's got their headset that is out and should have more capabilities soon. That's a really good system too, so. Good question. That's my suggestion there. Additionally, like if you wanna go really like patchwork, I set up a GCI, GSI 41? Oh no, Maca 41. Maca 41 audiometer, so think like old school kind of like dial, I'm like looking like you guys can look at me. You know like the old school kind of audiometer that you can turn the dials on. You know, portable thing. It's got the headphones in the back. You can connect a CD player to that. You can connect various different like, I think you can connect a PC to it. No, I can't remember. But what I did was I connected the CD player to it. Set it up there and worked on a health aide having her do like a pure tone screening, and then she could run the speech. And so that was a way that we played

around with it. It's a little patchwork. It's not pretty, but it does help you do speech. And I think the idea, the way I think about telemedicine is like what do I need? What are the possible ways I could do it? What's the best way to do it? Like what's the ideal way? Okay, what's realistic? And then I just try it, and then we go from there until we find a solution that like ends up looking pretty. Okay. Oh, I just was reminded about my second poll. There's still a bunch of people on the call, so let's go ahead and ask that poll really quick for people that are here. I kind of wanted to get a sense for how valuable this was for people in terms of, I asked that same question last time. Like, how many feel like you can take what you learned today and like try something tomorrow, or work to trying something in the next couple of weeks, and then how many still feel like I am so lost. I still have no idea what to do. And if you feel that way, here's my contact information. It's been up on the screen. You know. You can contact me, and I'd be happy to kind of see how I could help walk you through some scenarios that you have to deal with.

And then, lastly, you kind of like, well, I have an idea of what I can do, but still a pretty specific question that you haven't touched on, and so I would, you know, I would again, here's my contact information. Please reach out. I'd be happy to try and help you as best I can. I feel like I do this a lot, but I'm not an expert in every area, so I would be either help you with what I know already or help you find a way to do it or help get the information out there. All right, as people answer that, I will still take some questions. Okay, so Priscilla's asking, for automated hearing tests, are you doing BC or relying on tymps and reflexes for ruling out CHL and MHL? Yeah, so right now, like on the regular, we are not doing bone conduction automated. It has been done. There's a little research out there. A couple of those mobile audiometer systems I shared do have it, and I think it's a super cool thing. And I'm working with a couple companies to like build more like automated bone conduction models, algorithms. But yeah, we are relying on tymps, otoscopy, reflexes to kind of understand like if there's a middle ear component that we're battling. And we're getting such good images. That tells us half the battle. It would be nice to kind of know if we're seeing a change in the bone line,

especially like when it's a sudden hearing loss, but if the ear drums look normal and we're seeing change, then we're just making a lot of like informed decisions, even though . So good question, Priscilla. Yeah, we are using tymps reflexes to help us with otoscopy. Oh, cerumen management issues. That is a good one. I don't have a perfect answer for that. I can tell you that we've done a lot of like over-the-counter, Debrox and things like that. You know, cerumen management is just kind of one of those things that does need some in-person help if it's impacted, and it's not emergent, though, and so in several cases where we've ruled out other concerning things, some people have had to wait to get cerumen cleaned. And so we have not been doing a lot of this. Unfortunately I don't have a good answer for you. We just have been resorting to like good education and over-the-counter management, you know, and like peroxide, water mixes, and things like that.

Okay. Oh, thanks for the, I just got a compliment on best telehealth training so far. I really appreciate that. Thanks for the poll. It seems like everybody has something they can start now or maybe a specific question. I'm glad that this has been helpful for some, and I appreciate your time and just being willing to listen to me and my crazy ideas. Again, here is my contact information. I am more than happy to speak to anyone in particular about an area and yeah, I just wish you all luck and safety as we move through these next few months, and don't forget to use good infection control and also access to resources at your fingertips, like Ash is doing a great job. The academy is doing a great job. CDC's putting out a ton of information. States are doing a good job. You know, you are not alone. We are doing this together. Let's help each other out and just stay safe and let me know if you guys need anything. I really appreciate this opportunity, and I really value your questions and I'm honored that I could give this talk today.