

WHAT'S POSSIBLE WITH HEARING TECHNOLOGY TODAY

- Welcome, everyone. Thanks so much for joining this session. This is "Living LSL, A Family Learning Series". Today's webinar is What's Possible with Hearing Technologies Today. I'm Karen Hyder, your host, and I'm handing it over now to Dr. Terry Zwolan. Terry, go ahead and begin when you're ready.

- [Terry] Thank you, Karen, and welcome everyone. Thank you so much for joining us for what's possible with hearing technologies today. This webinar is part of Living LSL, Hearing First Family Learning series. You can sign up for upcoming Living LSL webinars or watch recordings of past ones on our website, hearingfirst.org/livingLSL. I also wanted to let participants know that we do not anticipate time for questions and answers today. So we welcome families to please post your questions in the Hearing First Family-to-Family Support Community, and for professionals to post your questions in the Hearing First Professional Learning Community. I'm so pleased to introduce my esteemed colleague and dear friend, Dr. Carol Flexer. Dr. Flexer is renowned audiologist, certified listening and spoken language specialist, and professor emeritus at the University of Akron in Ohio. An international lecturer and an educational audiologist. Dr. Flexer has authored over 155 publications, including 17 books, which are widely read today by professionals and parents of children who are deaf or hard of hearing. Many of you may be familiar with her work. She has served as past board president for the Educational Audiology Association, the American Academy of Audiology, and the AG Bell Academy for Listening and Spoken Language. Dr. Flexer has been supporting families and professionals for over 40 years, and her work has been instrumental in the amazing listening and spoken language outcomes we see every day in children diagnosed with hearing loss. Please join me in welcoming Dr. Carol Flexer.

- [Karen] Oh, I'm sorry. We're not hearing you Dr. Flexer. Please unmute your mic.

- How did that, does that work?

- Yes, got it.

- Oh, yay! You know how this technology is when it works it works and when it doesn't there's a problem. So, glad that that mic turned back on. Thank you for joining us today. We're so happy you're here. I am coming to you from my home in Hudson, Ohio, and we may have some storms today, so please bear with us. Anyway, thank you for joining us. So today, after we go through the slides and all, you'll be able to explain to adults and children the function, use, design, and care of your child's hearing devices. We're going to talk about the various technologies, how to care for them, manage them, making sure that they are functional for your child every waking moment. Gonna begin with the brain and then present these technologies as they occur on a continuum. And what does that mean? How does that work for our children? Beginning with hearing aids, cochlear implants, bone conduction hearing devices, remote microphones, and wear time issues. No matter how wonderful the technology is, it actually has to be used and worn. How do we do that? How do

we keep these on our children? We'll talk about that. And the ling six sound test as one way to monitor the effectiveness of that technology. Of course, hearing is about the brain. Please refer to the first webinar in the series when we talked about the brain and also the ebook that traces a family's journey as they learned about their child's hearing loss and about the impact of their child's brain on development. We tend to think we hear with ears, but actually it's our brain. Our ears act like a doorway to help get sound. And what do we mean by sound? We mean auditory information to our brain. I mean, like the eyes are the doorway to the brain for visual information and the nose for smelling, olfactory information, but knowing the meaning of that environmental information occurs in the brain. So the ears are the doorway. We have five senses. Hearing is a sense and the ears they're wonderful organs that are able to get auditory information to the brain. They're doorways to the brain. And that child, that doorway can be blocked a little bit, mildly, have a mild hearing loss, or maybe a moderate hearing loss, or the doorway can be essentially closed and we have severe to profound hearing loss and we might call that being deaf. So the idea is we have to get through that doorway, right? And the way that we get through the doorway, the technology we use depends on what's going on in the doorway. The goal is we need to get through the doorway with information, because information becomes knowledge. Think about the ear as the doorway to the brain for sound, for auditory information, spoken language, talking, reading. We hear with the brain. The ears are the way in. Here's another analogy, a way to think about technology. Let's think about a computer. Data input precedes data processing. Hearing loss or poor acoustic environments like a broken or malfunctioning computer keyboard prevent good information data from reaching the brain, the computer's hard drive. So we can think about the doorway problem as a problem with your data entry system. So technology, hearing technology can be viewed as a better keyboard, right? Hearing devices make it possible for data to reach your child's brain. Now, a great keyboard doesn't fix the hard drive, right? A keyboard allows us to enter a high fidelity accurate information to the hard drive where with exposure, practice, that child, your child can learn the meaning of the information that was directed to the hard drive from the keyboard. The purpose of your child's technologies wherever they are on the continuum is to get sound, auditory language information through the doorway to their, lemme hear ya, brain. There is no other purpose. And the choice of hearing technology, that is the choice of keyboard depends on what's happening in your child's doorway. And so we're gonna be talking about this array of keyboards today. Here is a nice graphic that really explains this whole hearing system. So here you have... See, what sound is or vibrations, back and forth vibrations? So we have the sound entering the ear canal through the middle ear changing to neural impulses, because the brain can only read neural impulses. All of these sense organs have to change environmental data to neural impulses that the brain can then process. And then through exposure, and practice, and language, the child learns the meaning of the neural impulses that have reached the brain. So vibrations change to neural impulses and what comes out of the child is what went in to the brain. So we need to listen carefully to how the child sounds. So if clear speech goes in, if the keyboard delivers clear speech, clear speech comes out. If garbled speech goes in, that is the keyboard isn't so good and we haven't breached that doorway, garbled in, garbled out, English in, English out, Spanish in, Spanish out. You don't put Spanish in and get French out. You see, the brain can only organize and learn the information that actually reaches it. The job of hearing technologies is to get that information to the brain. Well, how do we even know

your child has a hearing loss? How do we know they'll benefit from using hearing technology? How do we even know what technology to start with? What will be best for your child's brain? Well, of course, we start with a pediatric audiologist who specializes in testing and managing the hearing of children. Your child will be tested in a sound room using pure tones at specific frequencies, beep, beep, beep, beep, beep, not exactly like that. The reason we use pure tones is they make these pure tones that we test makeup speech just like the threads of a garment makeup the pattern. And then the audiologists record your child's threshold, the softest sounds they can hear on an audiogram. And an audiogram is only one part of a thorough hearing test. There's also speech perception testing, evaluation of middle ear function, case history. So here is an audiogram, and I really refer you to our second webinar, Knowing What Your Child Can Hear, to learn more about audiograms and especially our familiar sounds audiogram up in a moment. So across the top are frequencies or pitches from low to high pitch sounds. These are the threads that makeup speech. Along the side are soft to very loud sound. The lower on the graph, the louder the sound. And this is a familiar sounds audiogram that we put together and have as in the last webinar. And please, please download the ebook that goes with this audiogram to explain about the speech banana right here, which is the range of frequencies, pitches, and loudness intensities where specific speech sounds and environmental sounds occur. So this speech banana is the average loudness of spoken communication, average conversational level close distance. And there's just a sprinkling of vowel sounds which are more high energy low frequency up to consonant sounds where th is softest voiceless th softest speech sound in English. High-frequency weak, low frequency strong sound. Also in low frequencies is the melody. Speech is more than speech sound. It has loudness. It has duration. It has pitch. All of this is represented on this just delightful familiar sounds audiogram. Visit our website, download the audiogram and the ebook. Now, think about technologies as occurring on a continuum. We have a whole menu of ways that we can breach this doorway to get auditory information to your child's brain for their growth of knowledge, for their advancement of cognition. And the choice of technology depends on what's going on in the doorway. And the audiogram is a way to kind of measure what is going on in the doorway. The audiogram gives us doorway information, type and severity of hearing loss. As the doorway changes, the hearing technology may need to change with hearing aids, implants, bone anchored devices, remote microphones. Hearing technology is the way that children with hearing loss access information in the environment, spoken language, singing. All hearing devices are brain access devices. We often say to children put on your ears, but what we really should say is put on your brain, because they're brain access devices. Oh, hearing aids. Don't you love these pictures. I could just sit here and look at these pictures for all day. Nothing like happy babies that just make a day wonderful. Well, so what is it? What is this hearing aid? They are FDA cleared medical devices that amplify, they make sound louder. They get that sound through this doorway that has some sort of blocked. Hearing aids are the first technologies that we use to get auditory information to the brain and we can fit hearing aids even on newborns, really. Now, hearing aids don't correct the hearing loss, because what's going on in this organ is there, the hearing aids don't fix it. What the hearing aids do is amplify and shape the sounds actually your pediatric audiologist who programs the hearing aid to amplify and shape the sounds that are necessary to deliver complete speech information to your child's brain without being uncomfortably loud. And for many infants and children, hearing aids do provide,

they're really are the best keyboard for that child. They give that brain the most information, and probably about 70% of children with hearing loss wear hearing aids rather than the other devices. A hearing aid works. There's a microphone that picks up vibrations from the environment, sends them to the processor which is located in the hearing aids case, and the hearing aids internal processor analyzes these vibrations and converts them into an electrical signal that is then amplified and shaped by the pediatric audiologist who does this on a computer based on the child's hearing loss. And then the little loudspeaker in the hearing aid transmits these amplified sounds to your child's ear canal through a custom made ear mold that fits snugly in the ear canal. So if you weren't sure what you're looking at, what this is, is this is a way that we custom make ear molds that fit in your child's ear canal and deliver sound from the hearing aid through their ear canal. And this is a very soft silicone substance. Typically, it doesn't hurt at all. It feels goopy actually, but it doesn't hurt. And then the ear mold after this goopy stuff sets up and then this ear mold is just exactly as the shape of your child's ear canal. So it should fit snugly, and appropriately, and comfortably. Now, your child's ear canals are gonna keep growing. The younger they are the faster they're gonna grow, which means that we have to keep making ear molds, right? Because if your child's ear canal gets bigger and the ear canal now is too small, then it's gonna be uncomfortable, it's not gonna fit well, sound is gonna leak back out. You might hear that feedback that squeal that we just adore that's coming through these ear molds that no longer fit well. So we often have to make these ear molds often, right? Depending on how old the baby is, could be every few months for infants. But we have different ways. Now, the ear mold, some people have 3D printers that actually make that impression into an ear mold, other times we send these ear molds to a factory where the impression is made into the ear mold for your child. Ear molds can be made into any color. Some children love little sparkly, purple designer ear molds. Others want them clear, but there are choices. If we want to have the ear mold look like an accessory. Some people love the ear mold accessory. The amplified vibrations now, hearing aids through the ear mold sent to your child's outer, middle, and inner ear, and then onto the brain where through experience and practice your child learns the meaning of this information. In order for the hearing aid to transmit enough information to your child's brain, the child's inner ear, the cochlea has to be sufficiently intact, because this hearing aid uses all parts of the auditory system, right? All parts. So if these parts are put together enough, then enough information will reach the brain, but that cochlea has to be sufficiently intact. That means these little hair cell receptors, sensory receptors have to be intact. The hearing aid is the technology selected for your baby when the hearing loss is in the mild to moderately severe hearing loss range. Then it's highly likely that the hearing aid can send enough information to the brain. So I love this picture, 'cause it shows how this hearing aid looks on a little ear. And look at this one has a little designer ear mold here, little sparklies that are embedded in the silicone ear mold, right? And also hearing aids. Many companies have hearing aids in different colors. Again, some children love designer colors, others don't. They want the hearing aid to blend into their hair. Lots of choices. So we have a hearing aid case that has the processor in it. We have childproof battery doors, and now some hearing aids are completely rechargeable, others you put in rechargeable batteries. So you'll be working with your audiologist to know exactly how this works for your child. These are microphones. This is the receiver that changes the amplified signal back into an auditory one. Here's the ear hook where the signal travels through, ear mold tubing into the ear mold. It fits

comfortably and snugly in your child's ear. What does this do for your baby? Your pediatric audiologist will fit hearing aids so that all speech sounds, low pitch vowels, high pitch consonants "sh" will reach your child's brain, the melody, the rhythm. Auditory information has to first reach your child's brain before they can learn about it, right? Clear in, clear out, muddy in, muddy out. We want the best possible keyboard. Now, when we fit hearing aids, we first do what's called a verification step. You can't see it so well here, but it's called real ear measurement. A little probe is put in your child's ear. It doesn't hurt, but you can tell he's not having a really good time, right? It's just kind of it tickles, kind of a tickling feeling. And this probe is attached to a computer that measures the actual sound pressure that's in your child's ear canal. And that's how we start knowing that we have a good fit for your child. In other words, what's coming out of the hearing aid is matched to what your child's brain needs to make up all the speech sounds. Now, after we do the verification, we do what's called a validation. So that's when the hearing aids are now on the child, they're in the sound room, and we're seeing what they can hear, what's reaching their brain with their hearing aids on. Now, this is an example of a moderate hearing loss, because the circles are thresholds for the right ear. The X's are thresholds for the left thresholds means the softer sounds that your child can just barely hear. Up here would be hearing in the normal range. Down here, as you can see, would be a profound hearing loss. This is a moderate hearing loss in right ear and the left ear. All sounds above the hearing loss are not audible at an average conversational level. Now, if you were to get really close to this child and use a nice full voice close to them, they could hear what you're saying, but if you're just using your conversational voice at a conversational distance, this information wouldn't be available to them. Sounds below the thresholds are audible, sounds above are not. This is a moderate hearing loss. Moderate sounds not so bad, right? But look what you're missing. Okay, now, we've had this child sitting in the sound room and these tones are coming through the loud speakers through the hearing aids. Really we do each ear separately, but we just put A up here for general aided threshold. Now, look at this. With the hearing aids on, the child is detecting speech all of this information in the normal to minimal hearing loss range. Now, the hearing aids don't mean they now have a normal hearing. That's not it at all. The child still has a moderate hearing loss. What the hearing aids do is they amplify, make louder and shape these sounds so that your child's brain will have access to all these speech sounds when they're wearing the hearing aid. Look at the difference. Look at all the information that is not available to the brain through this doorway is blocked somewhere, right? But now we have a better keyboard. We've got hearing aids and now information is available to your child's brain in the normal hearing range. Now, all of our technologies as wonderful as they are, are not perfect replicas of an intact organic doorway nor do the technologies fix the doorway. The technologies do not fix the organic doorway. They are amazing technologies. They provide a keyboard to breach that doorway, right? Now, as good as they are, as I said, they're not perfect replicas. That's why it's very important to work with a specialist, your listening and spoken language provider, early intervention provider, speech language pathologist who can really help your child practice paying attention to and learning the information that gets through their new keyboard, because the brain is gonna need more practice with technology. We need to grow those connections in the brain. Well, you got to take care of this stuff, right? You always have to take care of technology. Making sure that it's working properly is just as important as making sure it's being worn. It would be a shame to put the technology on and

then it's not working right, it's distorted, or it hasn't been charged. So since your little one often can't tell you when their devices are working until we teach them to pay attention to that, and even then it's important for us as adults, as parents to monitor their technology with daily device checks and listening checks. Remember to take five minutes every morning, every morning, to get your child ready for a full day of listening and learning social engagement. Have to make sure those batteries are charged. Hey, listen, for all the technologies, battery charging is critical. So now we're going to talk about cochlear implant. Oh, wait a minute, sorry. I thought... Sometimes this keyboard skips, so we wanna make sure they're charged. This is what I wanted to make sure I got to which is a daily device check. Your child's pediatric audiologist, and, or the manufacturer of your child's devices will provide you with what we call a care kit. In this case, a hearing aid care kit, which will help to complete the daily device check. And you'll learn how to do a visual inspection to make sure all the parts and pieces are there and connected. Look for any debris or damage. Your device will have been in a moisture absorbent pack all night to keep it safe and to absorb moisture. Some of them also have infrared cleaning in them. The daily device and listening checks. You will be taught how to use a stethoset, which is like a hearing aid stethoscope or listening tube. We'll talk about the ling six sounds. And this is technology. Don't spray it with hairsprays. Direct heat, lotion, be careful of pets. I don't know why animals love to eat hearing aids. Well, you drop that hearing aid on the floor and your little dog is gonna chomp it right up. So don't drop it. Animals love it. So need to keep it in a safe place and water resistant storage. And of course make sure for all your technology that you have your warranty coverage, sometimes extra insurance, damage coverage, mysterious loss coverage, work with your audiologist and your manufacturer to make sure that your devices are fully covered, because these are babies and children. Sometimes stuff happens. Now, we're getting to cochlear implants. Another picture that I just love. We're gonna be talking about retention devices, but that's what you're seeing here, right? This wire is a part of the cochlear implant. What this does is it, see how it's clipped to the child's collar more a little bit later. But so if your child accidentally brushes off the magnet or the processor, it's not going to fall on the floor for your dog to gobble up. It's going to hang down your child's back held firmly by the clip. So you definitely want to have retention devices, because the technology sometimes, and this is for hearing aid as well as implants, can get knocked off and you just want to make sure you can retrieve it safely, and that also you don't step on it or eat it. Not that you would eat it, but you know. So what is a cochlear implant? Cochlear implants are hearing devices that provide brain access to sound through a surgical procedure. Usually outpatient takes about an hour and a half, two hours procedure. They'll tell you more about it. Implants are typically recommended when your child's brain can not access all the sounds of speech with hearing aids, usually a severe to profound hearing loss. In other words, that doorway is pretty closed and hearing aids are not really able to get enough information through the doorway to the brain. So we're going down in our continuum of technologies. We're saying, okay, what would be next to get more information to your child's brain? Because, and that would be a cochlear implant. Children are able to receive implants as early as nine months of age. There are specific audiologic and medical guidelines that your pediatric audiologist and physician will share with you. So you certainly will obtain all the information that you want. And of course, you can go look online. So much information online as well. How does it work? A cochlear implant actually replaces a part of the inner ear. That is the hair cells in the cochlea that are not working

properly. The implant works by sending electrical signals to directly stimulate the auditory nerve. And then that sends these neural impulses to the brain and information is carried on these neural impulses which are then processed and shared throughout the brain, and then your child learns what it means. You see, the information is sent to the brain, but then your child has to learn the meaning of it which is what happens, how the child learns to talk anyway. How does a child learn to talk anyway? Well, child with a typical doorway they just listen to their parents and caregivers speak with them, and talk with them, and read out loud, and sing. And a child with a doorway problem learns listening and talking the same way. They just need a different keyboard, hearing aid, cochlear implant, a different keyboard, so that when their parents speak with them, and read aloud, and sing, this keyboard can deliver, shape, and manage the sound to deliver it to the brain where through exposure, and practice, and language, the child learns the meaning of that information. Now, this cochlear implant consists of two main parts. One part is surgically implanted under the skin and there's a little electrode array that is inserted directly into the cochlea, the inner ear. Now, the second part called the sound or speech processor is worn on the ear. It looks like a hearing aid and has a removable magnetic piece that keeps the coil of the external device called the trans... There will be a short test. Every one are you taking notes? This will make sense. I promise. And the transmitter is seated directly over the surgically implanted device for transmission of sound. So after the surgery where the internal piece is put in place, there needs to be time, a week, two weeks, three weeks depending on the child and the situation for the incision to heal, because the skin is closed. The connection between the outer and the inner piece is through a magnet. It is not through open skin, no open skin, skin closed, so there needs to be healing time. The implant has the following parts. First, at the level of the sound processor, the microphone picks up auditory information from the environment and transmits that information to circuitry inside the processor. The processor's transmitter which is the coil right there, that's held in place by the magnet sends the signal through the skin to the internal receiver that was implanted under the skin, and then the receiver sends the information to the electrode array which is implanted in the cochlea. And the electrode array stimulates the auditory nerve fibers- Are you still with me? Which then sends this neural energy to the brain. And then finally, with auditory experience, listening practice, the signal sent by the implant can be interpreted by the brain, that is by the child as meaningful auditory information. So I love this picture, because it shows what this implant looks like when it's actually on a child. So you have... See this? It looks like a hearing aid, doesn't it? And this is the sound processor. Now, see there's a ear hook, but there's no ear mold? Now, I do need to say that sometimes we do make an ear mold as a retention mold to hold the hearing aid in, pardon me, an ear mold to hold the implant processor in place, but often we don't need that, right? And then, so then we have the signals that are sent through electrical signals now that are sent through the cable to the transmitting coil. And of course this whole external piece is held in place by a magnet. And then the signal is now sent into the child's cochlea. Now, what you see here, this is that retention device. You don't want to lose this equipment, right? And it's gonna fall off at some point. I mean, these are kids. They're gonna knock it off. It's gonna fall off. You want to have a retention device. And your audiologist and interventionist will make sure that you're comfortable about how to use it. The child isn't even aware of it. This is simply to keep track of the equipment, keep it safe, and when it falls off, it doesn't fall on the floor. Now, the cochlear implant does not restore normal

hearing, right? None of these devices do. You still have the same ear apparatus that you had before. So how this works is you need to have the implant, the electrode array really replaces the cochlear hair cells essentially, and sending electrical impulses to underlying neural tissue. So you don't need to have an intact cochlea. What you do need is an intact auditory nerve, but having the implant, as I said, that's your better keyboard. It's a way to get information to the brain. The keyboard doesn't program the brain. So your child isn't gonna wake up from their implant surgery and know their multiplication tables, right? It's a way now to enter information if they're at that level for multiplication tables, or enter information to learn spoken language, but there isn't a magical brain programming. This is a keyboard. So how do you know your child is a candidate? Well, that's when about 50% of the time the doorway is going to change for a child. That means the hearing loss may progress, about half the time it may get worse. That is the doorway will close more. And so it means that that hearing aid isn't gonna get enough information to the brain, but parents don't worry if the doorway changes. We've got an array. We have a whole array of technologies that are appropriate for your child. So if the doorway changes, we have technology to deal with it. And as cochlear implant technology improves and we learn more about it, who will benefit from an implant is changing. That is, we're more liberal criteria. We're learning that many children with moderately severe hearing losses, their brain will do much better with a cochlear implant keyboard than a hearing aid keyboard. So we very carefully evaluate the children. Trends are children are receiving implants at increasingly younger ages, even nine months of age, and who have more hearing, because the implant is value added. And some children may have normal hearing on one side and a completely closed doorway on the other side. We call that single-sided deafness. And we are now offering the possibility of putting an implant on that ear, the single sided deafness ear, because there's huge value in having auditory information go up both neural tracks to integrate through the brainstem and to populate the whole brain with auditory neural information. We want to hear from both sides, both ears. If a cochlear implant is recommended, you're gonna go to a cochlear implant center. Now, our service delivery models are interesting. Your cochlear implant center may be in the same building where your hearing aid audiologist is, but often your hearing aid audiologist is not your cochlear implant audiologist. Sometimes, yes, but often no. So there may be a whole different team you will see for a cochlear implant evaluation, surgeon, other professional, speech pathologist, et cetera. There are three implant manufacturers that are FDA cleared for children here. Your medical team will give you the information you need and choosing the implant device that best fits your baby is really important, because your baby is gonna wear their implant their whole life. Yeah. Now, the outside hardware does get updated and changed. So, but the point is that implant is going to be with your baby their whole life. The implant is programmed on a computer to optimize what the information that is getting to the brain. The two main processes of programming involve measuring the softest sounds your child can hear called T or threshold, and the upper stimulation levels that contribute to loudness that are C or M levels. And the implant programming does differ a bit by manufacturer. How is an implant different from a hearing aid? Very different. Hearing aids amplify sound and require a working cochlea. On the other hand, cochlear implants compensate for damaged or non-working parts in the inner ear of the hair cells. They don't require a working cochlea. See, very, very different. However, a cochlear implant does require a working auditory nerve. The cochlear implant bypasses some of the damaged parts

of the hair cells and delivers neural information directly. Got to take care of the implant, right? Have to look at it, make sure it's working. You have to take five... We strongly suggest you take five minutes every day which will make a big difference. Work with your audiologist and manufacturer to learn how to troubleshoot the device your child has. There are numerous YouTube videos that will give you a lot of information and that you can review for the specific care of your child's cochlear implant. Charging, charging, charging. Make sure they're charged. Why would my child start with a hearing aid and move to an implant? Well, hearing aids are really the first technology we fit on newborns and children. So your child did start their hearing journey with a hearing aid. Now, if the doorway changes and it might, or if it's later determined that the hearing aid is not the best keyboard for your child, then an implant may be recommended. The implant is the next technology in the continuum of devices available to your child at this day and age. For parents who choose listening and spoken language as desired outcomes for their child, it is critical to have the very best keyboard to get through the doorway to nourish your child's auditory brain for the development and growth of knowledge. We want the best keyboard with the clearest auditory information, so that brain has a lot to work with. So think of going from a hearing aid to an implant, think of the initial use of a hearing aid in infancy not as a trial, but rather as a brain activation opportunity. You see, even if the hearing aid allows only low frequency information to reach the brain, your baby's brain will be sparked with auditory data. I mean, think back to that familiar sounds audiogram. What's in the low frequencies? You have melody, duration, loudness, pitch, vowel sounds. There's a lot of information. Music, music, music is low frequency dominant. So there's a lot of information in those low frequencies. Even if we can only get an itty bit of auditory information through the doorway with a hearing aid keyboard, that information is valuable. In addition, your child will get used to wearing their hearing technology on their ears, the physical feel of it which will help them adjust to wearing the cochlear implant sound processors and you will have the satisfaction of talking, singing, and reading with your baby. Hearing aid use prior to an implant is a brain activation procedure. Now, we're getting to a whole different type of hearing device called bone conduction hearing devices. Oh, I love, I love, I love these children. What is it? A bone conduction hearing device is an alternative to a traditional air conduction hearing aid. It may be recommended if your baby's ears have a conductive hearing loss such as atresia. You see this complete closure of the ear canal? There's no air canal to get through, or maybe chronic ear infections. How does it work? Well, the bone conduction hearing device can be worn in two ways, on a headband, which is nonsurgical, or there is a surgical treatment where a piece of this device is inserted in the bone behind your child's ear. Another picture in a moment. So using a small box like hearing aid placed behind your child's ear, or right here you can see that, it vibrates the skull and sends information to the cochlea. Now, your child's inner ear or cochlea needs to be intact to receive this signal, because the bone conduction hearing aid device uses the cochlea to transmit sound to your child's brain. Initially for babies and young children and as a trial for older children, these small box-like bone conduction hearing aids are placed on the bone located just behind the ear and held in place with a headband. Surgical, non-surgical. So the age. Most surgical insertion of these devices can't happen until your child's at least five years of age. So this surgical consists of a device that is surgically anchored in the bones. See this? This is surgically put in the bone behind your child's ear. And then this other part snaps off, it's removable. And in this case, the headband is no longer needed, because the

hearing aid is always attached to the ear. Because bone conduction devices bypass the outer and middle ear, children with outer ear problems and middle ear problems when there's no pathway here, there's no clear pathway, then they may really be candidates for this sort of device. For either unilateral or bilateral. So the bone conduction devices work on the principle of efficient coupling that is connecting of the sound processor to the underlying bone in one of two ways. Well, this is the soft band approach, right? This device is held close to the head by the headband. And then if you choose and if the child's older, this device can be surgically implanted and it's called osseointegrated, because the implanted portion integrates with the bone in the skull. Now, a bone conduction device is very different. Well, it's different. Yes, it's different from a hearing aid, right? Because the hearing aid is attached to your child's ear canal by the ear mold. Look at this cute. She likes little polka dots right above that. See, designer ear molds. See the color of the hearing aid and accessory, right? So that the hearing aid and the traditional air conduction hearing aid is attached via an ear mold, and then the information, the auditory vibrations are sent through the ear canal and through the middle ear. Now, this non-surgical bone conduction hearing device is held tightly to your baby's head via a headband and vibrations are sent to the inner ear through vibrating the skull. See? So what happens? See, what does the cochlea actually get? It gets the vibrations. So the hearing aid vibrations come through the ear canal, the bone conduction vibrations come through vibrations of the skull. These are like gentle vibrations that deliver the auditory information. Do you have an ear canal where you can use an ear mold, or do you not, or does the conductive mechanism not work well? So how do I know that my baby is a candidate? Well, if they have atresia, they have a conductive hearing loss, the ear canal doesn't work, they're likely a candidate. You will be recommended to see a team of audiologists, surgeon, other team members that will recommend and discuss with you how this bone conduction device works. And there are several bone conduction manufacturers in the country that are available for your baby. Got to take care of it, right? Make sure it's working. Take five minutes every day. Work with your audiologist and manufacturer. There are numerous YouTube videos about how does this device work? How do I make sure it's working properly? Now, remote microphones next. Well, in two weeks, the next webinar is all about remote mics. So please stay tuned, because in most cases we're gonna with your hearing aids implants, bone conduction, we also want to recommend a remote mic, RM, where the person wears a wireless mic so their voice reaches your child's ear directly. And their remote mic is in addition to the microphone that's in your child's hearing device, because this remote mic that is close to your mouth or the talker's mouth helps your child hear best in any listening environment, noise, and distance. And there are different kinds of remote mics. More in two weeks. But you see, even when you're just outside playing with your child, you're not right next to them. So when you wear your remote mic, your child is hearing clearly. And in two weeks, I'm gonna talk about how do you use this remote mic at home, why, and how? Well, as good as these devices are, you got to wear. A child has to wear their hearing technologies 10 to 12 hours a day, at least. Well, we say 80% of their wake time, but 100% is better eyes open technology on, because wear time is an extremely critical factor in a positive listening and spoken language attainment. And it's not uncommon for little ones to take their devices off just like they take off socks and shoes. It's important to make a commitment to keep the devices on all waking moments and ask all caregivers and family members to do the same. Be persistent. Put the device right back on and it may be a

hundred times a day, but don't worry that won't last forever. Eventually your child will really keep their devices on. They'll put them back on if they fall off. Most of the devices have a feature called data logging, which is a summary technologically that's kept by the device of the child's device use. How many hours a day? Under what situations that is noisy? Some device, some of the data logging also logs the environment the child is in. So it's very important parents to review this data logging with your audiologist so you really have an objective idea of how many hours a day your child is wearing the technology. How do you keep this stuff on? Well, distraction, pull their attention away from the device and to something fun, right? We want the child to forget about pulling it off. Put it right back on. Don't make a big fuss, no drama here. We're just gonna very factually put it right back on calmly, no reaction. I know it's hard to outpersist an 18 month old or a two year old. You got to do it. You gotta be more persistent than they are. You gotta be tougher than them. And believe me, I have three children and 11 grandchildren. I know how tough that is to outpersist a child. That's what you gotta do. Most babies go through a phase of pulling their hearing aids off. Just put her right back on. But if it happens frequently, do tell your pediatric audiologist, your LSL professional, because we wanna make sure there's nothing else going on like an ear infection, or an irritated ear mold, a poor ear mold fit. We just wanna make sure that there isn't really a reason for taking off the device, right? That it's just because that's what the child is doing. So make sure parents work with your team to how do you keep these devices on to make sure there's no reason for taking them off, whether it's physical comfort, something wrong, their programming isn't right, something. Rule that out. Now, we have, as you saw in some of the other pictures, some wonderful tools and accessories for keeping devices on. There's adhesive. And, again, work with your pediatric audiologist. There's caps, headband, cords, hooks, clips, ear attachment, retainer devices. And on the website linked with this webinar on Hearing First website, you'll see a booklet that you can download that's all about helping you keep the devices on your child. And here are some pictures of the devices. We've seen headbands, and cords, and huggies. And how about a pilot's cap? That's what that looks like. See, we're serious about keeping these devices on. They've got to be on. That's how you grow a brain, right? Ling six sound test. This is something we do every day no matter what device the child has on. Ling six sound is named after Dr. Daniel Ling, a famous acoustician, and audiologist, and teacher. So you wanna use the test, you quick at home check. If your child responds to all sounds, they're ready for the day. Use a normal conversational voice. Why these six sounds? M as in me. Well, the reason we use these sounds is these sounds at an average conversational level, see how they completely encompass the speech banana the entire range for speech. M as in me centers around two 50 Hertz, the nasal murmurs, 300 Hertz. Oo right around the first formant. See what these are, are the primary bands of energy, because clearly speech sounds are not pure tones, they're not beep, beep, beep, they're ooo or mmm. So there's a band of energy. And so we are placing them on the audiogram where their primary band is. Ah as in hot. Ah is the loudest speech sound in English, right? You can see at an average conversational level, it comes in at around 50 dB HL, it features at a thousand hertz. Ee. Ee in order to distinguish oo, ee, oo, ee, you need to hear around 2000 hertz. Sh, s, sh, s, 2000, 4,000 hertz. So, Ling, brilliant, brilliant person was able to through acoustics screen your child's ability to detect the range of English speech sounds. So we want them to hear every single sound, but this is a quick screen. And for a child, their response, we look for any response. Older children, we want to see them perform an action, right? Like drop a

block. As they grow, they are able to talk, we want them to say these sounds back to us. Present the sounds at varying distances. Be sure to change the order you say them, so we're not giving them a memory test. There are also questionnaires that your caregivers will, your professionals will allow you to take, or will suggest you take which allows you to monitor your child's auditory progress, LittlEARS, PEACH, TEACH. So we have a variety of these tests that are available to people, to all of you. And you know what? We often give these tests over time, right? So we kind of want to track your child's progress with these tests. So what are some of the key points? What's important to remember? Oh, did you have your roller skates on through this? I mean, we zipped through all of these technologies and obviously we were just at kind of that surface level of them. There's a lot to know, but we wanted to give you all a preview about what are they? How do they work? Why would your child use them? How do you take care of them? What's in this whole continuum? Wonder what circumstances would you use one or the other? So that's what we really wanted to do today. And this will be recorded. This webinar will be recorded. You can go on your Hearing First website and look at the webinar again. And then you can download that booklet about how do you keep these devices on? So key points, all hearing technologies are brain access devices. The only purpose of wearing them is to get auditory information through the doorway to your child's brain for growth of neural connections and ultimately knowledge. Think about the various devices on a continuum. There's a whole menu of hearing technologies, of keyboards, that allow auditory information to get to your baby's brain no matter what is the status of their doorway. We have a variety of doorway devices. And doorways can change, but not to worry. We have devices for that. Babies start their journey with hearing aids and other devices are recommended as needed. The goal is to develop and integrate your child's brain with knowledge. We need to integrate auditory information with all of the other senses, so your child has a whole view of their world. The brain works best with auditory information from both ears. What do we mean? Both neural tracks. Eyes open, technology on. Wear devices all waking moments to reach your listening and spoken language outcomes. And children need to learn about their hearing loss and their devices to advocate for themselves. And in two weeks, I'll talk more about self advocacy. Thank you for listening. Thank you. So I would like you to write down, jot down a plan for explaining your child's hearing technology to others. How are you gonna do this? Who are you gonna share this information with? What are you gonna say? It always helps to think about it in advance. Remember, start with the brain, talk about the doorway, and then describe your child's keyboard. So we welcome families to post your questions in the Hearing First Family-to-Family Support Community, and for professionals to post your questions in the Hearing First Professional Learning. Please do that. And please join us for the next two webinars, How Remote Microphones Make a Difference, and Talk, Read, Sing to Grow Your Child's Brain. So thank you so, so much for joining us today. Please go to the website to obtain additional and reinforcing information, and have a great rest of the day. Bye-bye.