

HOW REMOTE MICROPHONES MAKE A DIFFERENCE

- I'd like to welcome everyone to our fourth in this series, Living LSL: A Family Learning Series, How Remote Microphones Make a Difference. I'm happy to turn things over now to Dr. Terry Zwolan to get us started. Terry, go ahead and begin when you're ready.

- Thank you, Karen, and welcome, everyone. Thank you so much for joining us today. This webinar is part of Living LSL, Hearing First's Family Learning Series. You can sign up for upcoming Living LSL webinars or watch recordings of past ones on our website at hearingfirst.org/livinglsl. It's my distinct pleasure to introduce our esteemed presenter, Dr. Carol Flexer. There's just so much to say about Dr. Flexer. She's a renowned audiologist who is also a certified listening and spoken language specialist and professor emeritus at the University of Akron in Ohio. She's an international lecturer, an educational audiologist, and she has authored over 155 publications, including 17 books, which are widely read today by professionals and by parents of children who are deaf or hard of hearing. She has served as past board president for numerous organizations, including 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 that we see each and every day in children diagnosed with hearing loss. So we're so proud to have you and please join me in welcoming Dr. Carol Flexer.

- [Karen] Oh, not hearing your audio. There you are.

- [Carol] How about that?

- [Karen] That's it.

- There I am. Okay, great. Thank you. So thank you all for joining us and thank you to Hearing First for putting together this wonderful Family Learning Series. I'm coming to you from my home in Hudson, Ohio, which is near Cleveland, and I'm so happy to have you join us from wherever you are in the country or maybe in other countries around the world. So today we're going to provide information about why remote microphones should be used from infancy, how they work, and how they use them, how you can use them at home and at school. So after this webinar, you'll be able to explain to family members, adults, and children, the purpose, features, and use of your child's remote microphone, RM stands for remote microphone, technologies in home, school, and community settings. So we used to consider that remote microphones were only to be used in

school settings, but not anymore. We know that even in infancy, RMs can help your child hear you more clearly in any location, they can overcome problems of background noise and distance, and we're gonna show how we can use these remote mics to increase both the quantity and quality of information that reaches your child's brain. Information that reaches the brain then becomes their knowledge, skills, and understanding. Going to emphasize the benefits of using remote mics and learn why they're important, how they work, and ways to use them in your daily life and routines, as well as at school, in the community, during activities like soccer practice. Going to start with the brain, of course, and then describe what's the problem? What's the science behind acoustic accessibility? Signal-to-noise ratio, a lot to know about that, and then discuss personal-worn remote mics, large area systems, classroom audio distribution systems. We're gonna talk quite a bit about how and why you use RMs at home. And, of course, self-advocacy skills are critical. Our children need to learn from a very young age about how to talk about their hearing loss, about their technology. You know, you can't really ask for what you need and advocate for yourself until you know what's actually going on. Well, to begin with, you know me, hearing is about the brain. We tend to think that we hear with ears. The ears are the way in but actually we hear with the brain. Think of your child's hearing loss like a doorway problem. The doorway to the brain through the ears can be blocked a little or a lot, depending on the specific hearing loss. You know, if there's any blockage in this doorway, then your conversation, lullabies, reading aloud, singing, it's not getting to your child's brain. So when we think of our amazing five senses as being doorways to the brain for different types of environmental information. So for example, the eyes are the doorway to the brain for visual images, but the eyes don't know the meaning of the image. So, for example, this image was your mother, this image is your house, the eye doesn't know the meaning of the image, your brain learns the meaning of the image through exposure and practice and conversation and language. And it's the same with the ears. The ears are the doorway, the way to get auditory information to the brain, right? But the ears don't know that that was your mother's voice or that was the dog barking. What knows voice or dog barking? It's the brain. How does the brain know? Through exposure, practice, language, conversation. You know, if you want to know more about the ear as the doorway to the brain, please review the first webinar in this series where we spoke about the brain and there is an ebook about tracing a family's journey through finding out their baby has a doorway problem to really getting the role of their baby's brain. And why are we wearing technologies? Well, the purpose of your child's technologies, including remote microphones, in fact, the only purpose is to get auditory information from the environment, through the doorway, to the brain, where your child can learn the meaning of that information. The meaning becomes their knowledge, their knowledge enhances their cognition. I love this little image. We have it in all of the webinars that we've been using. So what this explains is that what is going into this doorway, this ear doorway, this auditory information, it's vibrations. What this ear picks up is vibratory information and then those vibrations are sent through the outer, middle, and inner ear, they're changed to neural impulses and sent to the brain for integration and development, and all of the impulses that reach the brain from all of our senses have to be in the form of neural energy. And then the brain learns to understand these impulses through exposure, practice, language, and then what comes out of the person is a function of what went into the brain. So if clear speech goes into the brain, clear speech comes out. If garbled speech goes into the brain, garbled comes out. English goes in,

English out. Spanish goes in, Spanish comes out. You don't put Spanish in and get French out, right? So our job is to make sure that we get the best, the most complete auditory information through this doorway, to the brain, so what the child knows and what comes out is high-fidelity information for their cognitive development. So in that regard, I'd like to talk about a concept that has been featured by Dr. James Jerger, who is a very important person in audiology and has been for many years, and he has developed and expounded on multiple concepts. So here's how he uses the term extrinsic and intrinsic redundancy, because of course the terms can be used in many ways, but how Dr. Jerger uses it is extrinsic redundancy refers to the integrity of information from outside the person, the sensory input from the environment, we call that bottom-up input. And there are a lot of things that impact what actually reaches the child's doorway, right? Now, intrinsic redundancy, intrinsic, interior, refers to the cognitive capacity, the internal knowledge. What do you know? What's got to the brain? And intentional resources and the pay attention of the person. Intrinsic redundancy is often called top-down processing because what you know can influence how you receive and fill in the blanks of the sensory information. Now there's an inverse relationship between these two concepts, intrinsic, extrinsic redundancy, that we must consider because children don't know much yet, right? They haven't been alive very long. They have very shallow intrinsic frameworks. They just don't know stuff. So our job as parents, as educators for all children, is to have this bottom-up input, to make sure that we get as much high-fidelity, meaningful, ongoing information through the doorway, to the brain as possible. Our job is to create an intrinsic network. So how do we enhance the bottom-up sensory input? Well, we have two main ways. One is the way we speak and the other is our use of technology. How do we speak? Well, often too fast. Adults often speak faster than 200 words a minute. That makes it very difficult for children and many aging persons to process because they don't have this real high-functioning intrinsic capacity. So what do we need to do? We need to use clear speech. Slow down. Aim for about 124 words a minute. Who does that? Mr. Rogers did. You know, just click on Mr. Rogers and you can listen to how he speaks, pausing, using appropriate suprasegmentals, melody to enhance meaning, Oh, melody for meaning? Please refer to our second webinar where we talked about the audiogram and about the importance of blending the suprasegmentals and melody of speech with the actual speech sounds of vowels, consonants, and the information presented by vowels and consonants, so we need melody for meaning and consonants for clarity. Please review and look at the ebook for that second webinar. The talker's use of clear speech can improve the listener's speech understanding by up to 40%. Use of clear speech is critical for everybody but is extremely important for people who have doorway problems and when we're wearing masks. Masks really distort the audibility. And so in addition to clear speech, speaking slower, pausing, using good suprasegmentals, another really important way of enhancing extrinsic redundancy for the purpose of growing and developing intrinsic cognitive capacity is to use remote microphone technologies to improve the signal-to-noise ratio, to get more and clearer information to your child's brain. So what's the problem with getting information to the brain? Poor or average room acoustics at home or in school can negatively impact the child's ability to hear information, speech audibility, nevermind clarity, even just receiving information, but we want clear information because reduced speech audibility and clarity can decrease speech perception and hinder word understanding. Reduced audibility and understanding cause children to have to work harder at listening, listening

effort, the harder you work just to listen, we're decreasing the child's cognitive resources that we want them to have available for actually learning, for understanding and remembering, and creating top-down capacity. Lack of clear, easy auditory brain access drains a child's cognitive reserves, tires them, and weakens their communication and learning, which means they can miss information, which results in a slower pace of learning. So this is... I love this graphic that shows the transmission of information from speaker to listener because we have three important features. We have the speaker, we have the actual signal and the room in which that signal occurs, and then we have the listener, and all three of these features have a very critical role to play in communicating and in information transfer from brain to brain. So what's the speaker's role? Well, is their voice loud enough? Is their speech clear? Are the words they're using familiar? Are they chunking the words appropriately? Are they using good melody? And what about the listener's responsibility? Well, their hearing ability, if they have a doorway problem, you've gotta wear technology to breach the doorway and get information to the brain. And the listener needs to bring their intrinsic capacity, as much as possible, of their speech and language skills and their cognitive processing. And then the signal transmission. We have a room here. What's in the room? Background noise? What's the distance between speaker and listener? The greater the distance, actually anything beyond about six inches, and you start losing critical speech information. And reverberation, which is the echo in the room, which can distort the features of the signal. Any of these variables can influence the communication pathway between you and your child and can occur in any number of combinations. The acoustic characteristics of the room mainly determine the clarity and composition of the speech signal reached by the listener. I mean, for example, do you have the windows open and you hear car noise coming through? Do you have lots of glass in the room, for example? Or smooth surfaces, so your voice bounces back and forth and becomes distorted? Or is there carpeting and draperies? Is the room very large, which does interfere? You'll get more echoes in a large room. How many people are in the room? How many different communication events are occurring in the same room? All of that influences the integrity of the signal. For children, research has demonstrated that high levels of noise and reverberation can negatively impact not only speech perception but what happens if you don't perceive well, that is receive information and process this information for intrinsic growth, if you don't grow your cognition, what does that impact? Well, everything. Reading, spelling, behavior, attention, concentration, and all of this is true for children with typical hearing. And all of these features are even more harmful in terms of learning for children with hearing loss, doorway problems, or children who are at any risk for literacy and learning problems. Your child's ability to hear clearly depends on, as we were saying, the level of the talker's voice; the level of the listener's hearing and their use of technology; the distance between talker and listener, the further apart you are, the weaker and less clear the signal will be; the noise in the room; and any intervening objects or reflections that interfere with the talker's speech. Hey, what about your home? You know, so much important communication occurs in the home. Children with hearing loss have a lot of difficulty hearing in noise, even in noise that is friendly noise, right? All noise is problematic, even what we view as friendly noise. So turn off any unnecessary noise sources in your home, your TV, your computer, unless that's the focus of your conversation. Run the dishwasher or washing machine or vacuum when they will not interfere with communication. So here we have the mother who is using the dishwasher as a wonderful during

routines of daily living learning opportunity for names and colors and actions, putting in, taking out, wet, dry. Notice how the mother is wearing a remote microphone, the child has the receiver built into her device, and I'd like you to notice the little classy ear mold color she has, that rather than trying to hide that I have this amazing doorway device that brings the world into my brain, she's celebrating by having brightly colored, lovely ear mold accessories. Oh, and if you want to learn more about ear molds and hearing aids and all other devices and how to keep them on your child, please review the webinar from a few weeks ago where we talked about technology and wear time and look at the ebook that we have associated with that webinar. Let's talk now about another scientific principle that is very important for understanding the reception of clear information. And that concept is called signal-to-noise ratio, SNR, and it's also called speech-to-noise ratio, which is the relationship between the primary or desired signal, maybe your voice, your read alouds, your singing to your child, and all unwanted background sounds and noise. Anything that, see, any... What we mean by unwanted are any noise and sounds that aren't relevant to what's going on in that child's communication. Now, there's always noise in the environment. We want to minimize that noise. The more favorable the SNR, the more intelligible the spoken message. A positive SNR means the signal is louder than the noise. So if we say the SNR is +6 dB, we mean the desired signal, your voice, is 6 decibels louder than all background or undesirable noises. A negative SNR, for example, saying the signal is -6 dB SNR means the desired signal is 6 decibels softer than all of the surrounding, confusing, and obscuring background sounds. So what's a good SNR? Adults with normal hearing require an SNR of approximately +6 dB in order to hear the spoken message as consistently intelligible. Now, the decibel is a logarithmic and not a linear scale, which means that every decibel counts a lot. It means the desired signal needs to be +6 dB, and I'm taking acoustic license, we audiologists know that I am, the desired signal needs to be about twice as loud as background sound. Oh, speaking of SNR, you may be hearing a lawnmower outside my window. See, here's the thing. I live in this lovely condo complex that's large with all these lawns and then the community takes care of all the lawn mowing and I think they may be mowing today, but here's just something to know about our amazing auditory system. Not only can we pay attention to what we want to listen to, but we can also ignore what we don't wanna listen to, especially once we identify it. So we can identify if the lawnmower gets through my microphone and you hear it, identify it, and then, poof, ignore it. Now, children require a more positive signal-to-noise ratio than adults in order to receive intelligible speech. These children, they need the SNR to be approximately +15 or +20 dB louder than background sounds. The desired signal needs to be about 10 times louder. They need more extrinsic redundancy to facilitate bottom-up input in order to develop their intrinsic capacity. So who needs such a positive SNR? Well, that would be all children because for all children, we're developing their brain, and especially children with any type and degree of hearing problems. That would include ear infections, unilateral hearing loss, and, of course, any sort of doorway issue, whether the doorway's closed a little bit, just a little bit or a lot, right? We need a positive signal-to-noise ratio and the technology that makes that signal-to-noise ratio available. Well, you know, actually, every child is at risk from degraded speech and physical distancing. You know, that's what we still have going on for us in many learning environments for children, and for adults as well, that we're wearing masks, which do further degrade speech, and we need to have physical distancing. So the following populations are at really increased risk for learning in these degraded acoustical

settings. Well, all young children, we mean younger than about 15 years of age, due to immature auditory brain development. You know, the highest central auditory neural pathways and connections aren't fully developed until the child is about 15 years of age. Now it is so that the greatest neuroplasticity is at the youngest age. Neuroplasticity means the ability to grow and develop neural connections based on the child's, the neural, Neuroplasticity, to develop neural connections based on the brain's availability to that process. The younger, the better, even though that brain is always building. You know, there's neuroplasticity your whole life. We wouldn't ever learn anything new if the brain didn't have the capacity to rewire and wire that new information. So who else is at risk? Ear infections, sensorineural hearing loss, language, speech problems, learning, dyslexia, English as a second language, auditory processing, developmental delays, attention deficits. What can we do about it? We use remote microphones. And RMs are especially critical for children with all degrees and all types of doorway problems, but all children develop, well, all children will profit from having a remote microphone used in learning situations and I'm gonna talk about classroom remote microphones in just a moment. Now, in many cases, whether your baby uses hearing aids, implants, bone conduction devices, we add on an additional device called a remote microphone. To use an RM, the person talking wears a wireless microphone, and that's a transmitter, it's a microphone transmitter, so their voice can reach the child directly. The remote microphone is in addition to the microphone that's already in your child's hearing device. And what's also in your child's hearing device is the remote microphone system's receiver. Now, the remote mic can help your child hear their best in any listening environment. In general, RM systems use radio, Bluetooth, or light waves to send sound directly to the receiver, which is integrated into or attached to your child's primary hearing device. And there are different kinds of RM systems available. Please work with your pediatric audiologist to research and determine the best RMs for your children and the best environments for a particular RM use. So here you see a mother who is wearing a remote microphone just having a conversation with her child and her child, also who is a wearing nicely designer ear mold and hearing device with the receiver integrated into her hearing device. Now, aren't remote mics only for use in school? You know what that kind of means is aren't children only learning in school? We know that's not true, right? Can you think of any environment your child is in where there's nothing to learn here, nothing to know here, no one is saying anything important for you, there is no new information, no new social encounter information you need to know, nothing new here for you? I actually can't think of any situation, or for anyone really, but especially for children where our goal is to build their intrinsic capacity, I can't think of anywhere where there's nothing new for them to learn. And parents, you especially have so much to contribute to your child's intrinsic growth. So much of your knowledge of the world, your knowledge of loving family conversations, your knowledge of your child, your word knowledge, the way that you can express new information, you are your child's first and best teacher. Your use of the RM to develop your child's knowledge is absolutely critical. Of course your teacher needs to wear the remote mic as well but learning occurs everywhere in your child's life and your role, parents, is absolutely critical. And again, notice in this communication, the mother is wearing a remote mic, her voice is sent via radio waves to the receiver, which is in her child's hearing aid, and they are talking and having a conversation about the toys. So we definitely want to use these RMs at home and growing evidence suggests how much children benefit from an RM use at home

because acoustic accessibility is critical in all of a child's environments, not only for academic learning, but for social engagement, for social conversation. We want a fully well-rounded child who has knowledge and skills, not only in academic information, but in social development, in executive function development, in theory of mind, and getting information to your child's brain and developing their intrinsic knowledge and integrating the auditory pathways with the rest of the brain is how we do that. Here's another example, playing on a deck with your child. Any distance, any intervening winds or sounds compromises what's reaching your child, and we want the clearest information into that child's brain. So what uses a remote microphone system? Well, there's personal-worn remote mics and that means the microphone is worn by the talker, your receiver is into the child's technology, and the signal goes directly from the talker into your child's technology, and that provides the best signal-to-noise ratio. We also have large group or whole group systems to be used in school for children with typical hearing. Those are called sound-field systems or CADS, classroom audio distribution systems, and they're designed to benefit everyone in the room and I'll talk about each of these separately. Personal-worn FM, and as I said, this is the most effective way to enhance and optimize speech audibility, in other words, to emphasize extrinsic redundancy for a child, with a hearing loss, doorway problem of any type and degree, home, classroom, and community, and can improve signal-to-noise ratio by +15, +20, even +25 dB, reducing problems of distance and noise. Here we have a parent wearing the microphone transmitter. Actually, the reason it's on the desk is so both the child and the teacher or parent can speak into it. Again, notice how we have lovely, almost accessorized of colored hearing aid and of ear mold, no hiding here, celebrating the technology. This personal RM system is a two-piece device. One part is built into or connects to your baby's hearing aid or implant and the second piece is a wireless microphone that you wear that sends the sound of your voice directly to your baby's hearing device, through the doorway, and then on to their brain. The RM helps your baby hear clearly in noisy environments and even when they're not in your lap, really close to you. In fact, that would be most places your baby will live and play. Many families use their RM device for car travel, grocery shopping, restaurants, daycare, school settings, anywhere that noise and distance would make listening more difficult. We want to develop your baby's brain. Now, one type of personal RM has the RM receiver that is actually integrated directly into the ear-level hearing aid or implant sound processor case. Another type is where a small RM receiver boot or audio shoe, you can see that right here, is attached to the implant or hearing aid device. And a third type, there's another type not shown here, where there is a streamer, and a fourth type is when there is a neck loop. Now, once again, I'd like to point you to these really cute, this is a cochlear implant applique. Ooh, is it a Halloween monster? I can't tell what it is. But many children have many different appliques to put on their processors, their magnets to, again, celebrate, "Hey, I'm not embarrassed. I am happy, I am proud, I am advocating for my right and my access to auditory information of the world." And once again, look at this dynamite ear mold, right? You could have all different sorts of ear mold designs. Often, RMs may come as an accessory when the child receives a new hearing device. Now, what we mean is for some hearing aids and some cochlear implants, the company offers a specially designed microphone accessory that works with their specific device. Now, an accessory remote mic typically contains a fixed-gain. The strength of the remote mic remains the same regardless of the noise. For cochlear implants, some accessory remote mic systems can only be used with a

certain manufacturer's sound processor, so they are specifically made for the processor. So for example, the Mini Mic 2+ is the microphone accessory that comes with the Cochlear implant. The PartnerMic comes with Advanced Bionic and the Audiolink with MED-EL. And parents, when you have one of these cochlear implants, make sure you request the microphone accessory that comes with that device and work with your audiologist to learn, to make sure the mic is set and used appropriately. Now, another type of personal remote mic is called a universal mic system, and this is direct wireless streaming to a universal radio receiver that's attached to the hearing aid or sound processor. Now, these universal remote mic systems can be used with most cochlear implant and sound processors or hearing aids. Some universal remote mics contain what we call adaptive-gain. Adaptive-gain, that means the strength of the remote microphone increases as the ambient noise level increases. The universal receiver may be plugged into a variety of different devices. Of note, universal RMs are typically two to three times more expensive than the specific accessory RMs that come with the hearing aid or cochlear implant. And your child might have both, an accessory mic and a universal remote mic, accessory used at home, universal used at school. So please work with your implant audiologist, your pediatric audiologist to talk about these different systems. Now there's also a management issue about muting or not muting because the remote mic transmitter can be muted. When the primary talker is not speaking to a child who's wearing the RM receiver, the microphone can be temporarily turned off or set to mute so the child wouldn't hear you talking if they're involved in something else. On the other hand, there could be value in purposefully letting the child listen in to a back-and-forth conversation between family members, a teacher and another student, to hear how other people speak with each other, how they manage a conversation. Overhearing conversations of others is a very valuable way that children learn theory of mind, the capacity to understand others' thoughts and emotions, and to gain an understanding of the emotional exchanges between people. Now, challenges for parents and teachers is to make decisions. Do you want to have your child overhearing and listening in to other conversations? Or do you want to have the remote mic off if they're engaged in something else? The point is by always turning off the RM when the child is not the direct recipient of the conversation, we may be limiting their opportunity from learning from overhearing conversation of others. So here's how I often do it is if I want to leave the RM on while I'm talking to someone else is I tell the child that, even before they might exactly understand it. So I might say, "Hey, Susie, hey, I'm gonna be talking to Johnny over here about this book, but I'm gonna leave the microphone on so you can listen in 'cause I think you will be interested in our conversation about the book." You know, we want to make sure, parents and teachers, that our children know there's value in listening in to the conversation of others. That's not rude, that's how we learn how others negotiate and change topics and have concern for each other. Now, how about a whole different type? Classroom audio distribution system, CADS, these should be used in every classroom, loudspeakers in every classroom. Hey, we have lights in every room, right? We should make sure we have good sound in every room. This is typically used for large group instruction. The wireless mic is worn by the teacher and the sound of the teacher's voice is transmitted to and then presented from loudspeakers, one or more, that are anchored strategically to walls, shelves, or set in the ceiling. The teacher's voice is amplified and evenly distributed throughout the room so that everyone hears clearly. The purpose is not yelling, the purpose is even distribution so everyone hears as if they

have a front row center seat. And to CAD systems, there's typically a second wireless mic that can be passed around between students or that can be used for co-teaching. There are four basic delivery systems that are used, FM, digital RM, infrared, or induction loop. And again, your audiologist can explain the different modes of transmission in these large areas systems. So a primary value of the CAD is that it can focus students' attention. This is what you're to listen to. That remote mic is a wonderful teaching tool and teachers need to be in-serviced and coached about how to use the mic to create a listening attitude in the room to guide children about where to listen, not to distract them, to focus them. So students hear better in classroom with CADS than they do in an unamplified room. However, signals the child receives with CAD system are not as complete as the signals your child will receive when they wear their personal RM unit. And the loudspeakers need to be installed appropriately. They benefit all students in the room, they don't single out any child who might particularly benefit, a well-used and installed CADS can improve the signal-to-noise level by +15 to +20 dB depending on the noise level in the room, children definitely hear better in a CADS room than an unamplified room. This is all children. But signals from the loudspeaker that then have to go across the environment are not as pristine as the signals that are provided through a personal-worn FM when there is no environment to go through. You have the talker, radio waves, listener. So all of remote mics are valuable, they function a bit differently, and they will interact with your child a bit differently. Work with your pediatric audiologist and your educational audiologist. So, enhance your child's auditory feedback loop. To read aloud, this is for all of us, we need to develop this intrinsic auditory feedback loop. What the auditory feedback loop is the process of self-monitoring and correcting your own speech. So you hear what you say and you think, "Oh, that isn't what I meant to say." You correct yourself. That's your auditory feedback loop. All children, and especially our children with doorway problems, need to have their attention focused on their own speech, to hear their own speech clearly produced, and to change their production based on their output. So we need to enhance the signal redundancy of the child's own speech. So what do we do? We place the child's RM microphone close to their mouth when the child is reading aloud to you so they're reading into their RM so their own voice is clearly going into their receiver so that they will pay attention to how they sound. Because speaking and reading are related, speaking into the RM will highlight your child's speech, allowing your child to hear his or her own voice so they can monitor and control their speaking and reading fluency. And here is a short video clip of two children using the RM as they read aloud to enhance their auditory feedback loop.

- Three gills and damp skin, all fish need oxygen to breath.

- [Teacher] Hunter, I would love to hear from you.

- For most fish, being left on land would be a big problem but it's not a problem for the mudskipper.

- [Teacher] Awesome job. That was beautiful. That was excellent. Thank you so much.

- Yeah, so notice it's how that microphone is so helpful in directing that child's verbal productions. Now, I use that remote mic even with little ones when I'm reading aloud or when I'm talking, I'll talk into the remote mic, I'll pass the mic to you, I'll hold onto it if it's a little one, but I want to make sure that child is hearing not only my speech but their own. There are other devices and accessories that can connect to your child's hearing devices, to computers, to smartphones, to TVs. There are permanent systems like induction loop systems, infrared systems. Work with your professionals to learn more about how your child can access auditory information in every learning environment. That would be every environment, wouldn't it? So how can RM make a difference at home? Haven't you ever wished your soothing voice and nourishing words could be right next to your baby and your baby could hear everything? Actually, they can when you use the RM. We have a number of recent studies that have shown the difference between children listening with and without their RMs. Results indicate significantly better communication skills and higher level language skills for children whose families owned and used their RM systems at home. Use of the RM at home increases the number of words the child is able to hear. Notice the mother's wearing the mic and all of her children are receiving her voice. Studies have shown that when you wear that remote mic at home, your child hears as many as 5,280 more words per day. Use of RM promotes more conversations between caregiver and child and the use of the mic encourages and reminds the caregiver, the parent, you how critical what you have to say is, and to narrate and have conversations with your child throughout the day. Caregivers reported having a very favorable experience with the RM system. Positive changes observed in the child, improved attention, the child turns quicker 'cause they're hearing clearer, improved communication turns between parent and child, improved speech of the child. They're hearing themselves more as the parent passes the mic back and forth. The child is more independent and they're more confident as they are in auditory touch communication with their parent. We find that the use of the RM increases hearing aid use because you can't use the RM without the hearing aid or the implant. Specific situations, the child is more likely to keep their hearing aids on when they're also hearing the parent through the remote mic and studies have shown that children stop pulling their hearing aids out when the RM is used because information is coming to their brain. Parents report that the RM appears to increase child safety when the child plays outdoors, when they're in stores, when the child's hearing aids are covered, like, for example, with a thick hat, and in the car, parents can have conversations without having to take their eyes off the road to turn around to converse with their child. They have the mic on and the child is hearing them clearly through the RM while they are firmly in their child seat. Well, but there are challenges, right? Nothing is perfect. Need to learn how to use this RM, keep it charged, getting others to use it when necessary, deciding when to mute. Do you mute it? When do you unmute? And if you can't wear the hearing aid or implant, you also can't use the RM, and parents need practice integrating RM into routines of daily living in a natural way without disruption. Our job is to input quantity and quality of information into your child's brain. The RM increases extrinsic redundancy to grow intrinsic capacity. So now I want to talk briefly about teaching your child self-advocacy skills starting very young. Self-advocacy means the action of

representing oneself, your point of view. Being able to do this independently at a very young age, even at age two or three, gives this child a sense of purpose. They need to learn about their hearing loss and technology. Oh, I also did want to go back and I want to acknowledge my colleague Ritu Nakra, who is in Delhi, India. She is a parent of a young woman with hearing loss and a LSLS Cert. AVT, and we realized that we should be teaching self-advocacy skills. You can't advocate for yourself until you know what's going on with yourself, with your doorway, with your technology. So we realized there was a problem with teaching very young children these skills so we wanted to learn more about developing self-advocacy and also creating a tool that people could use to teach self-advocacy. So we identified different skills that we thought could be taught very early to young children. We identified 18 behaviors from the literature. We, Ritu and I, worked with a graphic designer and generated picture cartoons of children to clearly illustrate these concepts and we taught parents how to integrate these self-advocacy, speak-up-for-yourself behaviors through repetition in daily activities. And we group the self-advocacy skills that we teach, you know, we need to teach the knowledge, we need to teach the words, we need to teach the conversation, knowledge of the device, care, and social communication. So we identified 18 activities from knowing the name of the device, pointing to, telling the name, demonstrating how it works. You know, we learned that, when we spoke to parents, that even little two and three-year-olds could identify a unicorn and its horn, and it didn't even exist, a unicorn. And yet many children didn't know their device was called a hearing aid or an implant, didn't know what a battery was or the magnet was. Children need to know what are the words to talk about when the battery needs charging? Where is the device when it's not on your head? Why is it in a dry-aid kit? Why are you even wearing it? I hear with my implant, my brain hears with my implant, and no, no one can touch my device except my teacher and my parents. And how do you protect your device from getting wet, from getting damaged? And little ones can understand the effect of distance and noise and they need words for how to fix that, to explain about their device, for asking that noise be turned off, for asking for repetition, for asking for the use of an RM, for knowing the RM helps them hear more clearly. What are their devices called? Why are you using them? How do you ask for them? How do you talk about them? We can teach this to very young children. This is an example of some of the 18 training cards that we have. And Ritu and I wrote an article for "Volta Voices" so you can click on that article and read a lot more about them. Here's another sample of a card. And please take a, if you would like, a screenshot, these cards are free. They're in English, they're in Hindi, French, and they're being translated into Greek. And, of course, use any material you want, make your own. Ritu and I thought that once we identified that teaching self-advocacy to very young children is a need, we felt we wanted to create one possible solution for that need. So that's why we developed these cards. They're free, if you use them, you know, write in Hearing First, in the community section, write how it's working for you. Are they helping you to teach your child these critical self-advocacy skills? So this is a short clip of children. These aren't our little teeny ones using self-advocacy but this is how self-advocacy looks as you get a little older.

- 'Cause my ears are, they're not regular ears. They're just like, cochlear implants. They have FM boots so I can hear out of my FM, and yeah. When I can't hear the teacher, I always go and say, "Miss Feeney, I can't hear you," or, "Would you speak louder?"

- Yeah, see, children can certainly learn how to speak up for themselves. And we don't have to wait 'til they're in school to teach them this. There should be a seamless opportunity of learning to advocate for yourself. So what do we want to remember? All hearing technologies are brain access devices and the only purpose of wearing them is to build your intrinsic capacity, is to get auditory information through the doorway, to the brain, for growth of neural connections and knowledge. The RM device helps your baby hear you in noisy environments and when they're not close to you, and that would be most places where your baby will live and play. In light of the advantages of RM technology, and because babies and children require distance hearing and incidental learning, use that RM system with hearing aids and implants. Refit them as soon as possible after the initial fitting, using initially, most of the time, the accessory RM devices. And families benefit from coaching about when and how to use the RM outside of school. Most families end up using the RM at home about 60 to 70% of their baby or toddler's day and their actual primary devices are worn every single waking moment. Who wears the RM microphone transmitter? Who's the primary talker at a point in time? Mom, dad, grandma, sibling? Typical RM use situations, car, stroller, playground, store, dance class, Sunday school, soccer, kitchen, dining room, backyard, and so on. Your pediatric audiologist, please work with your audiologist to make sure your child's RM system is working properly, that it's programmed properly, that you know how to use and care for it. And your LSL specialist, your early intervention providers will support and coach you about home use. Use your RM daily to help grow and integrate your baby's auditory brain. And please begin early, teaching your child about their hearing loss, about their technology, that they hear with their brain, about what's going on here, what's happening, about celebrating their technology, about celebrating the opportunity to receive knowledge and information, both academic and social, from their environment, from their parents, their friends, as well as their teachers. So thank you for listening. Thank you for going through your doorway and into your brain. So, would like you to please think about what is your plan for use of your remote mic system at home? Jot down who you're going to talk about this action with. 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 Community. So there will not be questions and answers right now but please post your questions and have conversations in the Hearing First website. This webinar is being recorded so it will be available on Hearing First website if you would like to see it again, if you'd like to refer family members and care providers to look at this webinar and also the others. There's also a small ebook that comes with this webinar about how to use RMs at home and why and how. So we thank you for being here. Oh, you know what? Join us next month for the final of the Family Learning Series. What's it about? Talk, Read, Sing: Grow Your Child's Brain. Please join us November 3rd from 1 to 2 Eastern time. So thank you so much for joining us here at Hearing First. We loved having you participate in this webinar. Please enjoy the rest of your day. Goodbye.