

# HEARING IS ABOUT YOUR CHILD'S BRAIN

Welcome, everyone, to the session, it first in our series of Living LSL, a Family Learning Series, Hearing is About Your Child's Brain. Marge?

- [Marge] Thank you, Karen. Welcome, everyone. Thank you so much for joining us for Hearing is About Your Brain. This is the first webinar in the Living LSL series. We hope you'll register for the others on our website. You're welcome to post questions throughout our live session. Click the Q&A on your Zoom tool bar and type your questions in the space at the bottom. Tamera Elder, program leader at Hearing First and certified listening and spoken language specialist will be leading our Q&A at the end of the session. I am so pleased to introduce my esteemed colleague and dear friend, Dr. Carol Flexer. Dr. Flexer is a renowned audiologist, certified listening and spoken language specialist, and professor Emeritus at the University of Akron, Ohio. An international lecturer and 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 on 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.

- Thank you, Marge. Thank you. And thank you Hearing First for initiating this Family Learning Series. Thank you. So I'm coming to you from my home in Hudson, Ohio. And Hudson is northeast Ohio near Cleveland, and I'm thinking of all of you in your homes and in your businesses and thank you so much for joining us today. So what are we gonna do today? The purpose is after our time together that you'll be able to develop a plan for how to talk to your family and other caregivers about this relationship between your child's hearing loss, their technology, their brain development, and the outcomes that you hope to attain. How does this all connect? And how do you talk about this? The topics we're gonna cover is we're going to kind of take us through this journey with the Cooper family. Now the Cooper isn't their real name. We gonna talk about desired outcomes, how the world has changed. What do we now know about this auditory brain and how can we talk about what's going on here with your child's hearing loss? So I have several analogies that often help families and professionals describe what is actually going on with your child's hearing, with their brain development. These analogies I call the doorway conversation and the computer analogy. And hopefully it will be helpful as a way of describing what's going on here. Going to talk a little bit more about the brain and how your child learns to listen, talk and read and questions and answers. So the Cooper family, again, not their real name. Shortly after the Coopers welcomed the arrival of their baby, Dakota, they learned he has hearing loss. When he didn't pass newborn hearing screening, they made a follow-up appointment with a pediatric audiologist who confirmed Dakota's hearing loss. So Dakota is one of the many, many children today who were fortunate enough to have access to newborn hearing screening. So we know virtually right after birth if that child has a hearing loss. And families, maybe at the time you didn't feel like saying oh, thank you, that's exactly what I

wanted to know. But as we'll talk about today, the fact that we do know early has a powerful, positive impact, potentially on the child's auditory brain development and neural interactions. So when Dakota didn't pass the screening, went to see a pediatric audiologist and we really want a pediatric audiologist. An audiologist who specializes in diagnosing and managing hearing loss for infants and children. Very important to find one of those. The Coopers like most of us didn't know anything about childhood hearing loss at the beginning. So they quickly began their hunt for information, encouragement, and support. They knew they had a journey ahead of them. They did online research. They were able to speak with several professionals and directly with families online now. We have so many online contact possibilities so they heard directly from families who have children with hearing loss. After weighing the options and thinking about what they wanted for Dakota's future, they decided on a listening and spoken language approach and a listening and spoken language outcome for Dakota. See, the goal of LSL, and LSL is listening and spoken language. The goal of that early intervention and it's all family-focused is to guide and coach parents as your child's first and most important teacher to develop positive listening, speaking, literacy, academic and social outcomes from the very earliest months of life. You know, all of this learning begins at the beginning right at birth. The LSL communication approach aligns with the Cooper's desire to help Dakota learn to speak with family and friends, go to his local school, have opportunities to do whatever imagined as he grows up. Now, once the Coopers chose the LSL approach, they really wanted some specific guidance about what does it take to reach that outcome? Because they knew that any outcome takes something. They needed to know what that taking what is it? What do they need to do every day. What steps need to be in place? Conversations with families always start with determining the family's thinking and professionals and how we interact, what's your desired outcome? What is your long-term goal? How do you want to communicate with your child? What language or languages do you know and what language or languages do you want your child to know? Where do you want your child to be at age 3, 5, 14, 20? And what does it take to get there? We know that about 95% of children with hearing loss are born to hearing and speaking families. These families know how to hear and speak. Most are very interested in their child doing the same. And many families use a main language at home other than the school language, so likely, they are interested in their child speaking several languages. We can do that in this day and age. That is children with hearing loss can learn several spoken language when we do what it takes. We're gonna talk about what does it take? And the focus of these family-focused seminars is on families who have listening and spoken language as their desired outcomes for their child. This is what they want to have happen. And they want a professional team that's there to support them in attaining that desired outcome. What is this big picture about? You know, we need to start with what's the overview here? What's going on? What's the big picture in understanding spoken language and literacy outcomes for your baby, for your child. How do children actually learn how to listen and talk? Well, children learn how to do that by hearing and listening to the speech and spoken language of their parents. Their caregivers. Their family members. You know, we parents don't perhaps didn't actually know that one of our main jobs was to teach our children language. We just do that, right? By speaking with them and reading with them and singing with them and developing their brain and that happens but we aren't always consciously aware that that's what we're doing. Well, what about your child with hearing loss? Well,

they can learn spoken language just like their hearing peers when they're identified early. When they consistently wear their appropriately fitted hearing devices, such as hearing aids or bone-anchored devices or cochlear implants and when they are taught to listen through special listening and spoken language, LSL techniques that are guided by LSL specialists. See, your child that has a hearing loss can learn listening and talking and reading the same way as their hearing siblings and their hearing peers. We need to be very clear about how we need to intentionally make sure that child is in extra conversations. Extra read alouds. Extra sing alouds. We need to give that brain lots of practice, not different practice, parents, than you would for your hearing children or hearing friends. Not different practice. More practice. More thoughtful. More intentional. And your LSL specialists will provide guidance about what that looks like. Because we hear with the brain, we used to talk about hearing loss like it was an ear thing. Like we it was all about ears. Well, obviously the ears are critical. I'm gonna talk more about that in a moment. But the fact is the meaning of what is we're hearing happens in the brain. There is brain conversations everywhere. Isn't there? There is brain-based learning, like what was it before? Elbow-based learning? There is brain-based reading. It was always brain-based. Everything we do is brain-based as the governing system of our bodies, our organism, right? Is all brain based. But we didn't talk about it that way. We talked about as if the brain were like a casual bit player rather than the story of what's happening. Well, hearing is the same thing. Right? We used to talk about hearing about it's all about the ears. Well, ears are important as a way of getting information to the brain. So now hearing management is shifted more from ear conversations to brain conversations, because we know more about brain plasticity and auditory deprivation and critical periods for language learning. So I want to play this brief clip from the National Scientific Counsel on the developing child from Harvard University. This center has many, many clips. They are free. They are public access. And the reason I want to play this one is because it really lays down the foundation of auditory brain development. Listen.

- [Narrator] A child's experiences during the earliest years of life have a lasting impact on the architecture of the developing brain. Genes provide the basic blueprint, but experiences shape the process that determines whether a child's brain will provide a strong or weak foundation for all future learning behavior and health. During this important period of brain development, billions of brain cells called neurons send electrical signals to communicate with each other. These connections form circuits that become the basic foundation of brain architecture, circuits and connections proliferate at a rapid pace and are reinforced through repeated use. Our experiences and environment dictate which circuits and connections get more use. Connections that are used more, grow stronger and more permanent. Meanwhile, connections that are used less fade away through a normal process called pruning. Well-used circuits create lightning fast pathways for neural signals to travel across regions of the brain. Simple circuits form first, providing a foundation for more complex circuits to build on later. Through this process, neurons form strong circuits and connections for emotions, motor skills, behavioral control, logic, language and memory during the early critical period of development. With repeated use, these circuits become more efficient and connect to other areas of the brain more rapidly while they originate in specific areas of the brain, the circuits are interconnected. You can't have one type of skill without the others to support it. Like building a house, everything is connected and what comes first forms a foundation for all that comes later.

- You know, I love that clip because it's so clearly shows that all parts of the brain need to be connected, and they're connected through experiences that actually create the synapses. So that creating foundational neural structures really needs to occur in infancy. The earlier, the more powerful, the more cemented are going to be those connections. I'll talk more about that in a moment. But, you know the world is changed. Can you believe it's 2021? We just kind of skipped 2020, didn't we? Like I don't even remember 2020. But we are in 2021. And we've had newborn hearing screening for a number of years now in this country. And your child is part of this new generation of children who have been screened at birth who we know right away if they have a hearing loss. Who have access to advanced hearing technologies, digital technologies, who also are benefiting from what we know about brain development, early childhood development, family systems theory, language and literacy development. Your child is living in a new world where they can have earlier and higher quality auditory brain access. It's really a good thing. So the world really has changed. Right? The book, "Who Moved my Cheese?" It has actually been around for a while. But I really like it because it's a little parable about change, and change is signified by cheese. In other words, the cheese is your family, your work life, your community, and the thesis of this parable is the cheese is gonna move. Cheese is moving. Like it or not, the cheese is moving. You know, we can't control cheese moving. Mostly it's happening in this day and age, it's all about technology, right? So our choices involve reactions to cheese moving. According to the parable, are we hem and haw, I'm gonna drag my feet, I'm just gonna stay right here and hope things return to how they were in 1970? 1970 wasn't so bad, but that's gone now. That's in the vault. We're now at 2021, right? And so rather than hemming and hawing, we can anticipate we can and sniff and scurry according to the story, meaning we can anticipate, we can sniff out new pathways. We can get ourselves ready and anticipate and go with and maybe guide a bit this change that's happening. We're in an information/knowledge-based economy demanding high levels of spoken communication, of literacy. We're educating our children with a solid foundation of transferrable skills so they can take charge in the world of 2030, 2040, 2050 not 1970. Not 1990. Not really even 2025. World is moving on and it's moving on quickly. All of our children need to be ready for that. Oh, I like this little mouse. He does a little twirl here. Well, the world has changed for hearing loss too. And what I'd like to do to provide that illustration is play two audio clips of possible and I put in quotes oral outcomes before early identification, early intervention, before cochlear implant technologies. See, by oral, in the olden days, before we could actually get through this ear problem into the brain, the really only avenue that we had to try and develop spoken language was visual, right? And so we would call that oral. Oral meaning spoken. Talking. But we created that primarily we had to through visual means, through lip reading, and that sort. Right? Then I'm going to contrast that with a video clip of what auditory outcomes can be in this day and age. Now, the audio clips were made in 1982 through National Technical Institute for the Deaf for college students. Now these clips are not gonna be intelligible. And I'm playing them not to make fun of anyone. Not at all. But to show, to illustrate that really what gets into the brain is what comes out. All the brain can do is take in and put out. That's it. So that's why you're hearing this distorted speech. It's not a matter of intellect. It's not poor teaching. It's not parenting. It's just where the world was at that point in time. And then the video clip, these children are speaking with Australian accents because what goes in is what comes out. So here is the first clip. Again, it's not intelligible.

It's not to make fun of anyone. It's to show where we were in the olden days. And here is another example. So again, why that speech sounded that way is because the auditory brain was only able to receive an itty bitty, bitty bit of auditory information. That's all the brain had to work with so that's what came out. It's not what the person could do. It's all the person could do because of the information they had. So now we're gonna play a video tape showing what is possible in this day and age. Now these are children introducing themselves. It's not captioned because I really would like you to listen to what's possible when the brain receives more information. When this hearing loss is diagnosed earlier. When better technologies are able to be employed, like cochlear implants.

- My name is Katie Douglas and I attended Hear and Say Center when I was five months old.
- Hi I'm Jamie-Lee Lewis and I'm 17. And I came here at Hear and Say when I was one year old and there was only five students with Dimity Dornan at that time.
- Hi, I'm Jeanie Pacing and when I first went to Hear and Say, I was 2 1/2 years old.
- My name is Bill Redmond. I'm 24 years old. And I've been going to the Hear and Say Center for about 14 years.
- My name is Darcy and this is my sister Claudia. She is 4 1/2 and she'll be turning five and I'm nine.
- So Darcy and Claudia were bilaterally implanted at six months of age in Sydney, Australia. And they went to an auditory verbal listening and spoken language program, family-focused from the very beginning to be able to utilize that technology to develop their auditory brain centers. Now the reason that even with this great technology we still need to be intentional about developing the brain is because as good as our current technologies are, and they are amazing, none of them are as good as an intact organic doorway. They're wonderful but not the same as an intact organic doorway which is why the brain needs more practice. Not different practice than a typical child would have with conversations and reading and singing, but more practice because we need to give the brain more opportunity to develop those neural connections. So does 2021 Deaf look like 1990 Deaf? See what does Deaf look like in 2021? We've used the word deaf forever. Nothing wrong with the word at all. It's just important for everyone to recognize that the context has changed. The children in that Australian program, in that program in Australia, they would have sounded like those audio tapes you heard had they been born in 1960 or 1970 because those audio tapes were made in the 1980s and the children or the young people in the tapes were born in the 1960s and 1970s. If our little Australian children were born in the 1960s and 70s they would have sounded the same, right? Because what changed is the technology. What changed is information about the brain. What's changed is about early intervention. That's what's changed. So it's important that we can talk about part of hearing and deaf and all the words we use within today's context. So what do we now know about the auditory brain. Well, we know a lot. The brain, now this is what's so interesting. The brain unlike any other organ is essentially unformed when the baby is born. Right? The baby is born with about 100 billion neurons. That's right. B, billion. 100 billion neurons. But there is no connections between the neurons. The synapses aren't there. As we saw in the video tape from the Harvard Developmental Center, the synapses are formed by experiences in the environment. Everything that gets to our brain, our mind, is reduced to a pattern of neural

activities. And sound is associated with its own unique pattern of activities. And by the time human infants are born, the neural preparation for auditory language is specialized to speech because that's what is heard in utero for about 20 weeks. At birth, the human brain responds uniquely to speech. The auditory system is very complex through experience and exposure, there are more relays that is synaptic connections connecting the sensory organ of the ear to the brain than any other sensory system. Babies are born with neurons but the connection between them, experiences. Sound processing is one of the most computationally demanding tasks the nervous system has to perform. This task relies on exquisite timing of the auditory system which responds to input more than 1,000 times faster than the photoreceptors of the visual system. What this means is we can hear faster than we can see, taste, smell, or feel. So for example, human response to pitch frequency, ba-ba-ba, is we can, for example, now okay, let me just back up for one second. When I say the brain receives sound, what I mean is auditory information, and that sound begins as vibrations. So we can hear vibrations that's back and forth movement in an intact inner ear up to about 20,000 times per second. The mid-frequency of speech is called 1,000 hertz. That's 1,000 times, 1,000 back and forth. 1,000 vibrations. We can hear up to 20,000 of those. We can't even see 20. You see, hearing is a temporal sense. It occurs in time, primarily a temporal sense whereas vision is primarily a spatial sense. We see items in space. We hear events in time. So talking about the first analogy here, the Doorway analogy, I call it. What is that? So here is our challenge. How do we take information, and I just gave a little hint, a little taste of auditory information. But how does this auditory brain relate to understanding your child's hearing loss? How do we take more scientific information and how do we have now a story, a counseling meaningful story about your child's hearing loss. Well, let's start by defining terms, jargon, language, that your pediatric audiologist and LSL interventionist that we just use all the time, like everyone knows just what we're talking about, right? Well, let's start with sound. Sound is an event. It's not a label. For example, you don't hear mommy any more than you hear a table. What you hear is mommy in motion. She's talking, she's tapping on the computer. She's singing, she's dancing, she's walking because motion events create vibrations. Vibrations and it's vibrations that are picked up by this ear doorway and sent to the brain where they are coded as neural energy and then can occur as perception of information. Sound is an event. Sound is vibration. Sound carries information. What about language? Language is an organized system of communication used to share information. Spoken language consists of sounds, words, grammar, and all are used to express our inner thoughts. Our emotions. What's in our head? What is in our head? Language includes facial expressions, gestures, body movements. All are used to convey information. Well, how does information get into the brain? See, the brain is this squishy little organ. It's a little more than that, but it is the squishy thing that is entirely completely encased in bone. Some of the hardest bone in the body, encases this brain. Well, how does information get to the brain? How does the brain know anything? In fact, how does the brain know everything. Fortunately we have five amazing brilliant senses. Hearing, sight, smell, taste, touch. Every sense, each sense captures different types of environmental data, environmental information. And then changes that information into neural impulses that are read by the brain, because the brain can only read, process, create synapses for neural energy. How does that happen? Well, for example, the nose is the doorway to the brain for the sense of smell, for olfactory molecules, but the knowing of the meaning of the smell occurs in

the brain. So for example, oh, I believe that's a chocolate chip cookie. Or oh, diaper needs changing. Does the nose know diaper/cookie? No, the nose knows nothing. What knows diaper/cookie, it's the... I hear you...the brain. Well, how does the brain know diaper/cookie? By exposure and practice and language. The brain learns the meaning of those olfactory molecules. When we talk about someone who is a wine taster and we say, oh, what a nose they have, what a palate, it's not the nose or the palate. It's the brain. Through exposure and practice learns the fine distinctions of grapes or food. Another example, the eyes are the doorway to the brain for visual information. The eye captures optic wave lengths and then transduces, transforms, changes those optic wave lengths into neural impulses and the brain through exposure and practice and language learns the meaning of those optic wave lengths. So when you see mommy, a dog, the floor, does the eye know mommy, dog, floor? No. The eye knows nothing. The eye is a wonderful receptor. It's the brain that learns the meaning. Well, you know where I'm going. Right? The ear is the doorway to the brain for sound. For auditory information. The knowing of the meaning of that information occurs in the brain. So when you hear mommy singing and you hear the dog barking and you hear your dad walking and talking does the ear know mommy, dog, dad? No. The ear knows nothing. It's the brain. So we can consider or talk about your child's hearing loss as a doorway problem. The ear is the doorway to the brain for sound. What we mean by sound is information. Hearing loss of any type and degree obstructs this doorway, right? Maybe it's obstructed by fluid. Maybe there is a sensory neural hearing loss. If the doorway is obstructed a little bit, that could be a mild hearing loss. More - it's more a little bit, more is moderate and then closed could be deaf. Deaf is a closed doorway. Well, the purpose of technologies, the only purpose whether hearing aids or cochlear implants is to get sound through the doorway. Right? It's to get auditory information from the environment to the brain. There is no other purpose. Parents, when you put your technology on your child, their only purpose is to get information to your child's brain. And the type of technology that we use to reach the doorway depends on what's happening in the doorway, and if the doorway changes, then the technology changes because our job is to get knowledge, auditory knowledge to your child's brain. So here is another analogy. Call it a computer keyboard analogy. So data input precedes data processing. So the hearing loss or poor acoustic environments is like having a malfunctioning computer keyboard. And so the information that gets to the hard drive is faulty or it's incomplete or it's absent, right? So we can look at, in this analogy, we can look at technologies as a better keyboard. Right? This keyboard here in the organic structure is not working well for any number of reasons. We need to get a better keyboard because the goal is to get data to the hard drive and develop and program that hard drive so the choice of technology we use depends on what's going on in the original keyboard so we can insert a better keyboard to get to the hard drive. And a great keyboard doesn't fix the hard drive. It just gets you to the hard drive so you can now enter data. And an audiogram, and we'll talk more about audiograms next month. An audiogram is the way that we measure what's going on in the doorway, right? This is an amazing doorway. So we can determine what kind of doorway do we have, what sort of keyboard is here, what sort of different keyboard do we have to have to get information to your child's brain. To their hard drive. So what is hearing? Hearing is defined as brain perception of auditory information. First order event for the development of spoken language, social emotional skills, and we're all about brain development. And we have to get intelligible information into the brain. We want to give the brain the best

possible data to program and process. Because think about our organic structure. We have eyelids okay, everyone. Close your eyelids. What happens? Can't see. Close your ear lids. Oh that's right, there are no earlids. Our auditory brains are open for business 24/7. That's how critical auditory data how critical auditory information is for this neural integration and neural processing. For 20 weeks in utero, the inner ear is mostly developed for about 20 weeks. There is a lot of auditory information that gets into that baby's brain Through the mother's body. Lots of sound. Her voice, other sounds which means that a typically developing baby's auditory system, of a typically developing, that baby is born with 20 weeks of auditory exposure. Obviously not meaningful interaction. I mean there is not much going on. Well, a lot going on but not interactively, right? But that brain has been auditorily stimulated which means that we don't have a second to lose. Parents, that's why it's so wonderful that your babies were diagnosed at birth. Because if their brain missed that initial firing up, well, we now can immediately start activating those auditory centers to start connecting the different neurons in your child's brain because we want to connect all parts of your child's brain together. You know, it all works together. We hear mommy. We see mommy. We smell mommy and kiss and taste mommy. All of this works together. We want to give our child access and integration of all of their senses. And signal to noise ratio is the key to receiving intelligible information. And we gonna talk about that more in a few months. Stay tuned for the rest of these webinars. So hearing then is acoustic access to the brain. Brain perception of auditory information. Improving signal to noise ratio which is the relationship between what you want your child to hear and all this background noise. How do we manage that using technology? Hearing, getting auditory information to the brain. That's what we mean by hearing. Listening, now listening is activating that pre-frontal cortex. Not volitionally but through intention. Listening is when your child attends, pays attention to auditory information. And we wanna give your child's brain the best possible auditory information to pay attention to. And understanding is when your child learns the meaning of that information through language, social exposure, practice. And hearing must be made available to your child through that doorway. Best possible doorway before paying attention and listening can be taught and high fidelity knowledge and information learned. It's a process. We have to know the hearing thing before we can do the listening thing. So I love this summary because this just kind of puts together what's happening. You see, we have vibrations going into this organ of the ear. The vibrations follow the little line are then transduced, right into neural impulses and what comes out is what went in. So if clear speech, good doorway goes into the hard drive, clear speech comes out. If garbled speech goes in, garbled comes out. If English goes in, English comes out. If Spanish goes in, Spanish comes out. You don't put Spanish in and get French out, right? So we must pay close attention to what that child sounds like, what they're saying, because what goes in is what comes out. It's all about the brain. So this is actually a picture of the ear. The brain. It's all about the brain. Hearing loss isn't about ears. It's about your child's brain, and all of our wonderful technologies are designed as better doorways. As better ways to access the doorway. As ways to get knowledge information to your child's let me hear you, brain. Hearing technologies are brain access devices. So, families, what do we have to consider? Need to consider what auditory information is actually got to the brain through the doorway. What is the status of your child's auditory brain? What does your child know? What is your child's hearing age. Hearing age is how long has your child's brain had exposure and access to the highest possible fidelity of auditory information that's available through

today's technology. And your pediatric audiologist and LSL specialist can really help figure out the answers and keep track of these questions. So let's put this all together. And I call this The Logic Chain. Let's put this together. This meaning everything we have been talking about. This whole system. So I call it connecting the dots - The Logic Chain, and I think you're all going to get some more information about this after this webinar. This will be some of the follow-up information that's going to come along. The Logic Chain is a model that summarizes what we now know at this point in time about the ingredients necessary to build, to nourish, to create a listening, speaking and reading brain for your child. The logic's chain represents a system of foundational structures have to all be in place in order to attain that outcome. Can't skip a link. Can't skip a thing. We have a system here. And family-focused LSL is a critical part but not the only part of this chain. So what are the ingredients? We know research-based. We know we're not surmising, we not making it up. We know what it takes to optimize the probability of having a system that will attain an LSL outcome for your child if that's what you want families. What is it you want? And then understanding what it takes to get that and then having a system in place to optimize the opportunity for that outcome to occur. Well, first we got to get it's all about the brain. Creating the synapses from very early on through exposure and experiences and you've got to have that technology early, early, early. And general infant child language development in the family's home language with the support of an LSL specialist and we need to actively enrich the foundations and ongoing progression of literacy. See, children with doorway problems can develop literally skills just like children with typical hearing. When we do what it takes to create an auditory neural infrastructure with a great deal of exposure and experience in language and in knowledge and in wearing that technology. You know? And in teaching. We actually have a webinar. You'll be surprised to learn in a few months about how do we teach a child with a doorway problem reading just like a child with typical hearing, right? How do we do that with the use of technology and with extra practice in key elements? Stay tuned. So our biology is we hear with the brain. That is the vibrations clearly go through this amazing organ of the ear, but the knowing of the meaning of the auditory knowledge occurs in the brain. So hearing is in the brain. Your child's brain development is dependent upon the experiences they have with you and other caregivers and all of your children's brain not only your child that has a doorway issue but all your children's development is dependent on their experiences and the more you talk and have conversations, the more they're gonna know and the better their outcomes. You already know a fluent language or maybe several fluent languages and you can share that language with your children at home. Now, folks, here is the thing about technologies. You got to actually wear them. Now, just think about this. If a child has a typical auditory doorway their brain is receiving auditory information 24/7. If your child has a doorway problem, and is only wearing their better keyboard, say four hours a day, it will take their brain six years to receive the auditory exposure that a child with typical doorway received in one year. Will they be behind in what they know? How could they not be? Now I'm also not saying that our current technologies should be worn 24 hours a day because our current technologies are not engineered for 24 hours wear. So how long should they be worn? Well, we have data. We have studies. That show they need to be worn at least 10 to 12 hours a day, but actually more recent data show at least 80% of their waking time. So for example, if they're only awake 10 hours a day, our little toddler, then we want to make sure they wear their device at least eight hours a day. Some of our

older children should be wearing their devices at least 14 to 15 hours a day. 80% of their waking time, because wear time is a critical variable in attaining an outcome. Why? Because it's through this technology that the brain actually gets information. High quality information. Consistent information. So key points. For families such as the Coopers who want an LSL outcome, gotta remember, ears are the doorway to your child's brain. It's in the brain that the actual hearing occurs. And when I diagnose hearing loss I talk to families about yep, what we have here is a doorway problem. Our job is to get information to your child's brain, to develop, nourish, create, grow. Your child's technology must be fit and managed as soon as possible by a pediatric audiologist. I'm talking weeks, weeks after birth, weeks. And your child's brain access devices at least 80% of their awake time, eyes open, technology on. Guidance of your LSL specialist will provide support for you. And your child needs to be in a variety of conversation enriched environments. Not different from other children but more. More intentional. We have a brain to grow. So what about our Cooper family? The Cooper family continues to gain confidence in their natural parenting skills of talking, reading aloud, singing, dancing, socially interacting. See, the Coopers thought they'd have to learn something so different that they'd have to be a whole different type of parent than they thought they could be. That they will have to change everything they knew about raising children to raise Dakota. And what they learned is that isn't so. They can use their natural parenting skills. They need to learn new skills of technology management. Technology utilization. They need to learn more about distinguishing every opportunity to take advantage of creating knowledge in Dakota's brain. Not new different things than they would do. Actually, it's pointing out to the Cooper family opportunities to create knowledge and learning for all children, not just for Dakota. And they realized they actually do know how to do what it takes during routines of daily living. Routines of daily living, that's stuff we have to do no matter what. We have to get up. We have to get diapers, we have to feed, we have to dress, we interact. We need to do that no matter what. How do you find wonderful opportunities during everyday activities? Through the technology to enrich the brain and most importantly, the family has observed Dakota's rapid progress as he reaches age-appropriate developmental milestones. Their LSL practitioner and pediatric audiologist are guiding and coaching the Coopers to maintain their steady progress and to maintain their crucial role as Dakota's first and best and most important teachers. Thank you. Thank you for listening. Thank you. And now oh, while before I introduce Tami I'd like you to think about what is your plan for explaining the hearing-brain connection to others? Jot it down. Start thinking about how are you gonna use this information to explain about what's going on here with your child. And now I'd like to introduce Tami Elder. Tami?

- [Tami] Hi, Carol. Thank you so much. Hi, everyone. This is Tami Elder, programs leader with Hearing First. Thank you, Carol, for such an extraordinarily wonderful presentation. You really brought it home for us that hearing makes brain connections and how our auditory brain is foundational for learning and language development. Such great information for our families that are here today. We have time for a couple family questions that have come up during today's webinar. So here is the first. This parent asked, is there a way do identify how the child's input affects her output? Do audiologists or therapists use specific tests to determine exactly the cause of a speech articulation issue as it might pertain to an auditory input issue with a technology or anatomy?

- Wow. Such a great question. That's like the heart of it all. So that's why we need a great pediatric audiologist to be able to identify what's happening in the doorway, and to find the best possible keyboard for your child, whether it's a hearing aid or implant or maybe change the keyboard and then working with your audiologist and your LSL specialist, there is constant diagnostic interactions going on with your LSL specialist that is listening to your child. See the audiologist can measure what should be getting to the brain through the technology. But what we don't know is that, what is the brain doing? Is the brain getting enough practice? Enough exposure? And what does their speech sound like? We listen very carefully to every output from your child, even before they have words, even before they babble vowel consonants. They gonna babble vowels. We're gonna hear their suprasegmental. Can they make their voice loud and soft? Do they do long sounds and short sounds? Do they change pitch? There is a lot of information we have about early child language development that we apply those same benchmarks to our children that have doorway problems to identify what is actually getting to the brain, how is the child using it, what is coming out? Because it does take time for practice. It takes time. We need to identify the doorway. Fit the best keyboard. Wear that keyboard. Stimulate, enrich through natural interactions, pay close attention to what your child is listening to. Listen carefully to your child's verbal output no matter what form it takes and carefully monitor progress. And we do that together as part of our LSL system. I hope that helps.

- [Tami] That did. That was perfect. Thank you, Carol, for that. We have another couple questions about later auditory brain access. One from a parent whose baby wasn't diagnosed until she was 13 months of age. And she is worried about her daughter's auditory brain. And another question from a parent whose technology was not programmed properly for five years but is now programmed correctly. So it seems like both of those questions, the parents have concerns about later auditory brain development.

- Right. Well, also, excellent questions. And they're two very different questions. 13 months without having brain access is very different than five years. Because there is two general systems at stake. One is the neural development of the brain that comes with stimulation. So we need to stimulate and get those synaptic connections. That's one issue. The other issue is the input of knowledge, of information. The figurative data files in the hard drive. So the longer the delay, what happens is we have a delay in the neural development and a delay in the data files of knowledge. So 13 months, we still have a lot of time. I mean, probably would have been better. We want to take advantage of every opportunity but we don't ever want to rule out possibilities. So 13 months, work closely with your audiologist and LSL specialists and be in that enrichment paradigm because we still have a brain that is in its maximum neuroplasticity. That's a different sort of conversation we need to have.

- [Tami] Sure. Thank you, Carol, for that. Thank you. Well, let's go ahead. We have a lot of great questions that came in today and some questions from professionals as well. And so guess what? We've run out of time. No worries. We have a plan to answer these so stay tuned, everybody. We're continuing the Family Learning Series. So Carol, let's share the next webinars in the series.

- Okay. Go ahead. So next month, I'm going to be talking about what your child can hear. We're really going over the audiogram. We created a new version of the familiar sounds audiogram with an e-book that goes along with that to explain all of the details. And all these are designed to be delivered to families. And then in September, we gonna talk about all of these different doorway devices, the different keyboards, the whole continuum of technologies that we have. October, remote microphone. Why is the hearing aid or implant by itself not enough? Why do we need to have like an FM system? It's more than that. A remote mic to get even more information and not be hindered by distance and noise. And finally, in November, we're going through our whole system of what it takes for LSL. Our whole connect the dots thing. Then it's how do we enhance reading and singing? How do we integrate that child's brain for the maximum possibility of social outcomes and academic outcomes. So that's what we have coming up next.

- [Tami] Awesome. Thank you, Carol. Everyone be watching for more information about this phenomenal family series that we have. Thank you again, Carol. We can't wait for the next webinar. This has been great. And a huge thank you to all our participants from all of us here at Hearing First. The numbers have been incredible. The number of people we had participating and it demonstrates the need for this knowledge. Thank you. So thanks again, everyone. Have a great afternoon.

- Thank you very much. Bye, bye. See you next month.