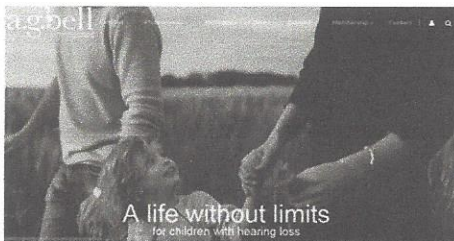


Workshop Presenters

Carol Flexer, Ph.D., FAAA, CCC-A, LSLS Cert. AVT
 Donald Goldberg, Ph.D., FAAA, CCC-SLP/A, Cert. AVT
 Gayla Guignard, M.A., CCC-A/SLP, Cert. AVT

About AG Bell



Related Background and Disclosures

- Audiologist (CCC-A)
- Speech-Language Pathologist (CCC-SLP)
- Listening and Spoken Language Specialist Auditory-Verbal Therapist (LSLS Cert. AVT)
- Direct Service Provider (1989-2010); Administrator/Leadership Positions-(2003-current)
- Mother-Advocate, IFSP, IEP, Transition, Voc Rehab, Community Services, Life (1995-present)
- Salary Paid by AG Bell
- Board Member, Council on the Education of the Deaf

AG Bell Since 1890



Learner Objectives

By the end of this course, learners will be able to:

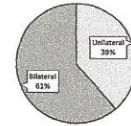
- List the range of communication and language opportunities for teaching infants, toddlers, and preschool-aged children who are deaf or hard of hearing
- Describe the critical importance of excellence in audiology as the foundation of listening and spoken language development
- Detail key components of assessment and intervention that equip professionals, parents, and ultimately, children in optimizing access to hearing, and therefore, spoken language

Your Learning Tools

- Take-Away Handout
- Small Group Discussion of 2-3 minutes: Share Take-Away Gems (Presenters will walk from table to table)
- “Ask Anything” Question Cards
- Online handout and additional resources

Hearing Loss in One vs. Both Ears

EHDI, 2016 Babies
<https://www.cdc.gov/ncbddd/hearingloss/2016-data/14-type-and-severity.html>

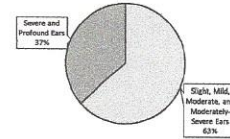


Workshop Table of Contents

- The Big Picture: An Introduction to Our Topic
- Hearing Now: Creating a Neurological Context
 - Small Group Discussion
- Audiology: The Foundation of Listening and Spoken Language
 - Break
- LSL: Nuts and Bolts
 - Small Group Discussion
- Knowledge and Skills of Certified LSL Specialists (LSLS Cert. AVT/LSLS Cert. AVEd)
- How Does LSL Fit in with EHDI?
- Resources
 - Small Group Discussion

Degree of Hearing Loss by Ears

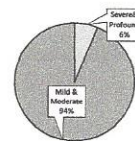
EHDI, 2016 Babies
<https://www.cdc.gov/ncbddd/hearingloss/2016-data/14-type-and-severity.html>



Getting on the Same Page-Data

Degree of Hearing Loss by Person

NHANES II & III Prevalence Ages 6-19 years
 Donahue (2007), Eisenberg et al. (2007); Tomblin & Hebbeler (2007)
 Retrieved from 11/15/17 handout, Longitudinal Outcomes of Children with Mild to Severe Hearing Loss: Auditory Experience Matters, Mary Pat Moeller, Ph.D



Getting on the Same Page-
Communication Options/Choices/Opportunities

Getting on the Same Page

• Myths and Misconceptions

- We all have them. What are yours?
 - If this, then _____.
 - We have all the time in the world to _____.
 - He can learn to _____ any time/later.

How do Children who are Deaf or Hard of
Hearing Communicate?

Individually and Specifically
Uniquely, yet Predictably
In Lots of Different Ways
No One Size Fits All!

Getting on the Same Page-
Evidence-Based Assumptions

Getting on the Same Page-
Myths and Misconceptions

Getting on the Same Page

- If Assumptions Must Be Made, Try to Make Them Based on Evidence:
 - Good, quality studies with large numbers of children and clearly defined research protocols exist
 - Baseline and regular comprehensive assessments of a child must happen across time. Otherwise, how will we know what is happening with that child?



Position Statements

- <http://www.agbell.org/Advocacy/Spoken-Language>
- <http://www.agbell.org/Advocacy/Cochlear-Implants-in-Children>
- <http://www.agbell.org/Advocacy/American-Sign-Language>
- <http://www.agbell.org/Advocacy/Communications-Access-Captioning>

Communication Milestones Birth-3 months

Hearing and Understanding

Expressive/Talking

- | | |
|--|---|
| <ul style="list-style-type: none"> • Startles to loud sounds • Quiets or smiles when spoken to • Seems to recognize your voice and quiets if crying • Increases or decreases sucking behavior in response to sound | <ul style="list-style-type: none"> • Makes pleasure sounds (cooing, gooing) • Cries differently for different needs • Smiles when sees you |
|--|---|

Listening and Spoken Language

- What is Listening and Spoken Language?
 - An approach to communication that involves use of specific strategies and techniques
 - A communication mode
 - An option/choice/decision

Communication Milestones Ages 4 to 5 years

Hearing and Understanding

Expressive/Talking

- | | |
|---|--|
| <ul style="list-style-type: none"> • Pays attention to a short story and answers simple questions about them • Hears and understands most of what is said at home and in school | <ul style="list-style-type: none"> • Uses sentences that give lots of details • Tells stories that stick to topic • Uses the same grammar as the rest of the family • Communicates easily with other children and adults |
|---|--|

LSL from Start to Finish

- From auditory awareness to full-blown communicative competence



<https://www.definitions.net/definition/Communicative%20competence>

Listening and Spoken Language

- Questions, Questions-Who, What, Where, When.... Why and How?



Wh-Questions Regarding Listening and Spoken Language

- Who? In Sessions-Parent/Caregiver-Child-LSL Professional
In Life-the Whole Family and then some (e.g. childcare)
- What? Listening through Hearing and Using Verbal Speech/Language
- Where? At home, in the community, in special settings as needed
(e.g. center-based environments)....everywhere
- When? (Early and Often) Individualized and determined by several factors including the child's age, an assessment that reveals a child's present levels of functioning *AND* as recommended by a professional who is a Listening and Spoken Language Specialist

Video Clip (two siblings ages 18 and 15) Impacted by Newborn Hearing Screening

Wh-Questions

- Why? From my professional and my parent perspective:
 - To develop communicative competence, a high level of literacy and the life skills that result from higher learning
 - To extend the family's (spoken) language, culture, history, and values to the child

What is the why for you?

TRANSITION TO NEXT PRESENTER

Wh-Questions

- How? Attain and Sustain
 - 1) Attain (develop) listening and spoken language by accessing the brain and doing so primarily through a child's sense of hearing in family-centered targeted intervention that is focused on bringing or returning child to a "typical" trajectory of development and is carried over into daily life within the context of the family and community
 - 2) Sustain listening and spoken language ability and skills by monitoring and managing the child's hearing, access to hearing in a variety of listening environments, auditory devices, continued learning of (higher-level language), academic, social, emotional, personal development, and interpersonal skills

Hearing Now: Creating a Neurological Context

Carol Flexer, PhD; CCC-A; LSLS Cert. AVT
Distinguished Professor Emeritus, Audiology
Northeast Ohio Au.D. Consortium (NOAC), and
The University of Akron
www.carolflexer.com

DISCLOSURES

Carol Flierer, PhD, FAAA, CCC-A, LSLS Cert. AVT, is a Distinguished Professor Emeritus of Audiology, The University of Akron, and is an international lecturer and consultant in pediatric and educational audiology.

Financial Disclosure:

Carol's travel costs to this conference are being funded by the AG Bell Association.

So, let's create a context that presents the big picture for families who want a listening, spoken language, and literacy outcome for their children.

Topics Discussed:

- What is the family's desired outcome?
- The world has changed!
- the relationship of the infant/child's brain neuroplasticity to the use of hearing aids, cochlear implants and wireless technologies
- A Model for Connecting the Dots: Promoting language, literacy and music for all children, based on the family's desired outcome

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The world has changed

- How did we used to talk about hearing loss, and what did we believe to be true?
- We used to believe and talk about hearing as if we heard with the ear – now we know that is not the case. The meaning of hearing occurs in the brain.
- The world has changed for hearing healthcare; we are in a new era.
- Advances in knowledge about brain plasticity, auditory deprivation, and critical periods for language development have shifted the concentration of hearing management from the ear to the brain.

Always start conversations with The Critical Question: What is the Family's Desired Outcome?

- The family's desired outcome guides us – ethically and legally.
- What is your long term goal for your child?
- How do you want to communicate with your child? What language(s) do you know?
- Where do you want your child to be at age 3, 5, 14, 20? What does it take to get there?
- 95% of children with hearing loss are born to hearing and speaking families.
- Many families use a main language at home other than the school language, so they likely are interested in their child speaking several languages.

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The world has changed

We have a new generation of children who are deaf or hard of hearing—a generation that is not only benefiting from advances in early hearing screening and the use of advanced hearing technology, but a generation that is also the beneficiary of what we now know about brain development, early childhood development, and language and literacy development.

Today's children experience a different context – a different ecology.

The Big Picture: The World Really Has Changed!

- *Who Moved my Cheese?* by Spencer Johnson, M.D. – a book about change
- We are an Information/Knowledge-based economy that demands high levels of spoken communication and literacy.
- We are educating children to take charge in the world of 2030, 2040, and 2050....not in the world of 1970 or 1990 or even 2020.

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Audio Clip# 2 of possible "oral" outcomes before early identification, early intervention, and cochlear implant technology

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Spoken Communication: Past And Present

1. Audio clip of possible "oral" outcomes before early identification, early intervention, and cochlear implant technology
2. Video clip of possible "auditory-verbal – Listening and Spoken Language (LSL)" outcomes in this day and age

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DVD of possible "auditory-verbal – Listening and Spoken Language (LSL)" outcomes in this day and age

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Audio Clip# 1 of possible "oral" outcomes before early identification, early intervention, and cochlear implant technology

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The Excitement of Music!

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Auditory Neurophysiology: What we now know

So, where to start?

Begin at the beginning

Making the connection between hearing loss, auditory neural deprivation, and use of hearing technologies -- and, how to explain this connections to families

Brain Clip

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Sample of References for Brain Research

- Kral A. (2013). Auditory critical periods: a review from system's perspective. *Neuroscience*, 247: 117-33.
- Kral, A., Kronenberger, W. G., Pisoni, D. B., & O'Donoghue, G. M. (2016). Neurocognitive factors in sensory restoration of early deafness: A connectome model. *The Lancet Neurology*, 15(6), 610-621.
- Kral, A., Lenarz, T. (2015). How the brain learns to listen: deafness and the bionic ear. *E-Neuroform*, 6(1):21-28.
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- Moon, C., Lagercrantz, H., & Kuhl, P. K. (2013) Language experienced in utero affects vowel perception after birth: A two-country study. *Acta Paediatrica*, 102,156-160.

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Brain Clip

Three Core Concepts in Early Development

Experiences Build Brain Architecture

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD
Center on the Developing Child @ HARVARD UNIVERSITY

References for Research about Outcomes

- Ching, T.Y.C., Dillon, H., Leigh, G., & Cupples, L. (2018). Learning from the longitudinal outcomes of children with hearing impairment (LOCHI) study: Summary of 5-year findings and implications. *International Journal of Audiology*, 57(S-2), S-105-S-111.
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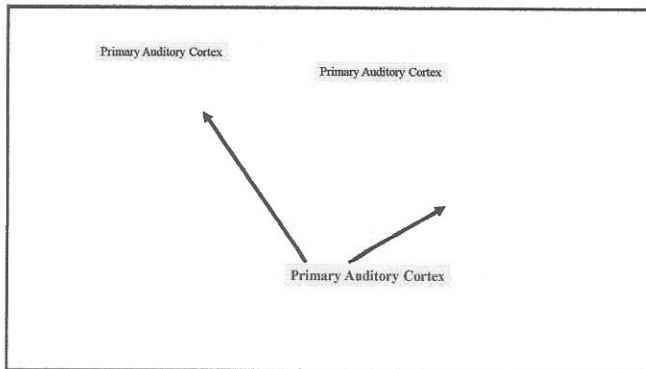
Let's begin with a Brief Summary of What We Now Know about the "Auditory Brain"

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Basic Science: (Kral et al, 2012; 2013; 2015; 2016)

- The results of Dr. Kral's studies (along with the research of others) suggest that when the brain does not have access to intelligible speech during the early months and years of a child's life, meaningful auditory input does not coordinate activity between primary and secondary auditory cortex.
- Instead, secondary auditory cortex assists with the processing of other functions such as visual processing.

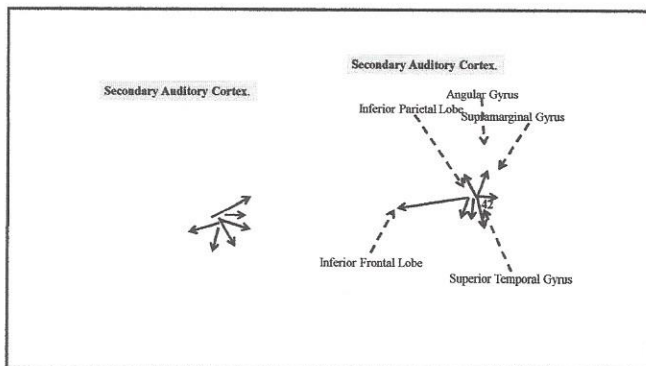
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Auditory System Complexity (Kraus, 2018)

- The auditory system has more relays connecting the sensory organ to the brain than other sensory systems.
- The auditory system contains some of the longest axonal tracts.
- Axonal tracts directionally link each of the auditory relays between the ear, brainstem, midbrain and cortex.

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An illustration of the auditory portion of the human brain's connectome.

Kral et al.... Basic Science Continued

That is, when auditory signals are not efficiently and effectively transmitted from primary to secondary auditory cortex, the secondary cortex cannot distribute spoken language and other meaningful sounds/information to the rest of the brain to create auditory meaning and knowledge; *this negative process is called "downstream degradation"*.

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Sound Processing Complexity (Kraus, 2018)

- Sound processing is one of the most computationally demanding tasks the nervous system has to perform.
- The task relies on the exquisite timing of the auditory system, which responds to input more than 1,000 times faster than the photoreceptors in the visual system.
- Humans can hear faster than they can see, taste, smell or feel.

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The Challenge: How do we take our current knowledge of neuroplasticity and auditory deprivation, and use that information to create a brain context for managing hearing loss?

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What is Language?

- Language is an organized system of communication used to share information.
- It consists of sounds, words and grammar used to express inner thoughts and emotions.
- Language includes facial expressions, gestures, and body movements.

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The Following slides describe a *Counseling Narrative*: Right from the start, explain complex information in a comprehensible fashion – offer the big picture!

Families often do not know what we are talking about.....define terms.

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How Does Information Get into the Child's Brain?



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To Begin With: What is Sound? (Boothroyd, 2019)

- Sound is an “event” – not a label.
- For example, you don’t “hear” Mommy. You hear Mommy walking, talking, singing, tapping, dancing.
- An event creates vibrations.
- Vibrations are picked up by the “ear doorway” and are sent to the brain as energy for coding, and for perception as information.

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Five senses capture environmental information and transform that information into neural impulses read by the brain:

- Hearing
- Sight
- Smell
- Taste
- Touch

For Example, the Nose is the "Doorway" to the Brain for the Sense of Smell – but, we smell with the *brain*.



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So, what is Hearing Loss? We can think about Hearing Loss as a "Doorway" Problem

- The ear is the "doorway to the brain" for sound.
- Hearing loss of any type and degree obstructs that doorway a little (hard of hearing), a lot (hard of hearing) or completely (deaf), preventing sound/auditory information from reaching the brain where the meaning of auditory information occurs.
- Hearing aids and cochlear implants break through the doorway to allow access, stimulation and development of auditory neural pathways.

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Another example: The Eyes are the Doorway to the Brain for Visual Information.

But, we see with the brain – not the eyes.



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The purpose of technologies (e.g. hearing aids, cochlear implants, remote wireless systems) is to get sound – auditory language information – through the doorway to the brain. There is no other purpose! The choice of technology depends on what is happening in the doorway.

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The point: The Ear is the "Doorway" to the Brain for Sound – Spoken Language/Information – Talking – Reading. We hear with the brain – not with the ears!



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An Audiogram is the way we measure the quantity and quality of the "Doorway" Problem

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Well then, What is Hearing?

- Hearing can be defined as *"brain perception of auditory information."*
- Hearing is a first-order event for the development of language – spoken communication, literacy skills, and social-emotional connections.
- Anytime the word "hearing" is used, think **"auditory brain development"** using 1 billion neurons with a quadrillion connections!
- Acoustic accessibility of *intelligible* spoken language is essential for brain growth.
- There are no "earlids" – the brain is available for auditory information 24/7.
- Signal-to-Noise Ratio (SNR) is the key to hearing intelligible auditory information – speech must be 10 times louder than background sounds. Download SLM APP on iPhones or Tablets.
- *Our early intervention programs and classrooms must take into consideration the child's brain access of acoustic information for language and for social growth.*

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It's All About The Brain

Hearing loss is not about ears; it's about the brain!

Hearing aids, RM systems and cochlear implants are not about ears; they are about getting auditory information to the brain!

They are "brain access tools".

THE EAR

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So, what Does "Deaf" Look Like in 2019?

- Does 2019 "Deaf" look like 1990 "Deaf"?
- We have used the same words for decades, but the context and possibilities have changed, dramatically!
- We can now talk about hard of hearing and deaf as descriptors of the status of the (ear) doorway.

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First display a picture of the "Brain Ear", and then the more traditional picture of the "doorway" ear, showing:

Outer (external), Middle and Inner Ear

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Therefore, we now know we must always consider:

- What auditory information has reached and developed the brain, through the ear/doorway?
- What is the status of the child's auditory brain?
- Where has the brain been?
- What does the brain "know"?
- What is the Child's "Hearing Age"?

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Putting it All Together – “The Logic Chain”

- The Logic Chain is a model that summarizes what we know, at this point in time, about the ingredients necessary to create a listening, speaking, and reading brain.
- The Logic Chain represents a system of foundational structures that must ALL be in place to optimize the attainment of a listening, spoken language and literacy outcome; no link can be skipped.
- Family-focused Listening and Spoken Language (LSL) intervention plays an integrated role – but not the only role.
- See Offer.HearingFirst.org/EHDI_Resources for the complete, research-based, document.

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Connect the Dots between Hearing and Literacy

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The Logic Chain Model – We now know all links must be evaluated and managed to create a SYSTEM for the attainment of a listening and spoken language outcome – if that is the outcome the family desires.

- **Brain Development >**
- **General Infant/Child Language Development in the Family’s Home Language >**
- **Early and Consistent Use of Hearing Technologies >**
- **Family-Focused LSL Early Intervention >**
- **LSL Early Intervention for Literacy Development**

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Listening is the Foundation of Reading

- It takes approximately 20,000 hours of listening to speech before a child’s brain has clear mental referents for each of the speech sounds.
- This listening ability is necessary to enjoy rhyming and to develop phonological awareness skills.
- Reading is parasitic on listening.
- **The Goal is grade-level literacy by the end of third grade!**

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Listening and Spoke Language (LSL) Development

How much parents converse with their child is the best predictor of the child’s language competence, whether or not the child has a hearing loss.

Parents need to speak the language(s) they know.

Wear hearing technologies 10-12 hours per day. “Eyes open, technology on”.

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Professionals -- Coach Families to Read, Read, Read to children!

Creating Neural Pathways for Reading: An Exercise in Plasticity, because Reading is not Natural

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Why Read Aloud?

- Exposure to storybooks is the biggest factor in a preschooler's vocabulary.
- More parent-child conversations occur during read alouds than during any other activity.
- Children who receive read-alouds show gains of more than twice as many new words.
- Reading aloud to children before age 6 effects language, literacy and reading development.
- *Think about reading aloud as a conversation, not as a task to be completed.*
- You can never read too much!

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To Summarize....

- Brain access devices must be worn at least 10 hours per day, and families are encouraged to speak their home language, beginning in infancy. Use a remote microphone system at home as well as at school.
- Children need to be immersed in a conversation-enriched (talking, reading aloud, and musical) environment in order to grow their brain with knowledge for spoken language and literacy development. The neurological concept is, "experience dependent plasticity".



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Reading Clip – in NICU

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To Summarize.....

- Hearing loss is a neuro-biological emergency, and we must act urgently to avoid auditory sensory deprivation!
- For families choosing a listening and spoken language (LSL) outcome for their children who are deaf or hard of hearing (status of the doorway), the appropriate hearing technologies for breaching that doorway must be fit and managed as soon as possible after birth by a pediatric audiologist.

Fitting hearing technologies is the first line of treatment for auditory sensory deprivation.



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Small Group Discussion

DMG Disclosures

- Salary paid by The College of Wooster
- Paid Professional Staff Member of the Cleveland Clinic Foundation
- Board Member, AG Bell International
- Board Member, Joint Committee on Infant Hearing (AG Bell Association representative)
- Board Member, Council on Education of the Deaf (AG Bell Association representative)

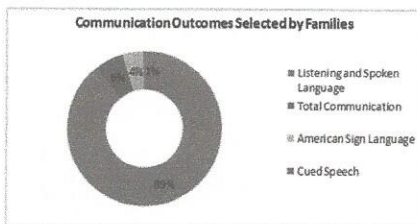
Communication Modes/Methods

Manual vs. "Oral"

Manual: ASL, MCE, Bi-Bi
 Combined: Total Communication/TC & Cued Speech
 Listening and Spoken Language:
 Auditory-Verbal (Acoupedics/Unisensory)
 &
 Auditory/Oral (with a history of reception via speechreading)

Audiology: The Foundation of Listening & Spoken Language

Family Choice:
 Snapshot North Carolina



Source: RECEPTION of North Carolina is a non-profit agency providing an impartial approach to meeting the diverse needs of families with children who are deaf or hard of hearing and the professionals who serve them.

The Ear

- Outer Ear
- Middle Ear
- Inner Ear
- "Beyond the Cochlea"

WE HEAR WITH OUR BRAIN –
 The EAR is just the way IN!

Let's talk about *HEARING!*

Universal Newborn Hearing Screening (UNHS)

Outer Ear/Tympanic Membrane/Middle Ear

Pinna / Auricle; Ear Lobe; Concha (ear canal opening);
External Auditory Meatus / EA Canal
(beware of CERUMEN – ear wax)

T M – “border” between the OE and ME

Ossicles: Hammer/Malleus; Anvil/Incus; Stirrup/Stapes

• Eustachian Tube (connecting the Middle Ear Space and the Nasopharynx – back of the throat)

Middle Ear Space should be air-filled

OME- Otitis Media with Effusion/ME Fluid

Audiometric Test Battery

- **Otoscopy**
 - visual inspection eardrum and ear canal
- **Tympanometry**
 - test of middle ear function
- **Acoustic Reflex Thresholds**
(ipsilateral / same side contralateral / opposite side)
- **Otoacoustic Emission (OAE) Test**
 - test of outer hair cell function in inner ear (cochlea)
- **Auditory Brainstem Response (ABR) Test**
 - provides info about inner ear and brain pathways for hearing
- **Behavioral Testing**
 - method of testing varies by age of patient

Inner Ear

- Cochlea
 - Scala Vestibuli / with perilymph
 - Scala Media / with endolymph
 - Scala Tympani / with perilymph
- Semicircular Canals (Vestibular System / Balance)

Otoacoustic Emission (OAE) Testing

- Measurements obtained from ear canal with probe
- Records cochlear responses to acoustic stimuli
- Reflects status of peripheral auditory system extending to the cochlear outer hair cells
- Will NOT identify Auditory Neuropathy

OAEs – Pros & Cons

Pros of OAEs

- Frequency-specific
- Present at birth
- Infant can be awake for testing

Cons of OAEs

- Only provides info about OHC status
- Requires normal middle ear function
- Response altered by ambient noise
- Does not indicate degree of hearing loss

UNHS

- Not all children are screened
- Some children are born at home – Train the midwives!
- Need to be sensitive to screen non-documented and other family's wee-ones
- Many U.S. programs only test with OAEs and likely miss ANSD (ideally need 2-test models-- ABR & OAE tests)
- Some hearing losses will be progressive
- Disease processes occur in the first months of life and are therefore missed at birth
- Hearing losses can be acquired

Auditory Brainstem Response (ABR) Testing

- Measurements obtained from surface electrodes
- Records neural activity in cochlea, auditory nerve, and brainstem in response to auditory stimuli
- Reflects status of peripheral auditory system, 8th nerve, and brainstem auditory pathway
- Will identify Auditory Neuropathy

JCIH Statement Principles (2000/2007)

1. All infants should have access to hearing screen by 1 month of age
2. All infants who do not pass the initial screen and subsequent re-screen should have audiological confirmation of hearing loss by 3 months of age
3. All infants with confirmed hearing loss should receive intervention services by 6 months of age
[Intervention refers to both fitting of Technology AND Early Intervention services from a "Qualified Provider"]

ABR – Pros & Cons

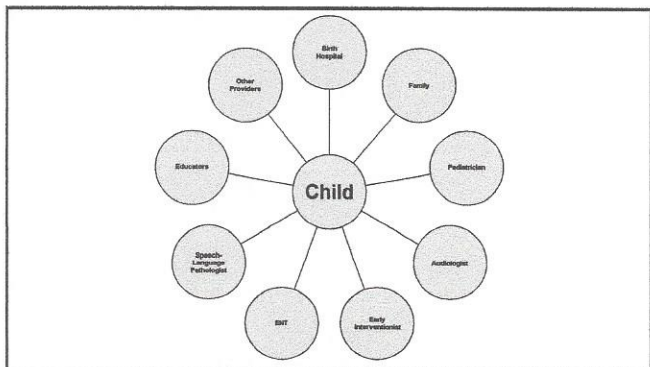
Pros of ABR

- Indicates degree of hearing loss
- Assesses greater area of the auditory pathway
 - Various stimuli options

Cons of ABR

- Assesses only synchronous neural function
 - Infant must be asleep for testing

What Happens Next?



TYPES of Hearing Loss

- Conductive Hearing Loss (affects the OE &/or the ME)
- Sensori-Neural Hearing Loss / SNHL (affects the IE &/or cranial nerve viii/the auditory nerve)
- Mixed Hearing Loss (combination of Conductive HL & SNHL)

(+ Non-Organic HL)
[+ (Central) Auditory Processing Disorders]

Behavioral Testing

- Conventional Audiometry
 - ~ age 5 years* & beyond
- Conditioned Play Audiometry
 - ~ age 2-5 years*
- Visual Reinforcement Audiometry
 - ~ age 6 months-2 years*
- Behavioral Observation Audiometry
 - ~ below 6 months*

**refers to developmental age of patient*

Audiogram

- Graphic representation of the hearing testing results
- X axis / Across the horizon / *abscissa*; the Frequency range; on the top left – low pitch; to mid pitch; and to the top right – higher pitches
- Y axis / up/down / *ordinate*; the intensity in dB HL range – top of the audiogram “soft” sounds; down the audiogram towards the bottom – “loud” sounds

When “Things” Go Wrong

- Outer Ear Disorders
- Middle Ear Disorders
- Inner Ear Disorders

Cochlea / Sensory problems
Beyond the Cochlea / *Neural* problems

Audiogram

- Red symbols for RE
- Blue symbols for LE
- NO Response (NR) arrow angled downward

Types of Hearing Loss from the Audiogram

- Within Normal Limits (WNL)
- Conductive Hearing Loss (Air-Bone Gap/ABG exists); BC thresholds are WNL and AC thresholds are abnormal/poor
- Sensorineural Hearing Loss (SNHL) – AC and BC thresholds are similarly abnormal/poor
- Mixed Hearing Loss: an ABG exists, the BC thresholds are poor and the AC thresholds are even worse (hence the ABG)

Other Auditory Measures

A variety of Speech Audiometric & Speech Perception measures may be completed

- Speech Recognition Threshold (SRT) Stimuli: spondee words – assesses low frequency hearing/especially vowel info.
- Word Recognition / Word Identification
- (closed set-picture pointing; or open set-repeat back procedures) Stimuli: PB words – more typically assesses higher frequency/consonant sounds

Audiograms

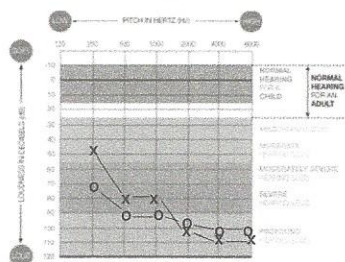


Image from League for the Hard of Hearing

Speech Perception/Other Measures

Word Recognition:

- * ESP (Pattern Perception *plus*)
 - NU-CHIPS
 - WIPI
 - PBK-50

Hearing Loss
Does NOT Equal
Auditory Function

Early Speech Perception
(ESP) (Moog & Geers, 1990)

(Moog & Geers, 1990)

NU-CHIPS

More Team Members

- Audiologists
 - Diagnostic (Auditory Electrophysiologist, Pediatric specialization)
 - Dispensing Audiologist
 - Cochlear Implant Audiologist
 - (Re) Habilitative Audiologist
 - Educational Audiologist

Speech Perception/Other Measures

Parent Report/Judgments & Pediatric Tools:

- Infant Toddler Meaningful Auditory Integration Scale (IT-MAIS)
- Meaningful Auditory Integration Scale (MAIS)
- Parents' Evaluation of Aural/Oral Performance of Children (PEACH)
- Mr. Potato Head, Pediatric Az, Baby Bio, MLNT, LNT, Checklist of Auditory Communication Skills, LittlEars, PLUS!

GOAL

AUDITORY ACCESS!
to lead to
BRAIN ACCESS !!!

Speech Perception/Other Measures

Teacher Report/Judgments:

- Teachers Evaluation of Aural Performance of Children (TEACH)
- SIFTER/s (Preschool, School-Age, Secondary)
- Listening Inventory for Education (LIFE) (Student Appraisal / Teacher Appraisal)
- Functional Listening Evaluation
- Functional Auditory Performance Indicators (FAPI)

Winning Combination

Appropriate Technology & Auditory Access
PLUS
Enriched Auditory Exposure

=

AUDITORY BRAIN DEVELOPMENT

(Dunn & Holcomb, 2019)

Hearing Sensory Technology

- Hearing Aids
- * Remote Microphone (RM) Technology
- * Other Hearing Assistive Technology
- * HAT: Listening / * HAT: Alerting Devices
 - * Cochlear Implants
 - * Auditory Brainstem Implants
- * Auditory Osseo-integrated Systems

(not correctly referred to as "Bone Anchored Hearing Aids," but specifically -- Ponto by Oticon and "Baha" by Cochlear Americas)

Remote Microphone Technology (RM/FM/s/IR) – **NON-NEGOTIABLE!**

Hearing Technology Worn Throughout the Child's Waking Hours

Signal-to-Noise Ratio (SNR)

Relationship of the intensity of the
speech / instructor's signal to the
intensity of the unwanted signal
(noise)

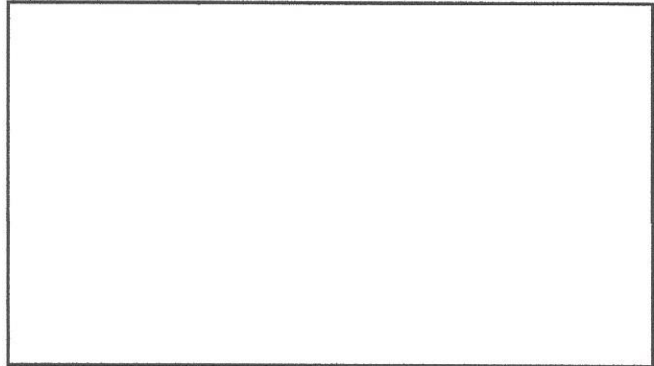
Should be a positive number
(+15 to +25)

"Technology Retention": Consider Trying

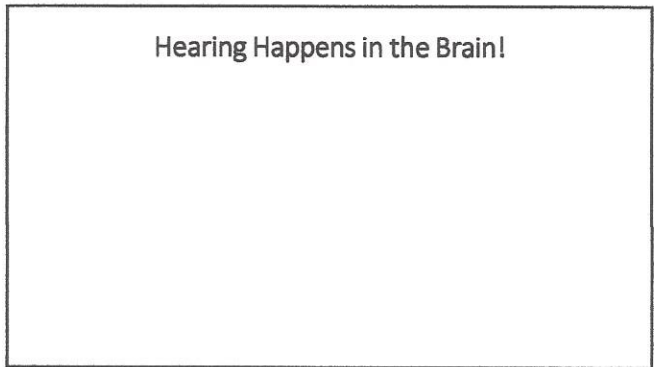
- www.hearinghenry.com
 - #1 -- EAR GEAR -- Spandex sleeve slips over hearing devices. Has stretch cord and plastic locking clip. www.gearforears.com
 - Oto/Critter Clips www.westone.com
 - JoyBandsLLC.com
 - www.Silkawear.com
 - Ciwear.com
 - Frogglez -- "No Hazzle Swim Goggles" www.thegromet.com
- www.hannaandersson.com (BEWARE of covering the mic)

(Gates, 2003, p. 423)

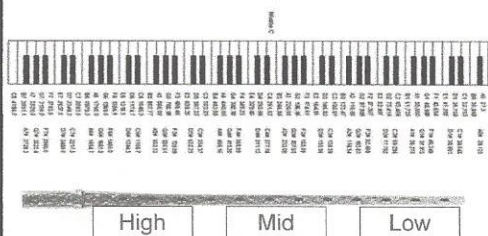
When to REALLY Refer for CI Evaluation



Frequency via Electrode Placement



Electrodes on the implant are arranged by frequency (pitch)



AG Bell "Audiologic" Protocol

Alexander Graham Bell Association's
Recommended Protocol for Audiological
Assessment, Hearing Aid and Cochlear Implant
Evaluation, and Follow-Up (2014)

AGBell Protocol Components

Overview of Audiological Management:

- * 1-3-6 (JCIH)
- * Recommendation of frequent evaluation

Questions for Good/Better/ "Best"

- * Pediatric Expertise?
- * "Aggressive" Testing Schedule?
- Is it the case that "Every dB counts/matters"?
- Is Parent/Clinician/Educators Input Critical?

Birth to Age 6 Months

- * Otoscopic Inspection
- * Child and Family History
- ABR (click versus tone pips) (replicate waveforms?)
(reverse polarity?)
- * Auditory Steady State Response (as appropriate)
- * OAE (as appropriate)
- * Tympanometry (Wide Band Reflectance)
- * Parent and Clinician Input/Observations (Auditory Behavior, "Overall" Development)

AGBell Protocol Components

Recommended Elements of the Initial Audiological Diagnostic Assessment:

- * Comprehensive Audiological Evaluation
(Birth to Age 6 Months; Age 6 to 36 Months)
- * Reports/Audiograms/Referrals

Age 6 Months to 36 Months

- * Otoscopic Inspection
- * Child and Family History
- * Parental Report of Auditory/Visual/Communication Behaviors and Milestones
- * Behavioral Audiometry
- * Speech Detection/Speech Recognition Threshold/Word Recognition/Speech Perception
- * Acoustic Immittance/Tympanometry and AR Thresholds
- * OAE testing (as appropriate)
- * Electrophysiological Testing (as appropriate)

Audiology Recommendations

Because – every dB counts!

<u>Unaided Testing</u>	<u>CI/HA Testing</u>
Right Ear	CI-Only
Left Ear	CI & HA
<u>Aided Testing</u>	HA-Only (if possible)
Binaural	<u>Bilateral CIs</u>
Right HA	Both CIs
Left HA	Right CI-Only
	Left CI-Only

Other Elements/Questions for Good / Better / "Best"

- Do the Parents understand the results?
- Do the Parents understand the management plan?
- What are the follow-up plan/schedule?
- Are parent questionnaires used – IT-MAIS, LittleEars?
- Audiogram and Report available? Understandable?
- Was the testing RELIABILITY noted?
- Copies to other providers?
- Referrals to other professionals? (pediatrics, ENT, genetics, social services, psychology/counseling, OT, PT, others?)

AGBell Protocol Components

Recommended Procedures to Assess Amplification:

- Electroacoustic Analysis
- Real-Ear-to-Coupler Differences (RECD) Measures
- Cortical Auditory-Evoked Response Testing
- Sound Field "Aided" Testing

(soft/~35 dB HL; conversational speech intensity/~45/50 dB HL)
(testing in Quiet and at varying SNR/s / testing in noise)

AGBell Protocol Components

RECOMMENDED ASSESSMENT PROTOCOLS –
By Age of Child (0-6 months, 6-12 months, 12-24 months, 24-36 months, Over 36 months)

- Electrophysiologic Testing (ABR, OAE, ASSR)*
- Immittance Testing*
- Behavioral Testing*
- Speech Perception Testing (Includes Recommended Speech Test Protocols by Age)*
- Testing With Technology*
- Hearing Aid / CI / Bimodal / RM-FM Testing*

AGBell Protocol Components

Recommended Audiological Management for
Children with CI/s

Hearing and Auditory Experience Matter!

AGBell Protocol Components

Recommended Audiologic Management
Regarding FM Systems

Brief History of Auditory Teaching

- Victor Urbantschitsch (1895)
- Max Goldstein/CID (1939)
 - Emil Froeschels
- Helen Beebe & Doreen Pollack
- Daniel Ling / Agnes Ling Phillips
 - Many others to follow!

Doreen Pollack
A-V Pioneer

Helen Hulick Beebe

Auditory-
Verbal
Pioneer

Book

- Educational
Audiology For The
Limited- Hearing
Infant And
Preschooler: An
Auditory-Verbal
Program D. Pollack, D.
Goldberg, & N. Caleffe-
Schenck

Video

Helen Hulick Beebe
(circa 1988)

Give back to parents
their natural role as
their child's first and
most important teacher

(adapted from Pollack, 1970)

It's ALL About Communication!

Principles of A-V Practice

- 4. Guide and coach **parents as primary facilitators** of child's listening and spoken language development through active consistent participation in individualized AVT.
- 5. Guide and coach parents to create environments that support **listening throughout the child's daily activities.**

Auditory Teaching /
Auditory Learning

DMG: Avoid the term "Auditory TRAINING"
Recommendation//Consider instead –
Auditory Teaching / Auditory Learning

Principles of A-V Practice

- 6. Guide and coach parents to help **integrate listening and spoken language into all aspects of the child's life.**
- 7. Guide and coach parents to **use natural developmental patterns ...**
- 8. Guide and coach parents to help their child self-monitor spoken language through listening.

Principles of A-V Therapy Practice (AG Bell Academy for Listening and Spoken Language, 2009)

- 1. Early diagnosis, audiologic management, and AVT.
- 2. State-of-the-art **hearing technology** to obtain maximum auditory stimulation.
- 3. Guide and coach parents to help their child use hearing as the primary sensory modality in developing listening and spoken language.

Principles of A-V Practice

- 9. Administer on-going formal and informal diagnostic assessments to develop individualized A-V treatment plans – **diagnostic therapy** – to evaluate clinical effectiveness
&
- 10. Promote education in "regular" **classrooms with peers with "typical" hearing** and *with appropriate support services* from early childhood onwards.

Principles of A-V Practice

Above PRINCIPLES were adapted from Pollack (1970)

- An A-V Practice requires **all** 10 principles to be in place.
- "Parents" also includes other caregivers who interact with the child.

Auditory Teaching Techniques

- Pay Attention to Acoustics
- Keep AUDIOLOGIC MANAGEMENT – "key" priority
- Beware of Repetition
- Use "Sabotage"
- Listening Age/Hearing Age
- Use Cognitive-Based Activities
- *"Teach Don't Test"*
- *"Put It Back Into Hearing"*
- Follow an AUDITORY Levels of Functioning

FOUNDATIONS OF AUDITORY TEACHING

Auditory-Based Teaching Does NOT Merely Mean Putting An Acoustic Hoop In Front of Your Mouth!

Auditory Teaching Techniques

- Emphasize LISTENING
- "Prompt Listen"
- 1-on-1 Time
- Parents are Partners
- "Hand Cue"
- Use Acoustic Highlighting
- Integrate speech/auditory learning & language goals
- Use "Pause Time"
- Use Conversational Turn-Taking
- "Role reversal"
- Keep High expectations

Use of Technology Throughout All Waking Hours

KEY:
Parents as partners and case managers

Major technique:
Careful attention to the Patient's "Levels of Auditory Functioning"
An Auditory "Hierarchy" *

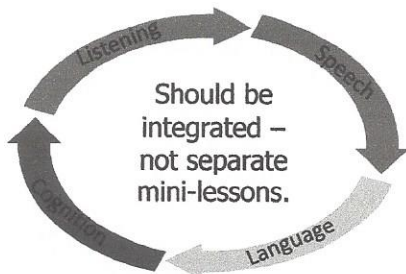
Pay Attention to Acoustics

- Positioning in therapy lessons
- Use of RM systems
- Use Acoustic modifications
- Know your "speech acoustics"

Levels of Auditory Functioning – My How Far We Have Come!

- Comprehension.*
Is there meaning to this sound?
- Recognition/Identification.*
Is this sound distinct from other sounds?
- Discrimination.*
Is this sound different from other sound?
- Detection.*
Was there a sound?

Interplay of Targets



Daniel Ling

Ling Six (Seven) Sound Test

ah (/a/)
 oo (/u/)
 ee (/i/)
 sh
 s
 m
 (Ling & Ling, 1978)

Consider
 "NO SOUND"
 as the
 7th Sound

(Rosemarie Drous,
 Formerly of the
 Helen Beebe Speech & Hearing
 Center)

"Sample" Auditory Dx Battery

- **Youngest:** Ling 6, ESP, IT-MAIS, PEACH
- **Preschool:** Ling 6, ESP, IT-MAIS, GASP!, TAC
- **Older:** Ling 6, ESP, GASP!, TAC, Listening Comprehension Test-2, SIFTER

Ling Six Sound Test

Distance for Detection/Identification

Sound	1'	3'	6'	9'	12'
/u/ oo					
/a/ ah					
/i/ ee					
/ʃ/ sh					
/s/ ss					
/m/ mm					

Assessment of Speech/Speech Intelligibility

Quick Check – Is the HA/FM/CI Working???
 – Ling Sounds

- Present auditorily
- Mix up the sounds
- Tell the parents/audiologist which sounds are not being heard?
 - Verify in "ALL" Conditions
- Consider: Enhanced communication from CI Centers to Schools & Schools to CI Centers

"Typical" Speech Sound Development

Assessment of Language

OTHER PROBES

- Case History
- Family Information
- Object Permanence
- Cause & Effect

Consider: Ireton/Minnesota; MacArthur-Bates; REEL-3; among others.

Receptive / Expressive Language

- Form
(Morphology, Syntax, Phonology)
- Content
(Semantics / Semantic Relationships)
- Use
(Pragmatics)

Transfer: Test Data to Intervention Goals/Objectives

- Use "tests" that assist you in developing intervention
- Be hierarchical
- Vary field size (closed/open set; # in set)
- Be functional
- Have fun! (otherwise – Why bother?)

Language Assessment

Evaluate FORM/CONTENT/USE at both the *receptive* & *expressive* levels

Use "typical" language assessment tools normed on "hearing" clients

Data Collection

- "Interventionists" should be keeping data.
- What outcomes are being measured/ monitored?
- Both "informal" and "formal" measurements are needed.

Measure/Monitor:

- LISTENING SKILLS / AUDITORY DEVELOPMENT
- SPEECH SOUND REPERTOIRE / SPEECH INTELLIGIBILITY
- RECEPTIVE LANGUAGE / COMPREHENSION
- EXPRESSIVE LANGUAGE

Data Collection

- **Measure** skills frequently
- Complete **longitudinal recordings/sampling**
- Use **“formal” diagnostic measures** addressing AUDITORY, SPEECH, LANGUAGE, & COGNITION
- Use **“informal” diagnostic tools**
- Continually **assess the PARENTS**, as well as the KIDDO who is deaf or hard of hearing!

Regan

Are We On Course?

- Overall – What is the Auditory-Speech-Language Progress ?
- **Some other specifics:**
 - Wear time of CI/s?
- Progression through auditory hierarchy (basic awareness of sound to Ling Sound detection to Ling Sound recognition/identification, Learning to Listen sound associations, etc.)?
 - Increases and changes in speech sound production?
- Receptive/Expressive language growth?

Charlie

Are We On Course?

- Typical Benchmarks:
- “Flat” serial audiograms in the “mild” hearing loss range
 - Improving speech perception measures (closed to open set; quiet to noise)
 - Closing the auditory-speech-language “gap”
 - Approximately 1 years growth in 1 years time

See Loud & Clear! – “Clinical Red Flags”
Amy McConkey Robbins (2005)

Ella

Henry

Jace

James

Nathaniel

Video

Which "tween" was born with a
bilateral, profound sensori-
neural hearing loss?

Girl on the Left or Right???

By Regan Brady

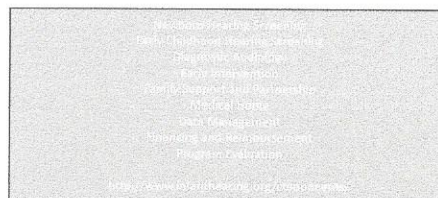
Listening to the Waves: Life with Cochlear Implants

www.listeningtothewaves.com

Small Group Discussion

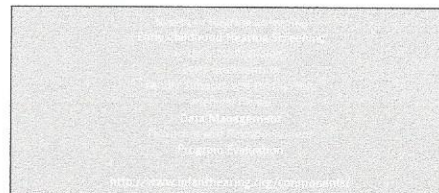
The Sky Is *Truly* The Limit!

About Early Hearing Detection and Intervention
EHDI Components



Listening and Spoken Language
Certification/Qualifications

EHDI Components:
How Does LSL Fit?



Federal Government Resources

- Centers for Disease Control and Prevention (CDC)
<https://www.cdc.gov/ncbddd/hearingloss/links.html>
- Health Resources & Services Administration (HRSA) Maternal and Child Health Bureau (MCHB)
<https://www.hrsa.gov/about/organization/bureaus/mchb/key-staff.html>
- Department of Education Office of Special Education Programs (OSEP)
<https://www2.ed.gov/about/offices/list/osers/osep/index.html>

Listening and Spoken Language Resources

- www.agbell.org
- www.agbellacademy.org
- www.hearingfirst.org

CDC Resources

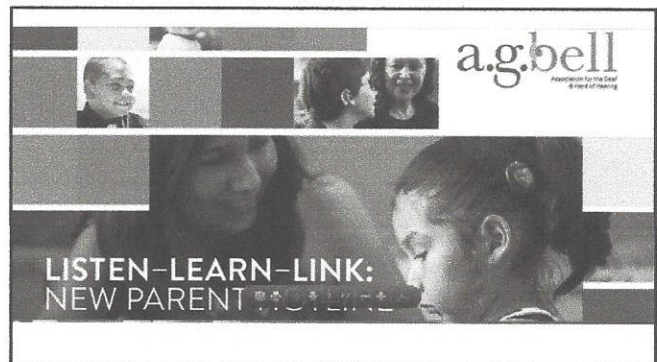
<https://www.cdc.gov/ncbddd/hearingloss/freematerials.html>

- Decision Guide to Communication Choices
- Making a Plan for Your Child
- Questions You May Want to Ask Your Child’s Audiologist
- Questions You May Want to Ask Your Child’s Early Interventionists
- Questions You May Want to Ask Your Child’s Physician

What We Know

Government Grant-Funded National Technical Assistance Centers

- EHDI-National Center for Hearing Assessment & Management (NCHAM)
- Family Leadership in Language and Learning (FL3)-Hands & Voices
- Early Childhood Technical Assistance Center (ECTAC)-Frank Porter Graham Center



Hotline Contact Info (Remember, you are not alone)

**Hotline Available
Monday-Friday**
newparenthotline@agbell.org

In the U.S.
1-833-LSL-LINK
(1-833-575-5465)

**International - Zoom video
conference calls can be
scheduled by request.**

Sponsored by:



Cochlear®



Ask Anything

Reach Us

Alexander Graham Bell Association
for the Deaf and Hard of Hearing

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info@agbell.org

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Our Mission

Working globally to ensure that people
who are deaf and hard of hearing can
hear and talk.

We want all families to be informed
and supported, professionals to be
appropriately qualified to teach and
help children with hearing loss, public
policy leaders to effectively address
the needs of people with hearing loss,
and communities to be empowered to
help their neighbors with hearing loss
succeed.

EHDI Involvement Chart Guignard, 2018

EHDI Component	Action/Question/ Feedback/Prize	Reason for Doing (WHY)	Person to Contact (WHO)	Strategy to Use (HOW)	By this
					Date (WHEN)
Birth					
Early Childhood Hearing Screening					
Diagnostic Audiology					
Early Intervention					
Family Support and Partnership					
Medical Home Care					
Management					
Financial Reimbursement					
Program Evaluation					