

Little Ears, Big Challenges

Hearing Loss in Children
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Hearing loss is just not just for grandma or grandpa. Hearing loss affects everyone of any age. And, if a child has an undetected or untreated hearing loss, it can have long lasting devastating effects on language and learning.

With the passage of Newborn Hearing Screening, hearing loss in babies is being detected earlier and being treated earlier, thus reducing the negative impact on language and learning. But, newborn screenings will not necessarily detect those losses that occur once the baby leaves the hospital. Therefore, it is important to know the risk indicators associated with permanent congenital, delayed-onset, or progressive hearing loss in childhood.

Incidence of Hearing Loss in Children

☺About 2 to 3 out of every 1,000 children (approximately 12,000) in the United States are born deaf or hard-of-hearing each year.

☺The number of Americans age 3 and older with some form of hearing disorder has more than doubled since 1971.

☺At least 1.4 million children, 18 or younger, have hearing problems.

☺Profound, early-onset deafness is present in 4-11 per 10,000 children, and is attributable to genetic causes in at least 50% of cases.

Incidence of Hearing Loss in Children

☺U.S. government survey data revealed that 12.5% of children ages 6 to 19 (approximately 5.2 million children) have permanent damage caused by exposure to loud noises.

☺In addition 15.5% of children ages 12 to 19 had some hearing loss in one or both ears, highlighting the fact that noise-induced hearing loss grows more prevalent with age.

"Are 1 Million Dependents in America with Hearing Loss Being Left Behind?"

☺A recent study conducted by the Better Hearing Institute found that:

✍Historically 50% of infants who failed an initial hearing screening were not brought in for their follow-up evaluation with a detailed hearing test

- ✍️ Only 12% of children under the age of 18 with hearing loss use hearing aids; yet an estimated 1.5 million youths under 21 y have hearing loss that may be improved with amplification
- ✍️ Three in 10 parents cite embarrassment or other social stigma reasons their child does not use a hearing aid
- ✍️ Many parents were advised inappropriately that their child could not be helped because they had sensorineural hearing loss
- ✍️ One in five parents cannot afford hearing aids for their children.
- ✍️ There is a tendency to minimize the impact of "mild", even "moderate" hearing loss as well as unilateral hearing loss among children despite the known impact on language, academic and emotional development.
- ✍️ The incidence of hearing loss among children may be as high as five times greater than reported in national polls, because the child's hearing loss may be outside of the awareness of the parent, pediatrician or educator.

😊 Hearing loss present at birth.

😊 Includes hereditary hearing loss or hearing loss due to other factors present either in utero (prenatal) or at the time of birth.

😊 Approximately 50% of hearing loss in children has a genetic cause

✍️ About 30% of children with genetic hearing loss have a “syndrome.”

✍️ 70% of children with genetic hearing loss have hearing loss that is “non-syndromic.”

😊 A non-genetic cause can be found in about 25% of cases of hearing loss.

✍️ Intrauterine infections including rubella (German measles), cytomegalovirus (CMV), and herpes simplex virus

✍️ Complications associated with the Rh factor in the blood

✍️ Prematurity/low birth weight < 1500 grams/3.3 lbs

✍️ Maternal diabetes

✍️ Toxemia during pregnancy

✍️ Lack of oxygen (anoxia)

✍️ Jaundice

☺ Family history of permanent childhood hearing loss

☺ Neonatal intensive care of >5 days, or any of the following regardless of length of stay:

- ✍ ECMO (**extracorporeal membrane oxygenation**)
- ✍ assisted ventilation
- ✍ exposure to ototoxic medications or loop diuretics
- ✍ hyperbilirubinemia (jaundice) requiring exchange transfusion.

☺ In-utero infections, such as CMV, herpes, rubella, syphilis, and toxoplasmosis.

☺ Craniofacial anomalies involving the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies

ACQUIRED

☺ hearing loss which appears after birth, at any time in one's life, perhaps as a result of a disease, a condition, or an injury

- ✍ Ear infections (otitis media)
- ✍ Ototoxic drugs/chemotherapy
- ✍ bacterial and viral (especially herpes viruses and varicella) meningitis.
- ✍ Measles
- ✍ Encephalitis
- ✍ Chicken pox
- ✍ Influenza
- ✍ Mumps
- ✍ Head injury
- ✍ Noise exposure

☺ Syndromes associated with hearing loss or progressive or late-onset hearing loss, such as

- ✍ neurofibromatosis, osteopetrosis, and Usher syndrome.
- ✍ Other frequently identified syndromes include Waardenburg, Alport (kidneys), Pendred (thyroid), and Jervell and Lange-Nielson (heart).

☺ Neurodegenerative disorders, such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich ataxia and Charcot-Marie-Tooth syndrome.

Approximately 25% of cases of hearing loss have an unknown cause.

Universal Newborn Hearing Screening (UNHS)

Background and Rationale for UNHS

☺ Early identification of hearing loss is supported by AAA, AAO-HNS, AAP, ASHA, and the Council on Education of the Deaf.

☺ The Joint Committee on Infant Hearing Year 2000 Position Statement endorses early detection of and intervention for, infants with hearing loss.

☺ One goal of Healthy People 2010 is to "increase the proportion of newborns who are screened for hearing loss by age one month, have audiologic evaluation by three months, and are enrolled in appropriate intervention services by age six months."

New York State Regulations

☺ Became effective on October 20, 2001, and requires all facilities caring for newborn infants to administer a newborn hearing screening program

☺ Options for administering the program vary depending on the number of births per year in the facility, as follows:

✍ Facilities with *over 400 births per year* (rolling three-year average) are required to provide UNHS prior to the infant's discharge from the hospital to home for all newborns born in or transferred to their facilities.

✍ Facilities with *400 births or fewer per year* (rolling three-year average) have the option to administer the program directly or to refer infants born in their hospitals to qualified providers in their communities.

The Role of the Early Intervention Program

☺ Timely follow-up is important for those infants who do not pass their initial hearing screening and for those infants who fail two newborn hearing screenings.

☺ Infants who have failed two hearing screenings are considered to have a suspected disability

✍ required to be referred to the Early Intervention Program under existing Public Health Law, section 2542, and Early Intervention Program regulations.

☺ If an infant who has failed their initial hearing screening does not receive a follow-up screening within 75 days post-discharge, the facility responsible for reporting data to the Department (usually the birth facility) may refer the family to early intervention for the purpose of facilitating a second hearing screening.

Developmental Milestones

☺ Birth

- ✎ listens to speech
- ✎ startles or cries at noises
- ✎ awakens at loud sounds

☺ 0-3 months

- ✎ turns to you when you speak
- ✎ smiles when spoken to
- ✎ recognizes your voice and quiets down when crying

☺ 4-6 months

- ✎ responds to "no" and changes in your tone of voice
- ✎ looks around for sources of noise (doorbell, vacuum, etc.)
- ✎ notices toys that make sound

☺ 7 months - 1 yr

- ✎ listens when spoken to
- ✎ turns or looks up when his/her name is called
- ✎ enjoys games like pat-a-cake or peek-a-boo
- ✎ responds to simple requests ("come here", "want more?")
- ✎ recognizes words for common items ("cup", "shoe", "juice") listens to simple stories, rhymes, or songs

☺ 1 yr – 2 yrs

- ✎ follows simple commands and understands simple questions ("roll the ball", "kiss the baby")
- ✎ can point to a few body parts when asked
- ✎ points to pictures in books when they are named

☺ 2-3 yrs

- ✎ can follow two requests ("get the ball and put it on the table")
- ✎ continues to notice sounds (phone ringing, television, etc.)
- ✎ understands difference in meaning (go/stop, big/little, up/down)

☺ 3-4 yrs

- ✎ can answer simple "who", "what", "where", "why" questions
- ✎ can hear radio and TV at the same loudness as others
- ✎ can hear you when you call from another room

☺4-5 yrs

- ✍pays attention to simple stories and can answer questions about it
- ✍people who know your child think he/she hears well
- ✍hears and understands most of what is said at home and in school

There are four types of hearing loss:
Signs of Hearing Loss in Children

- ☺Your baby does not startle or jump to loud sounds
- ☺Your baby does not stop sucking or crying when there is a new sound
- ☺Your 3-month-old baby does not coo at times or make eye contact when talked to
- ☺Your 9-month-old does not turn toward you when called from behind or make babbling sounds, such as "baba"
- ☺Your 1-year-old does not babble using a variety of consonant sounds (g,m,n,b,d)
- ☺Your 18-month-old does not use single words to express his or her wants
- ☺Your 2-year-old does not repeat words or phrases and does not use short phrases when talking
- ☺Your child has had many ear infections
- ☺Your child uses gestures to communicate

- ☺Your 4-year-old's speech is difficult for most people to understand
- ☺Your child often asks for things to be repeated
- ☺Your child seems to watch your face closely when you talk
- ☺Your child seems inattentive at home or school
- ☺Your child does not communicate as well as other children the same age
- ☺Your child often responds to a question with an unrelated answer
- ☺Your child prefers the TV or radio louder than others in your family
- ☺Your child has had many ear infections
- ☺Your child responds inconsistently to sound

Middle Ear Infections (otitis media) and Hearing Loss

- ☺Middle ear infections are the reason for up to 30% of pediatric office visits in American children.
- ✍Over 5 million Acute Otitis Media cases occur annually in US children.

- ☺Otitis media is second in prevalence only to the common cold.
- ✍About two thirds of children have at least one acute ear infection by the time they are three years old.

☺ About 17% of all children under two have recurrent ear infections, i.e., three or more episodes within a six-month period.

☺ Ear infections are more common in children because their Eustachian tubes are shorter, narrower, and more horizontal than in adults, making the movement of air and fluid difficult.

Signs and Symptoms

☺ General

- ✎ Pain in the ear, signaled by pulling on the ear in some infants
- ✎ Fever
- ✎ Eventual hearing loss
- ✎ Irritability, tiredness, lack of appetite or vomiting may also occur, especially in young children
- ✎ Usually occurs in children who have had an upper respiratory tract infection for several days

☺ Acute otitis media involves the rapid onset of symptoms including:

- ✎ Otolgia (denoted by pulling of the ear in some infants)
- ✎ Fever
- ✎ Hearing loss (secondary to fluid build-up)
- ✎ Irritability, and/or vomiting may also occur, especially in young children. These symptoms usually occur in children who have had an upper respiratory tract infection for several days
- ✎ Medical emergency – can lead to meningitis

How to Test for Hearing Loss in Children

☺ From birth to 6 months of age, hearing can be evaluated by

- ✎ Auditory Brainstem Evoked Response testing (ABR, BSER, BAER).
- ✎ Otoacoustic Emissions

☺ Children functioning beyond the 6-month developmental level can be evaluated through

- ✎ behavioral observation audiology (BOA)
- ✎ visual reinforcement audiology (VRA)
- ✎ Can miss unilateral losses!

☺ Conventional Audiometry

- ✎ Tympanometry
- ✎ Speech

Implications of Hearing Loss in Children

- ☺Hearing is essential for learning to talk
- ☺The most critical period for acquiring spoken language is from birth to 3 years of age

☺The earlier hearing loss occurs in a child's life, the more serious the effects on the child's development.

✍️Similarly, the earlier the problem is identified and intervention begun, the less serious the ultimate impact.

☺Any hearing loss at this critical stage will have lasting impact on language, cognitive and social development

There are four major ways in which hearing loss affects children

☺It causes delay in the development of receptive and expressive communication skills (speech and language).

☺The language deficit causes learning problems that result in reduced academic achievement.

☺Communication difficulties often lead to social isolation and poor self-concept.

☺It may have an impact on vocational choices.

Vocabulary

☺Slower development in children who have hearing loss.

☺Difficulty with abstract and function words like *before, after, the, an, are*.

☺Children with hearing loss have difficulty understanding words with multiple meanings. For example, the word *bank* can mean the edge of a stream or a place where we put money.

Sentence Structure

☺Comprehend and produce shorter and simpler sentences

☺Difficulty understanding and writing complex sentences, such as those with relative clauses or passive voice

☺Children with hearing loss often cannot hear word endings such as *-s* or *-ed*. This leads to misunderstandings and misuse of verb tense, pluralization, nonagreement of subject and verb, and possessives.

Speaking

☺Often cannot hear quiet speech sounds such as "s," "sh," "f," "t," and "k" and therefore do not include them in their speech. Thus, speech may be difficult to understand.

☺May not hear their own voices when they speak.

✍️May speak too loudly or not loud enough.

✍️May have a speaking pitch that is too high.

✍️ May sound like they are mumbling because of poor stress, poor inflection, or poor rate of speaking.

Academic Achievement

☺️ Difficulty with all areas of academic achievement, especially reading and mathematical concepts.

☺️ On average, achieve one to four grade levels lower than their peers with normal hearing, unless appropriate management occurs.

☺️ With severe to profound hearing loss - usually achieve skills no higher than the third- or fourth-grade level, unless appropriate educational intervention occurs early.

☺️ The gap in academic achievement between children with normal hearing and those with hearing loss usually widens as they progress through school.

☺️ The level of achievement is related to parental involvement and the quantity, quality, and timing of the support services children receive.

Social Functioning

☺️ Children hearing losses often report feeling isolated, without friends, and unhappy in school, particularly when their socialization with other children with hearing loss is limited.

How to Treat Hearing Loss in Children

Medical & Surgical

☺️ Removal of foreign objects

✍️ Wax

✍️ Beads

✍️ crayons

☺️ Antibiotics for otitis media

☺️ Tubes for recurrent infections

Hearing Aids and Assistive Listening Devices

☺️ Infants as young as 4 weeks old can be fit with amplification

☺️ Children identified with hearing loss who begin services before 6 months old develop language on a par with their hearing peers

☺️ In educational and home settings, children frequently connect their hearing aids to assistive listening systems.

✍️ FM systems

☺️ Different types of hearing aids for different losses

Cochlear Implants

☺️ Children who are deaf or severely hard-of-hearing can be fitted for cochlear implants.

☺ According to the FDA, at the end of 2006, more than 112,000 people worldwide had received implants.

✍ In the United States, roughly 15,500 children have received them.

☺ The implant consists of an external portion that sits behind the ear and a second portion that is surgically placed under the skin.

✍ A microphone, which picks up sound from the environment.

✍ A speech processor, which selects and arranges sounds picked up by the microphone.

✍ A transmitter and receiver/stimulator, which receive signals from the speech processor and convert them into electric impulses.

✍ An electrode array, which is a group of electrodes that collects the impulses from the stimulator and sends them to different regions of the auditory nerve.

Auditory (re)Habilitation

☺ Most speech training approaches are dependent on optimizing the use of residual hearing although some approaches use other modalities

☺ Intervention methods are individualized and may include speech production, expressive/receptive language, vocabulary, and auditory/speech-reading training activities

Auditory Processing Disorders

What is Auditory Processing

☺ What happens when your brain recognizes and interprets the sounds around you.

✍ Each component of the sound, e.g., rhythm, tone, duration, is decoded by various parts of the brain.

☺ A very complex action involving many different processes.

☺ Auditory disorder, not the result of higher-order global deficit such as autism, mental retardation, etc.

☺ Not all learning, language, and communication deficits are due to APD.

☺ Only an audiologist can diagnose APD.

SYMPTOMS OF APD

☺ Trouble paying attention to and remembering information presented orally

☺ Problems carrying out multistep directions

☺ Poor listening skills

☺ Needs more time to process information

☺ Low academic performance

☺ Behavior problems

☺ Language difficulty (e.g., they confuse syllable sequences and have problems developing vocabulary and understanding language)

☺Difficulty with reading, comprehension, spelling, and vocabulary

Types of AP Problems

☺**Auditory Figure-Ground Problems:** difficulty paying attention when there's noise in the background.

☺**Auditory Memory Problems:** difficulty remembering information such as directions, lists, or study materials.

☺**Auditory Discrimination Problems:** difficulty hearing the difference between sounds or words that are similar.

☺**Auditory Attention Problems:** difficulty maintaining focus for listening long enough to complete a task or requirement .

☺**Auditory Cohesion Problems:** difficulty with higher-level listening tasks.

How is an Auditory Processing Disorder Diagnosed?

☺A full audiological examination is usually needed in conjunction with a speech and language evaluation for a proper diagnosis to be made.

☺It is very important that a variety of tests be administered that evaluate the different components of sound, and how they are processed by your child to determine the type of auditory deficit.

Treatment is a team approach

☺On your child's treatment team will be an audiologist, a speech language therapist, and any other team professional deemed necessary.

☺Treatment generally focuses on:

✍changing the learning or communication environment

✍recruiting higher-order skills to help compensate for the disorder

✍remediation of the specific auditory deficits

THANK YOU

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