



Hard of Hearing or Deaf

Service Delivery Guidelines

Intervention guidance for service providers and families of young children who are hard of hearing or deaf



ALASKA EARLY INTERVENTION / INFANT LEARNING PROGRAM

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HARD OF HEARING OR DEAF

EARLY INTERVENTION GUIDANCE FOR SERVICE PROVIDERS AND FAMILIES OF YOUNG
CHILDREN WHO ARE HARD OF HEARING OR DEAF

JUNE 2011



MISSION

To promote positive development and improved outcomes for Alaska's families by creating a culturally responsive, comprehensive and accessible service delivery system that links service providers, empowers families and engages communities

–Alaska Early Intervention/ Infant Learning Program

HARD OF HEARING OR DEAF

Alaska Early Intervention/Infant Learning Program

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INTRODUCTION

Hearing loss is one of the most common birth disorders in newborns, and approximately 33 Alaskan babies are born every year with permanent hearing loss. When combined with children who develop hearing loss after they are born, as many as 15 in every thousand Alaskan children will have some degree of hearing disorder (1); many more will experience temporary hearing loss as the result of ear infections and other illnesses.

Unfortunately even mild degrees of hearing impairment can interfere with a child's ability to communicate effectively if the condition is not identified. In infancy, this can limit a child's ability to connect with his or her family and surroundings and to express himself or herself and be understood. As a child gets older, unaddressed hearing loss can lead to low academic achievement, social isolation, low self-esteem and limited employment opportunities. According to the American Speech-Language-Hearing Association (ASHA), children with hearing loss continue to be an under identified and underserved population.

Research tells us that early identification and intervention can assist children with hearing loss to develop the communication skills they need to succeed academically and socially. All children deserve the chance to learn and explore their world, participate in family life and join their larger communities.

Alaska law requires the screening of newborns for hearing loss, which aids in early detection, however, parents are encouraged to consult their pediatrician or primary care physician and get their child tested if they suspect their child of having a hearing deficit. Young children may develop hearing loss after they are born due to a variety of childhood diseases, such as meningitis, mumps, jaundice, encephalitis, or any illness causing a high fever. Some strong prescription drugs, even when used correctly to combat a serious illness, may also result in hearing loss.

PURPOSE OF THE GUIDELINES

The purpose of these service delivery guidelines is to provide parents and service providers with an overview of the best practices for early intervention and support of young children with hearing loss. These include those approaches shown to result in the best outcomes for children from birth to three.

While most of the recommended practices in the guidelines do not carry the force of regulation, they are intended to guide parents and early intervention providers in

making informed decisions about the most appropriate assessment procedures and intervention practices.

Not all practices will be appropriate in all cases. The guidelines are intended to be flexible, not prescriptive or limiting, and to set the tone for the family to be an instrumental part of early intervention. An Individualized Family Service Plan (IFSP) should be developed for each child based on his or her particular needs, the resources available, and input from the family and the early intervention provider or team.

EARLY INTERVENTION SERVICES IN ALASKA

Early intervention services are federally mandated under Part C of the Individuals with Disabilities Education Act (IDEA), a federal law passed in 1986. IDEA requires states to ensure that young children who may have disabilities or developmental delays receive an evaluation to identify the potential need for early intervention.

Alaska's early intervention services are administered by the Department of Health and Social Services, Office of Children's Services, Early Intervention/Infant Learning Program (EI/ILP). They include a flexible array of services for children birth to three years of age who experience disabilities or developmental delays, or who are at risk for developmental delays.

EI/ILP partners with grantees to provide services directly to families at a local and regional level. In 2010, services were provided to children throughout the state by approximately 115 highly qualified staff employed within 17 regional grantee agencies. Programs vary widely by staff and region size. Service may include:

- Developmental screening and evaluation
- Individualized Family Service Plans to outline goals for the family and child
- Child development information
- Home visits
- Infant mental health services
- Physical, occupational or speech therapy
- Specialized equipment
- Referrals to other needed services

EI/ILP APPROACH TO SERVICE DELIVERY

Because no single professional can meet all the needs of a child with developmental delays, EI/ILP encourages the use of a *transdisciplinary* approach, with a primary service provider assigned to each child and a team of professionals from different disciplines who share their expertise with the parents and other team members as needed to support the child's progress and participation in daily activities in the family's home and community.

In addition to taking a team approach to service delivery, the core values of the EI/ILP support services that are *evidence-based* and *family-centered*. By listening to the family throughout the process, intervention techniques can be modified on a continual basis to match the child's and family's unique needs and strengths.

MORE INFORMATION

More information and resources for early intervention services in Alaska are available at the EI/ILP website. The site includes a statewide directory of EI/ILP programs that cover all regions of Alaska.

 www.hss.state.ak.us/ocs/InfantLearning

UNDERSTANDING SPEECH, LANGUAGE, AND AUDITORY DEVELOPMENT

"Communication is not only the essence of being human, but also a vital property of life." —John A. Piece

It is important for families that have a child or children with hearing loss to have a good understanding of the mechanics of hearing, the types and causes of hearing loss, how language typically develops, and how hearing loss affects that development.

Speech and language are tools that we use to communicate thoughts, ideas, and emotions. Language is the set of rules, shared by the individuals who are communicating, that allows them to exchange those thoughts, ideas, or emotions. Language may be expressed through speaking, writing, signing, gestures, eye blinks, mouth movements and technology to communicate.

While there are many languages in the world, each includes its own set of rules for *phonology* (phonemes or speech sounds or, in the case of signed language, handshapes), *morphology* (word formation), *syntax* (sentence formation), *semantics* (word and sentence meaning), *prosody* (intonation and rhythm of speech), and *pragmatics* (effective use of language).

Language development also includes the learning of *expressive language skills*, or the ability to use language, and *receptive language skills*, or the ability to understand what is said or communicated. In other words, receptive language is how much the child understands and expressive language is how well a child is able to show what he or she feels. As in any language, spoken or signed, in the initial stages of language development, a child often understands more than they can produce.

WHAT IS TYPICAL DEVELOPMENT OF SPEECH AND LANGUAGE?

The most intensive period of speech and language development is during the first three years of life, a period when the brain is rapidly developing and maturing. These skills appear to develop best in a world that is rich with sounds, sights, and consistent exposure to the speech and language of others.

Increasing evidence suggests that there are critical periods for speech and language development in infants and young children. This means that the developing brain is best able to absorb a language, any language, during this period. The ability to learn a language will be more difficult, and perhaps less efficient or effective, if these critical periods are allowed to pass without early exposure to a language.

Although children vary in their development of speech and language, there is a natural progression or timetable for learning language. The milestones can serve as a guideline to typical development, and can help determine when a child needs extra support.

Typical Speech, Language, and Auditory Milestones

The beginning signs of communication occur during the first few days of life when an infant learns that a cry will bring food, comfort, and companionship. The newborn also begins to recognize important sounds in his or her environment. The sound of a parent's voice will be one important sound. As they grow, infants begin to sort out the speech sounds (*phonemes*) or building blocks that compose the words of the language they hear every day. Research has shown that by six months of age, most children recognize the basic sounds of their native spoken language.

The following checklist from the National Institute on Deafness and Other Communication Disorders (NIDCD) can help identify whether a child's speech and language skills are developing on schedule.

Table 1: Typical Speech and Language Milestones

Child's Age	Speech and Language Milestones
Birth to 5 months	<ul style="list-style-type: none"> Reacts to loud sounds Turns head toward a sound source Watches your face when you speak Vocalizes pleasure and displeasure sounds (laughs, giggles, cries, or fusses) Makes noise when talked to
6 - 11 months	<ul style="list-style-type: none"> Understands "no-no" Babbles (says "ba-ba-ba" or "ma-ma-ma") Tries to communicate by actions or gestures Tries to repeat your sounds
12 - 17 months	<ul style="list-style-type: none"> Attends to a book or toy for about two minutes Follows simple directions accompanied by gestures Answers simple questions nonverbally Points to objects, pictures, and family members Says two to three words to label a person or object (pronunciation may not be clear) Tries to imitate simple words
18 - 23 months	<ul style="list-style-type: none"> Enjoys being read to Follows simple commands without gestures Points to simple body parts such as "nose" Understands simple verbs such as "eat," "sleep" Correctly pronounces most vowels and n, m, p, h, w, b, especially in the beginning of syllables and short words. Also begins to use other speech sounds Says 8 to 10 words (pronunciation may still be unclear) Asks for common foods by name Makes animal sounds such as "moo" Starting to combine words such as "more milk" Begins to use pronouns such as "mine"
2 - 3 years	<ul style="list-style-type: none"> Knows about 50 words at 24 months Knows some spatial concepts such as "in," "on" Knows pronouns such as "you," "me," "her" Knows descriptive words such as "big," "happy" Speech is becoming more accurate but may still leave off ending sounds. Strangers may not be able to understand much of what is said Answers simple questions Begins to use more pronouns such as "you," "I" Speaks in two to three word phrases Uses question inflection to ask for something (e.g., "My ball?") Begins to use plurals ("shoes" or "socks") and regular past tense verbs ("jumped")

Source: National Institute on Deafness and Other Communication Disorders, National Institutes of Health, 2010 (www.nidcd.nih.gov/health/voice/speechandlanguage.html)

ENSURING LANGUAGE ACQUISITION THROUGH AMERICAN SIGN LANGUAGE (ASL)

A child is naturally inclined to use language, and whether gestures or speech, the early and often exposure to a language helps a child develop cognitive, social, emotional and psychological skills. Acquisition of American Sign Language differs from the acquisition of a spoken language, however, with understanding and communication milestones reached *earlier* than spoken languages (2).

There are numerous studies that show that ASL does not impede the acquisition of English, particularly when ASL is taught as a first language, when a deaf or hard of hearing child would otherwise spend the most critical months of language acquisition being exposed to little or no language at all (3).

“Too many Deaf children grow up in homes where they do not share a language with their parents or caregivers. Many of these children are not given adequate or timely opportunity to acquire a first language or develop the conceptual knowledge that interaction through a language promotes. Crucial developmental milestones for language acquisition in the early years are passed with minimal linguistic input. Academic achievement in subsequent years, which depends on strong language and conceptual abilities, is consequently an uphill battle.” (4)

HOW HEARING WORKS

Hearing is one of the five senses. It is a complex process of picking up sound and attaching meaning to it. The human ear is fully developed at birth and responds to sounds that are very faint as well as ones that are very loud. Even before birth, infants respond to sound. The ability to hear is critical to the attachment of meaning to the world around us (5).

ANATOMY OF THE HUMAN EAR

There are three main parts of the human ear— the outer ear, the middle ear, the inner ear. From the inner ear, the acoustic nerve carries electric signals to the brain’s central auditory system. This complex hearing mechanism is necessary to carry sound from our environment through the structures of the ear to the brain so it can be processed, giving us vital information about our surroundings.

Figure 1: Anatomy of the Human Ear

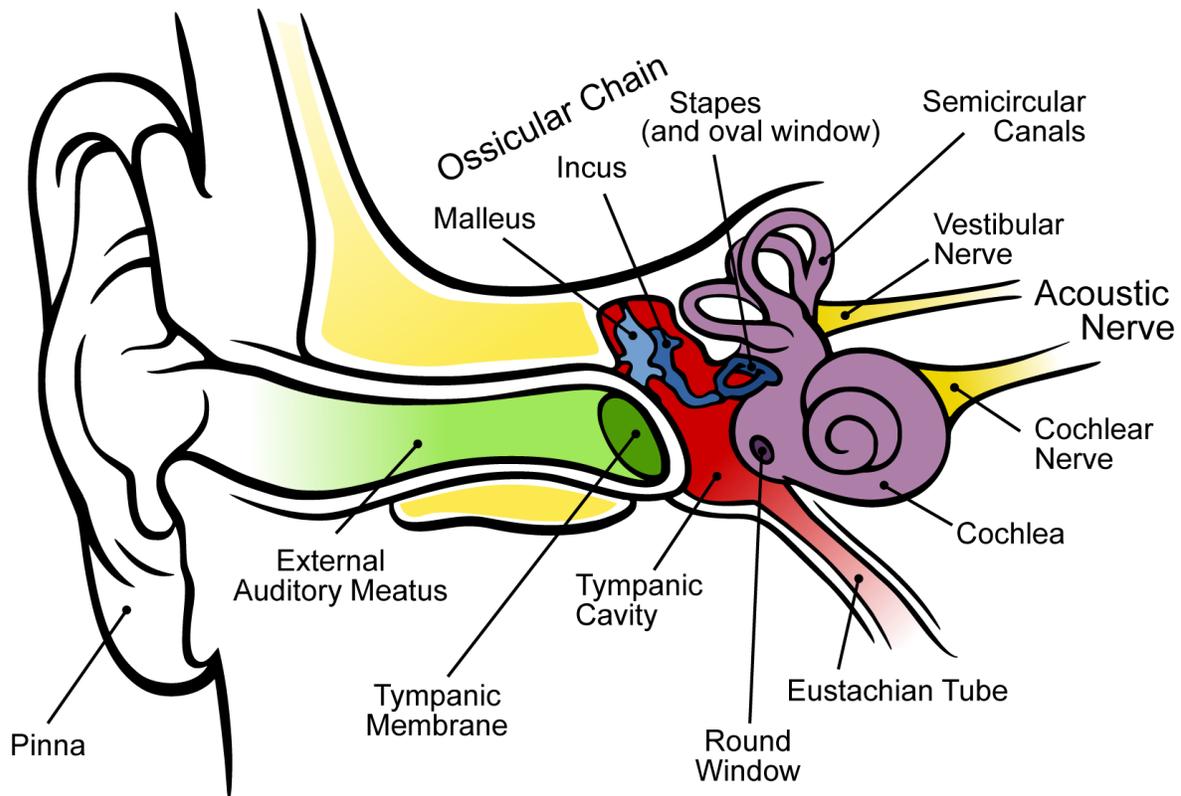


Illustration: Chittka L, Brockmann, Creative Commons

Outer Ear

The outer ear consists of the *pinna*, or *auricle*, and the ear canal (*external auditory meatus*). The pinna, the visible portion of the external ear, is made of cartilage and soft tissue so that it maintains a particular shape but is also pliable. The pinna serves as a collector of sound vibrations around us and funnels the vibrations into the ear canal. It assists us in determining the direction and source of sound.

The ear canal is about an inch long and ¼-inch in diameter. It extends from the pinna to the eardrum (*tympanic membrane*). The outer foundation of the ear canal is cartilage. The skin covering the cartilage contains hairs and glands that secrete wax. The hairs and wax help to prevent foreign bodies, such as insects or dust, from entering the ear canal. Near the eardrum, the wall of the ear canal becomes bony and covered tightly by skin.

Middle Ear

The middle ear begins at the eardrum at the end of the ear canal. The middle ear contains three tiny bones called the *ossicles*. These three bones form a connection from the eardrum to the inner ear. As sound waves hit the eardrum, it moves back and forth causing the ossicles to move. Thus the sound wave is changed to a mechanical vibration.

The first bone, the hammer (*malleus*) is connected to the eardrum. The hammer connects to the second ossicle, the anvil (*incus*), and then the anvil connects to the third bone, the stirrup (*stapes*). The mechanical energy transmitted through the three bones (*ossicular chain*) causes the in-and-out movement of the base of the stirrup (stapes footplate) in patterns that match those of the incoming sound waves. The stapes footplate fits into the *oval window*, the membrane at the point where the inner ear begins.

The middle ear is located in the mastoid section of the temporal bone (a skull bone on each side of the head) and is filled with air. A tube called the *eustachian tube* runs from the front wall of the middle ear down to the back of the nose and throat (the nasopharynx). This tube provides ventilation and access to outside air and equalizes air pressure on both sides of the eardrum—the middle ear side and the outer ear side. We can feel the eustachian tube at work when we feel air pressure changing in our ears as we yawn, chew, or swallow.

Because of the facial and skull structure of children, the eustachian tube runs almost level between the middle ear and the *nasopharynx*, rather than being in a more downward slanting position as it does in adults. The flat positioning of the tube in children creates risk for infection traveling from the nasopharynx into the middle ear.

Inner Ear

The inner ear contains the sensory organs for hearing and balance. The *cochlea* is the hearing part of the inner ear. The *semicircular canals*, the *utricle* and the *sacculle* are the part of the inner ear that control balance.

The cochlea is a bony structure shaped like a snail and filled with fluid. The mechanical energy from movement of the middle ear bones pushes in the oval window membrane in the cochlea. This force moves the cochlea's fluids which, in turn, stimulate tiny hair cells, the nerve receptors for hearing. Individual hair cells respond to specific sound frequencies (*itches*) so that, depending on the pitch of the sound, only certain hair cells are stimulated.

Signals from these hair cells are translated into nerve impulses. The nerve impulses are transmitted to the brain by the *cochlear nerve*, the hearing portion of the *acoustic* or *auditory nerve*. (The other part of acoustic nerve is the *vestibular nerve* which carries spatial orientation information from the semicircular canals.)

Acoustic Nerve

The acoustic nerve carries impulses from the cochlea to a relay station in the mid-brain, the *cochlear nucleus*, and on to other brain pathways that end in the auditory cortex of the brain.

At the cochlear nucleus, nerve fibers from each ear divide into two pathways. One pathway ascends straight to the auditory cortex on one side or hemisphere of the brain. The other pathway crosses over and ascends to the auditory cortex on the

other side of the brain. As a result, each hemisphere of the brain receives information from both ears.

Brain's Central Auditory System

The central auditory system deals with the processing of auditory information as it is carried to the brain. Central auditory processes are the auditory processes responsible for the following behaviors:

- Sound localization and lateralization
- Auditory discrimination (hearing the differences between different sounds)
- Recognizing patterns of sounds
- Time aspects of hearing (temporal aspects of audition): temporal resolution, temporal masking, temporal integration, temporal ordering
- Reduction in auditory performance in the presence of competing acoustic signals
- Reduction in auditory performance in the presence of degraded (less than complete) acoustic signals

CAUSES OF HEARING LOSS

A number of conditions can lead to hearing loss or deafness, including ear infections (*otitis media*), congenital causes and acquired causes.

Otitis Media

Otitis media is an inflammation in the middle ear (the area behind the eardrum) that is usually associated with a buildup of fluid, which may or may not be infected.

Symptoms, severity, frequency, and length of the condition vary. At one extreme is a single short period of inflammation without any pain or fever but with a thin, clear, non-infected fluid and a slight, temporary decrease in hearing ability. At the other extreme are repeated bouts of infection with thick, glue-like fluid and possible complications, including the possibility of permanent hearing loss. Fluctuating hearing loss nearly always occurs with all types of otitis media. In fact it is the most common cause of hearing loss in young children.

Otitis media is the most frequently diagnosed disease in infants and young children (6). Seventy-five percent of children experience at least one episode of otitis media by their third birthday. Almost one-half of these children will have three or more ear infections during their first three years of life (7). Health care costs for otitis media in the United States have been reported at \$3 billion to \$5 billion per year (8).

Otitis media is common in children because the eustachian tube, a passage between the middle ear and back of the throat, is smaller and more nearly horizontal in children than in adults. As a result, it can be blocked more easily by large adenoids, infections and other conditions. Until the eustachian tube changes in size and angle as the child grows, children are more susceptible to otitis media. While fever and ear

A Note about Ear Infections in Alaska

Ear infection or otitis media (see page15) is the inflammation of the middle ear, usually with fluid, which may or may not be infected. The condition is very common in young children, particularly in Alaska, and is a common reason for visits to the pediatrician. Otitis media often occurs in repeated bouts, causing periods of hearing loss that can affect young children during the critical time for language and speech acquisition. Some evidence exists that Alaska Native children (especially Eskimo groups) suffer ear infections at higher rates than other ethnic groups (13). Additionally, environmental conditions present in many Alaskan homes also contribute to increased rates of ear infection such as poor indoor air quality from wood smoke and tobacco use (14).

pains are common symptoms, a parent may observe any of the following symptoms in very young children suffering from ear infection:

- Inattentiveness
- Wanting the television or radio louder than usual
- Misunderstanding directions
- Listlessness
- Unexplained irritability
- Pulling or scratching at the ears

Unfortunately otitis media can cause more than just temporary discomfort; it can cause temporary or permanent hearing loss. Three tiny bones in the middle ear carry sound vibrations from the eardrum to the inner ear. When fluid is present, the vibrations are not transmitted efficiently and sound energy is lost. The result may be mild or even moderate hearing loss. Therefore, speech sounds are muffled or inaudible. Generally, this type of hearing loss is *conductive* and is temporary. However when otitis media occurs over and over again, damage to the eardrum, the bones of the ear, or even the hearing nerve can occur and cause a permanent, *sensorineural* hearing loss.

Congenital Causes

The term congenital hearing loss implies that the hearing loss is present at birth. It can include hereditary hearing loss or hearing loss due to other factors present either *in utero* (prenatal) or at the time of birth.

Genetic factors are thought to cause more than 50 percent of all incidents of congenital hearing loss in children (9). Genetic hearing loss may be *autosomal dominant*, *autosomal recessive*, or *X-linked* (related to the sex chromosome).

- **Autosomal dominant hearing loss.** In autosomal dominant hearing loss, one parent who carries the dominant gene for hearing loss (and who typically has a hearing loss) passes it on to the child. In this case, there is at least a 50 percent

probability that the child will also have a hearing loss. The probability is higher if both parents have the dominant gene or if both grandparents on one side of the family have hearing loss due to genetic causes. Because at least one parent will typically have a hearing loss in either case, there is a prior expectation that the child may have a hearing loss.

- **Autosomal recessive hearing loss.** In autosomal recessive hearing loss, both parents who typically have normal hearing carry a recessive gene for hearing loss. In this case the probability of the child having a hearing loss is 25 percent. Because both parents usually have normal hearing, and especially if no other family members have hearing loss, there is no prior expectation that the child may have a hearing loss.
- **X-linked hearing loss.** In X-linked hearing loss, the mother carries the recessive trait for hearing loss on the sex chromosome and passes it on to males, but not to females.

There are some genetic syndromes in which hearing loss is one of the known characteristics. Examples are Down syndrome (abnormality on a gene), Usher syndrome (autosomal recessive), Treacher Collins syndrome (autosomal dominant), Crouzon syndrome (autosomal dominant), and Alport syndrome (X-linked).

Causes of congenital hearing loss that are not hereditary in nature include prenatal infections, illnesses, toxins consumed by the mother during pregnancy, or other conditions occurring at the time of birth or shortly thereafter. These conditions typically cause sensorineural hearing loss ranging from mild to profound in degree. Examples include:

- Intra-uterine infections including rubella (German measles), cytomegalovirus, and herpes simplex virus
- Complications associated with the Rh factor in pregnancy
- Prematurity
- Maternal diabetes
- Toxemia during pregnancy
- Lack of oxygen (anoxia)

Late Onset or Acquired Hearing Loss

Late onset or acquired hearing loss is a hearing loss which appears after birth at any time in one's life, perhaps as a result of infection, disease, or injury. The following are examples of conditions that can cause acquired hearing loss in children are:

- Ear infections (see otitis media, page 15)
- Ototoxic drugs (drugs damaging to the auditory system)
- Meningitis
- Measles
- Encephalitis

- Chicken pox
- Influenza
- Mumps
- Head injury
- Noise exposure (10)
- Inherited

TYPES OF HEARING LOSS

The typically functioning ear responds to a wide range of frequencies (pitches) and intensities (loudness). Hearing loss generally reduces the intensity of a sound and can affect different frequency ranges, depending on the type and degree of hearing loss.

Conductive Hearing Loss

Conductive hearing loss occurs when there is a problem in the outer or middle ear. The most common cause of conductive hearing loss in young children is ear infections (see otitis media, page 15). It is important that ear infections be treated by a physician as quickly as possible to reduce the potential for hearing loss. Many children experience episodes of middle ear problems with no permanent hearing loss. Yet even with medical treatment, middle ear fluid that lasts for several months can result in significant developmental delays. Children with hearing loss are eligible for early intervention services through EI/ILP.

Conductive hearing loss in young children may also be due to a physical abnormality of the outer or middle ear.

Sensorineural Hearing Loss

Sensorineural hearing loss occurs in the inner ear (cochlea) and/or auditory nerve. Early causes of sensorineural hearing loss including genetic conditions, loss of oxygen during delivery, extremely low birth weight, and maternal viruses or drug use (particularly in the first trimester). A child also may be born with normal hearing and acquire a loss due to a viral disease such as meningitis, exposure to certain prescribed drugs and inherited conditions.

Mixed Hearing Loss

When a child has both conductive and sensorineural loss, it is called a mixed hearing loss. Children with permanent sensorineural hearing loss are as susceptible to middle ear infections as children with normal hearing. When they have fluid in the middle ear it may add a conductive component to their existing hearing loss making it even more difficult for them to hear.

Auditory Neuropathy or Auditory Dys-synchrony

Auditory neuropathy or auditory dys-synchrony (AN/AD) is an unusual and often confusing type of hearing loss that occurs when the inner ear is working normally, but when sound transmitted to the brain is not processed normally. A child with AN/AD may pass certain types of hearing tests such as otoacoustic emissions (OAE) tests, but fail others such as auditory brainstem evoked response (ABER). The child may seem to hear normally or may have a hearing loss ranging from mild to profound. Often a child's hearing will fluctuate and seem to be worse on some days than others.

Unilateral Hearing Impairment

Unilateral hearing impairment is a hearing loss in one ear, while the other ear has normal hearing sensitivity. In children, a unilateral hearing impairment can have a negative impact on the development of speech and language. Children will have difficulty hearing when background noise is present and in locating where a sound is coming from. They may also have difficulty understanding faint or distant speech. Since children with unilateral hearing loss are at risk for developing communication delays, it is important that parents learn strategies to foster development of spoken communication. A significant number of children with unilateral hearing loss later develop bilateral hearing loss.

ASSESSING HEARING LOSS

EARLY IDENTIFICATION AND DIAGNOSIS IS ESSENTIAL

All babies born in Alaska hospitals receive a newborn hearing screening before going home from the hospital. This test is usually performed while a baby sleeps and determines whether the newborn's hearing is functioning properly. Infants who are identified through newborn hearing screening are referred for testing by a pediatric audiologist. The pediatric audiologist is able to do a more thorough test of the baby's hearing to determine whether or not there is hearing loss.

The Alaska Early Hearing Detection and Intervention (EHDI) program works closely with medical providers and EI/ILP to coordinate and track newborn hearing screening, assessment and follow up services for infants and young children with hearing loss.

According to the Joint Committee on Infant Hearing, federal rules require that once any degree of hearing loss is identified in an infant, the child should be referred to early intervention services within two days and services should start as soon as possible, but no later than six months of age.

BEHAVIORAL CHARACTERISTICS OF CHILDREN WHO ARE HARD OF HEARING OR DEAF

Although the newborn hearing screening process is reliable, there are children who will not be identified through the screening and children who develop a hearing loss after the initial screening or after a later audiological examination. Therefore, families should continue to watch babies for behaviors that may indicate a hearing loss.

The following list of behaviors may indicate a problem with a child's hearing. If the answer to any of the following questions is "no," the family should speak with their pediatrician or primary care physician about having their child's hearing tested by a pediatric audiologist.

By 3 months

- Does the child startle or cry at loud noises in the environment?
- Does the child respond to sounds or your voice?

By 6 months

- Does the child like toys that make sound?
- Does the child turn to locate where a sound is coming from?

By 9 months

- Does the child turn and look when you call his or her name?
- Does the child respond to “no” or changes in the tone of your voice?

By 12 months

- Does the child babble and make sounds?
- Does the child understand the names of some simple objects such as “cup” or “shoe”?

By 15 months

- Does the child respond to simple directions?
- Does the child say some simple words?

HEARING PROFESSIONALS

The evaluation of a young child’s hearing is often a process that requires more than one visit to the audiologist. It is important that families find the appropriate professional to evaluate their child’s hearing. Audiological assessment and management should be conducted by staff trained to work with infants and young children. Although a number of professionals are capable of testing hearing, not all will be able to test an infant or young child, make a diagnosis, and recommend ongoing audiological services.

The professionals described below are involved with hearing management. A family’s local or regional EI/ILP provider can also share a list of professionals with whom they collaborate on a regular basis. Families may choose one of these professionals or ask their family physician for a recommendation and referral. In addition, a family’s health insurance company may have a list of “in-network” providers whose services are covered under their health care plan.

- **Audiologists.** Audiologists are trained to identify, diagnose, and manage all types and degrees of hearing loss. They are qualified to test hearing, prescribe hearing aids, and other assistive listening equipment, and to make recommendations for cochlear implant evaluations. Pediatric audiologists specialize in working with infants, toddlers, and preschoolers. Although all audiologists know about hearing loss, only pediatric audiologists are trained to diagnose hearing loss and provide amplification for very young children.
- **Pediatric Audiologists.** A pediatric audiologist has testing equipment that is specifically designed to be used with infants and toddlers. They use procedures for testing hearing that are appropriate for the child’s age and development. Parents of children eligible for EI/ILP services should consider the following criteria when choosing a pediatric audiologist to work with their young child.

TYPES OF HEARING TESTS USED WITH YOUNG CHILDREN

There are many different types of hearing tests. Tests used with a young child will depend on the child's age, ability to respond, and the reason the test is being performed. Often different kinds of tests are used together to determine the type and extent of hearing loss. The following is a brief description of the tests typically used by a pediatric audiologist.

Auditory Brainstem Response Measures (ABR). This may also be called *Brainstem Evoked Auditory Response (BEAR)* or *Auditory Brainstem Evoked Response (ABER)*. The test requires no voluntary response from the child. Earphones placed on or in the child's ears present the sounds, and electrodes on the surface of the scalp measure the electrical response of the child's auditory nerve, which are recorded by a computer. This method should be used for all infants under four months of age. The test usually takes place while the child is sleeping, but a child may be sedated if necessary. The use of sedation is rare for very young children. If a child requires sedation, the test must be conducted in a hospital. Although an automated ABR may be used in the hospital as part of newborn screening, it is not used as a diagnostic test. A diagnostic ABR performed by an audiologist takes longer and requires different equipment.

Auditory Steady State Response (ASSR). This test requires no voluntary response from the child. Once again, responses to sounds presented through insert earphones are measured through electrodes on the scalp. The audiologist reads a waveform that indicates the response of the child's auditory nerve and estimates the child's hearing levels across frequencies. The benefit of ASSR is that the results may provide more specific threshold information for infants who have profound hearing losses. This helps the audiologist in making decisions about hearing aid fittings or determining cochlear implant candidacy. At the present time ASSR is not available in all audiological clinics. For infants under four months no sedation is necessary.

Otoacoustic Emissions (OAE). This test requires no voluntary response from the child. A small probe is placed in the child's ear and sound is presented. When the ear receives the sound it sends an echo back through the ear, which is recorded by a tiny microphone in the probe. A computer then measures this response. This test will be conducted as part of a battery of tests for children less than three years of age. Although no sedation is necessary, if a child is being sedated for ABR, the audiologist may choose to do this test at the same time. OAE procedures used in newborn screening are not as comprehensive as those used for diagnostic purposes.

Immittance Measures. This test requires no voluntary response from the child. It is conducted by placing a small probe in the child's ear and introducing a low-pitched tone. For babies six months and younger a specialized higher pitched tone must be used. There is a small pump in the probe that changes the air pressure in the ear canal. This does not cause any discomfort to the child. The change in pressure causes the eardrum to move and a computer measures how the eardrum responds

to that pressure change. The audiologist can determine if there is any problem such as fluid in the middle ear space. The purpose of this test is to determine if there is anything wrong in the middle ear that needs to be evaluated by a pediatrician or an otolaryngologist, but it does not measure whether the child has a hearing loss or how much of a loss exists.

Behavioral Observation Audiometry (BOA). This test is conducted in a sound proof booth and requires a response from the child. Sounds are presented either through earphones or through loudspeakers. The pediatric audiologist uses an audiometer to present different sounds at different frequencies (pitches). The child's response to the sound such as eye widening or head turning is noted. The loudness of the sound is varied to determine the softest level to which the child responds. If the child is able to wear earphones, the response of the individual ears can be measured. When the loudspeakers are used, the audiogram (a graph of the test results) will describe the better of the two ears if an ear difference exists. BOA is appropriate for infants younger than six months of age. Although BOA is not used by itself to determine hearing levels, when it is used in conjunction with ABR, OAE and immittance measures, the pediatric audiologist can describe the hearing loss and make recommendations for hearing aids or other treatment.

Visual Reinforcement Audiometry (VRA). This test is conducted in a sound proof booth and requires a response from the child. Sounds are presented either through earphones or loudspeakers. The sound may also be presented through a small vibrator placed behind the ear. In VRA, the infant or toddler learns to turn toward an interesting toy when he or she hears a sound. This is done by pairing the child's response to the sound with the activation of a toy that lights up or moves. The pediatric audiologist uses an audiometer to present different frequencies (pitches) and controls the toy that reinforces the child for correct responses. The intensity (loudness) is varied to determine the softest level at which the child reliably responds to each pitch. The pediatric audiologist records the results on an audiogram. Immittance measures should be done in addition to this test to aid in diagnosing the type of hearing loss. With this information, the audiologist will be able to recommend hearing aids or other forms of treatment. This test is appropriate when infants can turn in response to sound, typically by six months of age.

Conditioned Play Audiometry (CPA). This test is conducted in a sound proof booth using earphones (air conduction) or by placing a vibrator behind the ear (bone conduction). It may also be done through loudspeakers if a child will not accept headphones. For this test, the child learns to respond to a sound by performing a task such as throwing a ball in a bucket. The pediatric audiologist uses an audiometer to present sounds at different pitches or frequencies and praises the child for the correct response (ball in bucket). The loudness or intensity of the sound is varied to determine the softest level at which the child repeatedly responds. The pediatric audiologist will record the results on an audiogram.

Immittance measures should be done in addition to this test to aid in diagnosing the type of hearing loss. With this information, the audiologist will be able to recommend hearing aids and other forms of treatment. This test is appropriate for children who can be trained to perform the play activity, typically by 30 months of age.

EFFECTS OF HEARING LOSS ON SPEECH AND LANGUAGE DEVELOPMENT

It is important to reiterate that the effects of hearing loss, even minimal loss, is profound. Table 2 describes the speech, language and psychosocial effects of different levels of hearing loss, from minimal to profound. It is taken from the *Professional Preparation of Cochlear Implants (PPCI)*.

Table 2: Effects of Different Levels of Hearing Loss

<p>MINIMAL HEARING LOSS (16 - 25 DB HL)</p> <p>Speech and Language Effects</p> <ul style="list-style-type: none"> ▪ Vowel sounds heard clearly ▪ May miss unvoiced consonant sounds ▪ Difficulty hearing faint or distant speech ▪ At 16 dB HL can miss up to 10 percent of speech signal when teacher at a distance greater than three feet ▪ At 20 dB HL or greater can result in absent, inconsistent or distorted parts of speech, especially word endings (s, ed) and unemphasized sounds ▪ With a 20 db HL hearing loss may miss morphologic markers or sporadically misunderstand ▪ Very short words will lose considerable loudness 	<ul style="list-style-type: none"> ▪ Inflections or markers carrying subtle nuances such as questioning may come through inconsistently ▪ Percent of speech signal missed will be greater when there is background noise <p>Psychosocial Effects</p> <ul style="list-style-type: none"> ▪ Unawareness of subtle conversation cues may cause child to be viewed as inappropriate or awkward ▪ May miss portions of fast-paced peer interaction which could have impact on socialization and self concept ▪ May exhibit immature behavior ▪ May be fatigued due to extra effort needed for understanding speech
<p>MILD HEARING LOSS (26 - 40 DB HL)</p> <p>Speech and Language Effects</p> <ul style="list-style-type: none"> ▪ Will hear some of speech sounds, primarily the louder voiced sounds ▪ Can "hear" but misses fragments leading to misunderstanding ▪ Can hear one-on-one conversation and follow directions in a quiet environment at close range, particularly if the speaker's face is seen ▪ Hears vowel sound clearly ▪ Misses short unstressed words (an, the, of) ▪ Misses voiceless consonants (f, k, p, s, t) which may interfere with understanding past tenses or plurals ▪ Has difficulty understanding in noisy environments ▪ May not hear faint or distant speech ▪ May leave out certain sounds or words ▪ Speech may be hard to understand ▪ Vocabulary and language may be limited with word endings or whole ▪ Words left out ▪ Will miss consonants, especially when a high frequency hearing loss is present ▪ Hears only the louder, voiced speech sounds 	<ul style="list-style-type: none"> ▪ Short unstressed words and less intense speech sounds (ie: voiceless stops and fricatives) are inaudible ▪ Degree of difficulty in school depends upon noise level in classroom, distance from teacher and configuration of hearing loss ▪ At 30 db hl can miss 25 – 40 % of speech signal ▪ At 35 - 40 db hl may miss 50% or more of class discussions ▪ Will miss brief or unemphasized words and consonants ▪ Often experience difficulty learning early reading skills such as letter/sound association <p>Psychosocial Effects</p> <ul style="list-style-type: none"> ▪ May have negative impact on self esteem as accused of "hearing when he/she wants to", "daydreaming" or "not paying attention" ▪ May believe is less capable due to difficulties understanding ▪ Begins to lose ability for selective listening ▪ Has increasing difficulty suppressing background noise causing learning environment to be more stressful ▪ May be more fatigued due to effort needed to listen
<p>MODERATE HEARING LOSS (41- 55 dB HL)</p>	<ul style="list-style-type: none"> ▪ Reduction of cues and information leads to

Speech and Language Effects

- Without amplification, will understand conversational speech at a distance of 3 - 5 feet only if sentence structure and vocabulary are controlled
- Speech signal missed can be 50 - 75% with 40 db hl loss and 80+% with 50 db hl loss
- Likely to have delayed or disordered syntax, limited vocabulary, imperfect speech production and flat voice quality
- May have inattention and learning problems
- Will have confusion of speech sounds
- May have limited vocabulary
- Can learn rhythm of speech well
- Vocal quality can be fair
- Speech intelligibility jeopardized
- Will not have clear access to verbal instruction due to typical noise in class
- Will miss most conversational speech sounds
- Will have difficulty learning abstraction in the meaning of words and the grammatical rules of language because do not hear some of the speech sounds and hear other speech sounds inaccurately
- Vowels are heard better than consonants
- Short, unstressed words such as prepositions, and relational words as well as word endings are particularly difficult to hear

- confusion among speech sounds and word meanings, limited vocabulary, difficulty with multiple meanings of words, difficulty in developing objects classes, confusion of grammatical rules, errors in word placement in sentences and omission of articles, conjunctions and prepositions will have omissions and distortions of consonants
- Strangers may have difficulty understanding speech

Psychosocial Effects

- Negative impact on self esteem as is accused of "hearing when he/she want to", "daydreaming' or "not paying attention"
- Communication can be significantly affected and socialization with peers can be difficult
- More fatigued than classmates due to effort needed to listen
- Often with this degree of hearing loss, communication is significantly affected, and socialization with peers with normal hearing becomes increasing difficult
- The child may be judged as a less competent learner
- There is an increasing impact on self-esteem

MODERATE TO SEVERE (56 - 70 DB HL)

Speech and Language Effects

- With hearing aids can usually "hear" people talking around him/her but will miss fragments of what is said resulting in difficulty in situations requiring verbal communication
- Without amplification, conversation must be very loud to be understood
- 55 db hl loss can cause child to miss up to 100% of speech intonation without working amplification
- Delayed spoken language, syntax, reduced speech intelligibility, flat voice quality likely
- Reliance on vision to complement hearing to achieve functional access to communication
- Age when amplified, consistency of hearing aid use and amount of language intervention strongly tied to development of speech, language and learning
- Has no access through audition to speech

- Nasal resonance possible
- Multiple confusions of speech placements
- Reading jeopardized
- With hearing aids can hear: clock ticking, liquid pouring, snapping fingers, doorbell, knock at the door, radio at normal level, voices, singing, conversation
- Language and speech will not develop spontaneously
- Cannot hear sounds or normal conversation
- Can hear own vocalizations, albeit distorted, some very loud environmental sounds and only the most intense conversational speech
- When spoken loudly at close range
- Results in severe speech/language problems

Psychosocial Effects

- Communication is significantly affected and socialization with peers can be difficult
- May result in child being judged by both peers and adults as less competent learner, resulting in poorer self concept, social

- Intelligibility poor
- May hear some very loud sounds
- Has poor vocal quality because cannot hear self

maturity and contributing to a sense of rejection

SEVERE HEARING LOSS (71- 90 DB HL)

Speech and Language Effects

- Without amplification may hear loud voices about one foot from ear
- When amplified, with hearing ability of 90 db hl or better should be able to identify environmental sounds and detect all the sounds of speech
- Hearing is difficult in all situations
- May hear a loud voice, but not understand what is said
- Hears environmental sounds such as a door slamming
- Does not hear a conversation without amplification
- Understands very little without the use of vision
- Spoken language development will be delayed or may not develop on its own
- Requires amplification and speech training to develop speech skills
- With hearing aids can hear: thunder, telephone ringing, alarm clock, piano, auto horn, radio at louder than average level, group singing, loud shouts, baby crying
- May be able to discriminate vowels, but not all consonants
- Can only learn language and speech with intensive special education
- Hearing loss results in severe language retardation, speech problems, voice, articulation, resonance and prosody problems

- Vocal pitch is frequently higher than that of normal-hearing people and the prosodic features of intonation and stress are missing, giving their voices a monotone quality
- Slow temporal patterning
- Inefficient use of the breath stream
- Prolongation of vowels
- Distortion of vowels
- Excessive nasality
- Articulation may have excessive mandibular movement, lack of tongue movement, posterior tongue positions, voiced-voiceless confusions for consonants, problems with coarticulation, substitution of visible sounds for those sounds that are difficult to see, better articulation for initial speech sounds than for medial or final speech sounds, stop/plosive confusion, and the intrusion of an undifferentiated neutral vowel between abutting consonants
- Naive listeners understand 20 - 25% of speech
- Use concrete rather than abstract words and concepts with poor syntactic constructions

Psychosocial Effects

- Child may prefer other children with hearing impairments as friends and playmates which may further isolate the child from the mainstream, however, these peer relationships may foster improved self concept and a sense of cultural identity

PROFOUND HEARING LOSS (91+ DB HL)**Speech and Language Effects**

- May not hear even loud speech or environments sounds
 - May be aware of vibration
 - May not use hearing to communicate
 - Does not understand without use of vision
 - Oral speech and language will not develop on its own
 - Pronunciation, pitch and rhythm are often poor
 - Severe language delay is possible
 - Does not develop spoken language without amplification and special training
- No sound awareness even for very loud speech
 - Very poor vocal quality
 - Poor breath control for speech
 - Vowels prolonged
 - Excessive nasality
 - Poor oral lingual movement
 - Confusion of placement of production for consonants
 - Intrusive neutral sounds for glides
 - Poor intelligibility
 - May hear some loud sounds but is aware of vibrations more than tones
 - Using hearing aid can hear: organ, audience applauding, heavy objects dropped on a hard floor, banging door, large deep bell (11)
-

APPROACHES TO INTERVENTION

Once a child is determined eligible for services, an EI/ILP family service coordinator can help the family put together a team of providers to develop an IFSP, based on the child's unique needs and strengths, while also providing support for the child and family.

For the child who is deaf or hard of hearing, the IFSP team might include an audiologist, speech language pathologist, early childhood special educator, occupational therapist and others, depending on the child's needs and the family's concerns and priorities. Generally, the team should include a licensed deaf educator, either directly serving the child or as a consultant to the other team members.

Further assessment of the child and of the family's priorities, concerns, and resources may be done after eligibility is determined to help identify the outcomes that will be addressed in the IFSP and the supports necessary to achieve the outcomes. The team will also consider assistive technology options and can help look for funding if necessary. The IFSP will include a plan for transitioning the child to school- and community-based services after age three.

PRINCIPLES OF EARLY INTERVENTION

The following basic principles should guide families and service providers in developing an effective intervention plan for young children experiencing communication delays due to hearing loss.

THE INTERVENTION TEAM SHOULD BE TRANSDISCIPLINARY

There are many professionals who work together to make up the intervention team, although one person may fill multiple roles on the team. EI/ILP believes it is the best practice to use a transdisciplinary approach for all early intervention and support services. Transdisciplinary means the parent and professionals from two or more disciplines teach, learn and work together across traditional disciplines or professional boundaries. The team, with the child's family as integral members, will identify the ways to work together to meet the developmental needs of a child with hearing loss. The team may designate one team member as the primary provider or interventionist. Team members may provide direct or consultative services or both.

Whatever service delivery model is used, hard of hearing/deaf educators need to be included in service delivery team. Understanding and working with deaf children and families must embrace a wider group of professionals and not focus solely on speech-language therapists and audiology.

The IFSP for a child with a hearing loss might include any of the following people:

- Family Service Coordinator
- Audiologists
- Special Educators
- Teacher of the Deaf and Hard of Hearing
- Speech-Language Pathologist
- Primary Care Physician
- Other Potential Team Members (Occupational Therapist, Physical Therapist, Psychologist, and Parent Navigator.)

In Alaska it may be difficult to find all the experts for your team, so you may have to be creative and resourceful to make certain that the child's has the resources that he or she needs. However, each IFSP team will have a family service coordinator to assist with coordinating all services across agency lines and to serve as a single point of contact in helping parents to obtain the services and assistance they need.

Individual providers who work with Alaska's young children should engage only in those aspects of their profession that are within the scope of their competence, considering their level of education, training, and experience. Licensed practitioners should follow the high-quality, evidence-based standards of their professions as determined by their state and national credentialing and professional associations.

FAMILY SUPPORTS ARE AN IMPORTANT PART OF INTERVENTION

Children with hearing loss may be more likely than other children to develop social, emotional, or communication difficulties. Early intervention and family supports can greatly reduce the potential effects of these difficulties. Family supports may include opportunities for training and resources, connections with other parents, as well as information on a variety of topics.

EI/ILP, in collaboration with the Alaska Early Hearing Detection and Intervention (EHDI) program, offers support, assistance, and advice to families on how to best meet their child's unique needs. This support should include access to a wide variety of information that is shared in an unbiased manner.

Family education can assist families to learn more about:

- The nature of their child's hearing loss
- How to help their child use his or her hearing
- How to help their child communicate

- Different intervention and communication options
- How to use their child’s hearing technology (hearing aids, FM systems, Cochlear implants), including environmental factors and conditions in the home and other settings that enhance hearing opportunities or make hearing more difficult
- General development of infants and toddlers including social emotional development
- How to prepare for a transition to new services once their child turns three years old

Parent support services may be delivered in a variety of ways such as:

- Parent education sessions
- Parent child interaction coaching
- Demonstration, modeling, or coaching of techniques
- Discussion of general developmental issues
- Opportunities to meet with other families who have children who are hard of hearing or deaf
- Opportunities to meet older children or adults who are hard of hearing or deaf
- Opportunities for sibling support
- Counseling support for families to discuss family issues related to the child’s hearing loss
- Childcare provider education

DEVELOPING A COMMUNICATION SYSTEM

Parents and children are partners in communication and must develop a communication system in order for a language system to develop. Children without hearing loss receive considerable exposure and practice in language by overhearing others speak. For children who are hard of hearing or deaf, these opportunities are more limited, but they need as many opportunities as possible to practice language. This is one of the reasons early intervention builds on a foundation of family participation rather than isolated practice in therapy.

Parents should introduce children with hearing loss to language as early as possible. The earlier any child is exposed to and begins to acquire language, the better that child’s communication skills will become. Research suggests that the first six months are the most crucial to a child’s development of language skills. Very early discovery of a child’s hearing loss or deafness provides parents with an opportunity to learn about communication options. Parents can then start their child’s language learning process during this important stage of development (12). For children of

deaf or hard of hearing parents, learning a sign-based language can begin when they are born.

Communication occurs in a number of ways including gestures, facial expressions, and vocalizations. Some children will develop language through sounds and speech, while others will develop language through gestures or sign language. And some children will use a combination of sounds, speech, and signs. A young child's program must provide options for the use of listening and speech and, if the family chooses, sign language.

It is the responsibility of the IFSP team to help determine the most appropriate method of communication for their child and family. Professionals should try hard to avoid biasing a family toward one communicative method or another, but rather assist them in learning about the range of options for communication and choosing what is best for their child and family. Choosing one method over another is a family decision and is often affected by the nature of the child's hearing loss and the family's style of communication.

American Sign Language (ASL)

American Sign Language is a complete, complex language that employs signs made with the hands and other movements, including facial expressions and postures of the body. It is the first language of many deaf and hard of hearing North Americans. ASL is said to be the fourth most commonly used language in the United States. Sign language is based on the idea that sight is the most useful tool a deaf and hard of hearing person has to communicate and receive information. Thus, ASL uses hand shape, position, and movement; body movements; gestures; facial expressions; and other visual cues to form its words. Like any other language, fluency in ASL happens only after a long period of study and practice.

Parents are often the source of a child's early acquisition of language. A child with hearing loss who is born to deaf or hard of hearing parents who already use ASL will begin to acquire ASL as naturally as a hearing child picks up spoken language from hearing parents. However, nine out of ten children who are born with hearing loss are born to parents who hear. Some hearing parents choose to introduce sign language to their children with hearing loss and often learn it alongside their child. As with any language, interaction with other children and adults is also a significant factor in acquisition. Even though ASL is used in America, it is a language completely separate from English; it contains all the fundamental features a language needs to function on its own including its own rules for grammar, punctuation, and syntax(12).

Signed Essential English (SEE)

This is not a language, but rather a system to use signs for exact English. This signing system does not use phonemes and according to research at the National Institute for Health, systems like this do not support strong reading and writing skills and

will not result in the acquisition of English. SEE is not widely used in the deaf and hard of hearing community. However this can be used as a communication tool between two separate languages such as English and ASL.

Listening and Spoken Language (LSL)

Listening and Spoken Language instructional approaches that help children with hearing loss learn spoken language. Children learn to make maximum use of auditory skills by listening, processing verbal language, and speaking. With advances in technology (powerful hearing aids, FM systems, and cochlear implants), sound is more available to children with hearing loss, and they can be taught to rely on listening for learning. The goal is to give children with hearing loss the necessary spoken language skills to function independently in the hearing world. This approach facilitates the development of reading and writing skills by developing proficiency in the English language.

Many of the strategies used by practitioners of the two approaches are similar. Basic tenets include: first, making certain that the child has optimal access to sound through full-time use of appropriate hearing instruments (hearing aids, FM systems, or cochlear implants); and second, helping parents provide an environment that promotes and stimulates the child's use of listening and learning of intelligible spoken language. Certification as an LSL therapist indicates specialization in this area beyond a master's degree level of training as a teacher of the deaf and hard of hearing, speech pathologist, or audiologist.

Cued Speech

This visual communication system relies on a system of eight hand shapes (cues) that represent different sounds of speech. These cues are used while talking, to make the spoken language clear through vision. This system allows the child to distinguish sounds that look the same on the lips. Use of residual hearing is also encouraged.

Total Communication

The philosophy of total communication is to use every method available to communicate with the child. Total Communication involves using spoken language, listening, sign language, ASL (American Sign Language), Signed Exact English (SEE), cued speech, lip-reading, finger spelling, writing, gestures and pictures along with the use of amplification.

It is difficult for families to learn about the different communication approaches and determine which one is best for them. The role of the ILP provider is to assist families in this process and to help them learn about the different options available.

Initially, a family may choose one program based on a particular philosophy or approach and then change their minds. Families may find that using a combination of approaches works well for them. The communication approach a family chooses will determine which professionals are included on the intervention team. All of the

communication approaches used in early intervention require a high level of family involvement and input.

AMPLIFICATION

Children who are hard of hearing or deaf will most likely require the use of assistive technology (AT). AT refers to any device or service that improves or maintains the capabilities of an individual with a disability. For children who have hearing loss, AT usually means hearing aids, cochlear implants and FM systems. It is critical for young children to begin amplification and intervention as soon as a hearing loss is identified.

HEARING AIDS

Hearing aids are appropriate for even the youngest children. They assist children by amplifying or making sound louder. But unlike glasses, which correct a vision loss, hearing aids do not restore normal hearing. Sounds are made louder by a hearing aid, but not necessarily clearer. Hearing aids are tools in the development of communication skills. In order for children to get the most benefit from hearing aids they must be used in conjunction with a comprehensive intervention program that focuses on hearing and communication.

Hearing aid selection and fitting is an ongoing process that is part of a child's intervention program. The initial process of identifying the most appropriate equipment can be overwhelming to families.

The pediatric audiologist works with the family to evaluate the benefit the child is receiving from the hearing aids. During this time the family and the intervention team will work together to assess these benefits, as well as any problems the child may have wearing the hearing aids. It is critical for young children to begin amplification and intervention as soon as a hearing loss is identified.

Infants and toddlers with hearing loss will then require frequent audiological evaluations to check on any changes in the hearing loss, the appropriateness of the hearing aids, and the proper functioning of their auditory equipment. Up to age three, hearing and amplification equipment should be monitored at least every three months.

What types of Hearing Aids and FM systems are appropriate for infants and toddlers?

All hearing aids have several common components. These include a *microphone* (captures sound from the air and changes it to an electrical signal), an *amplifier* (makes the signal louder), a *transducer* (changes the signal back to sound so it can be sent to the ear), and a *battery* (power source). The following types of hearing aids are commonly used with young children:

- **Behind the Ear Hearing Aids (BTE).** These units have all the components of the hearing aid encased in a device that fits behind the ear. The signal is delivered to the ear through an earmold. This is the most common hearing aid recommended for young children, though there may be some difficulty fitting them to very young infants, especially those with greater degrees of hearing loss. One of the most frequent problems associated with BTE hearing aids is keeping them in place behind the ear and close against the child's head. If a family is having a problem with this, they should tell their pediatric audiologist right away. There are simple adjustments that can be made and products that can be used to help.
- **Frequency Modulated (FM) Systems.** Children who use hearing aids often have difficulty hearing speech in a background of noise or when the speaker is further than three feet away. For these situations, a wireless FM system may be recommended. An FM system has two primary components: the receiver worn by the child and the microphone/transmitter worn by the talker. There are different types of FM systems that are appropriate for infants and toddlers. Some children may use an FM system as primary amplification. In that situation the child uses either a body worn unit or behind the ear unit that combine a traditional hearing aid and a receiver. This receiver is capable of receiving a radio signal sent out from the microphone/transmitter worn by the talker. There are other FM systems that can be attached to a child's personal hearing aids or cochlear implant speech processor. In this case the FM receiver is coupled to the child's personal technology with a specific adaptor.
- **Ear Molds for Hearing Aids.** Any hearing aid or FM system requires an earmold. The earmold is a soft, plastic, flexible piece that fits into the outer ear in order to direct the sound from the hearing aid into the ear. Young children's ears grow at an incredibly fast rate and ear molds will need to be replaced quite often. Earmolds may need to be remade as often as every two or four weeks when a child is very young. As the child matures, his or her growth rate will slow down and the earmolds may be remade less often. Earmolds must fit snugly in the outer ear or feedback (high pitch squealing) will occur. Although turning down the volume of the hearing aids reduces the feedback, it also reduces the strength of the speech signal the child hears. To make an earmold, the pediatric audiologist makes an impression by putting soft material into the child's outer ear and waiting for it to harden. This impression is sent to an earmold manufacturing company that makes a permanent earmold. The pediatric audiologist selects the type of earmold and the material from which it will be made.

Troubleshooting Problems with Hearing Aids

Parents need to understand and manage the hearing aids and/or auditory equipment for their child. The EI/ILP provider should help the family learn how to maintain hearing aids or amplification equipment. Not surprisingly, hearing aids on

children need daily maintenance by the adults in the child's life. The most common problems are dead batteries, ear molds clogged with wax, feedback noise (a high-pitched whistling noise), frayed cords, or a cracked hearing aid case. When any of these problems occur, the child is not hearing as well as he or she should be. Parents should be sure to check with the audiologist for information and demonstration of how to troubleshoot all of the child's equipment.

Additional information on acquiring assistive hearing and communication technology is available through the Guidelines for Assistive Technology as part of this series.

COCHLEAR IMPLANTS

A cochlear implant is a device that has two sets of components: *external* (those worn on the outside) and *internal* (those surgically implanted in the skull). For younger children the typical external components include a behind the ear speech processor, and a magnet worn on the scalp. The internal components consist of a receiver and magnet anchored in the skull, and a wire electrode array set in the cochlea of the ear.

The cochlear implant takes sound in through the external microphone and changes it into a specially coded electrical energy in the speech processor. That signal is transmitted to the internal receiver and electrodes that stimulate the auditory nerve and send a signal to the brain.

Cochlear implant surgery is conducted at a specially designated hospital by a specially trained otolaryngologist. After the surgery and short recovery period, the implant is set (mapped) to meet the hearing needs of the specific child. The mapping must be repeated on a regular basis to ensure that the child is hearing properly. Pediatric audiologists trained in cochlear implant mapping and management follow children with cochlear implants.

As with amplification devices, cochlear implants are tools that are used in a complete auditory management program. Cochlear implants are approved by the U.S. Food and Drug Administration (FDA) for children as young as 12 months who have a hearing loss in the severe to profound ranges and/or those who cannot benefit from amplification.

In order to determine eligibility for a cochlear implant, the pediatric audiologist will fit a child with hearing aids and evaluate the child's performance with them. During this time early intervention services will focus on use of the amplification equipment and communication development.

The decision about cochlear implants is always made in conjunction with a child's primary care physician and the implant center or medical institution involved. The implant center will conduct audiological, developmental, psychological, communication and medical evaluations in order to determine if a child is a candidate for a cochlear implant.

The reauthorization of the IDEA in 2004 specifically excluded cochlear implants as an AT device, therefore they cannot be funded by EI/ILP. The state does support intervention programs necessary for a child to benefit from his or her cochlear implant. However, the mapping of the cochlear implant is not considered an assistive technology service that is covered by the system.

Additional information can be obtained from EI/ILP providers or consultants that specialize in children who are hard of hearing or deaf. In addition, the child's EI/ILP family service coordinator can connect families with other parents who have gone through this decision making process.

Parents and providers can also get a variety of resources and information and make connections with other families of children who are hard of hearing or deaf through the Alaska Early Hearing Detection and Intervention (EHDI) Program, toll free (800) 799-7570 or local phone number (907) 269-3400, www.hss.state.ak.us/dph/wcfh/newborn.

PLANNING FOR TRANSITION

IDEA Part C services end when the child turns three years of age and becomes eligible for preschool special education services under Part B of IDEA. Families need to plan for this transition so, starting at the initial IFSP meeting, the service coordinator will talk with the family about what will happen when the child turns three or no longer needs EI/ILP services. The discussion and any activities identified to plan for a smooth transition will be written in Section IV of the IFSP, the transition plan. This plan is reviewed as needed throughout the time the child is receiving EI/ILP services and rewritten at least annually by the service coordinator with the parent's input.

ASSISTIVE TECHNOLOGY CONSIDERATIONS

If the child and family have acquired AT or equipment purchased by the EI/ILP system, the use of this equipment after the age of three will be discussed and addressed in the written transition plan. In general, children may keep AT devices purchased by EI/ILP as long as the device is needed. If a child continues to use equipment after the age of three, the EI/ILP will not assume responsibility for repair or maintenance.

WORKING WITH THE SCHOOL DISTRICT

To assist the school district in preparing for children who may need preschool special education services when they turn three years of age, parents are encouraged to notify their school district early about their child's needs. The family can contact their school district on their own or sign a release (Form 3-3) to allow the EI/ILP service coordinator to send relevant information to the district, such as copies of assessment and evaluation reports and IFSPs.

Before the child is two and a half years old, the EI/ILP service coordinator will ask the family if they want to make a formal referral to their school district. The referral (Form 3-8) serves as official notification to the school district that the family would like child to be evaluated to determine eligibility for preschool special education services. Even if the family has already signed a release of information form to the school district, the referral form needs to be sent to the school district to acknowledge the family's interest in an eligibility determination.

THE TRANSITION CONFERENCE

The service coordinator is responsible for convening a transition conference at least 90 days before the child's third birthday (or up to 9 months before, with agreement from all involved). The conference must include the parent(s), the service coordinator, a representative of the child's school district (if a referral has been sent), and anyone else the family feels would be helpful to plan for the child's transition.

The purpose of the conference is to discuss the services the child might receive once he or she turns three and to review or rewrite the transition plan as part of a review of the current IFSP. If the child is not being referred to preschool special education services, a transition conference must still be convened with the same participants with the exception of the school district representative.

The list below suggests some topics to discuss during the transition conference. Some items listed will require input from the child's school district personnel; others may require support from insurance or community programs.

- How and when will the child's eligibility for preschool special education services be determined?
- How is the child doing with the communication modality chosen by the family, and how will the child get access to language in this modality in the future?
- What is the child's continued need for audiological services, where will this occur, and how will it be paid for?
- What need is there for additional assistive technology equipment or services? And where can the family get assistance with acquiring and maintaining any assistive technology the child currently uses?
- Who will the family contact for ongoing information and guidance on the child's hearing impairment?
- What are the opportunities for interaction with peers, including children who are and are not hard of hearing or deaf?
- What are the transportation options?
- If the child will be going to a school program or other community program, what will the classroom environment be like, including the acoustics of the setting?
- What is the philosophy of this program?
- What are the levels of support needed for this child?
- Who are the staff who will be working with the child and family?
- Are there any additional needs for staff training?
- What supports or training are needed if the child is in a residential or foster home?

Transition Planning Tools

EI/ILP Transition Planning Handbook

A detailed, step-by-step guide for parents going through the transition process with a timeline of steps as a child gets older and an overview of the process to create an Individual Education Plan (IEP). Available at:

www.hss.state.ak.us/ocs/InfantLearning/afterage3/ilp_StepAhead.pdf

Alaska Transition Training Initiative

A consortium of early childhood programs and providers in Alaska, ATTI helps address transition issues for special needs children moving from Part C to Part B at age three. Learn more at:

www.alaskaearlytransitions.org/trainers.html

Stone Soup Group: Transitions

Information and resources for parents and caregivers transitioning someone with special needs from one phase of care to the next, including medical and legal issues, guardianship, Medicaid, and transitions into postsecondary programs. Links to parent groups, behavioral supports and assistance programs specifically for kids transitioning from an early intervention to early education can be found at:

www.stonesoupgroup.org/transitions.html

The Paper Trail Notebook

An organizational tool available from the Stone Soup Group, the Paper Trail Notebook can assist the family in identifying and organizing information that will be needed for transition, including records of medical history, appointments and providers. Available at no charge to families of children with special health care needs through EI/ILP providers or directly from the Stone Soup Group at (907) 561-3701 or by visiting:

www.stonesoupgroup.org/papertrail.html

ADVOCATING FOR PRESCHOOL- AND SCHOOL-AGE CHILDREN

Parents must continue to be strong advocates at every stage of their children's education. Preschool and school-age children with disabilities have additional protection and guarantees under federal law:

Individuals with Disabilities Education Act, Part B. IDEA Part B guarantees access to assistive technology and special education services for children from age three to 21 who experience disability. If it is determined that a child's hearing loss significantly affects his or her ability to learn and that he or she will require some specially designed instruction, the child will be eligible for services from the local school district upon his or her third birthday. Eligibility will be determined by the local school district with input from the EI/ILP.

Section 504 of the Rehabilitation Act of 1973. Section 504 is a civil rights law that prohibits discrimination against individuals with disabilities. Section 504 ensures that the child with a disability has equal access to an education. The child may receive accommodations and modifications. Unlike IDEA, Section 504 does not require the school to provide an individualized educational program. Under Section 504, fewer procedural safeguards are available to children with disabilities and their parents than under IDEA. If the child is determined to be covered under Section 504, the district must develop and implement a plan for the delivery of needed services. It is important to know that if a child is eligible for IDEA he or she is also considered to be protected under Section 504. However, if a child is eligible under 504, he or she may or may not be protected under IDEA.

Americans with Disabilities Act (ADA) of 1990. This is a civil rights law that guides our national approach to individuals with disabilities. There are numerous parts to this law covering the following areas: Employment, Public Service, Public Accommodations and Services Operated by Private Entities, Telecommunications Relay Services, and Miscellaneous Provisions. Of potential importance to families with young children is the section of this legislation that states, “No individual shall be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages or accommodations of any place of public accommodation by any person who owns, leases, or operates a place of public accommodation.” Interpretation of this law can be complex based on the difficulty and cost of the accommodation. Families often find the ADA law supportive in determining accommodations for involvement in community resources such as childcare or recreational activities. There are certain aids and services described in the ADA that support individuals who are hard of hearing or deaf. For example, “qualified interpreters or other effective methods of making aurally delivered materials available to individuals with hearing impairments are owed.”

ADA, Title IV: Telecommunications Relay Services. This guarantees access to telephone communication for persons with hearing impairments or speech impairments. It is important for EI/ILPs to have this equipment in order to communicate with parents who may be hard of hearing or deaf. There are two primary ways of communicating by telephone with someone who is hard of hearing or deaf:

- **Telecommunication Device for the Deaf (TDD)** is a machine that allows an individual with hearing loss to communicate through radio waves or over telephone lines by sending and receiving the message in print. This machine is called a *Text Telephone* or *Teletypewriter (TT/TTY)*.
- **Telecommunications Relay Service** provides full telephone accessibility to people who are hard of hearing, deaf or speech disabled. Specially trained Communication Assistants complete all calls and stay on line to relay messages either electronically to a TT/TTY or verbally to hearing parties.

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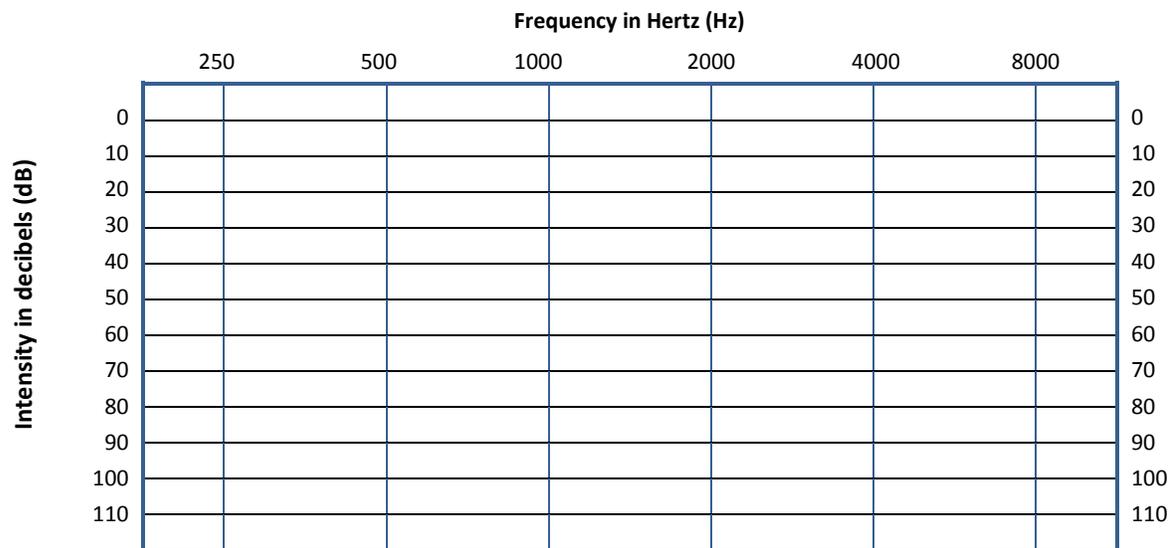
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APPENDICES

1. Description of an Audiogram
2. Questions to Ask When Selecting an Audiologist
3. Resources

DESCRIPTION OF AN AUDIOGRAM



Frequency: The horizontal axis is a display of frequency (pitch) going from low frequency sounds on the left side to high frequency sound on the right. The unit for frequency measurement is Hertz (Hz) also known as cycles per second (cps).

Intensity: The vertical axis is a display of intensity (loudness) going from low (soft) intensity at the top to high (loud) intensity at the bottom. The unit used on the audiogram is dB Hearing Level (dB HL).

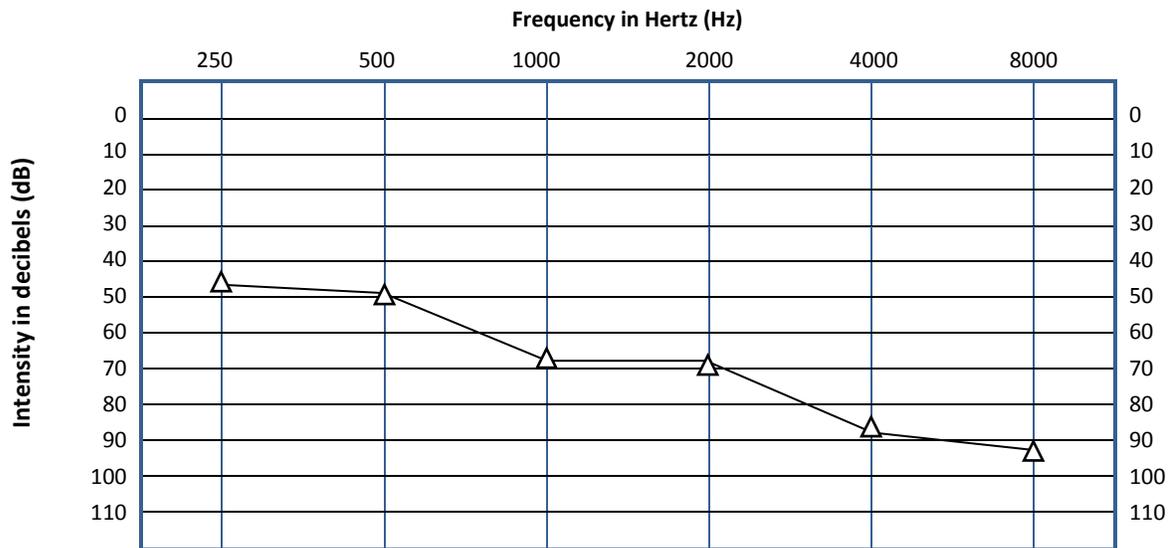
Hearing Level: Hearing Level is displayed on the audiogram as an interaction of intensity and frequency. That is, the audiologist determines the softest level (threshold) at which a person can hear a particular frequency and indicates that on the audiogram. As softer intensity is at the top of the audiogram, hearing levels marked on the upper part of the audiogram are better than those at the lower part. Therefore, the greater the degree of hearing loss, the further down on the audiogram the marks appear.

- **Air conduction:** Hearing level is determined using earphones and is marked (see the example below) as a circle for the right ear and an X for the left ear
- **Bone conduction:** Hearing level is determined using a vibrator placed on the mastoid bone behind the ear. A bracket is the symbol that designates the bone conduction response.
- **Sound field:** Hearing level is determined using a loudspeaker. An S is used to indicate the air conduction response of the better ear if there is an ear difference.

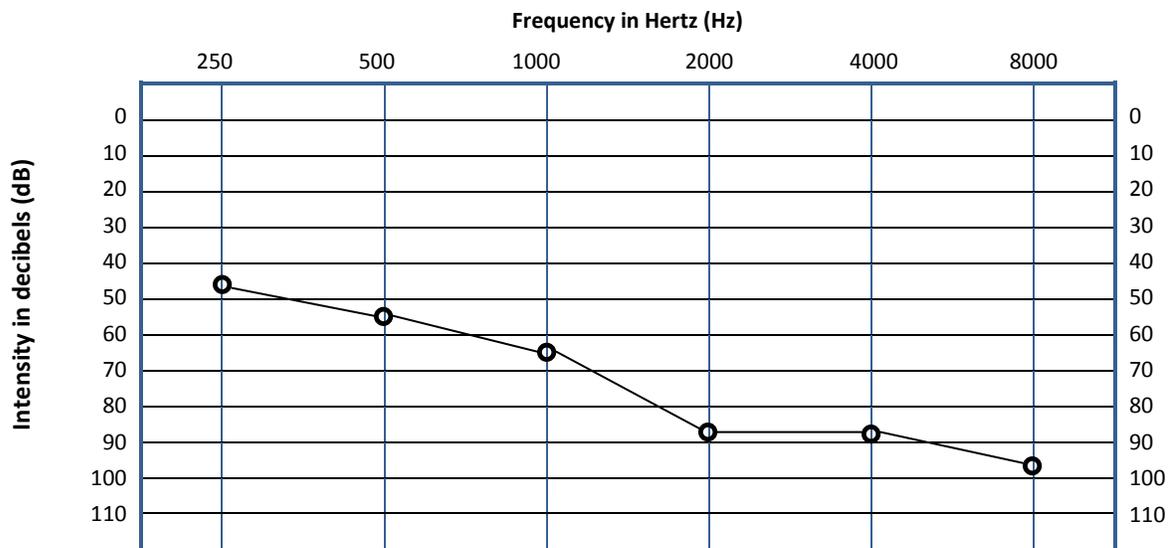
The following is an example of an audiogram for a child with a moderate to profound hearing loss in both ears:

APPENDIX 1

Left Ear



Right Ear



The audiograms pictured above demonstrate a moderate to profound hearing loss. Usually the results of an audiogram are depicted using one grid for both ears though occasionally the results for both ears are shown on separate grids as they are here to demonstrate how the results might look. Whether on one grid or separate grids, the left ear responses are recorded using an X and the responses for the right ear are recorded with a circle.

Look at the column that has “250” listed at the top. This 250 refers to a “frequency” or pitch of 250 Hz, which is a sound similar to “middle C” on the piano. This is the lowest pitch that was tested on this audiogram. Looking down that column, you can see that there is a circle at 50 dB, which means that the softest sound that the child

responded to occurred at an intensity of 50 dB. If you look at the child's responses further to the right on the audiogram, you can see how loud the sound had to be for the child to respond at 500, 1000, 2000, 4000, and 8000 Hz as the sound got higher and higher in pitch.

QUESTIONS TO ASK WHEN SELECTING AN AUDIOLOGIST

- Does the audiologist specialize in working with infants and young children?
- Has the audiologist worked with a large number of infants and young children with hearing loss?
- Can the audiologist evaluate a child's hearing within a short time after being contacted for an appointment?
- Will the audiologist review and explain the results of the audiogram with the family at the time of the evaluation?
- Will the audiologist explain the benefits of hearing technology and the purpose of any audiological recommendations?
- Can the audiologist provide hearing technology (hearing aids, FM systems, cochlear implants) for the child in a timely manner?
- Does the audiologist make ear mold impressions?
- Does the audiologist dispense hearing aids?
- Does the audiologist have loaner hearing aids available?
- Does the audiologist provide hearing aids on a trial basis?
- Does the audiologist have the resources to repair hearing aids in a timely manner?
- Can the audiologist evaluate the infant or toddler for a cochlear implant or refer the child to a cochlear implant center?
- Has the audiologist worked with EI/ILP and is he or she familiar with the program and its procedures for developing an IFSP and acquiring hearing aids or assistive technology?
- Will the audiologist provide a comprehensive written report, with a copy of the audiogram, in a timely manner?

RESOURCES

ALASKA RESOURCES

Alaska Deaf Community Services

475 Hall Street, Fairbanks, AK 99701. Phone (907) 451-4889

Alaska Deaf, Hard of Hearing and Blind Council

PO Box 90129, Anchorage, AK 99509

Email anchorage deaf center@gmail.com

www.alaskadeafcouncil.org

Alaska Early Hearing Detection and Intervention (EHDI) Program

Toll Free (800) 799-7570. Local (907) 269-3400

www.hss.state.ak.us/dph/wcfh/newborn

Alaska Early Intervention/Infant Learning Program

P.O. Box 240249, 323 East 4th Avenue, Anchorage, AK 99501

Toll-free (877) HSS-FMLY. Local (907) 269-8442

Alaska Governor’s Council on Disabilities and Special Education

3601 C Street, Suite 740, P.O. Box 240249, Anchorage, AK 99524-0249

Toll-free (888) 269-8990. Local (907) 269-8990. Fax (907) 269-8995

Alaska Registry Interpreter for the Deaf

PO Box 202010, Anchorage, AK 99520-2010

Email board@akrid.org

Alaska School for the Deaf and Hard of Hearing

(907) 742-4243

Assistive Technology of Alaska

3330 Arctic Blvd., Ste.101, Anchorage, AK 99503

Toll-free (800) 723-2852(ATLA). Local (907) 563-2599. TTY (907) 561-2592

Fax (907) 563-0699 | Email atla@atlaak.org

The Language Interpreter Center, Alaska Immigration Justice Project

431 West 7th Avenue, Suite 208, Anchorage, AK 99501. (907) 279-2457

Sail, Inc. Juneau Services for the Deaf

Sail, Inc., 3225 Hospital Drive, Suite 300, Juneau, AK 99801

Toll Free (800) 478-SAIL (7245). Local (907) 586-4920

ORCA (907) 586-0104. TTY (907) 523-5285. Fax (907) 586-4980

Afterhours/weekend interpreter requests (907) 463-7490

Email info@sailinc.org

APPENDIX 3

Stone Soup Group:

**Alaska Early Hearing Detection and Intervention (EHDI) Family Support /
Family Voices Alaska / Parent Training and Information Center**

307 East Northern Lights Boulevard Suite 100, Anchorage, AK 99503

Toll-free (877) 786-7327. Local (907) 561-3701. Fax (907) 561-3702.

Email amyw@stonesoupgroup.org

www.stonesoupgroup.org

NATIONAL AND ONLINE RESOURCES

Alexander Graham Bell Association for the Deaf and Hard of Hearing

(202) 337-5220 | Email info@agbell.org

<http://nc.agbell.org>

American Society for Deaf Children

(800) 942-2732 | Email asdc@deafchildren.org

www.deafchildren.org

Centers for Disease Control and Prevention (CDC)

Hearing Loss Resources for Families

www.cdc.gov/Features/HearingLoss/

Hands and Voices

(866) 422-0422 | Email parentadvocate@handsandvoices.org

www.handsandvoices.org

National Institute on Deafness and Other Communication Disorders (NIDCD)

31 Center Drive, MSC 2320, Bethesda, MD USA 20892

Email nidcdinfo@nidcd.nih.gov

The NIDCD Directory lists selected national organizations that provide information on communication disorders.

www.nidcd.nih.gov/directory

NIDCD Information Clearinghouse

1 Communication Avenue, Bethesda, MD 20892-3456.

Toll-free voice (800) 241-1044, TTY (800) 241-1055

Email nidcdinfo@nidcd.nih.gov

The Clearinghouse provides information and resources for health professionals, patients, industry, and the public. To obtain information, call the Clearinghouse Monday through Friday between the hours of 8:30 a.m. and 5 p.m. eastern standard time. Leave a message to request publications at other times.

Alaska Infant Learning Program

This report, historical data and other publications available at www.earlyintervention.alaska.gov

Call toll free in Alaska: 1 (877) HSS-FMLY (477-3659); In Anchorage 269-8442

INFANT LEARNING PROGRAMS THROUGHOUT ALASKA



The Alaska Infant Learning Program offers developmental services to families of children birth to 3. If you have concerns about your child's development make a referral to your local Infant Learning Program. Our Mission is to promote positive development and improved outcomes for Alaska's children birth to 3 by creating a culturally responsive, comprehensive and accessible service delivery system that links service providers, empowers families and engages communities.