

STATE OF ALASKA

Hearing Screening Guidelines for the Pre-school/School Population



DIVISION OF PUBLIC HEALTH
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INTRODUCTION/PURPOSE

Health screenings in schools serve to identify conditions that prevent students from attaining their optimal physical and mental levels. Good hearing is essential to oral language development, which is essential for learning for this population. Early detection of hearing problems will provide a child with a more favorable outlook for treatment and educational accommodations and improve the child's general well-being.



The goal of school hearing screening programs is to identify students with potential hearing deficits at the earliest stage possible in order to refer for diagnosis and treatment, if required. Hearing screening does not take the place of audiological/medical assessment or evaluation.

Hearing screening is a mandated school health service in Alaska (AS Sec.14.30.127). A hearing examination should be given to each child when they first enter school and

at regular intervals specified by the school district. While school nurses perform hearing screenings in many schools across the state, other schools may rely on other local or itinerant resources to administer screenings.

This guidance document provides necessary information to assist schools in completing the hearing screening requirements based on current evidence-based references and expert organizations. The intent of the State of Alaska's Hearing Screening Guidelines for the Pre-school/School Population is to identify and standardize appropriate equipment, tests, and procedures to use for optimal screening. School districts may utilize this information to develop their policies and procedures for school hearing screening. Because the pre-school population is included in some Alaska school settings, these guidelines contain testing procedures used for this age group as well as for students with developmental delays or behavioral reticence.

Though school hearing screening is mandatory by state law, these guidelines are offered as best practice and each school district may adopt the standards that best meet the needs of their student population.

BEST PRACTICE/REVIEW OF LITERATURE

As school districts consider the recommendations in this document, it may be helpful to understand current literature supporting the Alaska recommendations. This section provides background knowledge for hearing screening as well as a review of the evidence base for the recommendations.

Why is it important to screen for hearing loss?

The number of Americans with hearing loss has doubled during the past 30 years. As many as 738,000 individuals in the U.S. have severe to profound hearing loss. Of these, almost 8% are under the age of 18. It is estimated that 14.9% of U.S. children have hearing loss in one or both ears.¹ Hearing loss is the most common developmental disorder identifiable at birth and its prevalence increases throughout childhood due to the occurrence of late-onset, late-identified, and acquired hearing loss.²

Children who are hard of hearing have difficulties learning vocabulary, grammar, word order, idiomatic expressions, and other aspects of verbal communication.¹ In addition, congenital or acquired hearing loss in infants and children has been linked with poor academic performance, personal-social maladjustments, and emotional difficulties.³ Even a minimal hearing loss can have an impact on school and social performance. (Dr. Martin Beals, American Academy of Pediatrics, Alaska Chapter Hearing Champion)

The typical classroom is an auditory-verbal environment in which accurate transmission and reception of speech is critical for effective learning to occur. Hearing loss, even fluctuating hearing loss, interferes with the accurate reception of speech, especially in noisy classroom conditions. The behavioral effects of hearing loss often are subtle and resemble effects similar to children who experience attention deficit disorders, learning disabilities, language processing problems, or cognitive delays.²

Early identification of hearing loss and appropriate intervention within the first six months of life has been demonstrated to mitigate adverse consequences and facilitate language acquisition.³

As of January 2008, Alaska law mandates universal newborn hearing screening for all babies born in Alaska. Infants who do not pass their final newborn hearing screening, are referred for an audiologic diagnostic assessment. Of the babies who receive newborn hearing screening, about 20 are identified in Alaska each year as having a sensorineural or permanent conductive hearing loss. The incidence of neonatal hearing loss is reported at one to three per 1000 nationally. Alaska's reported cases of babies with hearing loss falls within the expected range. Of the 22 children diagnosed with hearing loss in 2012, fifteen were diagnosed by three months of age.⁴ Some hearing loss may not become evident until later in childhood.¹ The incidence of permanent hearing loss is thought to increase to as high as 19/1000 by age 18 here in Alaska. (Dr. Martin Beals, American Academy of Pediatrics, Alaska Chapter Champion) Considering the prevalence of transient hearing loss caused by ear infections along with other acquired causes of hearing loss, which are hard to quantify, the justification for screening school children for hearing loss is evident.

What are the types and causes of hearing loss?

There are several types of hearing loss, described by which portion(s) of the ear is involved: conductive, sensorineural, mixed, and central. See [Appendix A](#) for a diagram of the ear.

- Conductive hearing loss – occurs when sound is not transmitted efficiently through the ear canal, eardrum, and/or ossicles of the middle ear. Conductive loss is commonly caused by cerumen in the ear canal, fluid in the middle ear from upper respiratory tract infections, or a perforation of the eardrum. Other causes include allergies, poor Eustachian tube function, infections of the middle ear or canal (e.g. Swimmer’s Ear), benign tumors, presence of a foreign body, and absence or malformation of the outer ear, ear canal, or middle ear. Some of these conditions may be managed medically or surgically, while others may not.
- Sensorineural hearing loss – results from pathology associated with the inner ear (i.e., cochlea). Sensorineural loss can attenuate sound as well as distort sounds and speech to varying degrees. Common causes of sensorineural loss in children include congenital factors (genetic, prenatal, perinatal, or postnatal infections) or acquired factors (i.e., meningitis, ototoxicity associated with certain drugs). Exposure to loud noise, head trauma, and aging are other causes of this type of loss.
- Mixed hearing loss – occurs when there are elements of both sensorineural and conductive hearing loss. While the conductive component can frequently be medically or surgically corrected, the sensorineural component is typically permanent.
- Central hearing loss – occurs as the result of damage or dysfunction in the central auditory system (i.e., auditory nerve, brain). Causes include space-occupying lesions (i.e., brain tumors) and perceptual processing difficulties.^{1,5}

How is hearing loss defined?

Hearing is measured in terms of intensity and frequency.

The intensity or loudness of sound is measured in decibels (dB). The softest sound a person with normal hearing can hear is around 0 dB HL (Hearing Level) which is not the absence of sound but rather the value assigned to this softest detection level. A quiet library or a whisper occurs at 30 dB; typical conversation occurs between 45-60 dB; a blow dryer or kitchen blender ranges from 80-90 dB; a snowblower approaches 110dB; and a siren or firearms occur at 120-140 dB.⁶ A visual depiction of this information is found in [Appendix B](#).

The *range* of normal hearing in children occurs between -10 to 15 dB. Slight hearing loss is indicated at 16-25 dB, mild at 26- 40 dB, moderate at 41-55 dB, moderately severe 56-70 dB, severe at 71-90 dB and profound at 91 dB+.⁷

The frequency of the sound, or pitch, is measured in Hertz (Hz). A low tone or pitch would be the sound of a bullfrog (approximately 250 Hz) and a whistling teakettle represents a high frequency sound (4000 Hz). The threshold is the softest decibel level at which a person can hear tones at each of the test frequencies. Hearing loss can occur at any of the frequencies tested, typically in the range of 250 Hz to 8000 Hz, represented by a standard audiogram.^{8,9}

Hearing loss may be described as congenital (present at birth) or acquired (occurs after birth); bilateral (both ears) or unilateral (one ear); symmetrical (degree and configuration are the same in each ear) or asymmetrical (different degree and configuration in each ear); progressive (worse over time) or sudden (happening quickly); and fluctuating (changing over time) or stable (not changing over time).¹⁰

For school-age children, hearing impairment is defined as unilateral or bilateral hearing loss greater than 20 dB HL in the frequency region most important for speech recognition (approximately 500-4000 Hz).¹⁰

What is the goal of school hearing screening?

The purpose of school hearing screening is to identify and refer those students who demonstrate a greater probability for having a hearing impairment that could potentially affect their educational performance.¹⁰

Objectives:

- To promote an optimal level of hearing for all students
- To prevent the development of hearing problems that may affect the student's health and potential for learning
- To identify students with potential hearing problems
- To notify parents or guardians of abnormal screening results and the need for further examination by a healthcare provider or audiologist
- To inform teachers of students with hearing problems and provide recommendations from hearing specialists regarding the appropriate classroom environment and educational accommodations¹¹

Who determines best practice for school hearing screening?

This guidance document draws from current evidence-based recommendations of numerous professional organizations and expert resources. These include:

- American Academy of Pediatrics (AAP)
- American Academy of Audiology (AAA)
- American Speech-Language-Hearing Association (ASHA)
- Educational Audiology Association (EAA)
- Centers for Disease Control and Prevention (CDC)

The American Academy of Pediatrics (AAP) endorses hearing screening throughout infancy, early childhood, middle childhood, and adolescence in its *Recommendations for Preventive Pediatric Health Care*, 2007. The AAP's *Bright Futures* guidelines, adopted by the State of Alaska Department of Health & Social Services in May 2012, uses a developmentally based approach to address children's health care needs in the context of family and community. These guidelines offer best practice standards for hearing screening.¹²

The American Academy of Audiology (AAA) published *Clinical Practice Guidelines for Childhood Hearing Screening* in September of 2011. The AAA endorses detection of hearing loss in early childhood and school-aged populations using evidence-based hearing screening methods.²

The American Speech-Language-Hearing Association (ASHA) *Guidelines for Audiologic Screening* (1997) endorses the identification of school children at risk for hearing impairment that may adversely affect education, health, development, or communication as an expected outcome for hearing screening programs.¹⁰

What does the State law say?

Hearing screening in schools is mandated by Alaska Statute Sec. 14.30.127. The statute reads:

A vision and hearing screening examination shall be given to each child attending school in the state. The examination shall be made when the child enters school or as soon thereafter as is practicable, and at regular intervals specified by regulation by the governing body of the district.

The program of hearing screening is under the general supervision of the Alaska Department of Health and Social Services (DHSS). Access to the full statute is found at <http://www.legis.state.ak.us/basis/folio.asp>.

What elements are considered best practice for a successful hearing screening program?

- Screening tests are accurate and reliable.
- The school hearing screening site is suitable and appropriate for screening.
- Persons who screen students' hearing are trained and qualified.
- Community and healthcare provider referral mechanisms are in place so that those with possible hearing loss can receive additional evaluation and diagnosis, and appropriate treatment if needed.
- Student screening results are communicated effectively by the school to students, parents, and healthcare providers.
- Effective treatment and early intervention benefit those with identified hearing loss or hearing difficulties.
- Appropriate educational interventions are implemented to reduce the negative effects of hearing loss on student learning.
- The benefits of hearing screening outweigh the cost of implementing the screening program.¹³

When and how often should screening take place?

The American Academy of Pediatrics *Bright Futures* guidelines recommend performance of hearing screening for school-aged children at ages 4, 5, 6, 8, and 10 (usual corresponding grades of preschool, kindergarten, first, third, and fifth). *Bright Futures* further recommends risk assessment at ages 3, 7, 9, and 11 through 21 be performed with appropriate action to follow, if positive (abnormal). Risks include, but are not limited to: caregiver concern, family history of permanent childhood hearing loss, perinatal factors, certain infectious diseases, neurodegenerative disorders, head trauma, and chemotherapy. See [Appendix C](#) for a more complete list of hearing loss risk factors. The *Bright Futures* periodicity schedule is found at: <http://pediatrics.aappublications.org/content/133/3/568.full>.¹²

Additionally, literature further suggests that teachers, parents, and caregivers be aware of the observations, complaints, and behaviors that a child might exhibit which may be associated with hearing loss. A sample classroom hearing observation checklist is found in [Appendix D](#) and may be used to identify those students needing further assessment.

According to the American Academy of Audiology (AAA) guidelines, research on high-frequency hearing loss due to noise exposure supports the need to screen for hearing loss beyond the elementary school years. An increasing number of young people are likely to experience noise-induced hearing loss as the use of personal listening devices (e.g. iPod and MP3 players) and other potentially damaging activities (e.g. video games) continue to be popular.¹⁴ Sounds that are louder than 85dB can cause permanent hearing loss. Other sources of hazardous sounds include snow machines, firearms, power tools, personal watercraft, motorcycles, aircraft noise, fireworks, and loud rock concerts.⁶

Further research by AAA found that screening only through fifth grade identified between 50-75% of previously unidentified students. These findings led AAA to recommend hearing screening, *at minimum*, in preschool, kindergarten, and grades 1, 3, 5, and 7 or 9. In addition to the minimum grades screened above, more students with previously unidentified hearing loss will be found if grade 2 is added rather than adding another secondary grade.²



Further support for screening students in the middle and high school years is derived from the American Speech-Language-Hearing Association. ASHA recommends screening preschool, K-3, 7th, and 11th. They endorse their schedule based on increased potential for hearing loss among adolescents due to overexposure to high levels of noise. ASHA further stresses the

importance of identifying older children with risk for hearing impairment that may affect their educational, vocational, or social opportunities in the adult world.¹⁰

What are the recommended school hearing tests, equipment, and protocols?

Pure tone audiometry has been, and continues to be, the gold standard and widely preferred hearing screening procedure. Pure tone signals are presented at different frequencies and responses to the signals typically include a raised hand or conditioned response (e.g. dropping a block in a bucket).² Different techniques are used depending on the age of the child and his/her ability to follow directions or cooperate with the exam.⁵

AAP Bright Futures guidelines recommend testing each ear at 500, 1000, 2000, and 4000 Hz at 20-25 dB.⁵ Earlier ASHA guidelines included 500 Hz at 25 dB level as a means to improve identification of temporary hearing loss due to otitis media with effusion (OME). The most recent ASHA screening guidelines (1997) recommend a testing protocol that uses 20 dB at 1000, 2000 and 4000 Hz. Testing at 500 Hz has fallen into disfavor due to questionable validity as a means to identify OME. In addition, the 500 Hz frequency is more easily masked by room noise. Not passing at this frequency reduces the accuracy of valid screening for hearing loss issues that are likely to interfere with educational performance.²

The AAA also recommends performing a pure tone sweep at 1000, 2000, and 4000 Hz at 20 dB HL. Recent data supports the use of a 20 dB screening level as opposed to 25 dB HL. Using a screening level of 20 dB HL has been shown to increase the accuracy of correctly identifying those children with minimal hearing loss.² Children with minimal sensorineural hearing loss have been found to be at risk for social, emotional, communication, and academic problems. Children with mild hearing impairment make up a large portion of those who passed hearing screenings as newborns but who were later identified in the preschool or school-aged period. Pure tone screening at 25 dB HL potentially misses up to 62% of these children, rendering the screening process less valid.¹⁵

Concerns in the past for using 20 dB HL as the screening criteria for school screenings have been related to the often noisy acoustic environment in schools and the rate of referrals. Working with school administrators, faculty, staff, and students to ensure a quieter environment for more accurate screening at 20 dB is essential to improving screening outcomes over time. Evidence has shown that conducting immediate and same-day rescreens for children who do not pass an initial screening at 20 dB criterion should limit referrals for false-positives without sacrificing sensitivity to minimal sensorineural hearing loss. Combining pure tone screening with tympanometry screening on the same day can also reduce referrals and false positives.¹⁵

Many audiometers have options for tone presentation in addition to the steady pure tone signals. These include warbled or pulsed tones, which are supported in the literature for general use in audiometry. The alerting character of pulsed tones and associated reports of improved attention to the

screening task may be particularly useful in screening young children and in decreasing the over-referral rate.¹⁶

In addition to pure tone audiometry, AAA recommends the use of:

- **Otoacoustic Emissions (OAE)** testing only for preschool and school age children for whom pure tone screening is not developmentally appropriate. OAE screening is technically not a hearing test but rather an objective measure of inner ear mechanics. A small probe is placed in the ear canal and is used to present a stimulus and record the response. Screening programs using OAE technology must involve an experienced audiologist.
- **Tympanometry** as an immediate next screening step and/or second-stage screening method following failure of pure tone or OAE screening. Tympanometry is not a test of hearing but one that objectively measures the integrity and function of the middle ear system. Young child populations (preschool, kindergarten and grade one) should be considered for tympanometry screening in communities where medical professionals and school systems jointly target children with otitis media with effusion (OME) in addition to those with permanent hearing loss. OME, fluid in the middle ear without signs or symptoms of acute ear infection, can serve as a barrier to sound conduction. The conductive hearing loss associated with OME is variable, fluctuating, typically mild in degree, and usually resolves within three months. However, if middle ear effusion is present longer than three months, there is little chance of recovery without medical treatment. Even a minimal conductive hearing loss, as with minimal sensorineural hearing loss, may negatively impact speech/language development and academic performance.²

When is referral to a healthcare provider or audiologist indicated?

Hearing screening does not diagnose a hearing loss. It identifies children at risk for hearing loss who need further testing. In order to diagnose a hearing loss, a comprehensive audiological assessment conducted by an audiologist must take place.^{2, 10, 17} A two-tiered audiometry rescreening program is recommended by the AAA to reduce false positive results and over-referral. This protocol includes the initial screen, same-day rescreen of those who do not pass, and a second rescreening at a pre-determined number of weeks for those who do not pass the same-day rescreen. The AAA also provides guidance on, and recommendations for, referral when including the use of OAE and/or tympanometry as part of the two-tier screening process.²

Once the rescreening process is completed, referrals to an audiologist or healthcare provider should be facilitated. Referral for an audiological or medical examination is required with either of the following:

- ✓ The child has failed the second rescreen.
- ✓ The child is unable to perform the screening task.

Further referral consideration should be given for children who pass the screening when known risk factors for hearing loss are present (see [Appendix C](#)).

Who should perform hearing screening in schools?

Screening children for hearing disorder and hearing impairment requires considerable technological and professional expertise. ASHA recommends that the school hearing screening program be designed, implemented, and supervised by a licensed audiologist with clinical competence certification (CCC-A). They recommend screening practitioners be limited to audiologists, speech pathologists, and support personnel who are trained and supervised by a certified audiologist.¹⁰

The AAA recognizes that many school districts in the U.S. neither employ nor contract with an audiologist, and their hearing screening programs are managed by a non-audiologist who is typically a school health professional. Due to the importance of follow up with the medical community, they strongly recommend that the non-audiologist managers of school hearing screening programs (e.g. school nurses) utilize a single or small group of representative audiologists from their communities as an advisory body for the screening program. This assistance is to ensure the appropriateness of equipment, training, and protocols, as well as to facilitate buy-in from the community providers that will ultimately improve collaborative referrals, recommendations, and follow-up.²

STATE OF ALASKA HEARING SCREENING RECOMMENDATIONS

When determining which tests to include in a school hearing screening program and at what intervals, schools will need to take into account: district level resources (i.e., screening program budget, availability of equipment, educational audiology staff, and trained hearing screening personnel); the age and developmental level of the school population to be screened; and the willing involvement of medical and clinical audiology professionals available to, or in, the community to accept and document outcomes for hearing screening referrals.²

It is recommended that screeners be trained by a healthcare provider, audiologist, or other trained personnel and demonstrate competence to the school hearing screening program manager. Screeners should be familiar with the screening protocols and guidelines within this document.

RECOMMENDED SCREENING TEST:

Pure tone audiometry screening: Children should be screened for hearing loss using [Pure Tone Audiometry](#).

Recommended intervals:

Grades:

- ✓ preschool
- ✓ kindergarten
- ✓ 1st, 3rd, 5th, 7th, and 10th
- ✓ Screen 2nd grade if time and staffing allow.

Regardless of grade, screen students upon:

- ✓ initial entry in the school district
- ✓ entrance into special education and with follow up evaluations
- ✓ grade repetition
- ✓ request of teacher, parent, or healthcare provider
- ✓ evidence of known risk factors (see [Appendix C](#))

Do not test students who:

- ✓ wear hearing aids or other hearing devices, including those with cochlear implants
- ✓ have a previously known hearing loss and who are routinely evaluated by an audiologist
- ✓ have tenderness, drainage, or foul odor noted with visual inspection of the ear(s) prior to screening (this constitutes an immediate medical referral; screen at a later date)
- ✓ have obvious communicable conditions that may compromise infection control (screen at a later date)

Priority of screening: Optimal timing for hearing screening is the beginning of the school year (but not the first week). Prioritize the younger population, students new to the school district, and those with known risk factors first.

Screening parameters: Perform a pure tone screening at 1000, 2000, and 4000 Hz at 20 dB HL in each ear using a pass/refer criterion.

Rescreening parameters: Rescreen immediately or same day if the child does not pass the initial screen. Utilize additional screening options below, as available and appropriate, to determine next steps. If not an immediate referral for medical reasons, perform a second rescreen (third test) within 2-4 weeks.

Pass/referral parameters:

A child passes the screening when they respond to all frequencies at the 20 dB screening level in each ear. Refer results are indicated when a child fails to respond to any one of the screening tones in either ear.

- Immediate referral to a healthcare provider may be indicated when obvious medical concern (i.e., drainage, odor, pain) is noted at initial or subsequent screenings.
- Refer those students failing the second rescreen and those children unable to perform audiometry to an audiologist and/or healthcare provider.
- Parents and/or guardians should be notified of any abnormal screening results, and a written referral to the appropriate provider be presented to the parents.
- Encourage the parent to notify their primary care provider if choosing to directly seek audiological examination. School districts should encourage the bond between the family and their primary care provider, as the medical home is an integral part of the student’s support system.

Follow up with parent/guardian within one month of referral if results of medical or audiological evaluation have not been received.

Referral criteria in these guidelines may be used, but it is important to have a consensus of the medical and audiological professionals in the community regarding what they consider indicates need for further examination, and the process for these referrals.

ADDITIONAL SCREENING CONSIDERATIONS:

The following options may be considered in school districts that have additional screening equipment, staffing capacity, and specific training/expertise for their use.

- **Otoscope examination:** Screeners trained and experienced in [Otoscopy](#), should perform an assessment for all students failing initial screening and same day rescreen.
- **Otoacoustic Emissions (OAE) Screening:** Consider [OAE](#) screening for preschool and school age children for whom pure tone screening is not developmentally appropriate. Screeners utilizing this technology should have direction and training provided by a licensed audiologist.

- **Tympanometry Screening:** Consider [Tympanometry](#) as an immediate next step and second-stage screening method following failure of pure tone audiometry or OAE screening. Screeners utilizing this technology should have direction and training provided by a licensed audiologist.
- **Pure Tone Threshold Testing:** Consider [Pure Tone Threshold Testing](#), per individual school district policy, on students who have failed the second rescreen to give further information for a referral. Screeners should have direction and training provided by a licensed audiologist. Regardless of the threshold results, the student should be referred to an audiologist and/or healthcare provider. If conducted, threshold information may be provided with the referral.

See the [Equipment and Environment](#) section of these guidelines for a summary of specific recommendations for hearing screening equipment. See the [Protocols](#) section for a detailed description of the procedures for administering the identified hearing screening tests and the specific referral instructions for each. Sample forms are available in the [Appendices](#).

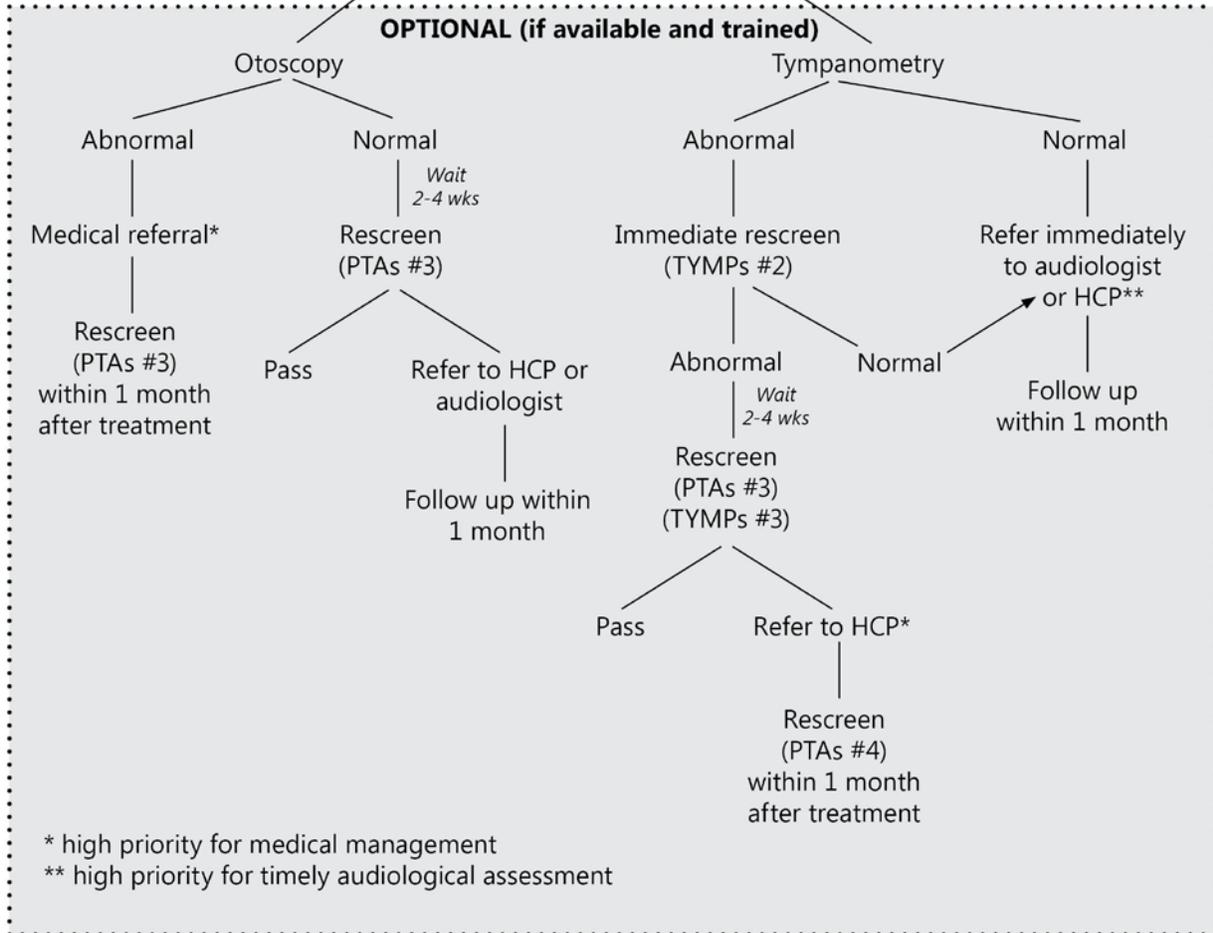
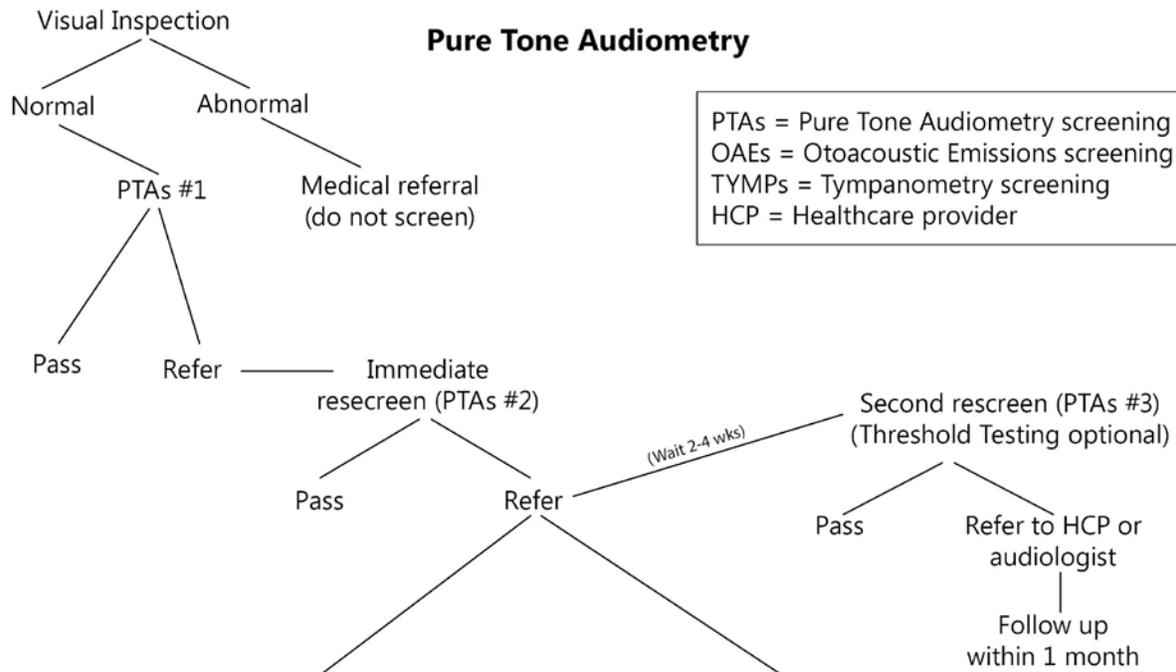
The following two tables contain summaries of the recommended tests and additional screening considerations with the intervals, equipment, and referral criteria for each. Flow charts follow for additional understanding of the steps involved for the recommended and optional hearing tests.

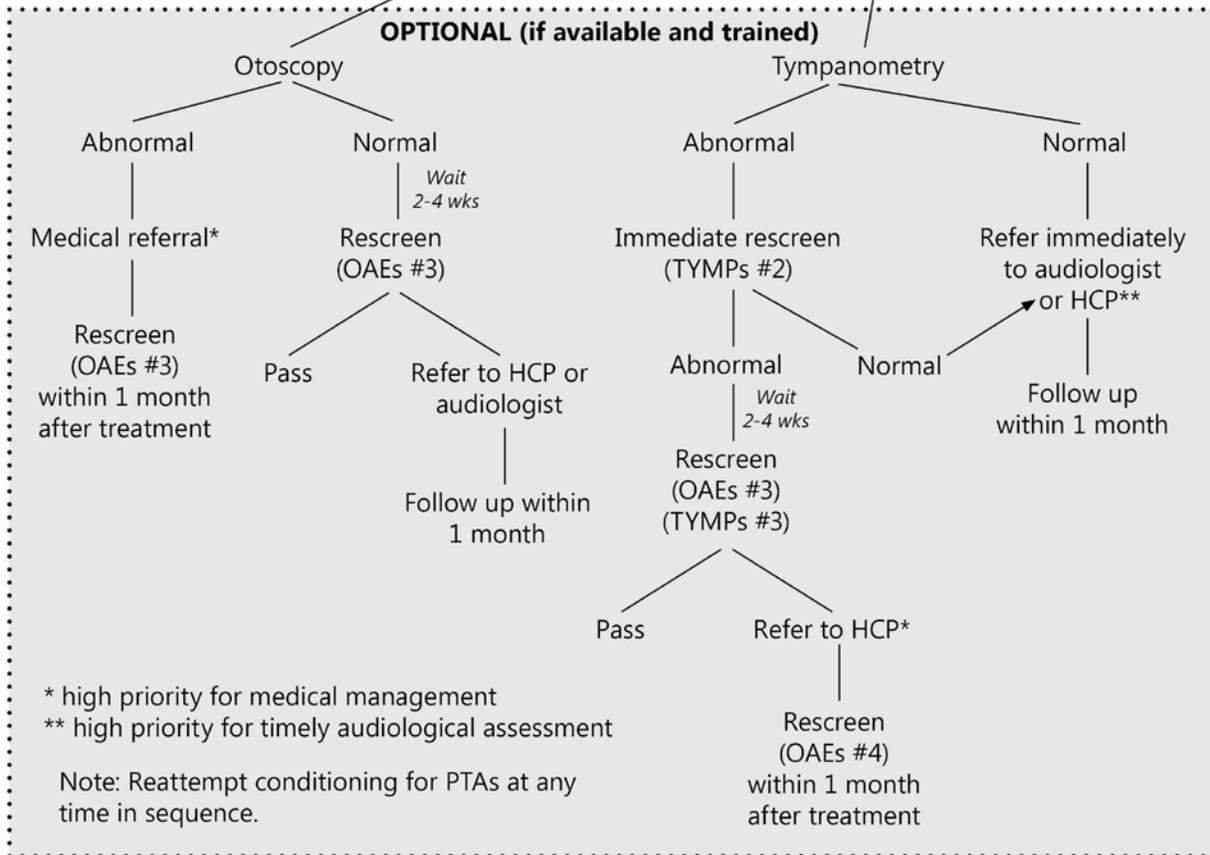
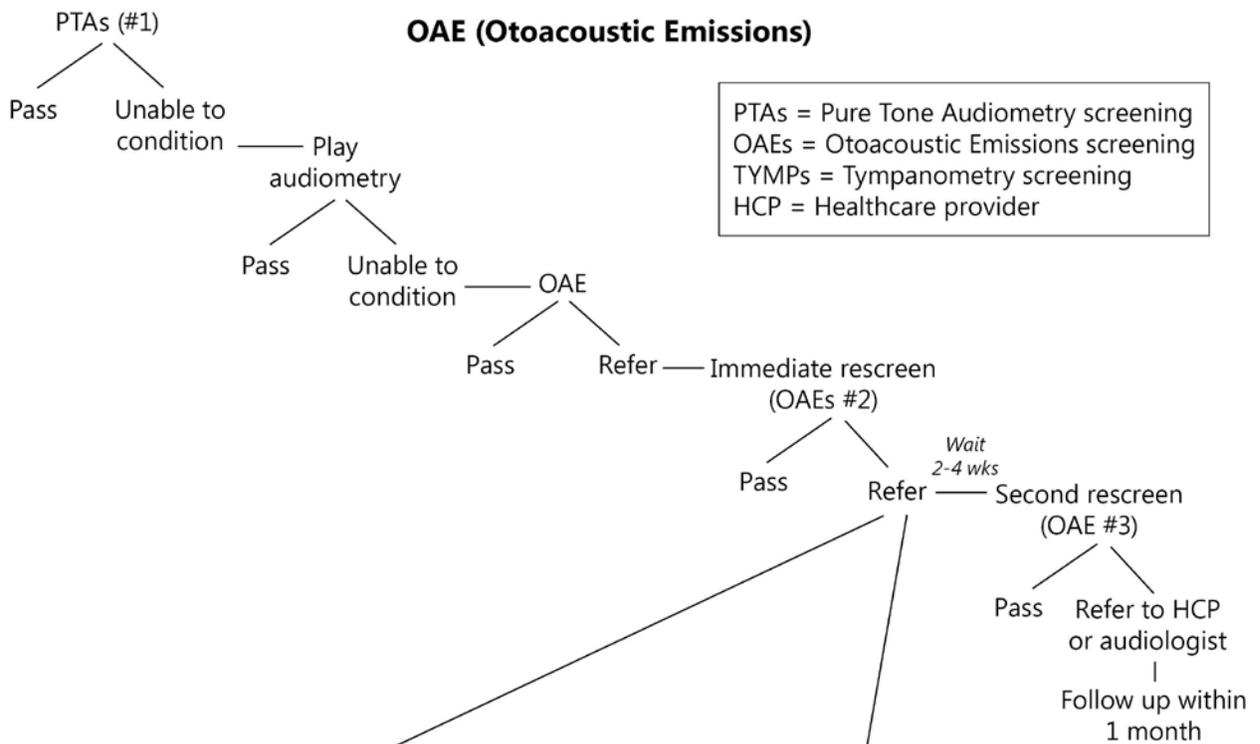
STATE OF ALASKA RECOMMENDATIONS

Test	Grade/Interval	Equipment and Environment	Screening Parameters	Rescreening and Criteria For Referral
<p>Pure Tone Audiometry</p>	<p>Preschool, K, 1st, 3rd, 5th, 7th, 10th (2nd if time and staffing allow)</p> <p>Regardless of grade, screen students: upon initial entry in the school district, entrance into special education and follow up evaluations, those with grade repetition, and any student upon request of teacher, parent or healthcare provider, or evidence of known risk factors.</p> <p>Who not to test: those students who wear hearing aids or other hearing devices, those with cochlear implants, children with previously known hearing loss who are routinely evaluated by an audiologist. Children with tenderness, drainage, or foul odor noted with visual inspection of the ear(s), which constitutes an immediate medical referral.</p>	<p>Portable pure tone audiometer calibrated to current American National Standards Institute (ANSI) specifications, capable of screening frequencies 1000, 2000 and 4000 Hz via air conduction with two headphones or insert style earphones)</p> <p>Conduct audiometer and environment listening check prior to commencement of hearing screening.</p>	<p>Perform visual inspection of the ear.</p> <p>Condition student to the testing procedure.</p> <p>Perform pure tone screening at 1000, 2000, 4000 Hz at 20dB in each ear.</p> <p>Present tone twice, if necessary.</p> <p>Pass = response to all frequencies at the 20 dB screening level in each ear.</p> <p>Refer= no response at one or more frequencies at the 20 dB screening level in either ear.</p>	<p>Rescreen immediately or same day if student does not pass initial screen.</p> <p>Refer to healthcare provider immediately if visual inspection or otoscopic exam* is abnormal.</p> <p>Perform second rescreen in 2-4 weeks on students who do not pass initial and same day rescreen.</p> <p>Refer to audiologist and/or healthcare provider any child who fails the second rescreen or cannot condition to audiometry.</p> <p>Follow up with parent/guardian within one month of referral if results of evaluation have not been received.</p> <p>*If screener is trained and experienced in otoscopy.</p>

FURTHER OPTIONAL CONSIDERATIONS

Test	Grade/Interval	Equipment and Environment	Screening Parameters	Rescreening and Criteria For Referral
Otoscopy	If trained and experienced, perform on any student who fails the initial pure tone audiometry screening and same day rescreening.	Otoscope with sufficient light to view the ear canal. Infection control strategies in place.	Examine both ears using age appropriate assessment techniques.	Refer immediately to healthcare provider for abnormalities including foreign body, drainage, odor, perforated eardrum, and/or cerumen plug. If no obvious medical concern, rescreen with audiometry in 2-4 weeks.
Otoacoustic Emissions (OAE)	If trained and experienced, consider for any child unable to condition to pure tone audiometry screening protocols, especially preschool students and special needs populations.	Distortion product emissions, 2-6 kHz range, calibrated to ANSI standards Quiet environment	Perform using OAE protocols. Pass/refer response noted. Rescreen immediately those with refer response. Perform otoscopy, if trained and experienced, to determine need for medical referral. Perform tympanometry, if available.	Rescreen with OAE and tympanometry within 2-4 weeks if abnormal tympanometry; if no tympanometer, perform second rescreen in 2-4 weeks. Refer to audiologist and/or healthcare provider: <ul style="list-style-type: none"> • children unable to test • students who fail the OAE screening but <i>pass</i> tympanometry • students who fail the OAE second rescreen
Tympanometry	If trained and experienced, consider for any student who fails initial and same day rescreen. Young children populations should be targeted for tympanometry screening.	Tympanometer with capability of -400 to +200 daPa range, calibrated to ANSI standards	Perform using tympanometry protocols. Rescreen immediately those outside normal parameters.	Perform second rescreen in 2-4 weeks, if student does not pass pure tone audiometry and tympanometry on immediate rescreen. Refer to audiologist and/or healthcare provider: <ul style="list-style-type: none"> • students who do not pass audiometry or OAE screening but <i>pass</i> tympanometry either on immediate or subsequent rescreens • students who do not pass audiometry and tympanometry upon second rescreen
Pure Tone Threshold Testing	If directed and trained by licensed audiologist, perform on student who fails second rescreen to give further information for referral.	Pure tone audiometer (as above)	Perform threshold procedure and document for referral.	Refer regardless of threshold results. Provide threshold information with screening results for referral, per individual school district policy.





DEFINITIONS

AAA – American Academy of Audiology

AAP – American Academy of Pediatrics

Ambient Noise – background noise present in the screening area

Amplification – the use of hearing aids and other electronic devices to increase the loudness of a sound so that it may be more easily received and understood

ANSI – American National Standards Institute

Atresia – closure or absence of the external auditory canal

ASHA – American Speech-Language-Hearing Association

Audiogram – a graph on which a person’s ability to hear the softest tone at different frequencies is recorded

Audiologist – a healthcare professional who specializes in preventing, identifying, and assessing hearing impairments and related disorders (e.g. balance or vestibular disorders and tinnitus) as well as managing any non-medical habilitation/rehabilitation of individuals with hearing loss

Audiometer – an instrument used to measure hearing

Auricle – largely cartilaginous projecting portion of the external ear; also called the pinna

Calibration checks – methods to determine the accuracy of an audiometer, otoacoustic emissions screener, and tympanometer. The two primary methods for audiometer calibration:

- Biological equipment check –generally performed by the screener at the time of equipment use to ensure that the audiometer is functioning properly
- Electronic – measurement of the absolute sound pressure levels of each frequency and other characteristics (e.g. harmonic distortion, frequency count, rise-fall time) generally performed annually by a trained technician who certifies that the equipment has met ANSI standards

Central hearing loss - occurs as the result of damage or dysfunction in the central auditory system, including the auditory nerve and brain centers involved in hearing /perception of sound. Causes include space-occupying lesions (i.e., brain tumors) and perceptual processing difficulties.

Cerumen – wax-like secretion found within the external auditory canal; ear wax

Cochlea – snail-shaped, fluid-filled capsule located in the inner ear which contains the organ of hearing

Cochlear implant – an electronic device consisting of an external microphone and speech processor with electrodes that are implanted in the inner ear to stimulate auditory nerve fibers. Individuals with severe or profound hearing loss benefit from cochlear implants which allow them to interpret sounds transmitted by the device.

Conductive hearing loss – a hearing impairment due to outer and/or middle ear problem preventing air-borne sound from being conducted to the cochlea

Compliance – a measurement of tympanometry which depicts tympanic membrane (ear drum) mobility

Congenital hearing loss – hearing loss which is present at birth regardless of causation; some genetic congenital hearing loss does not become evident until later in childhood.

Decapascals (daPa) – the unit of measurement of the pressure used in tympanometry. The usual measured range is from +200 daPa to -400 daPa.

Decibel (dB) – a measurement unit that represents the intensity (loudness) of sound

ENT – a medical doctor who specializes in the ears, nose, and throat; sometimes referred to as an otolaryngologist or otologist

External auditory canal – portion of the ear anatomy that extends from the auricle and external meatus (outer ear) to the tympanic membrane (ear drum)

Eustachian tube dysfunction – dysfunction of the small canal that connects the middle ear to the back of the nose and upper throat; purpose is to equalize the air pressure in the middle ear with the pressure outside it; dysfunction occurs when the tube fails to open during swallowing or yawning

Frequency – the number of vibrations per second of sound. Frequency is the “pitch” of sound and is measured in Hertz.

Hearing loss/impairment – a unilateral or bilateral sensorineural, conductive, and/or mixed hearing loss greater than 20 dB HL in the frequency region from 500 through 4000 Hz

Classified by the American Speech-Language-Hearing Association as follows:

- -0 to 15 dB - normal
- 16 to 25 dB - slight
- 26 to 40 dB - mild
- 41 to 55 dB - moderate
- 56 to 70 dB - moderately severe
- 71 to 90 dB - severe
- 91 + dB - profound

Hertz (Hz) – the unit of measurement that specifies the frequency of a sound wave; often referred to as the pitch of sound

Hearing aid – an electronic device that conducts and amplifies sound to the ear

High-risk – children who have one or more risk factors known to impact hearing

Incus – the middle bone of the chain of three ossicles in the middle ear

Inner ear – portion of ear anatomy internal to the middle ear and consisting of the cochlea, semi-circular canals, and vestibules

Intensity – the loudness of sound, measured in decibels (dB)

Malleus – the first bone of the chain of three ossicles in the middle ear; attached to the eardrum

Microtia – underdevelopment or complete absence of the auricle of the ear which may occur with or without atresia

Middle ear – portion of the ear anatomy that extends from the tympanic membrane to the inner ear

Mixed hearing loss – a combination of conductive and sensorineural hearing loss

Neonatal hearing loss - a hearing loss occurring between birth and 28 days of life

Otitis externa (Swimmer's Ear) – an infection of the ear canal most commonly caused by a bacteria; continually exposing the ear canal to moisture may cause loss of cerumen (ear wax) that protects the skin of the ear canal

Otitis media with effusion (OME) – fluid in the middle ear without signs or symptoms of acute ear infection

Otoacoustic emissions (OAE) – noninvasive, objective screening tool that evaluates the presence of a cochlear response to the conduction of sound, which can be suggestive of normal hearing; used in infants and young children who are unable to be screened with pure tone audiometry; does not diagnose hearing loss

Otoscope – instrument used to examine the ear canal and tympanic membrane

Outer ear – portion of the ear anatomy that extends from the pinna to the tympanic membrane and includes the auricle and external auditory canal

Ototoxic – conditions and medications that have the potential to damage the cochlea, auditory nerve, and sometimes the vestibular system of the ear

Ossicles – three small bones in the middle ear cavity (malleus, incus and stapes)

Pinna – external portion (visible) of the ear anatomy, sometimes called the auricle

Pitch – refers to frequency; measured in Hertz (Hz)

Play Audiometry - a modification of pure tone audiometry screening used with young children and/or developmentally delayed individuals in which a game is utilized to condition the child to provide an elicited response to the stimulus presented

Preauricular sinuses (“pits”) – a tiny pit in the skin in the area where the outer rim of the ear attaches to the face; preauricular sinuses can be indicative of other ear problems

Pressure Equalization Tubes (PE tubes) – small plastic or metal tubes inserted through the eardrum to drain fluid from the middle ear cavity and to equalize air pressure in the middle ear

Pure Tone Audiometry – a test to determine hearing sensitivity in response to different loudness levels of sound frequencies with the use of an audiometer

Pure tone – a tone of a single frequency produced by an audiometer; contains no harmonics or overtones

Pure Tone Threshold Testing – a hearing test performed to determine thresholds at specific frequencies

Sensorineural hearing loss – hearing loss due to pathology of the inner ear (cochlea), the nerve pathway from the inner ear (cochlea), and/or nerve of hearing to the brain stem; is usually irreversible

Skin tag - a growth of skin tissue (usually small, soft, and skin-colored) often near the ears or elsewhere on the face or neck; in rare cases skin tag(s) are associated with hearing problems

Stapes - the third bone of the chain of three ossicles in the middle ear

Threshold – the softest (minimum) decibel level at which an individual is able to respond to a stimulus (i.e., pure tone) at least 50 percent of the time

Tympanic membrane – a thin membrane between the external auditory canal and the middle ear cavity; moves in response to sound waves and sets the ossicles in motion

Tympanometry – an objective measurement of tympanic membrane mobility and middle ear pressure using sound (probe tone) and air pressure

White Forelock – a white tuft of hair that grows near the forehead associated with Waardenburg syndrome, a syndrome that causes deafness^{1, 18, 19, 20}

EQUIPMENT AND ENVIRONMENT

The types of equipment used for hearing screening will vary depending on the resources available to the program, the environment in which the screening will occur, and the expertise of the screening personnel.²

Audiometers and other equipment should be calibrated annually to current American National Standards Institute (ANSI) specifications. It is important to store equipment in a climate-controlled area (above freezing and below 90 degrees). Care should be taken to avoid dropping or banging the audiometer as it is easily damaged. Headphones should not be transferred from one audiometer to another without an additional calibration being performed. The cord should be stored free of tangling and twists. Screeners should be trained to perform an [Audiometer and Environment Listening Check](#) prior to the use of the equipment in order to rule out distortion, cross talk, and intermittency, and to determine that no defects exist in major components. Screeners should also be alert to excessive referrals during the screening process, and equipment should be checked any time it seems to be functioning improperly.^{2, 10, 17, 19}

Infection control is necessary to minimize exposure to microorganisms that can be transmitted from person to person. Headphones and toys or objects used during screening should be cleaned and disinfected before each re-use by using a product such as a wipe or spray. Alcohol should not be used to clean headphones; wipes that are designed to be used on rubber, such as AudioWipe Towelettes, should be used, and care should be taken to keep moisture away from the diaphragm of the earphone. Probe tips used for tympanometry, otoacoustic emissions testing, or otoscopy examination should either be disposable or cleaned and sterilized after each use. Cerumen should be treated as if it is an infectious material as its color and consistency may make it difficult to determine if there are contaminations from blood or other infectious substances.^{2, 17}

It is critical to locate a quiet environment in which to screen. Ambient noise sources from ventilation, adjacent hall or classroom noise, children moving about the room, and screening personnel giving instructions all contribute to inaccurate screening at 20 dB. Raising the presentation level of tones to accommodate a noisier environment renders the screening process less valid.¹⁵ The screening environment should not exceed 50, 58, and 76 dB SPL respectively for 1000, 2000, and 4000 Hz as measured by a sound level meter. If no sound level meter is available, screeners should perform an environment listening check before each day of screening. This involves testing the equipment by a normal hearing adult to perceive 1000, 2000, and 4000 Hz tones presented at the 20 dB HL screening level. If the environment fails the listening check, the room selection will need to be changed or the screening postponed until the appropriate acoustics of the screening environment can be assured.^{2, 17}

Equipment Recommendations

The following equipment recommendations can assist in the selection of appropriate screening equipment when initiating or updating a school hearing screening program. See the [Resources](#) section for a list of vendors who market hearing screening equipment.

Audiometers:

A pure tone ANSI calibrated portable audiometer with TDH supraaural headphones has been the gold standard for hearing screening in schools. Audiometers used for screening should be portable, lightweight, and durable. The audiometer should be capable of screening frequencies 500-4000 Hz via air conduction with two headphones (supraaural, circumaural) or insert style earphones. A patient response button is optional.² Use of speech materials for screening is not recommended; this includes the recorded speech feature available on certain audiometers. See Alaska Division of Public Health PowerPoint (link found in [Resources](#)) for recommended audiometers.

Otoacoustic Emissions (OAE) Screeners:

Otoacoustic emissions screeners* are automated, come with an assortment of disposable or reusable probe tip inserts, and can run on battery power, AC, or both. Some come with portable printers that allow the test results to be printed at the test site. Hand-held screeners have easy-to-read screens, menu options, and give a pass/refer test result requiring no interpretation. For school screening purposes, distortion product emissions with 2-6 kHz range is recommended, and equipment must meet calibration standards. The cost of general maintenance, calibration, battery replacement, software upgrades, and replacement probes all need to be taken into account when purchasing OAE equipment.² Consider portable OAE screening equipment with capabilities of user-controlled settings of intensity, frequencies, and sample size. Screening programs utilizing this technology should have direction and training provided by a licensed audiologist.²¹

Tympanometers:

There are a number of automated tympanometers* that are useful for screening. Equipment should be capable of quickly and easily providing measurements for all components that will be considered in the screening. These include ear canal volume, peak pressure, and gradient with a range of -400 to + 200 daPa range. The instrument needs to be calibrated to meet the ANSI standards. Although some instruments are capable of multi-frequency measures, a 226 Hz probe tone is appropriate for screening preschool and school-age children. Instruments that contain both a pure tone audiometer and tympanometer are available and can reduce the number of pieces of equipment that the school needs

*Contact a licensed audiologist or the Alaska Division of Public Health School Nursing/School Health Program if further equipment information is needed.

to purchase or transport and set-up. The disadvantage is that both are out of commission when one component malfunctions.²

Otoscopes:

The main requirement for an otoscope* is that there be sufficient light to view the ear canal adequately. Halogen bulbs now available in many otoscopes provide the necessary brightness. Infection control strategies must be followed when using an otoscope and the selection of disposable and/or latex-free specula should be considered.²

* Contact a licensed audiologist or the Alaska Division of Public Health School Nursing/School Health Program if further equipment information is needed

PROTOCOLS

Audiometer and Environment Listening Check

Purpose: To ensure the equipment is functioning properly and the environment is quiet enough to perform accurate audiometric screening

Equipment: Calibrated portable audiometer

Preparation: Select a quiet room free from visual distractions where hearing screening is planned. Plug in the audiometer (if electrical). Turn the power “on” and leave the unit “on” for the day. Be aware that some audiometers have an automatic shut off function so may need to be turned back on for subsequent screenings. Wash hands or use hand sanitizer prior to the listening check.

Procedure:

1. Examine the headphones. Check the cushions for cracks or splits. Be sure they are connected correctly to the audiometer with each plug in corresponding port, i.e., red/right ear cord in right port, blue/left ear cord in left port.
2. Examine the headphone cords for breaks. Gently untwist the cords if they are tangled.
3. Examine the audiometer controls and be certain that all are functioning.
4. Perform a listening check while wearing the headphones (if normal hearing adult):
 - Put the headphones on and check the screening levels of 1000, 2000, 4000 at 20 dB both in the right and left ear. Repeat the sequence, completing the process twice. If unable to hear all the tones, move to a quieter room and retest the equipment to determine if the problem is with the equipment or with the environmental noise level.
 - Set the frequency selector to 1000 Hz and output selector to the right ear. While pressing the tone presentation control, slowly rotate the dial from 0 dB to 50 dB listening for abrupt increases in loudness or “dead spots.”
 - Set the level at 0 dB. Press and release the tone presentation control listening for audible clicks. No click should be heard upon depressing and/or releasing this switch.
 - Press the tone button and move the cords to the headset listening for static or a loose connection.
5. The audiometer is in need of repair/maintenance if: there is no current calibration sticker or calibration is overdue, tone does not sound normal, no sound is produced when the tone switch is pressed, static is heard, the headphones do not remain in proper position over the ears, a dial or switch does not function, indicator lights do not glow, the cords are frayed, or the headphone cushions are ripped.

Further considerations:

The screener should remain aware of noise level throughout the screening procedure and avoid excess noise within the screening area including: talking, paper shuffling, and movement of desks and furniture. Avoid areas near fans or air conditioners, hall traffic, playground or street traffic, group activities (i.e., music, free play), bathrooms, lunchrooms, office equipment (i.e., copy machines), soft drink machines, refrigerators, and open windows. Keep the room uncluttered and free of visual distractions: avoid facing the child toward windows or open doors, avoid mirrors or other reflective surfaces.^{17, 18, 19}

Visual Inspection (External)

Purpose: To inspect the external ear canal and surrounding tissue for signs of ear disease or other abnormalities

Grades: All grades/ages

Equipment: Adequate lighting

Procedure:

1. Inspect the pinna and the area around it for any abnormalities such as preauricular sinuses/pits, skin tags, microtia, or atresia.
2. Check for position (set or tilt) of the ears, tenderness, redness, swelling, signs of drainage, foul odor, wax build-up in the outer ear canal, or dermatitis.
3. Palpate the auricle for any masses or areas of tenderness.

Pass: Children with normal appearance of all structures and no complaints of pain in the pinna or the tissue around the ear.

Refer: Children with any abnormality should be referred to a healthcare provider. Any physical abnormalities indicate a higher risk for hearing loss and necessitate an audiological work-up. Do not proceed with audiometry screening if tenderness, signs of drainage, or foul odor is present; this is an automatic medical referral.^{18, 21}

Pure Tone Audiometry

Purpose: To identify children with suspected hearing loss

Grades: Preschool, K, 1st, 3rd, 5th, 7th, 10th (2nd if time and staffing allow); any grade upon initial entry in the school district, entrance into special education and follow up evaluations, those with grade repetition, and any student upon request of teacher, parent, or healthcare provider or evidence of positive risk factors.

Equipment: Portable audiometer calibrated to current ANSI standards

Preparation: Plug the audiometer in an electrical outlet (if electric) and place the instrument on a table or hard, even surface in a quiet room free of visual distractions. Set up the chair for the student in a position facing away from the audiometer. Inspect the audiometer and perform the [Audiometer and Environment Listening Check](#) prior to proceeding with planned screenings. Wash hands or use hand sanitizer prior to the listening check and before each screening. Clean the earphone cushions prior to the listening check and between each screening using a non-alcohol wipe.

Prepare the student for the screening. Confirm the child's identity and perform [Visual Inspection](#). Explain the procedure; sample language: "I am going to put headphones on your ears (show them the headphones). You are going to hear some beeps in your right ear and then in your left ear, raise either hand every time you hear a beep, even if it is very soft. Put your hand down when the beep goes away." Other optional responses agreed upon may be considered as long as the response is consistent and reliably linked to the presentation of the stimulus (i.e., conditioned response). Examples include: hand clap, touch nose, high five, thumbs up, stomp foot, or say "beep."

For younger children, practice first without the headphones on. Put the headphones on the table, facing the child. Set the audiometer to 2000 Hz at maximum volume and have the child practice raising either hand when a tone is heard. Establish a different conditioned response at this time if necessary. Be sure to turn the intensity down before placing the headphones on the child as a 100 dB volume can be painfully loud next to the child's ear.

Stand in front of the child to place the headphones on the student. The red headphone is placed on the child's right ear and the blue headphone on the left ear. Ensure the headphones fit snugly on the child's head with the diaphragm in the center directly over the ear canal. Glasses and large earrings should be removed and hair tucked behind the ear. Be sure the child cannot see the screener pressing the button either directly or via a mirror or reflective glass.

If the audiometer is equipped with pulsed or warble tone option, consider using one of these tones, especially when screening younger children.

Procedure:

Conditioning steps

1. Set the selector switch to the “right” ear and present 40 dB at 1000 Hz for 2-3 seconds and then release.
2. If there is no response, re-instruct and try again. If the child still does not respond, consider one of the following:
 - ✓ switching to the “left” ear
 - ✓ increasing the level to 50 dB (only to establish the conditioned response)
 - ✓ changing to 2000 Hz tone
 - ✓ screening using [Conditioned Play Audiometry](#) protocols if appropriate for age or developmental level
3. If there is a response, proceed with the screening steps.

Screening steps

4. Turn the dial to 20 dB and present tones for 2-3 seconds at 1000, 2000, and 4000 Hz. Vary the length, and pause, between presentations. *Avoid presenting tones in a predictable pattern.*
5. Turn the selector to “left” and present tones for 2-3 seconds at 4000, 2000, and 1000 Hz (this reverse order saves time).
6. Tones may be presented twice consecutively, as needed, for each screening frequency.
7. Document screening results.

Pass: The student must respond to all tones at all frequencies in both ears.

Rescreen: Immediately rescreen any student who does not pass. *Remove the headphones; reinstruct the child (conventional or play audiometry), reposition, and rescreen.* If it is not possible to immediately rescreen, rescreen within the same day. Avoid using the term “fail” when speaking to the child.

If the child continues to miss any frequency in either ear, and the screener is trained and experienced in [Otoscopy](#)^{*}, visually inspect the ear canal and tympanic membrane with an otoscope. If the otoscopic examination is normal (or not performed due to screener’s lack of otoscopic training), perform a second rescreen (third test) in 2-4 weeks using the same screening protocols.

^{*}If the screener lacks training and experience using an otoscope, visual inspection should be limited to the external aspect of the ears.

Rescreen with pure tone audiometry within one month, those students who have completed medical treatment to determine their hearing ability and/or need for further evaluation.

Refer:

- To a healthcare provider: any student with abnormal visual inspection/otoscopic exam.
- To an audiologist and/or healthcare provider:
 - ✓ Any student who fails the second rescreen.
 - ✓ Any student who is unable to perform audiometry.
 - ✓ Any student with known risk factors for hearing loss or who, in the judgement of the screener, may require further evaluation (regardless of screening outcomes).^{17, 18, 19}

Conditioned Play Audiometry

Purpose: To improve reliability of response in young children or those difficult to test. Most children are able to perform the standard screening, but younger children often have difficulty pairing the tone to an act of hand-raising or button-pushing. A play conditioning game often enables them to respond to the tones in a reliable manner.

Grades: Children who are difficult to screen due to age or developmental level

Equipment: Pure tone audiometer calibrated to current ANSI standards, blocks and a container, a plastic ring tower, pegs and a pegboard, or any other type of toy that allows for this type of play activity

Preparation: Set up the audiometer and play supplies at an appropriately sized table in a quiet, comfortable setting with limited distractions. See [Pure Tone Audiometry](#) for further preparation instructions.

Procedure:

Conditioning steps

1. Demonstrate the “listening game” for the child. A sample description: “We’re going to play a listening game. When you hear a beep (any way you want to describe the test stimulus such as “whistle”, “bird”, “silly sound”, etc.), drop the block into the box (peg in pegboard, ring on tower, etc.)” You can use your own voice to simulate a tone before introducing the pure tones from the audiometer.
2. Give the child a block and make the vocal sound. S/he should place the block in the box. If this does not happen, try again, but have the child “race” you to see who can put the block in first after hearing the tone.
3. If the student can do this, introduce a 2000 Hz tone from the headphone by holding it near her/him at 70 dB HL. Do not put the headphones on just yet. If the child is able to drop the block in after hearing the tone, praise her/him and offer that s/he is going to hear more “beeps.” The child may give consistent responses after only one demonstration or may need several demonstrations to respond on her/his own.
4. Once the child understands the play audiometry technique, immediately reduce the volume to 40 dB *prior* to positioning the headphones on the student. Place the red headphone on the child’s right ear and the blue headphone on the child’s left ear ensuring a snug fit on the child’s head, while offering “you get to be an airline pilot” (or astronaut or rock star) to encourage the child to wear the headphones. Present 1000 Hz in the right ear at 40 dB to ensure the child is conditioned.

Screening steps

5. If the child responds correctly, drop down to the screening level of 20 dB HL and perform screening at 1000, 2000, 4000 Hz. (see [Pure Tone Audiometry](#)). Remember to vary the length and pause between presentations. *Avoid presenting tones in a predictable pattern.*
6. Reinforce the student with praise. If this is not effective, a tangible reward like a sticker may be given.
7. If the child throws the block in randomly, have him remove the block from the box and listen again. Praise good listening (rather than correct responses).
8. If the child cannot condition to play audiometry, stop and document “unable to screen.” Use [OAE](#), if available and qualified.

Tips:

- Be sure the student has no visual cues when presenting the stimulus.
- If the child refuses to keep the headphones on, remove one headphone from the headband (if possible), and hold it to the child’s ear saying, “We’re going to play the telephone game.” Be sure the stimulus is set for the headphone you have selected.
- Another technique for children having difficulty accepting the headphones is to put them on for only one or two seconds, then removing them and rewarding the child. Slowly increase the time with the headphones on.
- A child’s response time may vary. Some children respond when first hearing the tone and others will wait until the sound stops before dropping the toy. Either is a valid response as long as it is consistent and reliably linked to the stimulus presentation.
- Some children learn best by observing other students successfully complete the screening.

Pass: The student must respond to all tones at all frequencies in both ears.

Rescreen: Immediately rescreen any student who does not pass. *Remove the headphones; reinstruct the child, reposition, and rescreen.* If it is not possible to immediately rescreen, rescreen within the same day. Avoid using the term “fail” when speaking to the child.

If the child continues to miss any frequency in either ear, and the screener is trained and experienced in [Otoscopy](#)^{*}, visually inspect the ear canal and tympanic membrane with an otoscope. If the otoscopic examination is normal (or not performed due to screener’s lack of otoscopic training), perform a second rescreen (third test) in 2-4 weeks using the same screening protocols.

* If the screener lacks training and experience using an otoscope, visual inspection should be limited to the external aspect of the ears.

Rescreen with pure tone audiometry (conventional or play audiometry) within one month, those students who have completed medical treatment to determine their hearing ability and/or need for further evaluation.

Refer:

- To a healthcare provider: any student with abnormal visual inspection/otoscopic exam.
- To an audiologist and/or healthcare provider:
 - ✓ Any student who fails the second rescreen.
 - ✓ Any student who is unable to perform audiometry.
 - ✓ Any student with known risk factors for hearing loss or who, in the judgement of the screener, may require further evaluation (regardless of screening outcomes).^{18, 19, 22}

Otoscopy* (Optional)

Purpose: To inspect the internal ear canal and tympanic membrane for signs of ear disease or other abnormalities

Grades: All grades/ages

Equipment: Otoscope

Preparation: To prepare the child for otoscopy and reduce apprehension allow the child to see and handle the otoscope and turn the light on and off. Reassure that the examination may tickle but it does not hurt. Restrain the infant or young child to prevent sudden movement.

Procedure:

1. For infants and young children (<three years of age), pull the earlobe gently down and back; for the older child and adolescent, pull the ear up and back when preparing the ear for otoscopic examination.
2. With the otoscope, inspect the ear canal and tympanic membrane for signs of drainage, wax build up, foreign bodies, redness of the ear canal, and other abnormalities; note presence or absence of normal tympanic membrane landmarks, or perforation of the eardrum.

Pass: Children with normal appearance of all structures and no complaints of ear pain

Refer: Children with any abnormality should be referred to a healthcare provider. Any physical abnormalities indicate a higher risk for hearing loss and necessitate an audiological work-up. Do not proceed with audiometry screening if tenderness, signs of drainage, foul odor, redness, or signs of obvious infection is present; this is an automatic medical referral.^{18, 21}

* If the screener lacks training and experience using an otoscope, visual inspection should be limited to the external aspect of the ears.

Otoacoustic Emissions* (OAE) (Optional)

Description: Otoacoustic emissions are sounds detected in the external ear canal that are generated by the outer hair cells within the cochlea. The sound sent by the probe travels through the ear canal, the middle ear bones and in to the cochlea (the inner ear). From there, the sound continues to the brain, but a normal cochlea also sends a sound wave back to the ear canal where a small microphone picks it up. It is then analyzed by the equipment as a “pass” or “refer.” Since OAEs are a totally objective test, there are lower failure rates than with pure tone screenings. OAE assessment is not a test of hearing but rather a test of ear function; however, there is a correlation between normal ear function and grossly normal hearing.

Purpose: As an alternative test for students unable to complete [Pure Tone Audiometry](#), conventional or play

Grades: Any child for whom pure tone audiometry screening is not developmentally appropriate, especially preschool and special needs populations

Equipment: OAE instrument calibrated to current ANSI standards per manufacturer instructions

Preparation: The screening environment needs to be free from noise. Explain the procedure to the student.

Procedure: A small probe (foam or rubber) is placed in the child’s ear canal and is used to present the stimuli and record the response. No response is required from the student, although he will need to remain still and quiet.

Pass: No interpretation is required. The OAE equipment will display a “pass” or “refer” response.

Rescreen: Children with test results indicating “refer”, should be rescreened immediately (remove probe and reposition or replace probe if plugged with wax). If test results indicate “refer” again, perform otoscopy, if qualified, and determine the need for medical referral. Perform tympanometry, if available and qualified. A child with abnormal tympanometry should be rescreened with OAE and tympanometry within 2-4 weeks. If no tympanometer is available, perform a second OAE rescreen (third test) within 2-4 weeks.

* Performing an OAE screening requires advanced training. Screeners should be directed and trained by a licensed audiologist.

Refer: To an audiologist and/or healthcare provider:

- Children unable to test
- Students who fail the OAE screening but *pass* tympanometry (this constitutes immediate referral)
- Students who fail the second OAE rescreen

Considerations: If not done properly, OAE screening will produce over-referrals. There are many reasons why a child may “refer” on an OAE screening:

- The child is vocalizing or moving
- Wax (cerumen) or foreign object in the ear canal
- Fluid in the middle ear space (otitis media)
- Perforation of the ear drum or presence of PE tubes
- Noisy environment
- Hearing loss^{2, 22}

Tympanometry* (Optional)

Description: Tympanometry is an objective measure of testing the integrity and function of the middle ear system; however, it does not screen hearing levels. This test provides a measure of the health of the eardrum and the middle ear space behind it. The test is performed by placing a probe snugly into the ear canal while the child sits still. Varying degrees of air pressure and a low frequency tone are introduced into the ear canal to measure eardrum mobility, middle ear pressure and ear canal volume. Results are automatically recorded onto a graph called a tympanogram.

Purpose: As an immediate next screening step and second tier screening method in order to obtain further information about the integrity and function of the middle ear system and to determine if middle ear dysfunction may be present in order to guide next steps

Grades: Any student who does not pass [Pure Tone Audiometry](#) or [OAE](#) screening

Equipment: Tympanometer calibrated to current ANSI standards per manufacturer instructions

Preparation: Explain the procedure to the student. Ask them not to move, speak, or swallow during the test, which takes only a few seconds. Tell the child they will hear a tone and feel pressure in the ear as the measurements are taken.

Procedure:

1. Perform [Otoscopy](#), if qualified, to identify conditions such as ear canal blockages, pressure equalization (PE) tubes, tympanic membrane perforation, or other signs of obvious external or middle ear disease.
2. Select a probe tip that is the appropriate size for the student's ear canal.
3. Gently pull up and back on the ear while inserting the probe into the external ear canal to create a tight seal. If no seal is obtained, select another size probe tip. Keep in mind a seal may not be obtained if a PE tube or perforation is present.
4. Depending on the tympanometer, the test may begin as soon as the seal is obtained or the start button may need to be pressed.
5. Note the results of the tympanogram, which will automatically display the presence or absence of a curve. Note important tympanogram findings, including compliance, pressure, and ear canal volume. Interpret using the pass/refer criteria below.

* Performing tympanometry screening requires advanced training. Screeners should be directed and trained by a licensed audiologist.

Pass:

- Normal compliance (tympanic membrane movement): as low as 0.2 in younger children to as high as 1.4 mL in older children.)
- Normal pressure (of middle ear): +50 to -150 daPa
- Normal volume (of the ear canal): 0.3 to 1.4 mL; this parameter is worth noting when the tympanogram lacks a curve (e.g. larger volume may indicate PE tube patency or presence of eardrum perforation)

Rescreen: A tympanogram with results outside the normal parameters is a “refer” result. Rescreen immediately.

- If the child did not pass pure tone audiometry and tympanometry on immediate rescreen, perform a second rescreen (third test) in 2-4 weeks.

Refer: To an audiologist and/or healthcare provider:

- Children who do not pass pure tone audiometry or OAE screening but *pass* tympanometry either on immediate or at subsequent rescreens (this is a high priority for timely assessment by an audiologist as the child is at risk for permanent hearing loss)
- Students who do not pass pure tone audiometry and tympanometry upon second rescreen (this is a high priority for medical management of potential middle ear dysfunction)

Considerations: Abnormal tympanometry results may be indicative of any of the following:

- Fluid in the middle ear
- Perforated eardrum
- Patent or non-patent PE tube
- Impacted ear wax or other canal obstruction
- Scarring of the tympanic membrane
- Dysfunction of ossicles (middle ear bones)
- Eustachian tube dysfunction related to upper respiratory illness
- History of ear surgery^{2, 5, 22, 23}

Pure Tone Threshold Testing* (Optional)

Purpose: Perform as an immediate next step to provide more detailed information on the child's hearing status for a referral when a child has not passed pure tone audiometry second rescreen.

Grades: Any grade/age

Equipment: Pure tone audiometer

Preparation: Set up as in [Pure Tone Audiometry](#) in a quiet room, free from visual distractions. Explain the procedure to the student. Avoid using the term "fail" when speaking to the child. See [Pure Tone Audiometry](#) for further preparation instructions.

Procedure:

1. Screen the right ear or unaffected ear first.
2. Present 1000 Hz at 40 dB; decrease incrementally by 10 dB until there is no response, or down to 0 dB.
3. At the level where there is no response, increase in 5 dB increments until there is a response.
4. Decrease 10 dB until there is no response.
5. Increase in 5 dB increments until there is a response again.
6. Repeat until there are two responses at the same dB level; record this as the threshold level.
7. Repeat the same process for 2000, 4000 Hz.
8. Switch ears and repeat for test frequencies 4000, 2000, and 1000 Hz.

Refer: All students who qualify for threshold testing should be referred for further evaluation. Thresholds are solely to provide more information for the referral. Provide threshold information with screening results for referral, per school district policy.¹⁸

* Performing threshold testing requires advanced training that may be beyond the skill of some screeners. Screeners should be directed and trained by their school district audiologist. Threshold testing should never take the place of a medical or audiological evaluation.

ROLE OF SCHOOL NURSE/PROGRAM MANAGER

Program Planning

The value of the screening process depends on how well the program is planned and carried out and how the findings are used. Planning should occur with school administration and include collaboration with key school and district personnel as well as community providers. The extent of the hearing screening program should be based on the needs of the population served, weighed against the time and human resources required to conduct the screening, and be in alignment with state law requirements and the best practices identified in this document.^{2, 19}

Program management responsibilities for hearing screening must target:

- **Accountability** - the audiologist or designated non-audiology program manager is accountable for developing, supervising, and implementing the hearing screening program, as well as ensuring that screening personnel are trained and competent. School and public health nurses often coordinate to plan school-based hearing programs, particularly when the school district does not staff an audiologist. A single school-based staff member, such as the school nurse, should be responsible for program management at the school level including tracking referrals to facilitate follow-up of individual student recommendations.
- **Risk Management** - risk management involves management of the potential for infection, invalid screening results based on equipment malfunction or errors in calibration, and errors in student referral and follow-up. Parent notification is important for educational purposes and to allow them an opportunity to refuse screening of their child.
- **Program Evaluation** - program evaluation refers to the responsibility of the program manager to evaluate the effectiveness of the screening program.²

The hearing screening program should:

- Identify the overall program purpose or goal.
- Specify program objectives in measurable terms.
- Establish procedures and standards (best practices) for training nurses, volunteers, and others who will conduct the screenings.
- Establish procedures and standards (best practices) for screening, and for referrals and follow-up of students needing hearing health care including rescreening, monitoring, and further diagnosis/treatment.
- Anticipate the equipment, materials, space, services, and personnel needs, along with estimated costs.
- Identify timelines and a schedule that consider:

- Prioritization of the younger population, new-to-district students, and those with known risk factors (see [Appendix C](#))
- Number of students and grades to be screened
- Grade-level or school-wide assessment periods
- School activities, events and vacation days
- Availability of support personnel and volunteers to assist onsite with the screening process
- Weather-related factors
- Times of higher absenteeism (i.e., flu or allergy seasons)
- Adequate time for follow-up screening and evaluations
- Provide counseling and education about hearing health and conservation to help prevent the development or recurrence of hearing impairments, and to help prevent or reduce the handicap resulting from that impairment.
- Evaluate program outcomes.^{2, 19}

Additional Considerations for Hearing Screening

- Educate teachers, staff members, and parents about the signs and symptoms of hearing difficulties and elicit their observations. See [Appendix D](#) for a sample classroom hearing observation checklist that can be utilized as an education tool as well as for identifying those children of high risk for hearing concerns who should be given priority screening.
- Inform parents of the hearing screening process prior to the screening date to foster communication and understanding. A sample pre-screening letter for parents is found in [Appendix E](#).
- Meet with kindergarten and younger primary grade classes to familiarize students with the equipment and screening procedures prior to their screening date.
- Avoid the use of the word *fail* when describing screening results to the student, parents, or others.
- Consider apprising parents of normal hearing results as this may reassure them that the screening has taken place and that their child does not currently have any concerns. See [Appendix F](#) for a sample form.¹⁹

Hearing conservation should be part of a comprehensive hearing screening program as the potential for noise-induced hearing loss is of particular concern in the older student population and in students with frequent noise exposure (e.g. listening to loud music, especially through headphones or by attending rock concerts; riding snow machines or ATVs; operating power tools; shooting firearms without ear protection; flying in small planes or riding in power boats).¹³ Curriculum and further information for educating students, staff, and parents on the prevention of noise-induced hearing loss is available in the [Resources](#) section.

Referrals and Follow-up

- Parents should be notified by a written referral letter that includes the explanation of why the child needs further evaluation. The letter should invite the parent to contact the nurse or program manager should they have questions or concerns. A sample letter is found in [Appendix G](#).
- A form should be utilized that facilitates transfer of information to the audiologist or healthcare provider and allows a return response. A fax number should be included to encourage the examiner to easily return the results to the school. See [Appendix H](#) for a sample referral form.
- A written report from the hearing professional with the results of the examination and any recommendations for the school setting should be requested.
- Ideally, the referral form and the cover letter should be mailed or handed to the parent to ensure receipt and confidentiality. A same-day or follow-up phone call allows for assurance of their understanding of the referral, and parental questions/concerns about locating affordable care or other assistance needed. The nurse can then explore with them solutions to any barriers for obtaining an exam.
- A system of tracking referrals should be in place that notes the date of the referral, how and when the parent was contacted, date of professional examination, and result of follow up. See [Appendix I](#) for a sample tracking form.
- It is not unreasonable to expect a response from the parent/guardian within a two-week period, demonstrating that they understand the referral and have made an appointment for the evaluation. Follow-up with parent/guardian within one month of referral if results of the evaluation have not been received.^{8, 19}

Documentation

- Screening results need to be entered into the student's permanent health record. Some consideration needs to be given for an efficient means of noting screening results at the time of the screening. The tracking worksheet in [Appendix I](#) can assist with this need. Transfer of screening results to the permanent record in a timely manner is essential as notes or logs are not considered to be legal health records.
- Record the results for right ear and left ear separately. Document what screening tests were given, when they were given, and by whom.
- Hearing screening data is subject to FERPA (Family Education Rights and Privacy Act of 1974) and, as such, are disclosed to outside parties only on a need-to-know basis with written parental authorization.
- A system should be devised to store data for easy access as well as to protect confidentiality. Electronic records need to be password protected or have other system safeguards.

Common Testing Errors

A 2009 Towson University study revealed a number of mistakes made by new hearing screeners across the United States.¹⁷ A summary of these errors and solutions are found in [Appendix J](#).

Teacher Follow-up (Classroom Strategies)

The child's teacher(s) should be notified that the student has been referred for further hearing evaluation. Classroom accommodations may need to be implemented for students being evaluated for, or diagnosed with, hearing loss. These include:

- Speak clearly and distinctly at moderate speed, but do not shout.
- Gain the student's attention before giving instructions (say the student's name, touch her/him gently, tap her/his desk lightly, or use a "secret sign" and obtain eye contact); do not turn away to write on the board or cover your mouth while talking.
- Monitor comprehension by asking the student to repeat or summarize information or instructions; rephrase if the child does not understand, rather than repeating information verbatim.
- Give visual cues (i.e., outlines, key phrases/words/assignments written on the board, captioned films/videos, etc.) to supplement verbal instruction.
- Provide longer processing time for a response.
- Appoint a helper or note-taker for the child to supplement lecture notes.
- Teach students strategies such as asking for clarification or using a "peer buddy" to get help.
- Repeat or rephrase comments/questions from other students.
- Provide preferential seating near the source of instruction, with visual access to the teacher and away from noise sources such as heating/cooling systems, hallways, or playground noise.
- Seat the child with her/his better hearing ear (if there is a difference between ears) nearest the teacher and away from noise sources.
- Reduce classroom noise as much as possible.
- Improve acoustics by adding carpet, privacy dividers, and/or providing a quiet work area for the student to work.
- Use of classroom amplification or personal assistive listening equipment may be indicated with information provided by an audiologist.
- Children with hearing loss might be eligible to receive services through an IEP or Section 504 to maximize access to the general curriculum and meet their learning needs.^{24, 25}

Working with Students Who Wear Hearing Aids or Other Assistive Devices

While students with hearing aids and other assistive devices may be exempt from screening, it is important for school nurses to be aware of and familiar with these devices. Additionally, school nurses

should perform file reviews for students with these devices to ensure that routine hearing health care is current and ongoing with their hearing specialist.

Collaboration between the school nurse and other staff members is necessary to ensure that a clear plan is in place to support a student's use, care and maintenance of their hearing devices so s/he can receive maximum benefit from the academic environment.⁸

Hearing aids

Hearing aids are the most commonly used hearing device for amplification. Hearing aids do not replicate functionally normal hearing and work best in a quiet environment without additional background noise. The school nurse, teachers, and/or other identified staff members need to regularly check that the hearing aid is worn and functioning properly.



Extra batteries should be kept in the school health office or other designated location because the battery life is variable and a battery may die at any time. Hearing aids should be turned off when not in use and batteries changed when the aid does not work as a first troubleshooting step. It is important to remember that hearing aid batteries may pose a choking or poison hazard if swallowed.

Earwax, ear drainage, moisture, hair products, and heat can damage the aid. Special care and cleaning of the earmold

should be performed according to manufacturer's recommendations. Earwax can be removed with the assistance of a pipe cleaner or specific ear wax removal tool and soft cloth. Most earmolds can be unattached from the hearing aid and washed in warm, soapy water. Take care to dry the earmold completely before reattaching it to the aid after cleaning. An earmold blower can help rid the tubing of moisture. Earmold tubing often becomes hard and brittle, affecting the sound quality of the amplified signal. Tubing may need to be changed every three to six months by an audiologist or other trained professional.

Hearing aids should be rechecked by an audiologist at least annually for proper fit and function. Younger children may need rechecks several times a year, usually every three to six months.⁸

Bone conduction hearing aids

A bone conduction hearing aid (e.g. Baha device) can be used for a child with conductive hearing loss who cannot utilize a standard hearing aid or in cases of unilateral loss. A small bone vibrating device is held firmly against the mastoid bone with a headband, or attached to the skull with a titanium screw or magnet. The vibration of sound bypasses the outer and middle ear and stimulates the inner ear via bone conduction.⁸ For children with implanted bone conduction devices, it is important to be aware of the greater consequences of head trauma.²⁶

Cochlear implants

Cochlear implants directly stimulate existing auditory nerve fibers with electrical signals that are sent to the brain and interpreted as sound sensations. The receiver part of the device is implanted under the skin above the ear and inserted into the cochlea; the transmitter component attaches to the skull by a magnet to the receiver component. They are typically used for children with severe to profound sensorineural hearing loss.⁸

Students who have received cochlear implants may be at greater risk for development of acute otitis media and bacterial meningitis; school nurses should be aware of suggestive signs and symptoms.⁸ School staff need to be educated that other strong magnets, such as those in certain toys, can dislodge the transmitter component from the head and should not be near the child's head. (Alexandra Hatton, Au.D, CCC-A, Clinical Territory Manager, Cochlear Americas) As with implanted bone conduction devices, it is important to be aware of the greater consequences of head trauma for children with cochlear implants.²⁷

Other assistive devices

Assistive listening equipment, such as personal FM systems or sound-field amplification systems, may be used for some students in lieu of or in addition to hearing aids, Baha devices or cochlear implants. These assistive devices are often provided upon recommendation from an audiologist, healthcare provider, or educational specialist.⁸

Evaluation of the Screening Program

Screening programs should be evaluated to ensure reliability and validity. Reliability refers to consistency in obtaining the same results each time and place the screening tool is used for any given person on whom it is used. Validity indicates that the test is sensitive enough to accurately identify those with hearing loss conditions and specific enough to exclude those without. Screening will identify a few, but not too many, false positives. If there were no false positives, the screening would be at risk for under-identifying students at risk.⁸

Key questions to pose:

1. What percentage of the target population was screened?
2. Of those screened, what percentage was referred for a hearing evaluation?
3. Of those referred, what percentage received a professional hearing examination?
4. Of those examined, what percentage was found to have a hearing problem?
5. What types of hearing problems were identified?

Collecting and reviewing data can help identify gaps in the program reliability and validity, assure quality results and appropriate referrals, and provide pertinent information to improve the hearing screening program.

APPENDICES

[Appendix A](#) Anatomy of the Ear

[Appendix B](#) Audiogram of Familiar Sounds

[Appendix C](#) Hearing Loss Risk Factors

[Appendix D](#) Classroom Hearing Observation Checklist

[Appendix E](#) SAMPLE Pre-Screening Information Letter for Parents

[Appendix F](#) SAMPLE Report of Normal Results to Parents

[Appendix G](#) SAMPLE Referral Letter for Parents

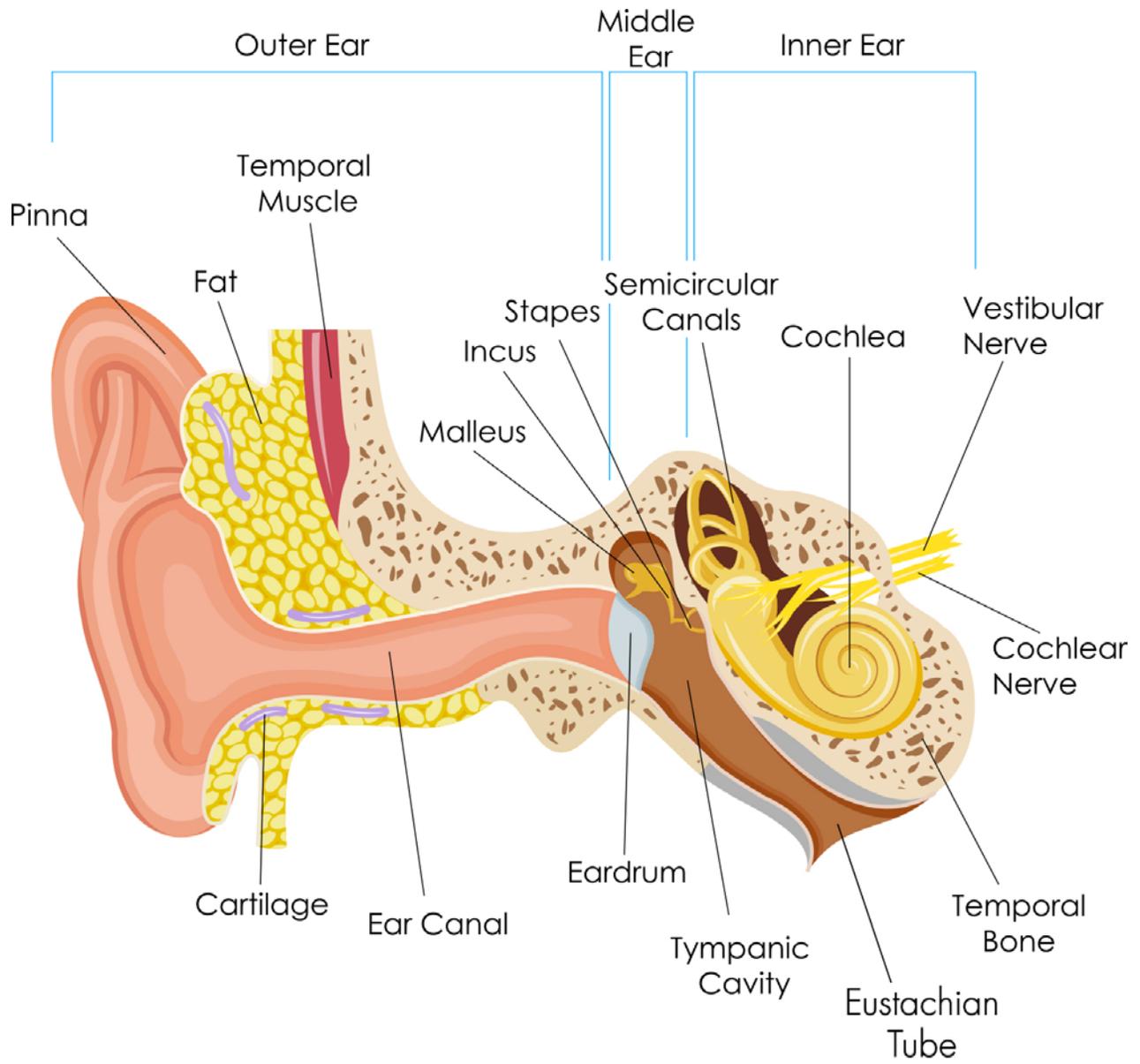
[Appendix H](#) Hearing Screening Referral Report Form

[Appendix I](#) SAMPLE Hearing Screening Tracking Worksheet

[Appendix J](#) Common Testing Errors and Equipment Troubleshooting

Appendix A

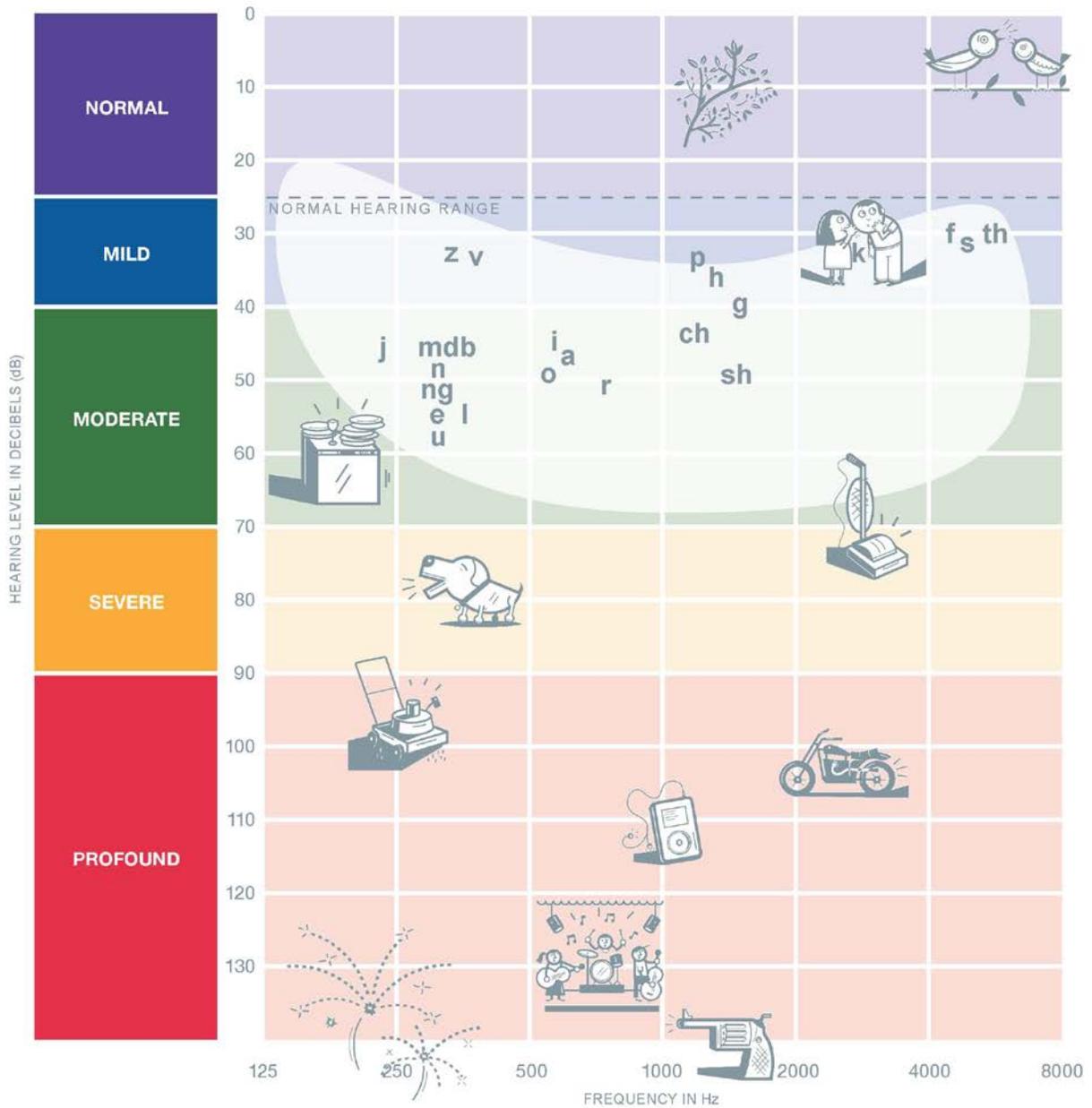
Anatomy of the Ear



EAR

Appendix B

AUDIOGRAM OF FAMILIAR SOUNDS



Appendix C Hearing Loss Risk Factors

Students at risk for acquired, delayed onset, progressive, or fluctuating hearing loss who may benefit from monitoring for hearing difficulties include those with:

- Caregiver, teacher, or self-reported concern regarding hearing, speech, language, developmental delay, or academic difficulties that may be hearing-related
- Family history of permanent childhood hearing loss
- Perinatal history of:
 - Premature birth
 - Neonatal intensive care for more than five days or any of the following: extracorporeal membrane oxygenation (ECMO), assisted ventilation, exposure to ototoxic medications (gentamycin, tobramycin) or loop diuretics (furosemide), and hyperbilirubinemia.
 - In utero infections (CMV, herpes, rubella, syphilis)
- Postnatal infections including meningitis, measles, encephalitis, varicella, influenza, mumps
- Craniofacial anomalies including those involving the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies as well as midline abnormalities such as cleft palate
- Diseases and syndromes such as Alport syndrome, Charcot-Marie-Tooth syndrome, Crouzon syndrome, Down syndrome, Friedreich ataxia, Hunter syndrome, Jervell and Lange-Nielson syndrome, neurofibromatosis, osteopetrosis, Pendred syndrome, Treacher-Collins syndrome, Usher syndrome, and Waardenburg syndrome
- History of frequent ear problems in infancy/preschool period or ongoing recurrent or persistent ear infections
- Head trauma, especially basal skull/temporal bone fracture
- Chemotherapy
- Exposure to potentially harmful levels of noise

Older students at risk for noise induced hearing loss are those with a “yes” response to any of the following questions:

- Do you have a problem hearing over the telephone?
- Do you have trouble following the conversation when two or more people are talking at the same time?
- Do people complain that you turn the TV volume up too high?
- Do you have to strain to understand conversation?
- Do you have trouble hearing in a noisy background?
- Do you find yourself having to ask people to repeat themselves?
- Do people you talk to seem to mumble (or not speak clearly)?
- Do you misunderstand what others are saying and respond inappropriately?
- Do you have trouble understanding the speech of women and children?
- Do people get annoyed with you because you misunderstand what they say?
- Have you been exposed to unusually loud noises? For example, do you use headphones to listen to music with the volume loud, ride snowmachines, operate power tools, shoot firearms without ear protection, frequently fly in small planes, or attend loud concerts?^{3, 5, 28, 29,30, 31}

Appendix D

Classroom Hearing Observation Checklist		
Student Name:		Grade:
Purpose: To identify hearing problems throughout the school year		
Procedure: The child is asked to report any complaints about his/her hearing. Teachers are asked to report any abnormal hearing behaviors or any hearing complaints as expressed by the child whenever they occur, and complete the hearing observation checklist. Provide the checklist to the school nurse for further assessment.		
Yes	No	Description: Child Complaints
		Pain in the ear(s)
		Fullness in the ear(s)
		Noise in the ear(s)
		Drainage from the ear(s)
		Cannot hear
Yes	No	Description: Child Behaviors
		Tugs at the ear(s)
		Asks to have things repeated
		Turns side of head towards the speaker
		Is inattentive to conversation
		Watches the speaker's lips
		Shows strain when listening
		Has difficulty with phonics
		Tends to isolate
		Talks too loudly or softly
		Has a speech problem
		Is not working to capacity in school
		Makes frequent mistakes in following directions
		Tends to be passive
Teacher Name:		Date completed:
Further Comments		

Appendix E SAMPLE Pre-Screening Information Letter for Parents

[School Letterhead]

School Hearing Screening Information

Date: _____

To: Parent(s)/Guardian(s)

Hearing screenings will be administered on _____ to all preschool and students in grades _____ as required by state law and school district policy.

Why is it important to have your child's hearing screened?

- Hearing is important for speech, language development, reading, learning, and social interactions.
- Even mild losses or loss only in one ear may interfere with academics.
- Children with hearing loss may appear to have poor attention or other learning problems;
- Hearing problems can be related to medical problems.
- Hearing can change between screenings.

Hearing screening will consist of one or more of the following:

Audiometry	Test of ability to hear various tones
Otoscopy	Examination of ear canal and drum
Otoacoustic Emission (OAE)	Test of inner ear response to specific sounds
Tympanometry	Test of middle ear function

A hearing screening does not diagnose a hearing loss but identifies students who **may** have hearing loss and require further evaluation.

How will the results be shared?

- ✓ If your child does not pass the initial hearing screening, they will be rescreened to determine the need for further evaluation. If your child does not pass the rescreen, the school nurse will contact you to share the results and may make a recommendation for a professional evaluation. A comprehensive examination by an audiologist and/or healthcare provider is necessary to determine if a hearing loss exists and to what degree and to determine/guide steps for intervention.
- ✓ If your child passes the hearing screening, you may be contacted by your school nurse with the results. You are welcome to contact the nurse to learn the screening findings.

If you have any questions about the school hearing screening for your child please contact the school nurse.

School Nurse

Phone/Fax/Email

Appendix F SAMPLE Report of Normal Results to Parents

Hearing Screening Report to Parents

Child's Name _____

Date _____

Your child passed the hearing screening at school today. Your child's screening included (check all that pertain):

<input type="checkbox"/>	Audiometry	Test of ability to hear various tones
<input type="checkbox"/>	Otoscopy	Examination of ear canal and drum
<input type="checkbox"/>	Otoacoustic Emission (OAE)	Test of inner ear response to specific sounds
<input type="checkbox"/>	Tympanometry	Test of middle ear function

The hearing screening is not a comprehensive test and is not meant to replace an examination by an audiologist or healthcare professional.

Please direct any questions to the school nurse at _____.

Hearing Screening Report to Parents

Child's Name _____

Date _____

Your child passed the hearing screening at school today. Your child's screening included (check all that pertain):

<input type="checkbox"/>	Audiometry	Test of ability to hear various tones
<input type="checkbox"/>	Otoscopy	Examination of ear canal and drum
<input type="checkbox"/>	Otoacoustic Emission (OAE)	Test of inner ear response to specific sounds
<input type="checkbox"/>	Tympanometry	Test of middle ear function

The hearing screening is not a comprehensive test and is not meant to replace an examination by an audiologist or healthcare professional.

Please direct any questions to the school nurse at _____.

Appendix G

SAMPLE Referral Letter for Parents

[School Letterhead]

School Hearing Screening Referral

Date: _____

To: Parent(s)/Guardian of _____

Today your child's hearing was screened at school. School hearing screening is performed to determine if your child has a potential hearing problem that could interfere with learning.

The hearing screening results indicate your child **may** have a hearing problem. Please take her/him to your medical provider and/or audiologist for further evaluation. Specifically of concern is (are) the test(s) marked below:

	Audiometry	Test of ability to hear various tones
	Otoscopy	Examination of ear canal and drum
	Otoacoustic Emission (OAE)	Test of inner ear response to specific sounds
	Tympanometry	Test of middle ear function

Please take the attached referral form with you for the evaluation and have the provider fill it out. Ask them to return it to the school.

If you need help with locating an audiologist and/or healthcare provider, paying for the examination, or have questions about your child's hearing screening, please contact me. If your child is already receiving follow up from a hearing specialist, please call me or send a note to share their findings.

School Nurse

Phone/FAX/email

Appendix H

Hearing Screening Referral Report Form

Identifying Information					
Child's Name:		Date of Birth:		Grade:	
Parent/Guardian Name:					
Screening Information					
Date of screening:			Date of referral:		
Pure Tone Hearing Screening Results:					
	1000	2000	4000	Observation/comments	
R	Pass ____ (20dB)	Pass ____ (20dB)	Pass ____ (20dB)		
	Refer ____	Refer ____	Refer ____		
L	Pass ____ (20dB)	Pass ____ (20dB)	Pass ____ (20dB)		
	Refer ____	Refer ____	Refer ____		
Other Hearing Screening Results:					
Evaluation Results					
School Completes	DIAGNOSIS/HEARING STATUS:				
	TREATMENT PLAN:				
	FOLLOW UP RECOMMENDATIONS/SCHOOL ACCOMMODATIONS:				
Examiner Completes	Signature of examiner:		Date:		
	Parent authorization for release of information				
	I, the parent/guardian of the above named child, authorize the exchange of information between the examiner and my child's school/school nurse. I understand this form will be faxed to the school nurse/screener so she/he may assist in sharing the above recommendations on a need-to-know basis at school to benefit my child's learning. I understand that I may refuse to sign this authorization and that my refusal will not affect my ability to obtain treatment, payment for services, or eligibility for benefits for my child; however, if this form is not submitted to the school, I understand that the school may not have sufficient information to address special hearing needs of my child. Parent/guardian signature _____ Date _____				
Return to school nurse/screener					
FAX Form to:			From:		
School Nurse/Screener			Examiner		
School Address			Address		
Phone			Phone		
Email Address			Email Address		
FAX #			FAX #		

Appendix J Common Testing Errors and Equipment Troubleshooting¹⁷

Pure Tone Audiometry	
Error	Solution
Not performing listening checks	Ensure audiometer is plugged in or charged. Perform a listening check every time the audiometer is plugged into the wall and every time it is turned on.
No tone or presence of static	Perform listening check first. Maintenance required. Do not use audiometer until repaired.
Improperly placed headphones	Do not place headphones over hair, away from the ears, or on the wrong ear (i.e., headphones reversed with signal for right ear directed to left ear). Use color code on headphones (right – red) or mark with tape. Squeeze the band to fit or place a pad on head under the band.
Presenting tone in a predictable pattern	Vary timing, do not present tones in a rhythm that listeners can guess when the tones are presented.
Allowing child to see/giving of visual cues (body language)	Face child away unless absolutely necessary to maintain focus and/or during play audiometry. Ensure child cannot see buttons when pressed.
Not switching from right to left ear	Always test the right ear first then remember to switch to the left ear.
Using a noisy room and increasing the intensity of the tone to overcome noise	If a quiet room cannot be found, <i>do not conduct the screening. You must find a quiet screening location.</i> False positive rate increases in noisy rooms causing: <ul style="list-style-type: none"> • Children to miss school and family to miss work unnecessarily to get further evaluation • Healthcare costs to increase • Appearance of screening program to be inaccurate False negative rate increases if intensity is turned up to compensate for noisy room causing: <ul style="list-style-type: none"> • Children with hearing loss to be under-identified which can result in long-term harm to their development, learning potential, and communication skills
Increasing the intensity of the tone to find the student's actual threshold	The extent of hearing loss can only be confirmed by further audiological testing. Screen at 20 dB HL and do not increase the level of the tone unless trained and directed by school district audiologist to perform threshold testing.
Not wanting to fail or refer the child: hearing screeners may think the student can hear the tone because they can communicate, and they may want all children to pass the test.	Do not present the tone a little longer or a few extra times. Use the 2-3 second rule for all tones. Remove the headphones and reinstruct the student. Refer for further evaluation if the student does not hear one or more of the tones.
Not cleaning headphones: studies have shown organisms can grow on the headphone cushions.	Clean headphones between each child.
Not feeling confident as a screener	Seek further training and get hands-on practice from program manager or other trained personnel.
Not realizing equipment has failed in the	Be on the alert for these issues. If equipment is faulty, discard

middle of a test; this may appear as an unusual pattern of response (e.g. several children in a row failing the same frequency), blinking power light on audiometer, or student report of strange noises or not hearing at all.	results from children affected, send audiometer for repair, and rescreen using another audiometer or reschedule the screening for a later date.
Passing a child who only missed one response	Mark fail/refer even if the student missed only one frequency.
Wanting to counsel a child (or parents) about screening results	Hearing screening does not diagnose a hearing loss so counseling should be avoided. Report only the result of the screening and encourage follow-up as referred. Using a standard form works well for this.
Assuming the child hears the tone but is just not raising his/her hand	Remove headphones, reinstruct, and test a second time. Refer the student per referral criteria if s/he does not respond to tone(s) with rescreening.
Talking in the screening room	Clearly communicate to all students and screeners that talking in the screening room is not acceptable; use an assistant to control noise, if possible.
Screening children with hearing aids or previously documented hearing loss	Do not place headphones on top of hearing aids, cochlear implants, or other listening devices. Children with previously documented hearing loss should be followed routinely by their hearing healthcare provider.
Tympanometry	
Error	Solution
Unit does not turn on	Ensure the tympanometer is plugged in or charged.
Test does not run	Check probe tip size; try another size to see if seal can be obtained. Child may also have a perforation or patent PE tubes not allowing test.
Ear canal volume too small (e.g. 0.2-0.4 cc)	Ear canal has collapsed or probe is on the canal wall; try bigger probe tip size. Canal may be occluded with wax; perform otoscopy, if trained.
OAE	
Error	Solution
Unit does not turn on	Ensure the equipment is plugged in or charged
Unit will not screen	Child may have a perforation or PE tubes not allowing test. A child's movement "artifact" or noise level may be too high for the test to run.
Abnormally large number of referrals (false negatives)	Environment and child must be quiet. Cerumen in the ear canal, fluid in the middle ear space, and perforation of the ear drum or presence of PE tubes are other reasons why a child "refers" on an OAE test.
Otoscopy	
Error	Solution
Poor visibility	Unit must be fully charged for brightness. Halogen bulbs provide necessary brightness.

RESOURCES

National

- American Academy of Audiology (AAA) – <http://www.audiology.org>
- American Speech-Language-Hearing Association (ASHA) – <http://asha.org>
- Hearing Loss Association of America – <http://www.hearingloss.org>
- National Library of Medicine. National Institutes of Health. MedlinePlus. Hearing Disorders and Deafness - <http://www.nlm.nih.gov/medlineplus/hearingdisordersanddeafness.html>
Supporting Success for Children with Hearing Loss - <http://successforkidswithhearingloss.com/>

Alaska

- Division of Public Health Universal Newborn Hearing Screening Program - <http://dhss.alaska.gov/dph/wcfh/Pages/newborn/default.aspx>

Training

- Early Childhood Hearing Outreach (ECHO) 2013 Pure Tone Hearing Screening in Schools videos: <http://www.infanthearing.org/earlychildhood/index.html>
- Alaska Division of Public Health, School Nursing/Health Services. Alaska Hearing Screening for Preschool/School Population PowerPoint. <http://dhss.alaska.gov/dph/wcfh/Pages/school/default.aspx>

Alaska equipment and calibration vendors:

MSR West
17528 W. Main St.
Monroe, WA 98272
800-950-3277
(360) 282-4170
www.msrmwest.com

Audiology Systems, Inc.
50 Commerce Dr., Suite 180
Schaumburg, IL 60173
855-283-7978
(425-420-0769
www.audiologysystems.com

Other sources for hearing screening equipment and supplies:

School Health	1-800-323-5465	http://www.schoolhealth.com/
MacGill School Health	1-800-323-2841	https://www.macgill.com/
School Nurse Supply	1-800-485-2737	http://schoolnursesupplyinc.com/
Moore Medical	1-800-234-1464	http://www.mooremedical.com/

Noise Induced Hearing Loss Prevention Resources

- Centers for Disease Control and Prevention (CDC) - Promoting Hearing Health in Schools.
<http://www.cdc.gov/healthyyouth/noise/promoting.htm>
- Dangerous Decibels Classroom Presentation Materials - <http://www.dangerousdecibels.org/>

Otoscopy Resources

- *Ear Disease: A School Nurse Manual* by Terry Owens M.D. Manticore Communications Inc. 1992
- *Diseases of the Ear: A Pocket Atlas* by Hawke McCombe. Peanut Publishing Co. 1995

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