



Alberta College of
Speech-Language Pathologists
and Audiologists

Hearing Screening Guideline Preschool to Adult

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Hearing Screening Guideline

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INTRODUCTION

This document has been developed to provide background and recommendations for standard procedures for a) developing a screening program, and b) guiding regulated members of ACSLPA in the procedure of screening to identify those who are *most likely to have peripheral hearing impairment and require audiological follow-up* (preschool and school-aged children, as well as adults). The ACSLPA Hearing Screening Guideline (HSG) is intended for use by regulated members and support personnel (**SP**)¹ who work with regulated members. This guideline was developed in response to ACSLPA member requests, from both professions, to update the previous guidelines for hearing screening as set out by the College in 2008. Those guidelines were written according to best practice methods at the time of release, as described by the American Speech-Language-Hearing Association (**ASHA**) in 1998.

ACSLPA's HSG Ad-Hoc committee reviewed the ACSLPA *Hearing Screening Guidelines* (2008) document and made changes based on existing research prior to 2014. ACSLPA Council approved these changes in July 2015. The guidelines continue to be subject to periodic review and revisions over time.

The information provided in this document outlines practices for conducting hearing screening for hearing impairment and is based on the professional opinion of the authors at the time of publication (September 2015). Resources are available to assist regulated members with screening techniques, the screening process, and the identification of risk factors for hearing loss which can be found at the end of this document, in the appendices and on the College website (www.acslpa.ca).

PREAMBLE

Hearing loss prevalence

Congenital, permanent hearing loss (**PHL**) is the most common congenital disorder for which screening techniques that satisfy widely accepted World Health Organization (**WHO**) performance criteria (Wilson & Jungner, 1968) are readily available. Its prevalence in the general newborn population is 1–4 per thousand in Western industrialized societies (Nelson, Bougatsos & Nygren, 2008; Mehra, Eavey & Keamy, 2009). Variation is attributable to the screening criteria, differing equipment algorithms, population genetics, socioeconomic and cultural factors, and the quality of perinatal care. The Alberta Universal Newborn Hearing Screening Project (2001–2004) reported a prevalence of 4.02/1000 babies with **PHL** (Institute of Health Economics, 2012). Another 0.5 cases per thousand may develop in the preschool period, due to cases of late-onset hearing loss or hearing losses due to postnatal infections or injuries (Watkin and Baldwin, 2011). In the absence of Early Hearing Detection and Intervention (**EHDI**) programs, the average age of identification of moderate to severe **PHL** is 24 months of age, whereas mild and moderate hearing loss may not be identified until school age.

For school-aged children aged 6–19 years, the prevalence of hearing loss of all degrees (including slight to mild sensorineural hearing loss, unilateral loss, and conductive hearing loss) is reported to be almost 15% (Niskar et al., 1998). This value increased to 19.5% in a 2005-06 study of 12- to 19-year-old youths, with unilateral and high frequency hearing losses being more

¹ Please refer to Appendix C for a full list of acronyms.

prevalent (Shargorodsky, Curhan, Curhan, & Eavey, 2010). Prevalence values of unilateral hearing loss in children vary from 30/1000–56/1000 (White & Muñoz, 2008; Bess, Dodd-Murphy & Parker, 1998), while prevalence reports for mild bilateral hearing loss vary from 9/1000–15/1000 (Tharpe, 2008; AAA, 2011). A recent Australian study showed an association between parental report of personal stereo usage and slight to mild sensorineural hearing loss (Cone, Wake, Tobin, Poulakis, & Rickards, 2010). Adolescent female youth in the US have shown an increased prevalence of noise-induced threshold shift (Henderson, Testa & Hartnick, 2010) compared to an earlier population study (Niskar et al., 1998), with increased personal stereo usage and lack of use of ear protection being postulated as contributing factors.

It is recognized that the prevalence of hearing loss in the adult population will also increase with age: 12% of those 65–74 years of age, and 26% of those 75 years+ report hearing limitations (Statistics Canada, 2009). Hearing loss is prevalent in nearly two-thirds of adults over 70 years, is frequently undertreated (Lin et al., 2013), and is an independent predictor of cognitive decline and incident all-cause dementia (Gurgel et al., 2014; Lin et al., 2011; Lin et al., 2013).

Hearing loss severity and nature

For the purpose of this document, the definition of *hearing impairment* is a loss of auditory sensation that produces thresholds of 16 **dB HL** or worse in children and 26 **dB HL** or worse in the adult population from 500–4000 **Hz** (and 6000–8000 **Hz** when included) in either ear (ASHA, 2011).

Hearing loss can be expressed in one or both ears with a range of severities and types. Severity labels range from “slight” to “profound” and even a so-called “minimal” hearing loss (16–40 **dB**) causes difficulty understanding speech at normal conversational levels in children (Dodd-Murphy, Murphy & Bess, 2014) and adults. Hearing loss types include:

- Conductive – involving sound transmission through the external and middle-ear structures;
- Sensory – involving the analysis of sound waves and their conversion to a complex pattern of nerve impulses by the cochlea; and,
- Neural – involving the further analysis and transmission of nerve impulses to higher brain centres.

Disorders may occur in any of these systems, alone or concurrently. Many conductive disorders are temporary and/or recurrent, but some may be chronic or permanent. Whereas most sensory or neural disorders are almost always permanent, some may be late in onset or progressively get worse over time.

Sensory deprivation

Early brain development is strongly affected by received stimulation, especially in the first three and a half years of life, which is a period of optimal neuroplasticity in the auditory cortex (Huttenlocher & Dabholkar, 1997). Studies of auditory cortical maturation in humans have shown adverse changes in the anatomy and physiology of the human auditory cortex, as well as functional limitations in auditory perception in the absence of adequate sound reception,

particularly during this sensitive developmental period (Cardon, Campbell & Sharma, 2012; Ponton & Eggermont, 2001).

Similarly, recent research findings have linked late onset sensorineural hearing loss in adults with cognitive decline, altered neural activity and temporal lobe atrophy (Lin et al., 2014; Lin et al., 2013; Peelle, Troiani, Grossman, & Wingfield, 2011).

Language acquisition and reading outcomes

Late identification (i.e., 6–24 months of age in the absence of **EHDI** programs) of permanent childhood hearing impairment (**PCHI**) is suspected of causing delays in oral speech articulation, language acquisition and reading readiness. Reading is a skill that is highly dependent on underlying language ability. According to Pimperton et al. (2014), early identification of **PCHI** is associated with benefits to language and reading outcomes in middle childhood. Their study confirmed that identification of **PCHI** by age 9 months was associated with significantly higher reading comprehension scores, which increases during the teenage years. Further, the non-verbal abilities of teenagers were similar in both early and late identified groups and the researchers suggest that the reading deficits were not from a general cognitive deficit but rather, “from the specific impact of delayed access to optimal language input early in life on language-related abilities” (Pimperton et al., 2014, p. 6).

Alberta does not have a province-wide (mass) screening program for infants, children or adults at the time of this publication. Although a provincial **EHDI** program is planned for full implementation by 2017, the current practice of identifying hearing loss remains sporadic for all ages (i.e., targeted hearing screenings for those suspected or identified with a communication disorder).

PURPOSE OF THIS DOCUMENT

A. Provide background and recommendations for standard procedures for developing a screening program.

The goal of a hearing screening program is to maintain an integrated sequence of activities, including the following:

- Selection of the target population (i.e., mass or all asymptomatic individuals vs. high risk populations);
- Selection of screening personnel;
- Training and supervision of screening personnel
- Implementation of defined protocols;
- Data management; and
- Referral and follow-up of those meeting set criteria (pass vs. fail) and managed by an audiologist, who is a regulated member of ACSLPA.

However, “the components of professional accountability and liability, risk management and quality assurance, and program evaluation must be developed prior to implementation of any screening program. Appropriate development of these components assists the audiologist in ensuring overall program quality and effectiveness” (**ASHA**, 1997; **AAA**, 2011).

In addition to program management, the audiologist is accountable for identifying risk factors (infection prevention and control or **IPC**, invalid screening results resulting from equipment malfunction or errors in calibration, loss to follow-up, etc.) that may impact the effectiveness of the screening program, and developing procedures to minimize or eliminate those factors.

Program evaluation may involve the development of mechanisms to determine pass/refer rates, false positive rates, false negative rates, and assure the effectiveness of follow-up protocols for patients who require rescreening or audiological follow-up. The types of data suggested to determine a program's effectiveness (i.e., sensitivity/specificity, and/or return on investment) include: a) number of clients screened; b) percentage of clients who did not pass the screening procedure (initial and rescreen); c) percentage of clients referred for audiological follow-up; d) number of clients diagnosed with **PHL**, etc. Evaluation should continue on an on-going basis in order to correct factors that negatively impact program performance and patient outcomes. Additional information can be found in guidelines developed by organizations such as the American Academy of Audiology (**AAA**, 2011) or **ASHA** (**ASHA**, 1997).

B. Guide regulated members of ACSLPA in the implementation of procedures for hearing screening (i.e., protocol) itself.

The goal of the hearing screening procedure is to identify individuals (preschool to adult) *most likely to have peripheral hearing impairment* that may affect everyday communication, educational success, social, language, and cognitive development and/or integrity.

Individuals with hearing loss may not possess any identifying risk factors of the disorder and may appear asymptomatic. Screening for the purpose of identifying individuals most likely to have **PHL** may reduce or prevent its many adverse effects. Its main intent is to minimize the immediate and long-term consequences of hearing loss in people of all ages, but as much as possible for children with hearing loss.

C. Act as a guide to help both audiologists and screening personnel in their respective tasks.

It should be noted that while ACSLPA recommends that an audiologist be accountable for a screening program and a resource for hearing screening procedural issues, other "trained" personnel (i.e., **SLP**, **SP**, etc.) are capable of performing the screening procedure under the direction of a designated audiologist.

With the incidence of acquired or late-onset hearing loss rising in the preschool and school-age period (**AAA**, 2011; White & Muñoz, 2008), this document supports the need for both SLP and audiology professions to advocate for the surveillance of hearing disorders in these and older populations (adulthood).

CONSIDERATIONS FOR DESIGNING A SCREENING PROGRAM

This document is intended to be a guide for regulated members and employers for initiating and maintaining an effective hearing screening program. While an audiologist (on behalf of their employer) must select a “target population”, equipment, etc. for a hearing screening program, certain variables have been identified for consideration in the recommendations found in this guideline.

Selection of a screening “test”

The appropriate selection of a screening test depends, in part, on the test’s performance in separating those with the target condition from those without the target condition. Whatever screening test is selected, a single cutoff value (the test criterion) must be chosen. The outcome of the screening is one of two possibilities: “pass” or “refer” (ASHA, 1997).

Visual/Otoscopic Inspection

It is important to visually inspect the external ear and ear canal to determine if any contraindications to screening exist. Visual/otoscopic inspection should not be used in isolation of pure tone or immittance (including tympanometry) testing and will not necessarily prevent one’s ability to participate in a hearing screening program. (i.e., presence of cerumen that is not occluding the ear canal). Otoscopic inspection does not yield specific information into the client’s hearing status, but may be used as per audiological training and scope of practice to determine if the client’s ear canal status is “safe.”

Training screening staff to complete visual or otoscopic inspection is the responsibility of the audiologist only. Visual inspection is to be completed prior to hearing screening and use of an otoscope is advised *whenever insert style ear phones are used*. Screening staff that do not have the required audiological education and training by an audiologist or otolaryngologist are not qualified to make statements about a client’s hearing or ear canal status based on ear canal or middle ear appearance (ASHA, 1997).

Selection of stimuli for hearing screening

Speech-frequency related tones (500, 1000, 2000 and 4000 Hz) are generally used as stimuli in hearing screening protocols for co-operative children and adults. Previously, 500 Hz was dropped from hearing screening protocols, but was supported by the use of tympanometric screening to identify low frequency hearing loss consistent with middle ear effusion. Five hundred Hz is also known to be difficult to hear in noisy environments, thereby producing over-referral to audiology for full audiometric assessment. The use of insert earphones in hearing screening reduces the impact of background noise.

While AAA Guidelines from 2011 are not supportive of the inclusion of 500 Hz, the document and other references suggest that when a failed screening at 500 Hz only was referred for audiological consult, 15% of the 3500 subjects were diagnosed with low frequency conductive hearing loss and none of them had normal hearing (FitzZaland & Zink, 1984). Further, the National Health and Nutrition Examination Survey (NHANES) III, Niskar et al. (1998) reported an incidence of low frequency hearing loss in 7.6% of the 6- to 11-year-old students and 6.6% for the 12- to 19-year-olds. AAA (2011) cites the work of Meinke and Dice (2007) which reported

inclusion of 500 Hz (mainly using a 20–25 dB intensity level) in 17/43 states with existing hearing screening protocols. It is not certain that insert-style headphones were used.

While ACSLPA does not support screening for middle ear disease through hearing screening or tympanometry in isolation, chronic middle ear disease is prevalent in the preschool and school-age population. **ASHA** estimated that 35% of preschool children experience intermittent hearing loss due to repeated or untreated ear infections (**ASHA**, 1997). Similarly, **AAA** (2011) reported that one third of children identified with middle ear effusion will relapse within a three-month time period. Despite the common occurrence of middle ear fluid, it is chronic and fluctuating hearing loss (including 500Hz), that is associated with communication difficulties, not fluid itself.

Some hereditary sensorineural hearing losses (e.g., those involving the Wolfram Syndrome 1 gene-WFS1) present as late onset low frequency progressive hearing losses at and below 2000 Hz (Pennings et al., 2003; Bernalova et al., 2001). Late diagnosis is common because these hearing losses can be missed in newborn hearing screening programs and there may be few symptoms. In a Japanese study (Fukuoka et al., 2007), clinical subjects with hereditary non-syndromic low frequency sensorineural hearing losses had a mean age of 10 years at diagnosis; many subjects exhibited 4-frequency pure tone averages (0.5–4 kHz) in the range of normal (< 20 dB) or mild hearing loss (21–40 dB). Low frequency hearing losses may be missed if 500 Hz is not included in the screening protocol and if progression has not reached 1000 Hz. Parving et al. (2000) reported a prevalence of 0.18/1,000 for low frequency sensorineural hearing impairment (LFSHI) in their study of inherited non-syndromic LFSHI. Examination of data from a large pediatric database (AudGenDB) revealed that progressive hearing losses were better identified when a pure tone average based on 0.5, 1, and 2 kHz was used (Lee & Hood, 2014). Given the concerns for prompt identification and treatment for both sensorineural and conductive low frequency hearing losses, it is recommended that 500 Hz be reintroduced with the expectation that insert phones be used to reduce the effects of environmental noise on screening.

In view of trends regarding the higher incidence of noise induced hearing loss in the adult and teen population, 6000 Hz can be included in the screening protocol, particularly when using insert headphones (reduces the incidence of collapsed ear canals), to identify permanent high frequency hearing loss.

At the time of publication of this document, there are no mass screening programs in the preschool, school age or adult populations in Alberta. The majority of individuals who receive a hearing screening are considered part of a targeted or high risk population who possess pre-existing illness or disorders (i.e., communication delays), which may suggest that the incidence of hearing loss is higher than in the general population. The number of individuals with diagnosed hearing loss in Alberta is unknown for specific population groups as there is no means of tracking this data provincially.

Manufacturers have recently added speech stimuli (in addition to pure tone stimuli) to screening and diagnostic audiometers. Speech stimuli are not frequency specific and may miss the presence of a partial hearing loss (i.e., high or low frequency) and are not recommended for hearing screening purposes (**AAA**, 2011).

Tympanometry screening for middle ear disorders vs. hearing loss

Based on a review of best practices, screening for outer and middle ear disorders or pathology is not recommended. Studies linking otitis media (**OM**) and speech-language development in the 1990s were criticized because they often focused on the number of episodes of otitis media with effusion (**OME**) and not the hearing loss associated with the condition – the variable hypothesized to affect development. According to Roberts et al. (2004), **OME** did not represent “a significant risk to speech production in otherwise healthy children” (**AAA**, 2011). Granted that **OM** is common in the childhood period and coexisting middle ear effusion can be classified as acute, recurrent or chronic, roughly 10–20% of children with known ear infections may have effusion at 12 weeks post-infection (Towards Optimized Practice, 2008).

Casselbrandt et al. (1985) examined preschool children at regular intervals for a year and found 50–60% of child care centre attendees experienced **OME** sometime during the year. Lous and Fiellau-Nikolajsen (1981) reported that 25% of school-age children had effusion sometime during the year (**AAA**, 2011). However, the presence of effusion does not predict the presence of or severity of hearing loss. Therefore, screening for middle ear dysfunction using only pure tones is not considered appropriate, as children with middle ear effusion may not fail a hearing screen.

Screening staff often have only one opportunity to screen a client’s hearing and obtain a “refer” result on that one occasion. Unable to rescreen at a later date when middle ear effusion has resolved, staff must refer that client to diagnostic audiology services for follow-up. Despite the potential for over-referral to audiology for a transient or temporary hearing loss, the immediate referral of a failed screening will better serve the client with chronic middle ear dysfunction and not delay diagnosis or treatment. Additionally, a client at risk of, or who possesses a communication disorder should be monitored by an audiologist for hearing loss associated with the presence of middle ear fluid (Alberta Health Services, 2014, p. 4) anyway.

Middle ear screening and assessment using tympanometry is considered a **restricted activity** that may pose significant risk to a client’s well-being and requires a high level of professional competence to be performed safely. Tympanometry has historically been used in conjunction with pure tone screening and may still be used in Alberta by both speech-language pathologists (**SLPs**) and audiologists. However, not all clinicians (nor **SP**) are competent to perform this task. A detailed case history form may developed by a registered audiologist and include criteria to determine which clients should be excluded from participating in tympanometry. Although tympanometry can be used as part of a hearing screening program, it is not a means of determining hearing status and it is recommended that it be used under the direction of an audiologist. Tympanometry screening should never be used in isolation (**ASHA**, 1997).

Otoacoustic Emissions (OAEs)

OAEs (distortion product or transient evoked **OAEs**) has been used in the screening of newborn hearing in Canada and worldwide. The intended use of **OAEs** measurement is to determine outer hair cell function in the cochlea and not hearing sensitivity. The absence of **OAEs** may not accurately predict hearing loss at any frequency, or to what degree in certain populations, and should not be used in isolation. As these guidelines are to assist the clinician in screening older children and adults, **OAEs** may be difficult to obtain in the presence of middle ear effusion (common in preschool population) and may be absent in adults with normal hearing. Therefore

OAEs will not be addressed in this context. According to **AAA** (2011) and **ASHA** (1997) guidelines, it is recommended that programs “screen populations age three (chronologically and developmentally) and older using pure tones” (**AAA**, 2011, p. 3) and “screening programs using **OAE** technology must involve an experienced audiologist” (**AAA**, 2011, p. 4).

Equipment

Otoscope and disposable specula (if using insert-style headphones): Consult audiologist regarding selection and use of this equipment as part of a screening procedure.

Pure-tone audiometer: Light, portable audiometer with two earphones (i.e., TDH style and insert style), that produces a minimum of octave frequencies between 250 and 8000 **Hz**, at levels ranging from 0 to at least 90 **dB HL** should be considered. Stimuli should include pulsatile presentation option.

Software: Tablet software is available for screening and diagnostic audiometry. At the time of publication of this document, there are no position statements available to guide its use or report its effectiveness in the screening of children or adults. Therefore, it is recommended that regulated members continue to use standard portable screening and diagnostic audiometers.

Headphone style: Standard circumaural or supra-aural headphones are acceptable and may be used in screening and diagnostic audiometry. However, regulated members should consider insert style headphones for screening purposes as they have many advantages over the traditional style headphones, including **IPC**, reducing the effects of ambient noise, preventing collapsed ear canals, etc. Caution must be taken when inserting the sponge tip and must be preceded by visual/otoscopic inspection to determine if the ear canal is “safe.”

Warning about exposure to magnetic fields:

There is potential for an adverse event to occur when screening, assessing, and treating clients with programmable, implanted medical devices, such as cardiac pacemakers/defibrillators and ventriculo-peritoneal (**VP**) shunt valves. Devices have reportedly failed on occasion when they came into contact with audio, wireless, and other devices radiating magnetic fields (i.e., personal and audiometric headphones, loudspeakers, magnetic toys, iPads/tablets, assistive listening devices and hearing aids).

Medtronic (manufacturer of implantable medical devices) reports the Strata shunt valve may be affected by magnetic energy of as little as 90 Gauss and warns patients that caution should be used around professional-type audio headphones (retrieved from: https://www.medtronic.com/content/dam/medtronic-com/products/neurological/shunts/ns-stratamagnetic_rev-e.pdf). Medtronic also cites that earbud type headphones and noise-cancelling phones may have a magnetic strength of 350 Gauss and 135 Gauss respectively. In addition, it was revealed that the standard TDH phones can emit as much as 25–325 Gauss, depending on their placement. Therefore, it is prudent to warn regulated members about the potential complications experienced with this population and to refrain from screening, but instead refer clients with a programmable **VP**

shunt to an audiologist for full audiological assessment with insert-style earphones.

Personnel

While this document is intended for regulated members of ACSLPA and **SP** (supervised by a regulated member), this protocol is available for use by other professions who conduct hearing screening. However, ACSLPA is not responsible for the misuse of this guideline or the actions of professionals belonging to another regulatory body (e.g., physicians, nurses, hearing aid practitioners, etc.).

Referral rates

An unacceptably high over-referral rate can cause dissatisfaction among those being screened as well as those to whom the referrals are sent, thereby reducing the effectiveness of the program. A high under-referral rate, which means that those with a condition are not identified, is also problematic and often results in delayed diagnosis and related consequences (**ASHA**, 1997).

One mechanism for avoiding the problem of a high over-referral rate is to increase screening for the prevalence of the condition in the population. This is done by identifying a subgroup within the population that is at greater risk for having the target condition than the larger general population (i.e., speech-language delay or cognitive disorder). Identification of a high-risk group can reduce an otherwise unmanageable over-referral rate to manageable proportions. Of course, there is a cost to such a decision. By selecting a high-risk subgroup (i.e., speech-language delays/disorders) for screening, those in the unscreened group who truly have the condition will be missed (**ASHA**, 1997).

It is advantageous to provide the initial screening prior to initiating other communication assessments, which will identify if the client's hearing is appropriate for reliable results on speech-language measures. If required, a second screening may be attempted after the speech-language assessment.

Rescreening after repositioning headphones and re-instructing the client has proven to reduce referrals by at least 25% (**AAA**, 2011). In Alberta, often a client is seen by the regulated member or screening personnel on one occasion only. Waiting to rescreen may delay identification of permanent sensorineural or chronic/fluctuating conductive hearing loss.

Follow-up

The World Health Organization (**WHO**) identified 10 principles for screening for a disease or condition, including the assumption that there will be access to facilities for diagnosis and treatment. As such, in rural Alberta where audiological services are not located in the immediate area where a hearing screening program is operating, referral of appropriate clients to more urban centres for confirmation and treatment of hearing loss is required. The **WHO** document, Principles and Practice of Screening for Disease (1968), suggests that, "provision for diagnosis, follow-up and treatment is vitally important; without it, case-finding must inevitably fall into disrepute" (Wilson & Jungner, 1968, p. 17).

Resources

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HEARING SCREENING PROGRAM GUIDELINE

An ACSLPA Guideline is a statement that provides information, directions and recommendations designed to assist clinicians in providing best practice based on available evidence. While regulated members are strongly encouraged to practice in compliance with guidelines, they are required to comply with the “must” statements within a guideline.

Expected Outcomes

To identify individuals (preschool to adult) most likely to have peripheral hearing impairment that may affect everyday communication, educational success, social, language and cognitive development and/or integrity and who require audiological follow-up.

Target Population

Any person, from a preschooler (three years of age) or older may be screened as outlined in this guideline. Any person difficult to test (or if the client is unable to perform conditioned play audiometry) must be referred to an audiologist for full audiological assessment.

Note that clients routinely followed by an audiologist need not participate in a screening program (**ASHA**, 1997).

Clinical Indications

Screen as needed, or requested, when the person has conditions that place them at risk for hearing impairment (see p. 25 and Appendix A). Any person who demonstrates contraindications as evidenced through visual inspection or case history should automatically be referred to an audiologist for full audiological assessment and/or medical referral.

PROGRAM REQUIREMENTS

A. Screening Personnel

For the purposes of this document, screening personnel includes, but is not limited to:

1. Registered audiologists;
2. Registered speech-language pathologists (**SLP**); and,
3. Support personnel (**SP**).

Screening programs are developed and maintained by a registered audiologist and personnel involved will be trained by and in contact with (as per **ASHA**, 1997) a registered audiologist who has training and experience related to the test procedures.

Screening procedures may be performed by non-regulated members under the supervision of regulated ACSLPA members (**SLPs** and/or audiologists) responsible for screening personnel. *However, persons (**SLP** and **SP**) conducting screening procedures are always advised to consult with a registered audiologist in the absence of a “screening program” to ensure safe and appropriate services are provided to the client.*

B. Equipment Specifications

1. Audiometer

- a. Audiometers used in the screening process may be diagnostic or portable in nature and must meet federal/provincial/agency specifications for electrical safety.
- b. Audiometers must be calibrated regularly, at least once every year, following the initial determination that the audiometer meets American National Standards Institute (**ANSI**) standards S3.6-2004 (or current version).
- c. Equipment service records must be maintained for 10 years from the date of the last entry.

Resources

- Alberta College of Speech-Language Pathologists and Audiologists. (2011). *Clinical documentation and record keeping guideline*. Retrieved from <http://acslpa.ca>
- American Academy of Audiology. (2011). *Childhood hearing screening* [Guidelines]. Retrieved from http://audiology-web.s3.amazonaws.com/migrated/ChildhoodScreeningGuidelines.pdf_5399751c9ec216.42663963.pdf
- American-Speech-Language-Hearing Association (1997). *Guidelines for audiologic screening* [Guidelines]. Retrieved from <http://asha.org/policy>

2. Headphones

Insert headphones (i.e., ER-3A), conventional (i.e., supra-aural or circumaural) or noise-cancelling headphones may be used in screening procedures.

Insert headphones are preferred for the following reasons:

- Hygiene (single use)
- Noise reduction in ambient noise
- Elimination of ear canal collapse
- Comfort and acceptance by pediatric clients
- Reduce potential for adverse events in clients presenting with programmable **VP** shunts for hydrocephalus (see *Introduction* and p. 25)

Resources

- Clemis, J.D., Ballad, W.J., & Killion, M.C. (1986). Clinical use of an insert earphone. *Annals of Otolaryngology and Laryngology*. 95(5 Pt 1), 520–524. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/3767222>
- Lo, A.H.C. & McPherson, B. (2013). Hearing screening for school children: Utility of noise-cancelling headphones. *BMC Ear Nose and Throat Disorders*. 13(6). Retrieved from <http://www.biomedcentral.com/1472-6815/13/6>

- Schneider, T., Knauff, U., Nitsch, J., & Firsching, R. (2002). Electromagnetic field hazards involving adjustable shunt valves in hydrocephalus. *Journal of Neurosurgery*, 96(2), 331–334. Retrieved from <http://www.hydroassoc.org/wp-content/uploads/kbase/Electro-Magnetic-Fields-and-Shunts.pdf>

C. Care and Maintenance of Equipment

An audiometer is a delicate electronic instrument and should be treated with care. The following recommendations will facilitate consistent operation of the equipment:

1. Every audiometer must be calibrated according to the **ANSI** Standard S3.6-2004 (or current version) at least once per year (last date of calibration will be indicated on a sticker on the unit).
2. Equipment service records will be maintained for 10 years from the date of the last entry.
3. The headphones require special care, as they are delicate devices. Damage to headphones can be irreparable. **NEVER** substitute another set of headphones for the set that is regularly used with the audiometer without recalibrating the device.
4. Please be careful to avoid the following:
 - Dropping the headphones
 - Snapping the headphone cushions together
 - Pressing the headphones down on a flat surface
 - Poking sharp objects into the diaphragm of the headphone
 - Water damage to the headphones
5. Damaged or cracked ear cushions need to be replaced to ensure optimum fit and environmental sound reduction. Cracked ear cushions cannot be sterilized. Chronic use of harsh detergents (i.e., alcohol) to clean may cause the ear cushions to dry and crack. Headphones that have lost their “spring” or become difficult to resize need to be replaced.
6. Certain extreme environmental conditions may be detrimental to the performance of the equipment. Be sure to avoid the following:
 - a. Extreme heat: **NEVER** leave the equipment resting on a radiator or near any other sources of extreme heat. **DO NOT** leave the equipment inside the car where it would be exposed to direct sunlight in hot weather. Extreme heat can cause serious damage to electronic equipment.
 - b. Extreme cold: Resistance to electrical current flow decreases as temperature decreases. The acoustic output of the audiometer will be affected if it has been sitting in a cold car. Delicate crystals in the microprocessor-based equipment can be damaged if the equipment is used when it is extremely cold. *Always allow time for the equipment to warm up to room temperature before turning on the audiometer.*

- c. High humidity: Do not expose the equipment to high moisture levels as this can damage the internal components.
7. Storage and Transportation Tips (to avoid damaging the equipment)
 - a. Do not leave the equipment switched on with the cover in place as this may cause overheating and damage internal components.
 - b. When transporting the equipment in a car, ensure that it is protected from vibration. Avoid sudden stops, drops, jolts or bumps.
 - c. Keep the headphones inside the audiometer case when not in use.
 - d. Most manufacturers provide information on appropriate temperature ranges for storage, transport, and normal operation. Check the manufacturer instructions provided with your equipment. If in doubt, contact the manufacturer or supplier.

D. Infection Prevention and Control (IPC)

1. Single-use devices (i.e., insert headphones, acoustically transparent disposable headphone covers, hospital-issue hair nets, etc.) are recommended with instruments requiring sterilization or disinfection. Chronic use of harsh detergents (i.e., alcohol) to clean may cause rubber ear cushions to dry and crack. Cracked ear cushions cannot be sterilized.
2. Surface decontamination of materials and devices (i.e., tabletops, toys, etc.) will take place when visibly soiled and between clients to prevent cross-contamination.
3. Personal Protective Equipment (PPE) will be used when indicated and when using decontamination agents.

Resources

- Alberta Health. *Prevent Infections*. Retrieved from <http://www.health.alberta.ca/health-info/prevent-infections.html>

E. Environmental Specifications (Room Acoustics)

1. Conduct hearing screening in a clinical or natural environment conducive to obtaining reliable results.
2. Sound level meters may be used to determine the level of ambient noise in the screening environment [as per **ANSI S3.1 – 1999 (R2013)**]. See *Preparation* – p. 25 and resource provided (below).
3. Some environments may exceed this standard for pure tone screening, but will still allow for accuracy where the screening tone is audible to the screening personnel (whose own hearing thresholds must be within normal limits or a listening check is conducted by someone who is known to have normal hearing thresholds).

4. A functional listening check (p. 26) must be performed each time the equipment is used in order to ensure that it is functioning properly. This takes only a few minutes and is worth the time that might otherwise be wasted if the equipment is not functioning optimally.

Resources

- American National Standards Institute. (2013). *Maximum permissible ambient noise levels for audiometric test rooms [ANSI S3.1-1999 (R2013)]*. New York, NY.

SERVICE DELIVERY COMPONENTS

A. Informed Consent

Ensure that informed consent is obtained and is in compliance with employer policies or agency requirements regarding consent (i.e., obtained in verbal or written form) prior to conducting screening measures and referrals to other professionals.

1. Ensure that clients/caregivers are informed and understand the services and options for service available to them.
2. Provide opportunity for the client/caregiver to ask questions and seek clarification.
3. Ensure that the clients/caregivers have the right to refuse consent or withdraw consent once given.
4. Obtain consent for services (including referrals to audiology) from the client or a substitute decision-maker when a client lacks the capacity to make decisions, subject to ACSLPA Standards of Practice, Code of Ethics and workplace policies.

Resources

- Alberta College of Speech-Language Pathologists and Audiologists. (2009). *Code of Ethics*. Retrieved from <http://acslpa.ca>

B. Inappropriate Procedures

1. Methods using the following:
 - a. Uncalibrated audiometer or acoustic signals (i.e., whisper test, analogue watch test, telephone hearing screening, hand-bell ringing, etc.);
 - b. Non-frequency specific (i.e., speech) stimuli/signals; or
 - c. Automated tests that are not conducted under the supervision of a registered audiologist.
2. Screening in a noisy environment: If the acoustic environment is not appropriate and 500 Hz is not audible to the screener, then screening must not take place and must be moved to an alternate location.

3. Raising the level of the attenuator to “find” threshold information or a response from the client if the client does not respond to the screening (i.e., 20 dB HL) stimulus.
4. Re-screening (second-stage) at a later date. After a “refer” result is apparent, reposition headphones and/or reinstruct client and re-screen immediately (same appointment).
5. Describing the results of a hearing screening as anything other than, no follow-up required (“pass”) or requires follow-up with an audiologist (“refer”).
6. Otoscopic inspection, tympanometry and OAEs performed in isolation and independent of pure tone screening to determine hearing status.

Resources

- American Academy of Audiology. (2011). *Childhood hearing screening* [Guidelines]. Retrieved from http://audiology-web.s3.amazonaws.com/migrated/ChildhoodScreeningGuidelines.pdf_5399751c9ec216.42663963.pdf
- American Speech-Language-Hearing Association. (1997). *Guidelines for audiologic screening* [Guidelines]. Retrieved from <http://asha.org/policy>
- Minnesota Department of Health. (2014). *Hearing screening training manual*. St. Paul, MN. Retrieved from <http://www.health.state.mn.us/divs/cfh/topic/hearingscreening/content/downloads/HearingScreeningManual.pdf>

C. Clinical Process

1. Instruct person to respond in a specified manner (i.e., conditioned play audiometry, conventional hand-raising, verbal, etc.) each time auditory stimuli are perceived.
2. Position headphones (insert or conventional) in/over ears and present a conditioning level pure tone (i.e., 40–50 **dB HL**) at initial frequency (i.e., 1000 **Hz**).
3. Drop attenuator to designated (by age) screening volume and present pure tones at 500, 1000, 2000 and 4000 **Hz** (6000 **Hz** optional). (See detailed protocols for specific ages).
4. *DO NOT raise the level of the attenuator to “find” threshold information or a response from the client.*
5. Record results on a form that contains the date of screening, demographic information, and ear-specific and frequency specific responses. Different agencies may have different forms, but will maintain the aforementioned.

Resources

- Alberta Health Services. (2014). *Audiological management for infants and children with middle ear dysfunction related to otitis media: AHS clinical reference*. Edmonton, AB.
- American Speech-Language-Hearing Association. (1997). *Guidelines for audiologic screening* [Guidelines]. Retrieved from <http://asha.org/policy>

D. Pass/Refer Criteria for Screening Procedure

1. “Pass” result is indicated if reliable responses to stimuli presented (20 **dB HL** pediatric or 25 **dB HL** adult) at 500, 1000, 2000 and 4000 **Hz** (and sometimes 6000 **Hz**) are obtained in both ears.
2. “Refer” result is indicated if client does not respond to at least 50% (required minimum of 2 and not more than 4) of the presentations at any frequency in either ear.
3. Re-screen (i.e., same day/appointment) if a “refer” result is obtained on the first screen prior to referring to audiology.

E. Re-screening

1. In the event a client receives a “refer” result at any frequency, rescreen **immediately** (i.e., same day/appointment).
 - a. Do not wait to re-screen at another appointment or report to audiology after one “refer” result.
 - b. There is no need to refer to audiologist IF the SECOND screening resulted in a “pass.”
2. Reposition headphones and reinstruct client prior to rescreening either ear.

Resources

- American Academy of Audiology. (2011). *Childhood hearing screening* [Guidelines]. Retrieved from http://audiology-web.s3.amazonaws.com/migrated/ChildhoodScreeningGuidelines.pdf_5399751c9ec216.42663963.pdf
- American Speech-Language-Hearing Association. (1997). *Guidelines for audiologic screening* [Guidelines]. Retrieved from <http://asha.org/policy>

F. Documentation

Regulated members of ACSLPA are to follow employer policies related to the minimum data sets required in their clinical documentation. These could vary based on a number of factors including, but not limited to, the practice setting (e.g., outpatient vs. inpatient, ambulatory care centre vs. community health vs. educational setting vs. private practice, etc.), client age, and the documentation’s intended audience.

Please refer to the ACSLPA *Clinical Documentation and Record Keeping* guideline document for more information.

Resources

- Alberta College of Speech-Language Pathologists and Audiologists. (2011). *Clinical documentation and record-keeping guideline*. Retrieved from <http://acslpa.ca>

G. Follow-up Procedures

1. Participation of a client in a screening procedure involves discussion regarding the results of the screen with the client or caregiver/family.
2. A “refer” result (on the re-screen) is indicative of the need for further assessment and is not necessarily indicative of **PHL** and will be described as such.
3. Recommendation for discharge (“pass”) or audiological assessment (“refer”) must be documented in the client’s chart/file, and when the client declines referral for further testing (against recommendation).
4. Audiology services are available for follow-up services across the province of Alberta. If there are no audiological services available in the client’s region, the screening personnel will recommend that the client/family see an audiologist in another locale as directed by the screening program’s supervising audiologist.
5. The client/caregiver may choose private (i.e., fee-for-service) or publicly funded services in the province.
6. Results of a failed screening should be forwarded to the consulting audiologist directly by the screener/referral source (including the screening form that provides client demographics, contact information and results of the screening procedure for all frequencies and both ears).
7. Provision of additional information is recommended, especially if the client was unresponsive, was difficult to test, did not understand instructions, was not in good health, or has other developmental delays.

H. Data Management

Please see information regarding recommendations surrounding transmission, retention, storage and disposal of records addressed in the ACSLPA *Clinical Documentation and Record Keeping* guideline.

Resources

- Alberta College of Speech-Language Pathologists and Audiologists. (2011). *Clinical documentation and record keeping guideline*. Retrieved from <http://acslpa.ca/>

I. Privacy and Confidentiality

SLPs and audiologists need to have access to information in order to provide professional services, including assessment and intervention with clients. While clients generally understand that numerous individuals require access to their health information in order to provide quality care and treatment, clients also expect that their privacy will be respected and that their information will be treated confidentially.

Regulated members of ACSLPA must respect the confidentiality of client information. Requirements for privacy and confidentiality of client information are stated in the ACSLPA Standards of Practice and the ACSLPA Code of Ethics. Privacy legislation varies, depending on the type of organization that the practitioner works in. Please refer to the ACSLPA website for the most current information: <http://acslpa.ca/about-the-college/governance/governing-legislation/>

Resources

- Alberta College of Speech-Language Pathologists and Audiologists. (2011). *Clinical documentation and record keeping guideline*. Retrieved from <http://acslpa.ca>
- Alberta College of Speech-Language Pathologists and Audiologists. (2009). *Code of Ethics*. Retrieved from <http://acslpa.ca>

HEARING SCREENING PROTOCOL COMPONENTS

Please consider viewing ACSLPA's webinar: *Hearing Screening: Tricks of the Trade* (available at <http://acslpa.ca/for-slps-audiologists/research-resources/webinars>). This video presentation provides an overview of the basic process and technique for screening children and adults, toys and methods that have been proven successful when doing conditioned play audiometry and demonstrates two young children having their hearing screened. Risk factors for hearing loss and disorders associated with different types of hearing loss are also discussed.

A. Case History and Visual/Otoscope Inspection

Ideally, a thorough case history will be obtained prior to screening and include a signed consent and completed questionnaire from the client or caregiver. See *Informed Consent* on p. 20.

When visual inspection of the individual is considered suspect (i.e., anatomical abnormalities – see list below), medical referral is warranted and referral for comprehensive audiological assessment may also be appropriate for these cases to gather more in-depth information. *A registered audiologist should be consulted to determine client candidacy to participate in the screening program.*

In general, any person experiencing the following will be excluded from screening and be referred to the appropriate professional (see Appendix A):

PHYSICIAN

- sudden hearing loss (not related to ear infection or wax)** URGENT REFERRAL
- current, chronic or recurrent ear infections
- otorrhea (drainage) and/or blood discharge from the ear canal
- otalgia (ear pain)
- impacted cerumen
- foreign object in the ear canal
- inflammation of the ear

AUDIOLOGIST

- sudden hearing loss (not related to ear infection or wax)** URGENT REFERRAL
- already under the care of an otolaryngologist/ENT specialist or audiologist
- pinna, ear canal, eardrum, head and neck abnormalities
- history of **PHL** in a close/immediate family member
- head injury (requiring recent hospitalization)
- any High Risk Registry (**HRR**) criteria
- clients presenting with programmable **VP** shunts for hydrocephalus

B. Preparation

The acoustic environment for hearing screening is very important. The room will be as quiet as possible. A soundproof environment would be preferable to conduct hearing screenings, but may not be available. In determining whether or not a room is quiet enough for screening, close the door and listen for the following constant or intermittent sounds: hum

from overhead lights, fan/heating/air conditioning noise, intrusion of outdoor noise, indoor noise from nearby halls and rooms, etc. The examiner must perform a listening check of the instrument with the desired headphones in order to determine if the room is quiet enough.

For those with access to a sound level meter with 1/3 octave band measurement capability, the maximum allowable ambient noise levels for hearing screening at 20 **dB HL** using supra-aural earphones are 36, 41, 49, 52 **dB** and 52 **dB SPL** for 500, 1000, 2000, 4000 and 6000 **Hz** (if used) respectively [ANSI S3.1-1999 (R2013)]. Corresponding values (listed in the same order) for use of insert earphones for screening at 20 **dB HL** are: 65, 62, 64, 65 and 68 **dB SPL**.

Performing a Function/Listening Check of the Equipment

The audiometer is an electronic instrument designed to measure the sensitivity of a person's hearing. It is calibrated to produce pure tones at various frequencies in order to measure hearing loss in decibels (**dB HL**).

The examiner will carry out the following procedure each time the audiometer is set up:

1. Close the door to the test room. Plug in the audiometer.
2. Ensure that the headphone jacks are properly plugged into the right (red) and left (blue) sockets.
3. Turn the power switch on.
4. Listen to each headphone at the 20 **dB** intensity level, for each frequency – 500, 1000, 2000, and 4000 **Hz** (6000 **Hz** if used). The examiner will place the headphones in their ears / on their head and sweep through the test frequencies.
5. Assuming the hearing of the examiner is normal, if they can hear the tones at 10 **dB** at all frequencies, then the client being tested should also detect the tones at the appropriate level (i.e., 20 **dB HL**). Listening checks at 10 **dB** below the screening level are recommended in some guidelines. (AAA, 2011; Minnesota Department of Health, 2014).
6. If the acoustic environment is not appropriate and 500 **Hz** is not audible to the screener, then screening will not take place or must be moved to an alternate location.

Resources

- Alberta College of Speech-Language Pathologists and Audiologists. (2010). *Hearing screening: Tricks of the trade* [Webinar]. Edmonton, AB. Retrieved from <http://acslpa.ca>
- American Academy of Audiology. (2011). *Childhood hearing screening* [Guidelines]. Retrieved from http://audiology-web.s3.amazonaws.com/migrated/Childhood_ScreeningGuidelines.pdf_5399751c9ec216.42663963.pdf
- American National Standards Institute. (2013). *Maximum permissible ambient noise levels for audiometric test rooms* [ANSI S3.1-1999 (R2013)]. New York, NY.

- Minnesota Department of Health. (2014). *Hearing screening training manual*. St. Paul, MN. Retrieved from <http://www.health.state.mn.us/divs/cfh/topic/hearingscreening/content/downloads/HearingScreeningManual.pdf>

C. Screening Pure Tones

1. Test frequencies are 500, 1000, 2000, and 4000 **Hz** (6000 **Hz** is optional for teens and adults).
2. The screening level is 20 **dB HL** for children (Dodd-Murphy et al., 2014) and 25 **dB HL** for adults (ensure ambient noise levels are sufficiently low to allow testing to be completed).
3. Any consistent type of response is acceptable (i.e., hand raising, verbal response, etc.) With younger children, a conditioned play audiometry technique may be used (see conditioned play protocol). Any two positive responses from three presentations is considered a “pass.”
4. Failure to respond to at least 50% of the (2 of the 3, or no more than 4) presentations, at any frequency, at the screening level in either ear constitutes a “refer” result.
5. In the event the client does not receive a “pass” on this occasion, a rescreen is indicated immediately or before the client leaves your care. The clinician is instructed to remove the headphone(s) and reposition them/reinstruct client. Repeat screening procedure (single or all frequencies) prior to communicating with the parents and prior to referring to an audiologist.
6. Referral of a client, who fails the screening on the second attempt, will be made to an audiologist. The screening personnel should be familiar with resources available to the client and refer them to the appropriate audiology service for follow-up as outlined by the program’s supervising audiologist.

Resources

- American Academy of Audiology. (2011). *Childhood Hearing Screening [Guidelines]*. Retrieved from http://audiology-web.s3.amazonaws.com/migrated/ChildhoodScreeningGuidelines.pdf_5399751c9ec216.42663963.pdf
- Dodd-Murphy, J., Murphy, W., & Bess, F.H. (2014). Accuracy of school screenings in the identification of minimal sensorineural hearing loss. *American Journal of Audiology*, 23(4), 365–373.

D. Recording Results (PASS / REFER Criteria)

1. The results of the pure tone hearing screening must be recorded in client chart. Hearing screening forms may be provided by the employer.
2. EXAMPLE: Design of forms may vary depending on employer requirements. Record a symbol for a positive response (“√”) or for no response (“x”) under the appropriate box for each frequency for the right and left ear for pure tone testing. Remember that an individual must respond to at least 50% of the (three or four) presentations at each frequency to receive a “pass” result for that ear. Responses will be recorded on a screening form (see example below):

Chart for Hearing Screening												
Initial Screen	500 Hz			1000 Hz			2000 Hz			4000 Hz		
Right Ear	√	√		√	√		√	√		√	x	x
Left Ear	√	√		√	√		√	√		x	√	x

Re-screen	500 Hz			1000 Hz			2000 Hz			4000 Hz		
Right Ear										√	√	
Left Ear										√	√	

E. Referral Process (See Appendix A)

1. Refer the client to an audiologist if:
 - the client fails the immediate (same day/appointment) re-screening;
 - the client could not be conditioned to the task (i.e., using play during the re-screen); or
 - the client is difficult to screen (non-compliant).
2. Inform the client/caregiver of the screening result. If a client has failed the screen or was uncooperative, indicate to the client/caregiver that with his/her permission you will make a referral to an audiology facility for follow-up (out of region if required). Allow the client/caregiver to choose a facility and inform them that he/she will be contacted by that facility to arrange an appointment.
3. For clients who have failed the re-screen, forward the results to the audiology facility to which the client is being referred. It is important to send the completed form as soon as possible so that follow-up can be arranged promptly.
4. If unable to conduct the hearing screen, for whatever reason, please note that in the “comments” section of the form.

F. Audiology Services

Audiology services for those who fail the hearing screening are available in many regions in the province. Know your referral location for audiology services as suggested by the screening program's supervising audiologist.

When looking for a professional to assist with hearing, ensure that the person is a "Registered Audiologist" or "R.Aud". The client/caregiver may choose private (i.e., fee-for-service) or publicly funded services in the province.

Resources

- Public: <http://www.albertahealthservices.ca/FacilitySearch/?filter=services>
- Private: <http://www.health.alberta.ca/documents/AADL-Vendors-Hearing-Aid.pdf> **

This list is in constant flux due to ongoing revisions. For inquiries call Alberta Aids to Daily Living (AADL**). You can inquire with a chosen facility regarding the availability of audiology services in private practice businesses.

(DETAILED) CONVENTIONAL HEARING SCREENING PROTOCOL

A. Screening Procedure

This procedure will be followed by the examiner each time screening is attempted:

1. The audiometer will be plugged in or turned on and a listening check must be done before use. The power indicator light (i.e., may be marked “Power On”) must come on.
2. Check inside the audiometer to be sure that the red (right) plug and blue (left) plug are in the correct red and blue sockets and are fully inserted into the receptacles.
3. Position the audiometer with the control panel facing the examiner. The client should be seated on a chair, facing away from the tester, in such a way that the client cannot see the tester’s hand while he/she is operating the audiometer.
4. Visually inspect client for pinna, ear canal, head and neck abnormalities. If abnormalities are present, do not screen and refer client to a registered audiologist for full audiological assessment (see Appendix A and *Referral Process* on p. 28). If no abnormalities are identified, proceed with screening.
5. Instruct the client carefully. Explain to the client that he/she should let the examiner know when a sound is heard, responding right away even if the beep sounds far away. The client should raise his/her hand for as long as the sound is heard, and put it down when the sound disappears.
6. Play audiometry would be approached slightly differently (child who is not yet able to raise his/her hand when the beep is heard). See *Detailed Conditioned Play Audiometry Protocol*, p. 32.
7. When using TDH or circumaural headphones, remove the client’s glasses (if worn) to prevent inadequate acoustic seal or discomfort. Brush the hair behind the ears. Position the headphones so that the small round diaphragm in the middle of the headphone is directly opposite and over the ear canal.
8. If using insert headphones, select appropriate size of tip (pediatric or adult). Pinch the end tip to collapse the sponge prior to inserting into the client’s external ear canal. Insert the sponge tip into the canal, leaving the sponge visible and potentially flush with the opening of the canal (no further than the cartilaginous portion of the ear canal) to maximize sound retention and reduce the effects of ambient noise. If the entire sponge is capable of going further than flush with the opening of the canal, use a larger size sponge.

B. Presentation of the Stimulus

Examiners will follow these presentation instructions each time screening is attempted:

1. Begin with the right ear.
2. Set the frequency dial to 1000 **Hz** and the intensity to condition the client at 40–50 **dB** with headphones on the client.
3. Press the button for the right ear and hold for three seconds, observing the response.
4. If the client responds, then reduce the intensity to screening level (i.e., 20 **dB HL**) and present the tone again. After conditioning, the intensity level **MUST** remain constant for the entire test.
5. Pause between presentations for at least three seconds. The interval time between tones will be irregular (short and long) to avoid having the client anticipate a rhythm and guess when the tone should be heard.
6. Present each tone at least 2 times and not more than 4 times at the same intensity. At least two positive responses out of three (and not more than 4) presentations constitute a “pass” at that frequency. Remember that the client must respond at each test frequency (500, 1000, 2000, and 4000 **Hz** and 6000 **Hz**, if included) in each ear in order to “pass” the overall screening.
7. Next, turn the frequency dial to 2000 **Hz** and follow the same procedure.
8. Turn the frequency dial to 4000 **Hz** and repeat the procedure.
9. Turn the frequency dial to 6000 **Hz** (if included) and repeat the procedure.
10. Turn the frequency dial to 500 **Hz** and repeat the procedure.
11. Select and press the indicator button for the left ear and repeat the procedure starting at step 6.
12. Repositioning the headphones and careful reinstruction will likely reduce the number of referrals to audiology for follow-up.

(DETAILED) CONDITIONED PLAY AUDIOMETRY PROTOCOL

3 years to 5 years chronological or developmental age

See also ACSLPA Webinar: *Hearing Screening: Tricks of the Trade**

Consider conditioned play activities an ice-breaker with small children. If hearing screening is considered part of a speech-language assessment, make every effort to conduct hearing screening prior to the assessment. A second or rescreening is to take place at the end of an assessment in the event of a “refer” result on the initial screen to reduce over-referrals due to headphone placement issues. Repositioning the headphones and careful re-instruction will likely reduce the number of referrals.

Any number of tasks may be used in conditioned play audiometry (i.e., putting a block or small toy in a bucket or large container, placing a piece of puzzle in a puzzle board, or placing pegs in a pegboard). The task should be appropriate to the child’s dexterity, age, and developmental level. If the client is unable to perform conditioned play audiometry, the client must automatically be referred to an audiologist for audiological assessment (with receipt of client/caregiver consent).

A. Screening Procedure

1. The audiometer will be plugged in or turned on and a listening check must be done before use. The power indicator light (i.e., may be marked “Power On”) must come on.
2. Check inside the audiometer to be sure that the red (right) plug and blue (left) plug are in the correct red and blue sockets and are fully inserted into the receptacles.
3. The audiometer will be positioned with the control panel facing the examiner. The client should be seated on a chair, facing away from the tester, in such a way that the client cannot see the tester’s hand while he/she is operating the audiometer.
4. Visually inspect client for pinna, ear canal, head and neck abnormalities. If abnormalities are present, do not screen and refer client to a registered audiologist for full audiological assessment (see follow-up procedures). If no abnormalities are identified, proceed with screening.
5. When using TDH or circumaural headphones, remove the client’s glasses (if worn) to prevent inadequate acoustic seal or discomfort. Brush the hair behind the ears. Position the headphones so that the small round diaphragm in the middle of the headphone is directly opposite and over the ear canal.
6. If using insert headphones, pinch the end tip to collapse the sponge prior to inserting into the client’s external ear canal. Insert the sponge tip into the canal, leaving the sponge visible and potentially flush (no further) with the opening of the canal to maximize sound retention and reduce the effects of ambient noise.

B. Conditioning and/or Re-instructing

Examiners will follow these presentation instructions each time screening is attempted.

1. **Place the headphones on the table** (so they are functioning like a loudspeaker) and hand the child a peg.
2. Set the frequency indicator to **1000 Hz** and present the tone at **90 dB HL** (or limits of the audiometer) for two to three seconds.
3. The tester will demonstrate an appropriate response the first few times the tone is presented to ensure the child understands the task.
4. Allow the child to practice several attempts and praise the child with each successful response. Use hand-over-hand assistance to train response, if required.
5. Once the child consistently responds appropriately, introduce the headphones directly into position and reduce the intensity of the tone to the level indicated below.
6. If the tester is unable to perform conditioned play audiometry, the child must automatically be referred to an audiologist for audiological assessment.

C. Presentation of the Stimulus

1. Begin with the right ear.
2. Set the frequency dial to **1000 Hz** and the intensity to **40–50 dB** to continue conditioning the response, now with headphones on.
3. Press the button for the right ear and hold for three seconds, observing the response.
4. If the child responds, then reduce the intensity to screening level (i.e., **20 dB HL**) and present the tone again.
5. Pause between presentations for at least three seconds. The interval time between tones will be irregular (short and long) to avoid having the client anticipate a rhythm and guess when the tone should be heard.
6. Present each tone at least 2 times and not more than 4 times at the same intensity. The intensity level **MUST** remain constant for the entire test. At least two positive responses out of 3 (and not more than 4) presentations constitute a “pass” at that frequency. Remember that the client must respond at each test frequency (**500, 1000, 2000, and 4000 Hz** and **6000 Hz**, if included) in each ear in order to “pass” the overall screening.
7. Next, turn the frequency dial to **2000 Hz** and follow the same procedure.
8. Turn the frequency dial to **4000 Hz** and repeat the procedure.
9. Turn the frequency dial to **500 Hz** and repeat the procedure.
10. Select and press the indicator button for the left ear and repeat the procedure starting at step 6.

SCREENING ADULTS (18+) FOR HEARING DISABILITY

A. Common Causes of Hearing Loss in Adults

Acquired hearing loss in the adult population can have many etiologies. Occasionally there may be more than one risk factor for an individual to sustain a hearing loss over time. Ototoxic medications, illness, and exposure to loud noise are only a few common causes. For more information on potential causes for hearing impairment in the adult population please see websites such as Speech-Language Audiology Canada (**SAC**) at www.sac-oac.ca and **ASHA** at <http://www.asha.org/public/hearing/Causes-of-Hearing-Loss-in-Adults>.

B. Standard Screening Protocols

Standard pure tone screening measures may be used with the adult population as well (see above conventional procedure/protocol). Hearing screening presentation levels in the adult population (aged 18 years or more) has been suggested as 25 **dB HL** (5 **dB** higher than pediatric population) across the speech frequencies (500-4000 **Hz**) and higher (6000 or 8000 **Hz**), if possible. For screening at this slightly higher intensity level the maximum permissible ambient noise levels are 5 **dB** higher than for the 20 **dB HL** screening level (**ANSI**, 2013) for circumaural and insert-style headphones (see *Preparation* – p. 25).

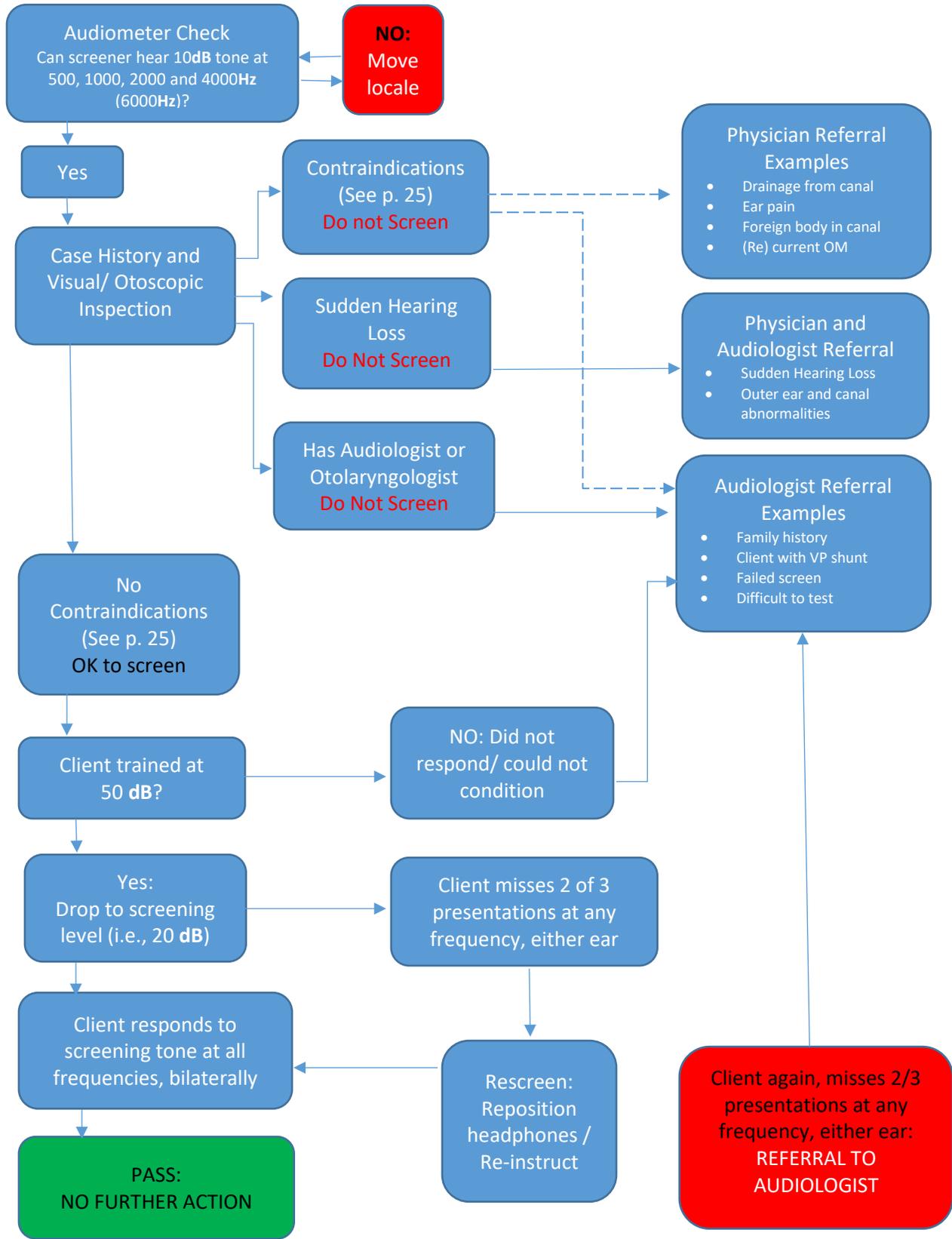
C. Checklists as Hearing Screening Tools

Alternatively, use of *Hearing Handicap Inventory for the Elderly* (**HHIE**; Chou, Dana, Bougatsos, Fleming & Beil, 2011) or *Self-Assessment of Communication* (**ASHA**, 1997) may be acceptable when screening for hearing sensitivity is not an option. Referral to a registered audiologist may be determined by the results of the selected inventory.

Resources

- American Speech-Language-Hearing Association. (1997). *Guidelines for audiologic screening* [Guidelines]. Retrieved from <http://asha.org/policy>
- American National Standards Institute. (2013). *Maximum permissible ambient noise levels for audiometric test rooms* [**ANSI** S3.1-1999 (R2013)]. New York, NY.
- Chou, R., Dana, T., Bougatsos, C., Fleming, C., & Beil, T. (2011). Screening adults aged 50 years or older for hearing loss: A review of the evidence for the U.S. Preventive Services Task Force. *Annals of Internal Medicine*, 154(5), 347–355 & W105-W118. Retrieved from <http://www.uspreventiveservicestaskforce.org/uspstf/uspshhear.htm>

APPENDIX A: HEARING SCREENING PROTOCOL



APPENDIX B: PEDIATRIC RISK INDICATORS FOR HEARING LOSS

This document serves as a companion to the Hearing Screening Guideline (ACSLPA, 2015) to assist the clinician in the selection of the target population to be screened and in identification of children most likely to have peripheral hearing impairment (and require audiological follow-up) that may affect everyday communication, educational success, social, language and cognitive development and/or integrity. See p. 35 for risk indicators and resources for hearing impairment in adults.

RISK INDICATORS ASSOCIATED WITH PERMANENT CONGENITAL, DELAYED-ONSET, OR PROGRESSIVE HEARING LOSS IN CHILDHOOD

Risk indicators that are marked with a “§” are of greater concern for delayed-onset hearing loss.

1. Caregiver concern§ regarding hearing, speech, language, or developmental delay.
2. Family history§ of **PCHI**.
3. Neonatal intensive care (**NICU**) of more than 5 days or any of the following regardless of length of stay: **ECMO**§, assisted ventilation, exposure to ototoxic medications (gentamycin and tobramycin) or loop diuretics (furosemide/Lasix), and hyperbilirubinemia that requires exchange transfusion.
4. In utero infections, such as **CMV**§, herpes, rubella, syphilis, and toxoplasmosis.
5. Craniofacial anomalies, including those that involve the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies.
6. Physical findings, such as white forelock, that are associated with a syndrome known to include a sensorineural or permanent conductive hearing loss.
7. Syndromes associated with hearing loss or progressive or late-onset hearing loss§, such as neurofibromatosis, osteopetrosis, and Usher syndrome; other frequently identified syndromes include Waardenburg, Alport, Pendred, and Jervell and Lange-Nielson.
8. Neurodegenerative disorders§, such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich ataxia and Charcot-Marie-Tooth syndrome.
9. Culture-positive postnatal infections associated with sensorineural hearing loss§, including confirmed bacterial and viral (especially herpes viruses and varicella) meningitis.
10. Head trauma, especially basal skull/temporal bone fracture§ that requires hospitalization.
11. Chemotherapy§

REFERENCE

- Joint Committee on Infant Hearing (**JCIH**). (2007). *Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs*. American Academy of Pediatrics, *120*(4), 898–921. Retrieved from <http://pediatrics.aappublications.org/content/120/4/898.full?ijkey=oj9BAleq210IA&keytype=ref&siteid=aapjournals#sec-48>

APPENDIX C: ACRONYMS

AAA	American Academy of Audiology
AADL	Alberta Aids to Daily Living
ACSLPA	Alberta College of Speech-Language Pathologists and Audiologists
AHS	Alberta Health Services
ANSI	American National Standards Institute
ASHA	American Speech-Language Hearing Association
CMV	Cytomegalovirus
dB	Decibels
EHDI	Early Hearing Detection and Intervention
ECMO	Extra-corporeal Membranous Oxygenation
HHIE	Hearing Handicap Inventory for the Elderly
HHR	High Risk Registry
IPC	Infection Prevention and Control
HL	Hearing Level
Hz	Hertz, cycles per second, frequency
JCIH	Joint Committee on Infant Hearing
NICU	Neonatal Intensive Care Unit
OAE	Otoacoustic Emissions
OM	Otitis Media
OME	Otitis Media with Effusion
PCHI	Permanent Childhood Hearing Impairment
PHL	Permanent Hearing Loss
PPE	Personal Protective Equipment
SAC	Speech-Language Audiology Canada
SLP	Speech-Language Pathologist
SP	Support Personnel (with SLP or Audiologist)
SPL	Sound Pressure Level
VP	Ventriculoperitoneal (shunt)
WHO	World Health Organization

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