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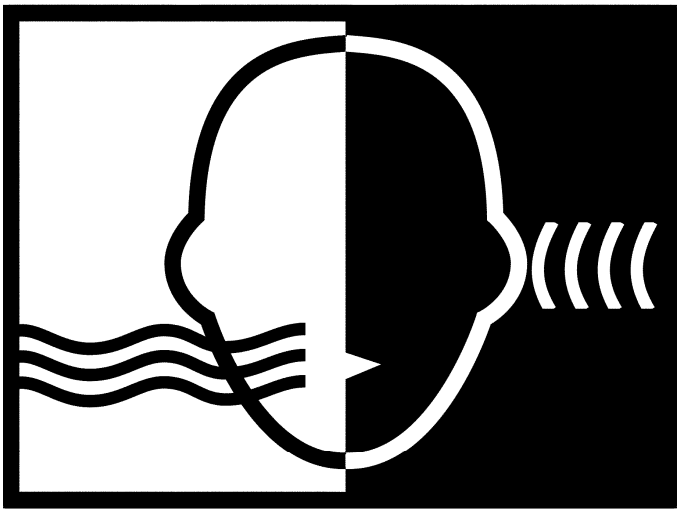

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PRACTICE STANDARDS AND GUIDELINES FOR HEARING ASSESSMENT OF CHILDREN BY AUDIOLOGISTS

APPROVED MARCH 2008

PRACTICE STANDARDS AND GUIDELINES
HEARING ASSESSMENT OF CHILDREN BY AUDIOLOGISTS

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EXECUTIVE SUMMARY

Hearing Assessment of Children by Audiologists

Hearing loss affects a child's speech-language, cognitive and social development and academic potential. Therefore, the prompt identification of hearing loss and intervention to mitigate its effects is of critical importance. Comprehensive hearing assessment for children by audiologists includes behavioural, physiologic and developmental measures and multiple tests in a test battery which is outcome-based, valid and reliable. Using a test battery or a multi-component approach to assessment provides cross-checks for assessment accuracy and facilitates interpretation.

This document describes the practice standards and guidelines for hearing assessment for children by audiologists and outlines the resource requirements, required competencies, components and a model of service delivery to provide appropriate, efficient, and accurate assessment of the auditory system of children at all ages.

Since the introduction of newborn hearing screening in Ontario and elsewhere, referral for hearing assessment for children often occurs in the first months of life. In this population and others of an equivalent developmental level, a reliance on electrophysiological measures in the attainment of threshold estimates is necessary and is considered adequate for proceeding with hearing aid fitting or other intervention.

For older children and children at a more advanced developmental level, behavioural hearing threshold measurement is possible and appropriate. Regardless of the procedures used in the acquisition of hearing thresholds and threshold estimates, certain principles representing standards of practice for audiologists in the performance of these procedures apply, and are outlined in this document. The ultimate goal of hearing assessment is to define the type, degree and configuration of hearing impairment such that appropriate intervention can proceed in a timely manner.

A) PREAMBLE

Practice Standards and Guidelines (PSGs) are necessary to ensure quality care to the people of Ontario who require hearing health care. The initial assessment of auditory function is fundamental to providing quality hearing health care. It is the intent of this guideline to provide audiologists in Ontario with an overview of the specific processes for hearing assessment in children and to provide some of the knowledge necessary to make responsible decisions regarding paediatric hearing assessment. This guideline is meant to be used as a decision-making framework. It is not intended to be a tutorial or to provide audiologists with all the information required for hearing assessment for children. Audiologists are ethically responsible to ensure their competence in hearing assessment for children and to ensure that their patients/clients are safe during the performance of these services. Specialized competencies are required for paediatric populations. It is essential that audiologists have the necessary expertise, resources and equipment for hearing assessment in this population where the risk of harm may be amplified.

This PSG incorporates both "must" and "should" statements. "Must" statements establish standards that audiologists must always follow. In some cases, "must" statements have been

established in legislation and/or CASLPO documents. In other cases, the "must" statements describe standards that are established for the first time in this PSG.

"Should" statements incorporated into this guideline describe best practices. To the greatest extent possible, audiologists should follow these best practice guidelines. Audiologists should exercise professional judgment, taking into account the environment(s) and the individual patient/client's needs when considering deviating from this guideline. Audiologists must document and be prepared to fully explain departures from this guideline.

B) DEFINITION OF SERVICE

This document describes hearing assessment for children by audiologists. Permanent hearing impairment is a low prevalence disorder that has significant developmental implications if not identified early. The incidence of congenital permanent hearing impairment, i.e. present in the newborn population, has been shown to be 4/1000 of a degree of moderate or worse in the better ear.[1] This incidence doubles through the early school years due to late onset and progressive congenital impairment. Additionally, transient conductive impairment due to otitis media and other disorders may be present in up to 33 per cent of all preschool children at any given time.[2]

The main goals of hearing assessment for children are (i) to determine the presence or absence of hearing impairment, (ii) to provide a sufficient audiometric basis, in the case of identification of hearing impairment, to begin treatment or intervention to improve hearing, and (iii) to provide a baseline for follow-up services such as surveillance for late-onset or progressive hearing impairment, candidacy for assistive devices, referral to intervention services and additional evaluation. The specific objectives of hearing assessment are to obtain valid and accurate estimates of ear-specific, frequency-specific hearing thresholds and to determine the type of any hearing impairment present (conductive, sensorineural and mixed).

The philosophy of PSGs is intended to be consistent with the World Health Organization's (WHO) International Classification of Functioning (ICF), Disability and Health[3] to support the use of unified terminology across health-related disciplines.[4, 5] Discussion of the purpose of hearing assessment for children is framed using WHO terminology as illustrated below.

The overall objective of hearing assessment for children is to optimize the individuals' ability to communicate in natural environments, and thus improve their quality of life. This objective is best achieved through the provision of services that are integrated into meaningful life contexts. The WHO's established health classification system, the ICF, offers service providers an internationally-recognized conceptual framework and common language for discussing and

[1] Fortnum H, Summerfield Q, Marshall D. (2001) Prevalence of permanent childhood hearing impairment in the United Kingdom and implications for universal neonatal hearing screening: questionnaire based ascertainment study. BMJ 323:1-6.

[2] Widen, J.E., Folsom, R.C., Cone-Wesson, B., Carty, L., et al. (2000). Identification of neonatal hearing impairment: hearing status at 8 to 12 months corrected age using a visual reinforcement audiometry protocol. Ear & Hearing 21(5):471-487.

[3] World Health Organization. (2001). The International Classification of Functioning, Disability, and Health. Geneva, Switzerland: Author.

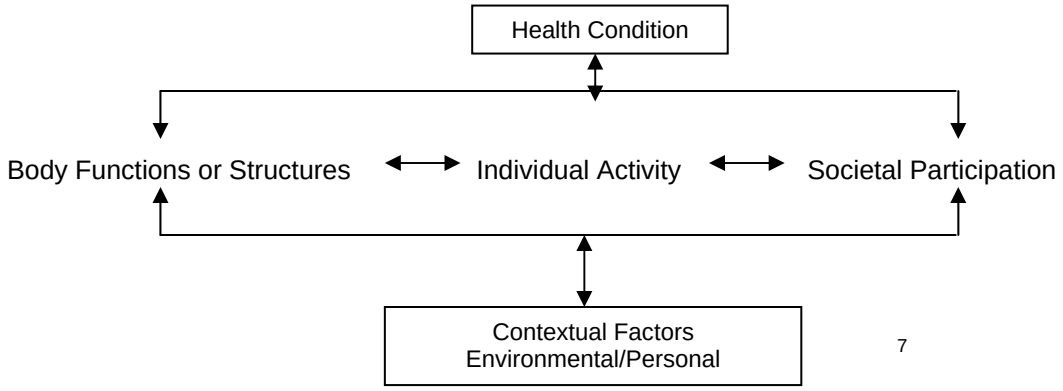
[4] Eadie, T. L. (2001). The ICIDH-2: Theoretical and Clinical Implications for Speech-Language Pathology. *Journal of Speech-Language Pathology and Audiology, 25(4)*, 181-200.

[5] Threats, T. T. (2002). *The International Classification of Functioning, Disability and Health.* Heart and Stroke Foundation of Ontario, Presentation, Aphasia Institute, Toronto.

describing human functioning and disability.[6] This framework can be used to describe the role of audiologists in enhancing quality of life through hearing assessment for children, regardless of setting, as illustrated below.

Hearing assessment must address not just the ear and hearing function but also the unique set of characteristics of the whole person, including hearing and communication needs and demands, linguistic and cognitive abilities, limitations of vision and motor control, familial attitudes to impairment and interventions, and listening and communication environments and supports.

Dimension	**Definition**	**Examples**
Impairment	Problems in body structures and/or body functions such as significant deviation or loss	Hearing loss sufficient to interfere with communication ability: delays in speech-language, cognitive and social development and academic potential; disorder of neural structures in the auditory cortex in terms of processing auditory information
Activity/ Participation	Aspects of functioning from an individual or societal perspective	Difficulty in conversations, limitations in expressing ideas, opinions, choices, wants and needs; social isolation, dependence on others for functional communication, academic difficulties, and limited employment opportunities
Contextual Environmental Factors	Factors that impact disability ranging from the individual's immediate environment to the general environment	Need for continuous family and friendship support to enable communication, financial constraints, inflexible academic environment
Contextual Personal Factors	Individual factors that influence performance in the environment	Race, gender, age, lifestyle, habits, upbringing, coping styles, social background, education, past experiences, character style, behaviour



[7]

[6] World Health Organization. (2001). The International Classification of Functioning, Disability, and Health. Geneva, Switzerland: Author.

[7] Eadie, T. L. (2001). The ICIDH-2: Theoretical and Clinical Implications for Speech-Language Pathology. *Journal of Speech-Language Pathology and Audiology, 25(4)*, 181-200.

Hearing assessment for children by audiologists encompasses all components and factors identified in the WHO framework. That is, audiologists work to improve quality of life by reducing impairments to communication and hearing by lessening limitation to activity and participation and/or modifying the environmental barriers of the individuals they serve. Audiologists serve individuals with known impairments, delays or disorders (e.g., permanent or transient hearing impairment) as well as those with activity limitations or participation restrictions (e.g., communicative and social interaction, academic involvement and limitations to success) related to auditory impairment which may not have been formally identified. The role of audiologists includes prevention of specific disorders, as well as identification, and (re)habilitation of these functions.

C) SCOPE OF PRACTICE

The *Audiology and Speech-language Pathology Act, 1991,* states: "The practice of audiology is the assessment of auditory function and the treatment and prevention of auditory dysfunction to develop, maintain, rehabilitate or augment auditory and communicative functions." 1991, c. 19, s. 3 (1). Hearing assessment is within the scope of practice of audiologists in Ontario. Hearing assessment to quantify and qualify hearing in terms of the degree, type and configuration of the hearing loss in children requires specialized skills. This should only be performed by audiologists who are well trained and experienced in procedures and who are fully prepared to manage any problems that might develop. Expertise in hearing assessment is gained through the academic training program, hands-on training, experience and continuing education opportunities. Specialized competencies are required and individual audiologists must decide whether they have the competencies to offer hearing assessment for children. It is essential that audiologists have the necessary expertise, resources and equipment to provide hearing assessment for children in order to minimize harm for infants and children and their families requiring these services.

D) TARGET PATIENT/CLIENT POPULATION

The target population for hearing assessment for children is any child who is at risk for, suspected of, or identified with auditory impairment, disorder, or disease, including, but not limited to:

- Children referred from newborn hearing screening (universal newborn hearing screening, UNHS).
- Children for whom there is suspicion of delayed communication development, otologic concerns, and/or a question of auditory responsiveness.
- Children whose case histories include risk indicators associated with congenital, progressive or late onset permanent hearing impairment.
- Children with developmental delay.

Target Impairment

The target impairment includes any degree of hearing threshold elevation which will compromise auditory development and speech perception, in the absence of intervention. Most hearing impairment is characterized by a loss of sensitivity to sound, as reflected in audiometric thresholds. Additionally, hearing impairment includes the cluster of disorders commonly termed 'Auditory Neuropathy[8]/Auditory Dys-synchrony'[9] (AN/AD). AN/AD is included in the target

[8] Starr A, Picton T, Sininger Y, Hood L, Berlin C. (1996). Auditory neuropathy. Brain 1193:741-53

because it may be present in up to 10 per cent of infants with permanent hearing impairment and because even if there is negligible loss of hearing sensitivity, there is likely to be a significant disorder of speech perception.

E) RESOURCE REQUIREMENTS

Audiologists must have the following resources to perform hearing assessment for children:

1. An audiometric test environment compliant with ANSI S3.1 - 1999 (R 2003 or current version) for maximum permissible ambient noise levels for audiometric test rooms. [10] If any portion of the hearing assessment is conducted through a sound field speaker, then the room should meet the minimum dimensional requirements for speaker calibration.

2. A type 1A (ANSI S3.6 - 2004 or current version) full-range dual channel diagnostic audiometer with insert earphones (Etymonic 3A or 5A pending Health Canada approval) and TDH style headphones (ANSI S3.7 - 1995 (R 2003) or current version), and bone conduction oscillator (ANSI S3.13 - 1987 (R 2007) or current version);

3. High resolution otoscope with paediatric and standard tips;

4. A type 1 (ANSI S3.39 - 1987 (R 2007) or current version) full-range acoustic immittance measurement system;

5. Materials required to meet the standards for infection control based on the needs of the practice. In most instances, resources to ensure cleaning, sanitization and low level disinfection will be sufficient (e.g., disposable gloves, cleaning solutions). In cases where the need for infection control is semi-critical, such as with a patient/client who presents with non-intact skin, resources for intermediate or high level disinfection will be required. (Refer to Infection Control for Regulated Health Professions, CASLPO Edition: 2006.)

All of the above equipment should be routinely checked for function and calibrated annually as defined in the appropriate standard (CASLPO Position Statement on Servicing Requirements by Audiologists (in press)).

PRACTICE STANDARD E.1

Audiologists must have the required resources in order to perform hearing assessment in children.

The following resources are optional in the performance of hearing assessment for children in general, but must be utilized when specific test procedures are needed to meet the individual needs of the child.

1. Diagnostic auditory brainstem response technology capable of 2-channel recording at multiple frequencies via air and bone conducted stimuli;

[9] Rance G. Auditory Neuropathy/Dys-synchrony and its Perceptual Consequences. (In press)
[10] Frank, T. (2000). ANSI Update: Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms. American Journal of Audiology, 9, 1-6.

2. A type 1 (ANSI S3.39 - 1987 (R 2007) or current version) full-range acoustic immittance measurement system capable of both low frequency (226Hz) and high frequency (660 - 1000Hz) tympanometry;

3. Distortion product or transient evoked otoacoustic emissions test equipment;

4. Visual reinforcement audiometric system, with at least two animated toys or video reinforcers;

5. Selection of toys for conditioned play and distraction during visual reinforcement audiometry;

6. Cerumen management tools and materials. Refer to *Cerumen Management for Regulated Health Professionals Guideline (2004)* for appropriate techniques and materials;

7. Real-ear measurement system (ANSI S3.35 - 2004, ANSI S3.42 - 1992 (R 2007) or current versions).

PRACTICE STANDARD E.2

Audiologists must have the required resources to meet the needs of the population served and procedures utilized.

In the event that these resources are deemed necessary for the completion of an assessment of an individual and the audiologist does not have them available, appropriate expedient referrals must be made.

PRACTICE STANDARD E.3

Audiologists must make appropriate and expedient referrals when they do not have the required resources to meet the needs of the patient/client.

F) COLLABORATION REQUIREMENTS

It is important that the audiologist understands his/her role in the hearing assessment process. Appropriate referrals must be facilitated when assessment results indicate a need for further assessment or treatment beyond the available resources, scope of practice or expertise of the audiologist. In the event that personal amplification or an advanced listening technology is the preferred treatment option and the assessing audiologist does not prescribe or dispense these devices, a referral must be made to an appropriate professional.

PRACTICE STANDARD F. 1

Audiologists must refer when their competencies or service delivery are not sufficient to meet the patient/client needs or safely manage the risks.

There may be more than one audiologist involved in hearing assessment and ongoing care of the child, and therefore it is important that each audiologist understands his/her role in the provision of hearing assessment in children. The transference of a portion or all of hearing

assessment procedures between audiologists is not a delegation but rather collaboration. The role and level of responsibility of each audiologist to the patient/client in hearing assessment and habilitation procedures is determined by the wishes of the patient/client and by the existing collaboration between audiologists. This collaboration must be in the best interest of the patient/client and must meet the requirements of the Position Statement on Concurrent Intervention by CASLPO Members.

Where the roles of the audiologists overlap, both members must adhere to the Position Statement on Concurrent Intervention Provided by CASLPO Members. The following factors must be considered and documented:

1. The rationale to support the provision of concurrent intervention;
2. The goals of intervention and the role of each clinician in achieving those goals;
3. The method of ongoing communication between clinicians;
4. The frequency of ongoing communication.
5. The method of communication with others involved with the patient/client's care (such parents, family and health care professionals).

PRACTICE STANDARD F.2

The assessing audiologist must collaborate with other audiologists involved in the care of a patient/client according to the Position Statement on Concurrent Intervention Provided by CASLPO Members.

There may be situations where two or more other professionals will be providing care to the same patients/clients. The CASLPO code of ethics requires that members "maintain positive professional relationships with their colleagues, students and other professionals".

The method of communication with others involved with the patient/client's care (such as significant others, teachers, health care personnel or home/school providers) should be specified at the beginning of the intervention.

PRACTICE GUIDELINE F.1

Audiologists should specify the method of communication with others involved in the patient/client's care.

The member must make reasonable attempts to resolve any disagreement directly with the other professional, and take such actions as are in the best interests of the patient/client. The CASLPO Position Statement on Resolving Disagreements between Service Providers (2007) must be followed.

PRACTICE STANDARD F.3

Audiologists must adhere to CASLPO's Position Statement on Resolving Disagreements between Service Providers when disagreements occur.

G) HEALTH AND SAFETY PRECAUTIONS

All components of service delivery must be executed in such a way as to ensure the safety of the patient/client and clinician by adhering to generally accepted infection control practices. Audiologists must employ routine infection control practices according to Infection Control for Regulated Health Professionals, CASLPO Edition (2006). Audiologists must implement additional precautions specific to the practice of audiology and the particular procedures employed. Audiologists should pay particular attention to the requirements for handwashing and the criteria for disinfection. "Hand washing is the single most important procedure for preventing infections."[11]

The audiologist must make every attempt to determine the status of the patient's/client's external ear and ear canal prior to beginning the assessment. (See Standard I.7) In the event of an abnormality (e.g., presence of blood, fluid, inflammation, other potentially infectious substance, or impacted cerumen), portions or all of the assessment may be precluded until the presenting condition is appropriately treated. Modification or discontinuation of the assessment due to an abnormality is at the discretion of the audiologist.

PRACTICE GUIDELINE G.1

Audiologists should consider modification or discontinuation of an assessment if the presenting condition of the external ear or ear canal requires treatment.

In the event that the audiologist proceeds with all or a portion of the hearing assessment, any device that makes contact with the abnormality must be disinfected or disposed of in an appropriate fashion.

Audiologists must also ensure that appropriate precautions are taken to prevent risk of harm to themselves. All staff responsible for cleaning and sterilizing equipment must be properly trained and should wear personal protective equipment appropriate to the task. Precautionary measures for blood- and fluid-borne pathogens must be taken when necessary. Although the handling of otoscope and probe tips is usually considered non-critical, audiologists must protect themselves and staff appropriately with patients/clients with chronic non-intact skin (e.g., chronic middle ear drainage) or where skin is fragile, such as with infants.

PRACTICE STANDARD G.1

Audiologists must employ routine infection control practices and implement additional precautions specific to the practice of audiology.

Audiologists must adhere to the Preferred Practice Guideline for Cerumen Management for appropriate infection control guidelines if the ear to be assessed requires cerumen removal before proceeding with the insertion of a probe or tympanometry tip.

[11] Canada Communicable Disease Report, Supplement: Infection Control Guidelines for Hand Washing, Cleaning, Disinfection and Sterilization in Health Care. December 1998, page 1.

PRACTICE STANDARD G.2

Audiologists must follow the Preferred Practice Guideline for Cerumen Management when cerumen management is indicated.

H) COMPETENCIES

The audiologist must:

1. Demonstrate knowledge of:
   a. Anatomy and physiology of the auditory system.
   b. Normal auditory functioning and development
   c. Disorders of the auditory system and the nature of their presentation in diagnostic assessments.
   d. Instrumentation associated with diagnostic assessment.
   e. Interpretation of test battery results as relates to hearing disorders.

2. Demonstrate knowledge of child development, specifically in the areas of normal auditory, speech and language development, and other developmental milestones.

3. Demonstrate knowledge of signs and symptoms of developmental delays and disorders in children, and risk indicators that negatively impact child development.

4. Demonstrate the ability to obtain a relevant case history from the parent/caregiver and child, as appropriate, with particular attention paid to perinatal and paediatric risk indicators, auditory disorders and common aetiologies.

5. Demonstrate knowledge of the interpretation of case history results as relates to hearing disorders.

6. Demonstrate knowledge of an appropriate otoscopic examination technique of the external ear and ear canal.

7. Demonstrate knowledge of the pathologies of the external ear and ear canal that may be identified through otoscopic examination, how they relate to hearing disorders and their treatment.

8. Demonstrate knowledge of and skill in evidence-based hearing assessment procedures.

9. Demonstrate knowledge of a range of hearing assessment techniques appropriate for the developmental level and attention of the child.

10. Demonstrate skill in engaging infants and children, play techniques, and preparing infants and children for test procedures such as operant conditioning, behaviour management.

11. Demonstrate knowledge of an appropriate tympanometric assessment protocol to demonstrate the presence or absence of pathologies of the outer and middle ear.

12. Demonstrate knowledge of interpretation of tympanometric assessment results as relates to pathologies of the outer and middle ear and hearing disorders.

13. Demonstrate knowledge of an appropriate acoustic stapedial reflex assessment protocol to demonstrate the presence or absence of pathologies of the acoustic stapedial reflex arc.

14. Demonstrate knowledge of interpretation of acoustic stapedial reflex assessment results as relates to pathologies of the acoustic reflex arc and hearing disorders.

15. Demonstrate knowledge of an appropriate protocol for manual pure-tone audiometry including air conduction, bone conduction and masking techniques.

16. Demonstrate knowledge of the interpretation of the results of manual pure-tone audiometry as relates to hearing disorders.

17. Demonstrate knowledge of speech audiometry protocols including speech recognition thresholds, word recognition, and comfort and loudness discomfort levels.

18. Demonstrate knowledge of the interpretation of speech audiometry assessment results as relates to hearing disorders.

19. Demonstrate knowledge of the interpretation of combined test battery assessment results as relates to hearing disorders.

20. Demonstrate knowledge and skill in family-centred service provision with an emphasis on linguistic and cultural sensitivity, privacy protection and informed consent.

21. Demonstrate knowledge and skill in counselling families about hearing loss and other related concerns.

22. Demonstrate knowledge and skill in the appropriate use of supportive personnel when utilized. (See CASLPO Position Statement on Guidelines for the Use of Supportive Personnel.)

PRACTICE STANDARD H.1

Audiologists must have the required competencies to perform procedures covered in this PSG.

I) COMPONENTS OF SERVICE DELIVERY

1. INFORMED CONSENT

Audiologists must obtain valid and informed consent, as defined in the Health Care Consent Act[12] from the child or substitute decision-maker for all procedures related to hearing assessment (refer to CASLPO's position statement Consent to Provide Screening and Assessment Services (2007). The child or parent/legal guardian must be fully informed of:

[12] Health Care Consent Act, 1996 S.O. 1996, CHAPTER 2 Schedule A [online]. http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/96h02_e.htm

- The nature of the procedures that will be conducted.
- The expected patient/client response during each procedure.
- Any discomfort or risk that may be associated with a given procedure.
- The outcome of a given procedure and its interpretation as relates to a patient/client's hearing disorder.
- Recommendations for treatment or follow-up.

Audiologists are reminded that the crucial element in obtaining consent is the discussion of the information listed above and not the act of signing a consent form.

Informed consent to perform hearing assessment can be provided in written or verbal format. (refer to Obtaining Consent for Services: A Guide for Audiologists & Speech-Language Pathologists (CASLPO 2007)).

PRACTICE STANDARD I.1
Audiologists must obtain informed consent for the hearing assessment.

The *Personal Health Information and Protection Act* (PHIPA), 2004, requires that audiologists must also obtain knowledgeable consent to the collection and use, retention and disclosure of any information obtained during hearing assessment. This consent can also be provided in written or verbal format.

PRACTICE STANDARD I.2
Audiologists must obtain knowledgeable consent to collect and manage information obtained during hearing assessment.

It is recognized that, depending on the child and the situation, children may be involved to varying degrees in the hearing assessment process. The *Health Care Consent Act,* 1996, indicates that there is no fixed age at which a child becomes mentally capable of providing consent. As a result, children who are judged mentally capable to provide informed consent may choose to include or exclude their parents/guardians from the hearing assessment process. Children are considered capable if they are able to understand the information provided and appreciate the consequences of the decision.

Consent can be withdrawn at any time by the child (if capable) or the parent/legal guardian.

2. DETERMINATION OF NEED

Hearing loss affects a child's speech-language, cognitive and social development and academic potential, thus the prompt identification of hearing loss and intervention to mitigate its effects is of critical importance. Any child who is at risk for, suspected of, or identified with an auditory impairment, disorder, or disease and who will potentially benefit from hearing assessment, in terms of ruling out hearing impairment as a cause of the developmental concern; or through identification of hearing impairment, should be assessed for hearing function.

The audiologist must assess the needs and/or capabilities of patients/clients in order to appropriately assess hearing. Child patients/clients will have variable abilities to comply with

hearing assessment procedures primarily based on age, but also on developmental level and physical and cognitive capacity.

PRACTICE STANDARD I.3
Audiologists must perform a determination of need.

3. RISK MANAGEMENT DETERMINATION

Risks of performing the procedures described in this document may include but are not limited to:

- A condition of the physical state of the ear that would contraindicate the performance of the intended procedures.
- A behavioural or other state of the child that would contraindicate the performance of the intended procedures.
- Noise-induced hearing damage due to excessive sound levels being used in the performance of assessment procedures.
- Physical harm to the patient/client in the preparation for hearing assessment procedures such as skin preparation for ABR electrodes, cerumen management in preparation for insertion of probes and phones, etc.

Audiologists must take steps to minimize the above risks associated with performance of the procedures described in this document as well as from the misdiagnosis of either normal hearing, or hearing impairment (as listed in APPENDIX 2: Potential Risks from Audiometry).

PRACTICE STANDARD I.4
Audiologists must use caution and procedures that minimize the discomfort associated with assessment procedures.

4. PROCEDURES

A. Case History

The purpose of obtaining a thorough case history is to determine the focus of the hearing assessment process. Particularly in the preschool population, time for hearing assessment may be limited by the child's attention and cooperation. Therefore, the audiologist will need to give the most pertinent information the highest priority in order to proceed with appropriate follow-up services. Accurate diagnosis of any hearing impairment will rely on interpretation of the test battery in the context of the child's behaviour and development, and may suggest the need for a particular hearing assessment strategy or modification of procedures.

PRACTICE STANDARD I.5
The case history information must be used to inform the hearing assessment process.

The case history conversation should be family-centred, linguistically and culturally sensitive, and in the language of the parent/caregiver's choice, if possible.

PRACTICE GUIDELINE I.1

Audiologists should conduct the procedures covered in this PSG in a manner which is family-centred, and linguistically and culturally sensitive.

History taking should seek to determine at least the following:

- Source of the referral, and therefore, the professional context for the concern;
- Parent/caregiver and child, as appropriate, statement of concern;
- Observation of child's behaviour, auditory responsiveness, achievement of developmental milestones (especially speech and language milestones);
- History of auditory disease;
- Identification of risk factors and/or symptoms that would contribute to a hearing impairment;
- Previous hearing screening and assessment results.

PRACTICE STANDARD I.6

Audiologists must obtain or have access to a case history which contains the components specified.

At the end of the case history conversation, the hearing assessment procedures to be undertaken must be explained to the parent/caregiver as part of the informed consent process (Standard I.1).

B. Otoscopy

Cursory otoscopy must be attempted at the start of the hearing assessment. The main purposes are to assist with determining the appropriate direction for coupling techniques, and to detect any anomaly of the external and middle ear that indicates referral to physician or would prevent the insertion of a probe or probe tip into the ear canal.

PRACTICE STANDARD I.7

Audiologists must attempt otoscopy at the beginning of the hearing assessment process.

C. Frequency-specific threshold determination

Frequency-specific and ear-specific thresholds are the goal of hearing assessment and as such, will be pursued with an efficient and valid strategy. Common features of any hearing assessment protocol for children include the following:

Transducer – In the absence of specific contraindications, insert earphones (ER-3A) are the transducer for air-conduction testing. Insert earphones have several advantages over supra-aural earphones, including reduced acoustic crossover (increased inter-aural attenuation), decreased likelihood of collapsed external ear canals, accurate location of sound delivery, and increased comfort. Supra-aural earphones (TDH/MX41 type) are to be used when insert phones

are contraindicated, such as when the ear canals are very small or stenotic or when the child does not tolerate the insert phones. A bone conduction oscillator is also necessary. Establishment of bone conduction thresholds requires accurate and stable placement of the oscillator. If proper force and stability of the oscillator cannot be achieved with the standard headband, a band of elastic fabric with Velcro attachments may be used.

Stimuli – Stimuli employed will represent a portion of the frequency range that holds importance for the acquisition of speech, and the achievement of associated thresholds will allow for appropriate follow-up procedures including the fitting of amplification. Preferred stimuli will include tonepips, or pure tones in the frequency range of 500-4000 Hz, in order to determine if hearing ability is adequate for the development of normal speech and language. As many frequencies as possible should be obtained across the frequency range, contingent upon the ability of the child to co-operate with test procedures and with a focus on the frequencies of most importance to address the concern about the child's hearing for the child and the reason for referral.

Personnel - In most test situations, it is feasible for a single audiologist to perform hearing assessment for children. However, in the case of preschool-aged children, it is recommended that if a single audiologist performs the role of tester, the tester and instrumentation be inside the soundroom together with the child. If an assistant is used, either to help maintain the child's co-operation or attention, the role of assistant may be assumed by another audiologist or by an individual who is supervised by the audiologist.

Specific procedures for threshold determination will be determined based on the developmental level, skills and abilities of the individual child, and must be based upon one of the techniques described in 3a-d) below:

PRACTICE STANDARD I.8

Audiologists must attempt to obtain frequency-specific and ear-specific thresholds/threshold estimates using procedures described in this PSG.

i. Auditory Brainstem Response (ABR)

For infants less than about six months of age, and for all children who are developmentally unable to reliably perform behavioural assessment, threshold estimation is based on objective, physiologic measures. It is usually possible to obtain accurate, frequency-specific and ear-specific pure-tone threshold estimates by these techniques, typically within 10 dB of conventional audiometric thresholds.[13] In most cases, tonepip ABR can provide information about the hearing status that can inform appropriate follow-up such as amplification fitting and language development interventions. Unless there are specific contraindications, there should be no reason to delay next steps in the management of infants with hearing impairment until behavioural assessment is possible. As such, ABR threshold estimation methods must be of the highest possible quality.

[13] Stapells DR. (2000). Threshold estimation by the tone-evoked auditory brainstem response: a literature meta-analysis. J Sp-Lang Pathol Audiol 24:74-83.

As in all hearing assessments, in the absence of specific contraindications, insert earphones are the required transducer for ABR testing by air conduction. In the case of ABR, insert phones have several specific advantages including reduced stimulus artifact, decreased background noise, less acoustic cross-over, decreased likelihood of collapsed canals, and increased comfort.

Tonepip ABR threshold estimates by bone conduction will also be required to quantify conductive and sensorineural hearing loss components recognizing the output limits of bone conduction oscillators.

For a complete description of procedures, and technical parameters, see the Ontario Infant Hearing Program Assessment Protocol.[14]

Click ABR stimuli are no longer used to infer frequency-specific threshold estimates, but do have a role in determining neural integrity specifically where the concern is for retrocochlear pathology, auditory dys-synchrony, and residual hearing The results of click stimulation in combination with the results of the other hearing assessment components may determine the likelihood of the above auditory disorders and appropriate subsequent activity.

Tonepip ABR thresholds in dBnHL are not directly equivalent to perceptual thresholds in dBHL, and both dBnHL and dBHL are defined with reference to adult norms. ABR thresholds need to be converted to bias-free estimates of true perceptual threshold in dB HL (as described in the Appendices), in order to specify hearing aid prescription parameters and to accurately monitor hearing sensitivity over time.

Behavioural Assessment

With children for whom it is developmentally appropriate, behavioural hearing assessment will form the basis of frequency-specific testing, and procedures will include visual reinforcement audiometry (VRA) or Conditioned Play Audiometry (CPA).

Note: Behavioural assessment in sound field does not result in sufficient information for proceeding with intervention, if required, and as such is not appropriate for determining auditory thresholds, unless the use of headphones is contraindicated. Sound field measurements may be useful for other purposes, such as initial conditioning for behavioural assessment, demonstration of responsiveness or non-responsiveness or counselling with parents/caregivers.

ii*)* Visual Reinforcement Audiometry (VRA)[15]

For VRA, children are conditioned to respond to an auditory stimulus by producing a head turn in the direction of a reinforcing visual display. This technique has been shown

[14] Ontario Infant Hearing Program: Audiologic Assessment Protocol and Support Documentation, 2006 (Available at www.mtsinai.on.ca/IHP)

[15] Widen JE, Folsom RC, Cone-Wesson B, Carty L, et al. (2000). Identification of neonatal hearing impairment: hearing status at 8 to 12 months corrected age using a visual reinforcement audiometry protocol. Ear & Hearing 21(5):471-487.

to be effective in determining frequency-specific thresholds regardless of type or degree of hearing impairment.[16]

The child, seated in the test room, is facing forward with the reinforcing toys at eye level, and ideally at 90 degrees to the right and/or left side(s). Before performing threshold search, it is important to establish that the child will respond to supra-threshold stimuli with the appropriate head-turn response in the direction of the toys. Once the child is determined to be under stimulus control, a standard bracketing procedure is used to search for the minimum level at which the child will respond at each test frequency.

In order to have a measure of the reliability of the infant's head-turn responses, control trials are used at regular intervals in order that the audiologist may determine whether a head-turn response occurs in the absence of auditory stimulation, i.e. false positives.

iii) Conditioned Play Audiometry (CPA)

There is not a body of evidence that defines a CPA protocol, but it is possible to apply a structure similar to that used in VRA, where there is supporting documentation for the use of a well defined protocol. Therefore, a recommended CPA protocol for determining thresholds may be based in principle on the VRA procedure described by Widen et al. (2000).[17]

CPA assesses a child's hearing acuity using conditioned responses to sound by engaging in play-oriented activities. The child will be conditioned to perform a specific play-based activity each time a stimulus is heard. Activities might include putting a block in a bucket, placing a peg in a hole, etc. The challenge in the conditioning of the child for CPA is to accomplish the wait-listen-respond paradigm that will allow for a reliable outcome. Air conduction thresholds are obtained and bone conduction thresholds are obtained as indicated using this procedure.

iv) Conventional Audiometry

By the time children have mastered CPA, conventional audiometry becomes the most efficient and appropriate procedure for obtaining frequency-specific information during hearing assessment. For details on conventional audiometry, refer to the CASLPO PSG for Hearing Assessment of Adults by Audiologists (in progress).

D. Otoacoustic Emissions

Otoacoustic emissions provide an objective assessment of peripheral or preneural auditory function. They are useful in the process of providing objective hearing screening, and also contribute to the identification and monitoring of auditory neuropathy or dys-synchrony.

OAEs should be included in a protocol for assessing hearing in children who either present with a condition that may be associated with a hearing loss or present with a risk factor for late onset

[16] Widen, J .E. (1993). Behavioral screening of high-risk infants using visual reinforcement audiometry. Seminars in Hearing, 11(4), 342-356.

[17] Widen JE, Folsom RC, Cone-Wesson B, Carty L, et al. (2000). Identification of neonatal hearing impairment: hearing status at 8 to 12 months corrected age using a visual reinforcement audiometry protocol. Ear & Hearing 21(5):471-487.

or progressive hearing loss. Additionally, if there is any uncertainty about the reliability of threshold estimates, OAE measurement may be used for cross-check of results.

PRACTICE GUIDELINE I.2

Audiologists should attempt to perform otoacoustic emissions measurement as part of a complete hearing assessment for children.

OAE measurements do not yield threshold estimates and cannot determine whether a child does or does not have hearing impairment. However, there is a relationship between OAE amplitude and the severity of hearing impairment. For hearing levels greater than about 40 dB, an OAE is unlikely to be observed at the frequency of the loss.

E. Middle Ear Analysis

Middle Ear Analysis (MEA) includes tympanometry (measurement of acoustic immittance or its components) as well as measurement of stapedius muscle reflexes (reflexes).

PRACTICE STANDARD I.9

Audiologists must attempt to measure acoustic immittance or its components as part of a complete hearing assessment for children.

For infants up to and including six months corrected age, tympanometry must be done using a 1 kHz probe frequency.[18] For children over six months corrected age, in general, tympanometry is done using a 226 Hz probe frequency.

PRACTICE STANDARD I.10

Audiologists must use a 1 kHz probe frequency when performing middle ear analysis on children less than six months of age a 226Hz probe frequency corrected age.

The measurement of reflexes should be attempted wherever feasible. Because reflexes are absent in a high proportion of newborns and young children who have no evidence of a middle-ear disorder when using contralateral measurements, and with low-frequency probe tones, the presence or absence of reflexes should also be measured in the ipsilateral mode with a 1 kHz stimulus and a 1 kHz probe for children less than six months of age.[19]

PRACTICE GUIDELINE I.3

Audiologists should attempt to measure stapedius muscle reflex thresholds as part of a complete hearing assessment for children.

[18] Margolis RH, Bass-Ringdahl S, Hanks W, Holte L, Zapala D. (2003). Tympanometry in newborn infants – 1 kHz norms. JAAA 14(7):386-395.

[19] Margolis RH, Bass-Ringdahl S, Hanks W, Holte L, Zapala D. (2003). Tympanometry in newborn infants – 1 kHz norms. JAAA 14(7):386-395.

Reflex presence is defined by a clear, negative decrease in acoustic immittance that is repeatable at any stimulus level.

F. Speech-based Measures

In a behavioural hearing assessment, and at the discretion of the audiologist, air-conduction thresholds for Speech Awareness (SAT) or the Speech Recognition (SRT) may be established for each ear for the purposes of cross-checking behavioural thresholds obtained with frequency-specific stimuli or to assist in conditioning. Word recognition testing can be used as a gross measure of auditory perception; however, these measures do not provide frequency-specific information and cannot be used as a basis for subsequent referral or intervention including hearing aid fitting.

For school-aged children, speech-based measures take on added significance when the concern is for auditory processing abilities or other related learning activities. For detail on the procedures involved in this assessment, please refer to the PSG for Hearing Assessment of Adults by Audiologists (in progress).

PRACTICE GUIDELINE I.4

Audiologists should attempt speech-based measurement procedures when relevant to the hearing concern or reason for referral.

G. Assessment Procedures for Hearing Aid Prescription: RECD measurement

Real Ear to Coupler Difference measurements[20] are an obligatory component of the provision of hearing aids for children. For detailed explanation of procedures, refer to CASPLO Preferred Practice Guideline for the Prescription of Hearing Aids to Children (2002).

PRACTICE STANDARD I.11

Audiologists must attempt RECD measurements when relevant for follow-up procedures and referral.

Additionally, the degree of hearing loss established during hearing assessment has the potential to be misinterpreted when it is based on the audiometer dial reading either from behavioural assessment or when obtained from corrected ABR thresholds (dBeHL) because it does not take into account the unique acoustics of the child's ear. In order to resolve this misinterpretation, the definition of threshold can be converted to SPL, and the HL audiogram can be adjusted to accurately reflect the degree of loss by incorporating RECD measurements into the assessment reporting procedures. This is important in terms of definition of the hearing loss, counselling, and the choosing of appropriate treatment strategies. In the event that the individual RECD measurement is unobtainable, age-related predicted values can be applied.[21]

[20] Moodie, K.S., Seewald, R.C., & Sinclair, S.T. (1994). Procedure for predicting real ear hearing aid performance in young children. American Journal of Audiology 3, 23-31.

[21] Ontario Infant Hearing Program: Protocol and Support Documentation for the Provision of Amplification, 2005 (Available at www.mtsinai.on.ca/IHP)

5. CONTINUUM OF CARE:

Upon referral, the audiologist assesses the determination of need of the child, his/her competence in performing the required procedures, and assesses risk. If appropriate, the audiologist proceeds with audiologic hearing assessment of the child and, dependent upon the outcome, (e.g., diagnosis of hearing impairment, if any), offers to provide or initiates the involvement of other providers, as required. The sequence of procedures is as follows:

- Audiologic hearing assessment of the child by audiologist including review of results with the parent/caregiver and child as appropriate. In the event that the results indicate normal hearing recommendations for follow-up must include information on risk indicators for late onset and progressive hearing impairment, information on speech and language developmental milestones, and signs and symptoms of hearing loss;
- Medical assessment/evaluation (required when any permanent hearing impairment is identified);
- Referral for services to support the psychological needs of the parent/caregiver and to help with decision-making will assist the timely access to intervention and language development services;[22]
- Referral for, or provision of, information on amplification options is made when results of the hearing assessment indicate the child is a candidate for hearing aids, cochlear implants or other assistive devices;
- Intervention services to support the language development and early literacy skills of children identified with hearing impairment are of critical importance to the optimal development of the child and preparation for academic success. Unbiased, evidence based information regarding services to support language development must be given to the family in order that they can make informed decisions regarding service delivery for their child. (as required);
- Audiologic Rehabilitation (as required);
- Hearing reassessment/hearing aid re-evaluation (required if chosen by the family).

PRACTICE STANDARD I.12

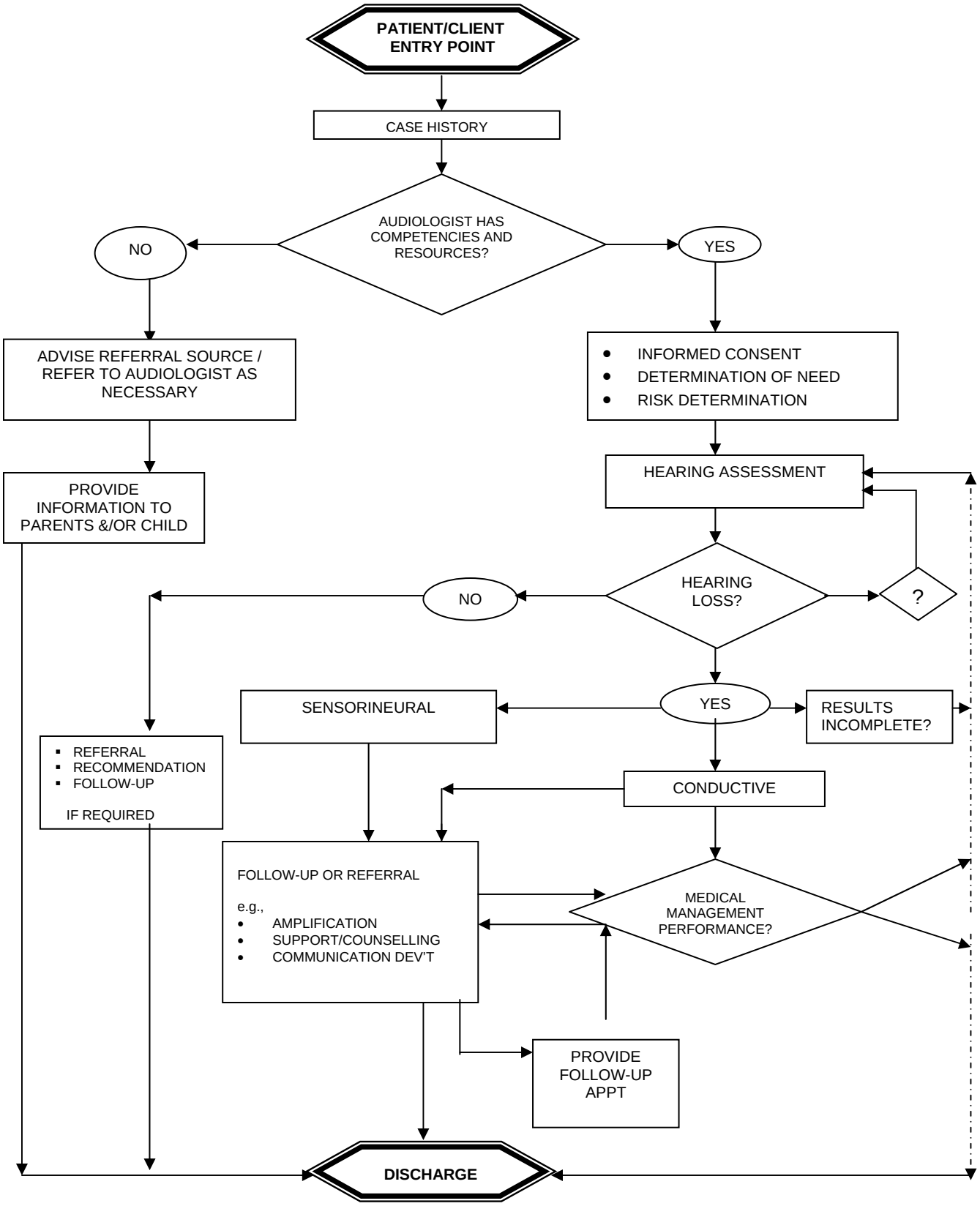
The audiologist must make appropriate referrals when the presenting condition requires intervention that goes beyond audiologic management.

PRACTICE STANDARD I.13

Audiologists must inform the patient/client of appropriate support and intervention services or refer so that the patient/client can be provided with the appropriate information.

[22] Brown, C.L. & Mackenzie, S. (2005). The Role of the Audiologist and Family Support Worker in the Ontario Infant Hearing Program: A Team Approach. Journal of Speech-Language Pathology and Audiology 29(3) 106-111.

The following diagram outlines the components of care necessary for audiologists to follow when assessing hearing for hearing loss in children.



6. INITIATING THE INVOLVEMENT OF OTHERS

Audiologists must refer a patient/client to another professional in situations where:

1. The audiologist does not have the competencies to meet the patient/client individual needs.

2. The determination of risk is such that the audiologist cannot safely provide service to the patient/client.

PRACTICE STANDARD I.14
Audiologists must refer the patient/client when their competencies are not sufficient to meet the patient/client needs or safely manage the risks.

7. DISCHARGE CRITERIA

Discharge of the patient/client must occur when certain basic therapeutic goals have been met including:

- Normal hearing is identified, and recommendations are given that include information on risk indicators for late onset and progressive hearing impairment, signs and symptoms of hearing loss, and speech and language developmental milestones, where appropriate.

- If the identified hearing impairment is determined to be conductive in type, information is provided that includes the implications of the audiologic diagnosis. Recommendation for medical treatment and management is provided, and in the instances where follow-up hearing assessment may not be required.

- If the identified hearing impairment is determined to be mixed or sensorineural in type, information is provided that includes the implications of the audiologic diagnosis and recommendations for follow-up. These may include the need for medical treatment and management, information on amplification options, the importance of early intervention and the need for services to support language development, and transition to another service provider is arranged.

PRACTICE STANDARD I.15
Audiologists must discharge the patient/client when therapeutic goals are met.

J) DOCUMENTATION

All hearing assessment records must be maintained in accordance with CASLPO standards.

PRACTICE STANDARD J.1
Audiologists must retain documentation in accordance with CASLPO standards.

K) GLOSSARY

Assessment
Use of formal or informal measures by an audiologist or speech-language pathologist, in accordance with the member's scope of practice, to determine a patient/client's functioning in a variety of areas of functional communication and/or swallowing or hearing, resulting in specific treatment recommendations.

Child
A person 18 years of age and under. In some situations, this PSG may apply to individuals above the age of 18, for example in the education system, where some individuals attend secondary school until the age of 21.

Intermediate Level Disinfection
Level of disinfection required for some semicritical items. Intermediate level disinfectants kill vegetative bacteria, most viruses and most fungi but not resistant bacterial spores.

Intervention
Includes any member or supportive personnel involvement in the provision of member services to patients/clients, including but not limited to screening, assessment, treatment and management.

Low Level Disinfection
Level of disinfection required when processing noncritical items or some environmental surfaces. Low level disinfectants kill most vegetative bacteria and some fungi as well as enveloped (lipid) viruses (e.g., hepatitis B, C, Hantavirus and HIV). Low level disinfectants do not kill mycobacteria or bacterial spores. Low level disinfectants-detergents are used to clean environmental surfaces.

Noncritical Items
Those items that either touch only intact skin but not mucous membranes or do not directly touch the patient. Reprocessing of noncritical items involves cleaning and/or low level disinfection.

Patient/Client
Individual with a possible or confirmed communication and/or swallowing disorder, who is meant to benefit from a member's intervention.

Screening
Use of pass/refer measures by an audiologist or speech-language pathologist, in accordance with the member's scope of practice, to identify persons who may have a hearing, communication and/or swallowing disorder/delay. Screening is used only to determine the need for a speech-language pathology assessment and/or an audiologic assessment. Screening may be conducted by a member or supportive personnel. Interpretation and communication of the results of a screening are limited to advising the individual on whether or not there may be a need for a speech-language pathology assessment and/or an audiologic assessment and must not be used for treatment planning.

Semicritical Items
Devices that come in contact with nonintact skin or mucous membranes but ordinarily do not penetrate them. Reprocessing semicritical items involves meticulous cleaning followed preferably by high level disinfection (level of disinfection required is dependent on the item. Depending on the type of item and its intended use, intermediate level disinfection may be acceptable.

Treatment
An intervention that has as its goal to enhance the communication and/or swallowing skills of the patient/client.

L) REFERENCES

American Academy of Pediatrics (2004). Clinical Practice Guideline, Diagnosis and Management of Acute Otitis Media. Pediatrics 113(5): 1451-1465.

American Academy of Pediatrics (2004). Clinical Practice Guideline, Otitis Media with Effusion. Pediatrics 113(5): 1412-1429.

American Speech-Language-Hearing Association. (2004). Guidelines for the Audiologic Assessment of Children from Birth to 5 Years of Age [Guidelines]. Available at http://www.asha.org/members/deskref-journals/deskref/default

ANSI S3.1 - 1999 (R 2003), "American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms"

ANSI S3.6 - 2004 "American National Standard Specification for Audiometers"

ANSI S3.7 - 1995 (R 2003), "American National Standard Method for Coupler Calibration of Earphones"

ANSI S3.13 - 1987 (R 2007), "American National Standard Mechanical Coupler for Measurement of Bone Vibrators"

ANSI S3.20 - 1995 (R 2003), "American National Standard Bioacoustical Terminology"

ANSI S3.21 - 2004, "American National Standard Method for Manual Pure-Tone Threshold Audiometry"

ANSI S3.35 - 2004, "American National Standard Methods of Measurement of Performance Characteristics of Hearing Aids under in situ Working Conditions"

ANSI S3.39 - 1987 (R 2007), "American National Standard Specifications for Instruments to Measure Aural Acoustic Impedance and Admittance (Aural Acoustic Immittance)"

ANSI S3.42 - 1992 (R 2007), "American National Standard Testing Hearing Aids with a Broad-Band Noise Signal"

Bagatto, M, Moodie, S, Scollie, S, Seewald, R, Moodie, S, Pumford, J,
Liu, R (2005) Clinical protocols for hearing instrument fitting in the Desired Sensation Level Method. Trends in Amplification 9(4):199- 226.

Bagatto, M.P., Scollie, S.D., Seewald, R.C., Moodie, K. S., & Hoover, B.M. (2002). Real-ear-to coupler difference (RECD) predictions as a function of age for two coupling procedures. Journal of the American Academy of Audiology, 13(8).

Bagatto, M. (2001). Optimizing your RECD measurements. The Hearing Journal, 54(9), 32-36.

Bess, F. H., Dodd-Murphy J., & Parker R. A., (1998). Children with minimal sensorineural hearing loss: prevalence, educational performance, and functional status. Ear & Hearing, 19(5), 339-54.

Brown, C.L. & Mackenzie, S. (2005). The Role of the Audiologist and Family Support Worker in the Ontario Infant Hearing Program: A Team Approach. Journal of Speech-Language Pathology and Audiology, 29 (3), 106-111.

Brown, D.K., Tobolski, C., Shaw, G., Dort, J. (2000). Towards determining distortion product otoacoustic emission protocols for newborn hearing screening. J Sp-Lang Pathol Audiol; 24:68-73.

Carney, A., & Moeller, M. P. (1998). Treatment efficacy: Hearing loss in children. Journal of Speech, Language and Hearing Research, 41, S61-S84.

CASLPO: Obtaining Consent: A Guide for Audiologists & Speech-Language Pathologists. (2007).

CASLPO: Position Statement on Consent to Provide Screening and Assessment Services (2007) College of Audiologists and Speech-Language Pathologists of Ontario.

CASLPO: Preferred Practice Guideline for Earmold Impressions (2002) College of Audiologists and Speech-Language Pathologists of Ontario

CASLPO: Preferred Practice Guideline for Dispensing (In progress) College of Audiologists and Speech-Language Pathologists of Ontario

CASLPO: Preferred Practice Guideline for the Prescription of Hearing Aids to Children (2002) College of Audiologists and Speech-Language Pathologists of Ontario

Cone-Wesson, B., Ramirez, G. (1997). Hearing sensitivity in newborns estimated from ABRs to bone-conducted sounds. J Am Acad Audiol;8(5):299-307.

Cone-Wesson, B., Vohr, B.R., Sininger, Y.S., Widen, J.E., Folsom, R.C., Gorga, M.P., Norton, S.J. (2000). Identification of neonatal hearing impairment: infants with hearing loss. Ear & Hearing; 21(5):488-507.

Cunningham, M., Cox, E.O. (2003). Hearing Assessment in Infants and Children: Recommendations Beyond Neonatal Screening. Pediatrics; 111(2): 436-440

CWGCH (2005): Canadian Working Group on Childhood Hearing: Early Hearing and Communication Development: Resource Document (91pp).
Available at www.phac-aspc.gc.ca/rhs-ssg/index.html

Diefendorf, A.O. (2003). Behavioural hearing assessment: considerations for the young child with developmental disabilities. Seminars in Hearing Aug; 24(3): 189-200.

Eadie, T. L. (2001). The ICIDH-2: Theoretical and Clinical Implications for Speech-Language Pathology. Journal of Speech-Language Pathology and Audiology, 25(4), 181-200.

Erber, N. (1982). Auditory Training. Washington, D.C.: Alexander Graham Bell Association for the Deaf.

Feigin, J. A., Kopun, J. G., Stelmachowicz, P. G., & Gorga, M. P. (1989). Probe-tube microphone measures of ear canal sound pressure levels in infants and children. Ear and Hearing, 10 (4), 254-258.

Fortnum, H., Summerfield, Q., Marshall, D. (2001) Prevalence of permanent childhood hearing impairment in the United Kingdom and implications for universal neonatal hearing screening: questionnaire based ascertainment study. BMJ 323:1-6.

Gorga, M.P., Neely, S., Ohlrich, B., et al. (1997). From laboratory to clinic: a large-scale study of distortion product otoacoustic emissions in ears with normal hearing and ears with hearing loss. Ear & Hearing; 18(6):440-455.

Gravel, J.S. (2002). Potential pitfalls in the audiological assessment of infants and young children. In Seewald RC and Gravel JS (Eds.): A Sound Foundation through Early Amplification 2001: Proceedings of the Second International Conference. Phonak AG, pp 85-101.

Gravel, J. S., & Hood, L. J. (1999). Pediatric Audiologic Assessment: Chapter 10. In F. Musiek & W. Rintelmann. Contemporary Perspectives in Hearing Assessment. Boston: Allyn & Bacon.

Hunter, L.L., Margolis, R.H. (1992). Multifrequency tympanometry – current clinical application. Am J Audiol; July: 33-43

Hyde, M. (2005) A Model of Hearing Health Care for Ontarians, Final Draft, CASLPO: 21-22

Hyde, M., Friedberg, J., Price, D., Weber, S. (2004). Ontario infant hearing program: program overview, implications for physicians. Ontario Medical Review; 71(1).

Infection Control for Regulated Health Professionals, CASLPO Edition (2006) http://www.caslpo.com/english_site/documents/InfectionControlCASLPOEDITION.pdf

Johnson, K.C. (2002). Audiologic assessment of children with suspected hearing loss. Otolaryngol Clin North Am; 35(4):711-32

JCIH 2000. Joint Committee on Infant Hearing – Year 2000 Position Statement. Principles & Guidelines for Early Hearing Detection & Intervention Programs. www.jcih.org

Kei, J., et al. (2003). High-frequency (1000 Hz) tympanometry in normal neonates. JAAA; 14:20-8.

Kopun, J. G., & Stelmachowicz, P. G. (1998). Perceived Communication Difficulties of Children with Hearing Loss. American Journal of Audiology, Vol 7(1), 30-38.

Kruger, B. (1987). An update on the external ear resonances in infants and young children. Ear and Hearing, 8(6), 333-336.

Liden, G., & Kankkunen, A. (1969). Visual Reinforcement Audiometry. Acta Otolaryngologica, 67, 281 –292.

Ling, D. (1989). Foundations of Spoken Language for Hearing Impaired Children. Washington, D.C.: Alexander Graham Bell Association for the Deaf.

Margolis, R.H., Bass-Ringdahl, S., Hanks, W., Holte, L., Zapala, D. (2003). Tympanometry in newborn infants – 1 kHz norms. JAAA; 14(7):386-395.

McMillan, P.M., Bennett, M., Marchant, C., Shurin, P. (1985). Ipsilateral and contralateral acoustic reflexes in neonates. Ear & Hearing; 6(6):320-324.

Moodie, K.S., Seewald, R.C., & Sinclair, S.T. (1994). Procedure for predicting real ear hearing aid performance in young children. American Journal of Audiology: 3, 23-31.

Moore, J.M., Thompson, G., Folsom, R.C. (1992). Auditory responsiveness of premature infants utilizing visual reinforcement audiometry (VRA). Ear & Hearing; 13(3):187-194.

Moore, J. M., Wilson, W. R., & Thompson, G. (1977). Visual reinforcement of head turn responses in infants under 12 months of age. Journal of Speech and Hearing Disorders, 42, 328-334.

Nozza, R.J. (2002). Developmental psychoacoustics: science to practice. In Seewald RC and Gravel JS (Eds.): A Sound Foundation through Early Amplification 2001: Proceedings of the Second International Conference. Phonak AG,:37-46.

Ontario Infant Hearing Program: Audiologic Assessment Protocol and Support Documentation, 2005 (Available at www.mtsinai.on.ca/IHP)

Ontario Infant Hearing Program: Protocol and Support Documentation for the Provision of Amplification, 2005 (Available at www.mtsinai.on.ca/IHP)

Palmu, A., et al. (2001). Normative values for tympanometry in 7- and 24-month old children. Audiology; 40:178-84.

Palmu, A., et al. (2003). Normative values for tympanometry in 4-5 year old children. IJA 42:327-30.

Rance, G. Auditory Neuropathy/Dys-synchrony and its Perceptual Consequences. (In press)

Seewald, R. C., & Scollie, S. D. (1999). Infants are not average adults: Implications for audiometric testing. The Hearing Journal, 52 (10), 64-72.

Sininger, Y.S., Abdala, C., Cone-Wesson, B. (1997). Auditory sensitivity of the human neonate as measured by the auditory brainstem response. Hearing Res; 104:27-38.

Stapells, D.R. (2000). Threshold estimation by the tone-evoked auditory brainstem response: a literature meta-analysis. J Sp-Lang Pathol Audiol24:74-83.

Stapells, D.R. (2000). Frequency-specific evoked potential audiometry in infants. In RC Seewald (Ed): A Sound Foundation through Early Amplification. Phonak AG pp 13-32.

Stapells, D.R., Oates, P. (1997). Estimation of the pure-tone audiogram by the auditory brainstem response: A review. Audiology & Neuro Otology 2:257-280.

Starr, A., Picton, T., Sininger, Y., Hood, L., Berlin, C. (1996). Auditory neuropathy. Brain 1193:741-53

Talbott C.B. (1987). A longitudinal study comparing responses of hearing-impaired infants to pure tones using visual reinforcement and play audiometry. Ear & Hearing 8:175-179.

Thompson, G., Thompson, M., McCall, A. (1992). Strategies for increasing response behavior of 1- and 2-year-old children during visual reinforcement audiometry (VRA). Ear & Hearing13 (4):236-240.

Threats, T. T. (2002). The International Classification of Functioning, Disability and Health. Heart and Stroke Foundation of Ontario, Presentation, Aphasia Institute, Toronto.

World Health Organization. (2001). The International Classification of Functioning, Disability, and Health. Geneva, Switzerland: Author.

Widen, J.E., Folsom, R.C., Cone-Wesson, B., Carty, L., et al. (2000). Identification of neonatal hearing impairment: hearing status at 8 to 12 months corrected age using a visual reinforcement audiometry protocol. Ear & Hearing 21(5):471-487.

Widen, J .E. (1993). Behavioural screening of high-risk infants using visual reinforcement audiometry. Seminars in Hearing, 11(4), 342-356.

Widen, J. E. (1993). Adding objectivity to infant behavioural audiometry. Ear and Hearing, 14, 49-57.

Yang, E.Y., Stuart, A. (2000). The contribution of the auditory brainstem responses to bone-conducted stimuli in newborn hearing screening. J Sp-Lang Pathol Audiol 24:84-91.

Yoshinaga-Itano, C., Sedey, A., Coulter, D., Mehl, A. (1998). Language of early- and later-identified children with hearing loss. Pediatrics 1025:1161-71

M) SUMMARY OF STANDARDS AND GUIDELINES

NOTES ON SOURCE OF EVIDENCE:

CASLPO DOCUMENTS:	Publications of the College, which may include Position Statements, Practice Standards and Guidelines, Regulations and any other CASLPO publications.
LITERATURE:	Publications in the peer-reviewed professional literature that have been utilized by the author in the writing of the Practice Standards and Guidelines. Specific references are provided in footnotes in the text and in the references.
INFECTION CONTROL DOCUMENTS:	Specific literature and publications related to infection control. Specific references are provided in footnotes in the text and in the references.
CONSENSUS:	Reflects the opinion of experienced CASLPO members on best practices.

SECTION		STANDARDS AND GUIDELINES	SOURCE OF EVIDENCE
E. Resource Requirements	**STANDARD**	**E.1** Audiologists must have the required resources in order to perform hearing assessment in children. **Summary of resource requirements:** 1. Diagnostic auditory brainstem response technology capable of 2-channel recording at multiple frequencies via air and bone conducted stimuli; 2. A type 1 (ANSI S3.39 - 1987 (R 2007) or current version)) full-range acoustic immittance measurement system capable of both low frequency (226Hz) and high frequency (660-1000Hz) tympanometry; 3. Distortion product or transient evoked otoacoustic emissions test equipment; 4. Visual reinforcement audiometric system, with at least two animated toys or video reinforcers; 5. Selection of toys for conditioned play and distraction during visual reinforcement audiometry; 6. Cerumen management tools and materials. Refer to *Cerumen Management for Regulated Health Professionals Guideline (2004)* for appropriate techniques and materials; 7. Real-ear measurement system (ANSI S3.35-2004, ANSI S3.42-1992 (R 2007) or current versions).	LITERATURE CONSENSUS

SECTION		STANDARDS AND GUIDELINES	SOURCE OF EVIDENCE
E. Resource Requirements (continued)	**STANDARD**	**E.2** Audiologists must have the required resources to meet the needs of the population served and procedures utilized.	LITERATURE CONSENSUS
		E.3 Audiologists must make appropriate and expedient referrals when they do not have the required resources to meet the needs of the patient/client.	LITERATURE CONSENSUS
F. Collaboration Requirements	**STANDARD**	**F.1** Audiologists must refer when their competencies or service delivery are not sufficient to meet the patient/client needs or safely manage the risks.	CASLPO DOCUMENTS
		F.2 The assessing audiologist must collaborate with other audiologists involved in the care of a patient/client according to the Position Statement on Concurrent Intervention Provided by CASLPO Members.	CASLPO DOCUMENTS
		F.3 Audiologists must adhere to CASLPO's Position Statement on Resolving Disagreements between Service Providers when disagreements occur.	CASLPO DOCUMENTS
	GUIDELINE	**F.1** Audiologists should specify the method of communication with others involved in the patient/client's care.	CONSENSUS
G. Health and Safety Precautions	**STANDARD**	**G.1** Audiologists must employ routine infection control practices and implement additional precautions specific to the practice of audiology.	LITERATURE INFECTION CONTROL DOCUMENTS
		G.2 Audiologists must follow the Preferred Practice Guideline for Cerumen Management when cerumen management is indicated.	CASLPO DOCUMENTS

SECTION		STANDARDS AND GUIDELINES	SOURCE OF EVIDENCE
	GUIDELINE	**G.1** Audiologists should consider modification or discontinuation of an assessment if the presenting condition of the external ear or ear canal requires treatment.	LITERATURE INFECTION CONTROL DOCUMENTS
H. Competencies	STANDARD	**H.1** Audiologists must have the required competencies to perform procedures covered in this PSG. **Summary of competencies:** The audiologist must:: 1. Demonstrate knowledge of: a. Anatomy and physiology of the auditory system. b. Normal auditory functioning and development c. Disorders of the auditory system and the nature of their presentation in diagnostic assessments. d. Instrumentation associated with diagnostic assessment. e. Interpretation of test battery results as relates to hearing disorders. 2. Demonstrate knowledge of child development, specifically in the areas of normal auditory, speech and language development, and other developmental milestones. 3. Demonstrate knowledge of signs and symptoms of developmental delays and disorders in children, and risk indicators that negatively impact child development. 4. Demonstrate the ability to obtain a relevant case history from the parent/caregiver and child, as appropriate, with particular attention paid to perinatal and paediatric risk indicators, auditory disorders and common aetiologies. 5. Demonstrate knowledge of the interpretation of case history results as relates to hearing disorders. 6. Demonstrate knowledge of an appropriate otoscopic examination technique of the external ear and ear canal. 7. Demonstrate knowledge of the pathologies of the external ear and ear canal that may be identified through otoscopic examination, how they relate to hearing disorders and their treatment. 8. Demonstrate knowledge of and skill in evidence-based hearing assessment procedures. 9. Demonstrate knowledge of a range of hearing assessment techniques appropriate for the developmental level and attention of the child. 10. Demonstrate skill in engaging infants and children, play techniques, and preparing infants and children for test	CONSENSUS

SECTION		STANDARDS AND GUIDELINES	SOURCE OF EVIDENCE
H. Competencies (continued)	**STANDARD**	procedures such as operant conditioning, behaviour management. 11. Demonstrate knowledge of an appropriate tympanometric assessment protocol to demonstrate the presence or absence of pathologies of the outer and middle ear. 12. Demonstrate knowledge of interpretation of tympanometric assessment results as relates to pathologies of the outer and middle ear and hearing disorders. 13. Demonstrate knowledge of an appropriate acoustic stapedial reflex assessment protocol to demonstrate the presence or absence of pathologies of the acoustic stapedial reflex arc. 14. Demonstrate knowledge of interpretation of acoustic stapedial reflex assessment results as relates to pathologies of the acoustic reflex arc and hearing disorders. 15. Demonstrate knowledge of an appropriate protocol for manual pure-tone audiometry including air conduction, bone conduction and masking techniques. 16. Demonstrate knowledge of the interpretation of the results of manual pure-tone audiometry as relates to hearing disorders. 17. Demonstrate knowledge of speech audiometry protocols including speech recognition thresholds, word recognition, and comfort and loudness discomfort levels. 18. Demonstrate knowledge of the interpretation of speech audiometry assessment results as relates to hearing disorders. 19. Demonstrate knowledge of the interpretation of combined test battery assessment results as relates to hearing disorders. 20. Demonstrate knowledge and skill in family-centred service provision with an emphasis on linguistic and cultural sensitivity, privacy protection and informed consent. 21. Demonstrate knowledge and skill in counselling families about hearing loss and other related concerns. 22. Demonstrate knowledge and skill in the appropriate use of supportive personnel when utilized. (See CASLPO Position Statement on Guidelines for the Use of Supportive Personnel.)	
I. Components of Service Delivery	**STANDARD**	**I.1** Audiologists must obtain informed consent and document the hearing assessment. **I.2** Audiologists must obtain knowledgeable consent to collect and manage information obtained during hearing assessment. **I.3** Audiologists must perform a determination of need.	CASLPO DOCUMENTS CASLPO DOCUMENTS CONSENSUS

SECTION		STANDARDS AND GUIDELINES	SOURCE OF EVIDENCE
I. Components of Service Delivery (continued)	**STANDARD**	**I.4** Audiologists must use caution and procedures that minimize the discomfort associated with assessment procedures.	CONSENSUS
		I.5 The case history information must be used to inform the hearing assessment process.	CONSENSUS
		I.6 Audiologists must obtain or have access to a case history which contains the components specified.	LITERATURE CONSENSUS
		I.7 Audiologists must attempt otoscopy at the beginning of the assessment process.	LITERATURE CONSENSUS
		I.8 Audiologists must attempt to obtain frequency-specific and ear-specific thresholds/threshold estimates using procedures described in this PSG.	LITERATURE CONSENSUS
		I.9 Audiologists must attempt to measure acoustic immittance or its components as part of a complete hearing assessment for children.	LITERATURE CONSENSUS
		I.10 Audiologists must use a 1 kHz probe frequency when performing middle ear analysis on children less than six months of age.	LITERATURE CONSENSUS
		I.11 Audiologists must attempt RECD measurements when relevant for follow-up procedures and referral.	LITERATURE CONSENSUS
		I.12 The audiologist must make appropriate referrals when the presenting condition requires intervention that goes beyond audiologic management.	LITERATURE CONSENSUS CASLPO DOCUMENTS
		I.13 Audiologists must inform the patient/client of appropriate support and intervention services or refer so that the patient/client can be provided with the appropriate information.	CONSENSUS CASLPO DOCUMENTS
		I.14 Audiologists must refer the patient/client when their competencies are not sufficient to meet the patient/client needs or safely manage the risks.	CASLPO DOCUMENTS
		I.15 Audiologists must discharge the patient/client when therapeutic goals are met.	CASLPO DOCUMENTS
		Components of Continuum of Care: • Audiologic assessment of the child by audiologist; • Medical assessment/evaluation (required when any permanent hearing impairment is identified); • Referral for service to support psychological needs; • Referral or provision of information on amplification options; • Information Intervention services to support language development; • Audiologic Rehabilitation (as required) • Hearing reassessment/hearing aid re-evaluation (required if chosen by the family).	

SECTION		STANDARDS AND GUIDELINES	SOURCE OF EVIDENCE
	GUIDELINE	**I.1** Audiologists should conduct the procedures covered in this PSG in a manner which is family-centred, and linguistically and culturally sensitive.	CASLPO DOCUMENTS
		I.2 Audiologists should attempt to perform otoacoustic emissions measurement as part of complete hearing assessment for children.	CONSENSUS
		I.3 Audiologists should attempt to measure stapedius muscle reflex thresholds as part of a complete hearing assessment for children.	CONSENSUS
		I.4 Audiologists should attempt speech-based measurement procedures when relevant to the hearing concern or reason for referral.	CONSENSUS LITERATURE CONSENSUS
J. Documentation	STANDARD	**J.1** Audiologists must retain documentation in accordance with CASLPO standards.	CASLPO DOCUMENTS

N) CONTRIBUTIONS TO DEVELOPMENT

AUTHOR: Stacey Weber

EXPERT PANEL:

André Marcoux	Glen Sutherland
Shane Moodie	Joanne Querney
Vicky Papaioannou	Dana Storms
David Pfingstgraef	Jill Taylor

STAFF: Barbara Meissner Fishbein

APPENDIX 1

ABR threshold adjustment factors for Estimated Hearing Level (EHL) derivation [23],[24]

	Air Conduction				Bone Conduction	
Frequency (Hz)	**500**	**1k**	**2k**	**4k**	**500**	**2k**
Minimum Level (dBDial*)	**40**	**35**	**30**	**25**	**30**	**30**
Adjustment (dB)*	**-15**	**-10**	**-5**	**0**	**-5**	**-5**

* *For AC ABR threshold estimates greater than 70 dB dial, if 5 dB final step size is used for the threshold bracket then the absolute value of the Adjustment should be reduced by 5 dB at any frequencies.* The rationale is that with a 10 dB step size, the possibility of response presence at a level 5 dB lower (untested) is included in the statistical adjustment for bias, whereas with a 5 dB step there is no such possibility, because the lower level is now proven response-negative.

Examples: 2k 80 (+), 70 (-): EHL = 80-5 = 75 dBEHL
2k 80 (+), 75 (-): EHL = 80-0 = 80 dBEHL

where (+) and (-) represent definite response detection outcomes.

For any AC ABR threshold, it is discretional to reduce the absolute value of the Adjustment by 5 dB, if the response at the lowest level considered positive is minimal AND the EEG noise level is very low (such as a Residual Noise Level of 20 nV or below). The rationale is that with exceptionally quiet EEG, the ability to identify small, near-threshold responses is increased, and if such a response is seen, the negative offsets normally used are likely to be on average excessive.

Examples: 500 Hz 50 (+), 40 (-): EHL = 50 -15 = 35 dBEHL
500 Hz 50 (+, small, v.low noise), 40 (-): EHL = 50 – (15-5) = 40 dBEHL

These adjustment factors may occasionally yield small, negative air-bone gaps. Such a finding is expected, given that the adjustments are based on group mean normative data.

[23] Bagatto, M, Moodie, S, Scollie, S, Seewald, R, Moodie, S, Pumford, J, Liu, R (2005) Clinical protocols for hearing instrument fitting in the Desired Sensation Level Method. Trends in Amplification 9(4):199-226.

[24] Ontario Infant Hearing Program: Protocol and Support Documentation for the Provision of Amplification 2005 (Available at www.mtsinai.on.ca/IHP)

APPENDIX 2

Risk of Harm of Hearing Assessment for Children by Audiologists[25]

In children, the direct risk of physical harm due to inadequate knowledge or incompetence in audiometry is limited to those procedures that involve insertion of objects or introduction of elevated air pressures into the external ear. This may occur during cursory otoscopy, with the use of insert earphones, or during measurements of the tympanogram or acoustic reflex responses. Other harms that are more substantive and probable can arise indirectly, due to procedural error or omission. Given that pure-tone audiometry is a fundamental component of audiologic assessment that guides both medical and audiologic rehabilitative actions, it is inevitable that significant audiometric errors can lead to significant errors in overall assessment, audiologic diagnosis, medical diagnosis and intervention, and in rehabilitative intervention. Some classes of potential harms are outlined below. A detailed list of potential physical and mental harms is given in Table G.

Summary of Specific Potential Harms from Audiometric Errors or Omissions

General harms

False diagnosis of normal hearing: failure to manage a genuine disorder
False assurance and failure to seek necessary help
Reinforcement of denial of functional limitations
Failure to detect a psychogenic disorder
Increased anxiety, frustration and disillusionment with hearing health care
False diagnosis or overestimation of hearing loss: needless anxiety and labelling
Failure to detect asymmetry of hearing loss and flag a possible acoustic tumour, for which early intervention is associated with better surgical outcomes
Failure to detect a conductive hearing loss component that may be treatable medically
False diagnosis of a conductive component that is absent
False diagnosis of fluctuating or progressive hearing loss that is treatable medically
Inappropriate medical referral, further investigations and treatments
Lack of provision of necessary assistive technologies
Provision of unnecessary assistive technologies
Provision of inappropriate assistive technologies
Physical damage to residual hearing from overamplification
Needless discomfort from and aversiveness of amplified sound
Failure to achieve maximum benefit from assistive technologies
Needless continuation of significant functional limitations
Development of inappropriate and maladaptive attitudes and behaviours
Needless disruption of family relationships
Needless loss of workplace productivity
Inability to perceive auditory warning of environmental and occupational hazards
Inappropriate medico-legal outcomes and remedies
Inappropriate access to occupational health resources and financial compensation
Ineffective use of personal and health care resources

Other paediatric harms

Parental false assurance, needless anxiety, or confusion
Continuation of inappropriate family-child communication styles
Lack of timely information and decision-making by parents
False inference of behavioural, psychological or developmental disorder
Failure to develop speech and language appropriately
Failure to optimize readiness for school
Failure to optimize classroom functioning
Psychological, cognitive, and social development harms

[25] Hyde, M. (2005) A Model of Hearing Health Care for Ontarians, Final Draft, CASLPO: 21-22