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AUDIOLOGY: RESERVED ACTS

REQUEST AND JUSTIFICATION SUBMISSION

2011 MARCH 13

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This document sets out the reserved acts which MSHA is requesting for audiologists. For each proposed reserved act, MSHA describes how an audiologist provides services that fall within that reserved act, as well as background information about the type of education and practical experience audiologists obtain so they can provide those services competently and independently.

For a few of the proposed, reserved acts, an audiologist would have to obtain post-graduate training or further experience before they would be able to provide those services. MSHA will indicate which of the proposed reserved acts require such additional training and experience.

When indicating the need for advanced competencies based on additional training and experience, MSHA has considered whether or not it would be necessary for there to be some form of specialty certification before a registrant would be permitted to perform certain of these identified reserved acts. MSHA believes that specialty certification is not required as it would be reasonable for the College to rely on the ethical and legal duty of its registrants to perform only those tasks that fall within the scope of their competency.

As regulated professionals under the Manitoba Speech and Hearing Act, MSHA members are trained to assess their own skills, knowledge, and abilities. They are required by the Standards of Practice and Code of Ethics to recognize their own limitations and, if they do not have the required competencies, to either refer to others or obtain the necessary skills before proceeding.

Relying on self-assessment to set limitations on the performance of a reserved act is a principle that is applied by many other health professions. An obvious example would be physicians, who as a profession will probably be granted almost all of the reserved acts. But not every physician has the knowledge, skill and ability to perform safely and independently every reserved act that will be granted to the medical profession. Like many regulatory bodies, the College of Physicians and Surgeons must rely on its members to identify situations when they do not have sufficient competencies to provide the required medical service.

MSHA believes that audiologists have demonstrated their commitment and ability to recognize the limits of their competencies and to practice within those limitations. Since 1991 there have been no complaints laid against members for practicing outside their areas of competence. MSHA is confident that audiologists will continue to recognize the limits of their competencies and to practice within those limitations. The requirement to do so will be set out in the CASLPM Standards of Practice and Code of Ethics. In addition, CASLPM will issue Practice Directions which will clearly outline the services to be provided in the performance of the reserved acts as well as the competencies required to deliver those services.

<u>Reserved Act #1</u>

Making a diagnosis and communicating the diagnosis and its impact to an individual or his or her personal representative in circumstances in which it is reasonably foreseeable that the

individual or representative will rely on the diagnosis to make a decision about the individual's auditory and/or vestibular health care.

DESCRIPTION OF SERVICES:

The focus of this reserved act is on the diagnostic skills which an audiologist employs when clients present with symptoms (e.g., hearing loss, auditory processing deficits, tinnitus, dizziness, etc.,) involving the audiovestibular system. The task of an audiologist is to diagnose the presence, degree, and locus of the disorder and, where appropriate, provide intervention and/or management. The audiologist must also communicate the diagnosis and provide a full account of the implications and clinical options.

It is crucial to define the range, nature, and scope of an audiologic diagnosis. Audiologists are ideally and uniquely equipped to identify the presence, degree, configuration, and locus of audiovestibular disorders and their impact based on a comprehensive audiologic examination. Clinical results are considered in conjunction with a client's case history information, complaints, and symptoms in order to yield a diagnosis of a specific audiovestibular disorder or the need for referral to a physician for further medical investigation. An auditory communication disorder that is attributable to damage of the sensory cells within the cochlea secondary to age (presbycusis) or excessive noise exposure can be fully diagnosed by an audiologist. In contrast, a hearing loss secondary to a retrocochlear pathology (e.g., acoustic schwannoma) is likely to be initially identified by an audiologist, but requires referral to a physician for diagnosis using advanced imaging procedures. Importantly, audiologists are able to expertly distinguish between audiovestibular disorders that require medical intervention and those that do not.

Example 1:

A 31 year old female client presents to an audiologist with a complaint of gradually worsening difficulty hearing and tinnitus. She denies otalgia, dizziness, or any significant history of excessive noise exposure or middle ear infections. She reports that her younger sister has recently noticed a similar decline in hearing sensitivity. The audiologist conducts an otoscopic examination which confirms clear canals and intact tympanic membranes bilaterally and then proceeds to perform acoustic immittance measures. Tympanograms confirm normal tympanic membrane mobility and Eustachian tube function while acoustic stapedial reflexes are absent on both ipsilateral and contralateral stimulation. Threshold measures reveal a mild to moderate bilateral conductive hearing loss, with normal bone conduction thresholds with a reduction below normal at 2000 Hz only. This "notch" in the bone conduction scores is referred to as "Carhart's notch." These findings fit the typical audiometric profile of a client with otosclerosis. Knowing this, the audiologist proceeds with multi-frequency tympanometry and, as expected, measures abnormally high middle ear resonance frequencies bilaterally. The client is informed that results reveal a mild to moderate conductive hearing loss and the results are highly suggestive of an ossicular disorder called otosclerosis that typically involves stapes fixation and may be amenable to surgical treatment pending examination by an otolaryngologist. Options for audiologic management through amplification would also be discussed. The audiologist's report to the family physician includes the statement that the findings are "consistent with abnormal stiffening of the ossicular chain, as is often seen with Otosclerosis" and recommends an otolaryngology consult.

A comprehensive audiologic examination is far more than the determination of audiometric thresholds (i.e., specification of hearing sensitivity). Audiologists consider the clinical results

from a wide range of available objective and subjective audiologic measures. The diagnostic test battery varies on a case by case basis, with the audiologist's choice of tests dictated by case history, symptoms, complaints, as well as other client-specific factors including age and cognitive status. Client motivation must also be clinically considered as audiologists encounter clients who are inclined to either exaggerate or conceal auditory disorders.

Clients typically present to audiologists directly, or by way of referral from other health professionals (commonly family physicians, otolaryngologists, pediatricians or neurologists, speech-language pathologists, registered nurses), classroom teachers or teachers of the deaf and hard of hearing, school psychologists, industrial or school screening programs or from other audiologists. In the example discussed above, namely the identification of an ossicular-based conductive hearing loss that is secondary to otosclerosis, it is reasonably foreseeable that the client would rely on this diagnosis to make a decision about his/her health care (i.e.: seeking a medical opinion regarding potential surgical amplification options).

Differential diagnosis is necessary to rule out diseases affecting the auditory system that would require treatment by a physician. For example, a client identified with unexplained unilateral sensorineural hearing loss or tinnitus requires physician referral for evaluation for conditions that originate outside the auditory system and/or can only be medically investigated or treated. This is also true in cases where hearing loss may be syndromic, viral, or secondary to auto-immune compromise. While these cases are relatively rare, audiologists are qualified to identify these clients and minimize the risks/cost of under/over-referral that negatively impact quality of care and health care costs. Importantly, audiologists are crucial in identifying, managing, co-managing, or referring cases of audiovestibular disorders and play an integral role on multidisciplinary health care teams.

An audiologic exam is not complete without providing appropriate counseling to clients and/or their care givers. Clinical results and diagnoses must be presented in a way that is both meaningful and comprehensible, and clients must be equipped to make informed decisions with respect to any interventions that are recommended. An accurate and portrayal of treatment benefits and limitations must be clearly communicated and be predicated on client-centered, evidence-based, practice standards. It is reasonable and foreseeable to expect that the information presented to the clients during the counseling process will, in many cases, influence their decisions regarding their health care.

The following briefly summarized case examples will illustrate the process of diagnosis and the range of clients seen by audiologists, as well as indicate when a referral would normally occur.

Example 2:

A 52 year old male visits an audiologist to inquire about a hearing aid. The audiologist's behavioural test battery reveals an asymmetrical sensorineural high frequency hearing loss, worse on the left. Word recognition is very poor and acoustic reflexes are absent on the left. Otoacoustic emissions testing results for cochlear function are consistent with the audiometric results bilaterally. Based on these findings, the audiologist performs electrophysicologic measures of auditory evoked potentials (e.g., auditory brainstem response) and finds abnormal prolongation of interpeak latencies for the left ear. The client is then referred to an otolaryngologist (directly, or by way of his family physician) for further evaluation (which, in all likelihood, would include an MRI). The audiologist reports that "results suggest the presence of retrocochlear pathology affecting the eighth cranial nerve". Decisions regarding a hearing aid

fitting or other rehabilitation are deferred until a medical diagnosis is completed and the effects of medical treatment on hearing are determined.

Example 3:

An eight month old baby is referred by her pediatrician after recovering from meningitis. The infant responds only to very loud sounds during behavioural (visual reinforcement) audiometry. The audiologist completes a threshold auditory brainstem response test and finds no response below 80 dB HL for either ear. Otoacoustic emissions testing confirms a hearing loss of cochlear origin. Rehabilitation includes referral to a program for hearing impaired infants which includes family support, possible binaural amplification, and communication intervention.

Example 4:

Nursing staff from a care facility ask an audiologist to see a 91 year old resident of a care facility when they notice that she is increasingly disoriented. They wonder whether her hearing is decreasing or if she is experiencing progressive cognitive decline. The audiologist performs behavioural testing with portable equipment in the resident's room, as she is unable to travel to the clinic. Results indicate only a mild high frequency sensorineural hearing loss with good word recognition. An observation and interview reveals that the resident is able to carry on a conversation, even in a moderately noisy environment, without amplification and to hear her television without difficulty. The audiologist informs the nursing staff that the resident is experiencing no significant hearing handicap and recommends that the woman's physician reassess her cognitive status.

Example 5:

A 45 year old female visits an Audiologist for a hearing assessment. She complains of decreased hearing in her right ear. She further notes that her right ear feels plugged and her own voice sounds as though she were talking in a barrel. The Audiologist begins the clinical assessment by performing otoscopy and notes a large accumulation of cerumen in the right ear canal. The behavioural test battery indicates a mild conductive hearing loss in the right ear. The Audiologist debrides the ear canal of cerumen and repeats the behavioural assessment and finds normal hearing sensitivity in both ears.

EDUCATION AND EXPERIENCE:

Currently, a master's degree is the entry level designated for the field of audiology in Canada. The Master's level academic curriculum for audiologists is designed to give the audiology student a broad knowledge of normal and abnormal auditory physiology and development, as well as sensory, cognitive, speech, language and psychological aspects of human function. This prepares the student to go beyond simple diagnosis of hearing loss or vestibular dysfunction and to both assess the impact of a hearing loss or vestibular dysfunction on quality of life and communication and to independently diagnose and plan case management strategies. Generally, there are at least 150 hours of classroom instruction specifically focused on diagnosis.

Most traditional degree programs also require approximately 30 weeks of full-time supervised practice (350 – 400 client contact hours), including work with children and adults, in health,

industrial and educational settings. On average, 50% of this practical training is focused on the diagnostic process.

Reserved Act #2

Ordering or receiving reports of screening or diagnostic tests which would assist in the diagnosis and intervention plan to promote and maintain an individual's communicative, auditory and/or vestibular health care needs.

DESCRIPTION OF SERVICES:

Audiologists will order and receive screening and diagnostic tests in order to diagnose and treat hearing or vestibular disorders.

Audiologists working with clients who have had diagnostic tests, including but not limited to, evoked potential assessments, MRIs, CTs, cerebral spinal fluid testing, skull x-rays, psychological evaluation, etc. base many of their clinical decisions on the results of these tests. Audiologists require access to these reports in order to make informed decisions regarding the diagnosis and treatment of these clients.

Example #1:

A 42 year old male was referred for an audiologic evaluation by his otolaryngologist. The client presented with a gradual progressive hearing loss, headaches, and an unsteady gait. . The audiologist's behavioural test battery reveals an asymmetrical sensorineural hearing loss, worse on the left. Word recognition is very poor on the left and fair to good on the right. Acoustic reflexes are absent bilaterally. Otoacoustic emissions testing results for cochlear function are consistent with the audiometric results bilaterally. Based on these findings, the audiologist performs electrophysicologic measures of auditory evoked potentials (e.g., auditory brainstem response) and finds abnormal prolongation of interpeak latencies for the left ear. The client's vestibular function is assessed using a Video Nystagmography (VNG) battery. The results of this evaluation indicate a weakness of the left vestibular system. The client is sent back to his otolaryngologist for further assessment. The audiologist reports that "results suggest the presence of retrocochlear pathology affecting the eighth cranial nerve". Decisions regarding a hearing aid fitting or other rehabilitation are deferred until a medical diagnosis is completed and the effects of medical treatment on hearing are determined. Supported by the results of the audiologic evaluation an MRI is ordered by his otolaryngologist and reveals a CPA tumour which is subsequently removed surgically. The client is left with no residual hearing on the surgical side and is then referred for follow up for audiologic and vestibular rehabilitation.

Example #2:

A 13 year old boy is referred for an audiologic evaluation by his classroom teacher. The teacher reports that the student appears to hear normally but is having significant difficulty academically. The student has recently been diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). The classroom teacher is working with the student and his family to put strategies in place to accommodate this diagnosis. The audiologist's evaluation results indicate essentially normal

hearing acuity bilaterally. Based on the normal hearing results, case history information and the report of the ADHD diagnosis, the audiologist evaluates the student for Auditory Processing Disorder (APD). The results of assessment confirm a diagnosis of APD. The audiologist reports these findings to the family and the teacher. The audiologist may offer strategies for adapting the student's educational environment, remediation activities or therapy, and/or the fitting of an assistive listening device.

Example #3:

A three month old infant is diagnosed with permanent hearing loss after being identified as being at risk through the infant hearing screening program. The infant is referred to the otolaryngologist for evaluation. It is also recommended that the child's family see a geneticist. The results from the geneticist indicate the presence of a genetic disorder which has implications for the hearing loss. Thus, the child is fitted with amplification and will be followed more closely in view of the reported genetics information.

EDUCATION AND EXPERIENCE:

As it stands, the Master's level academic curriculum for audiologists provides students a broad and comprehensive knowledge of normal and abnormal audiovestibular and general embryology, physiology, neuroanatomy and pharmacology. Moreover, audiologists receive in-depth training in all aspects of auditory communication including speech and language development, cognition, and psychoacoustics and are able to identify or examine the social, academic, and psychological factors that can cause, interact with, or be secondary to auditory disorders. Just as audiologists' reports can be invaluable to physicians and other professionals who are involved in client care, audiologists are able to utilize results of other specialties, when necessary, to assist in the diagnosis and management of audiovestibular disorders. With respect to auditory disorders, audiologists are typically the professionals best positioned to evaluate potential impacts on quality life and to determine whether any further medical investigation is warranted. Generally, audiologists receive at least 150 hours of classroom instruction specifically focused on diagnosis, and considerably more in their clinical training.

Most traditional degree programs also require some 30 weeks of full-time supervised practice (350 – 400 client contact hours), including work with children and adults, in health, industrial and educational settings. On average, 50% of this practical training is focused on the diagnostic process. Some of this practical training is also focused on the screening process. In addition, students will often complete a three (3) credit hour university course in APD assessment and treatment techniques. Students are occasionally exposed to APD assessment and treatment techniques during their practicum placements. Advanced post graduation competency work in this area may be obtained through professional courses, workshops, and peer training.

<u>Reserved Act #4</u>

Inserting or removing an instrument or a device, hand or finger

(a) into the external ear canal.

Reserved Act #5

Administering a substance into the external ear canal up to the eardrum

(a) by injection;

(b) by irrigation.

Reserved Act #13

Putting into the external ear canal, up to the eardrum, a substance that

(a) is under pressure; or

(b) subsequently solidifies.

DESCRIPTION OF SERVICE AND EDUCATION:

Several circumstances in which an audiologist will insert or remove a device into the external ear canal, administer a substance by injection or irrigation and put into the external ear canal, up to the eardrum, a substance that is under pressure or subsequently solidifies are described below. After each example, there is a brief outline of the applicable educational component.

An audiologist determines that a specific physically invasive procedure is indicated as part of the test battery or as part of case management and will proceed with the procedure, unless some contraindication is present.

Performing the services that fall within these reserved acts does not require an order from or supervision by a physician. In fact, establishing such a requirement would interrupt and delay client care in many situations. Physicians, other than otolaryngologists, are not commonly trained in several of these procedures.

1) When performing otoscopy the speculum of an otoscope is placed into the ear canal (Reserved Act #4) in order that the tympanic membrane and the interior of the ear canal may be visualized. Some otoscopes are attached to a video monitor to allow better visualization. This modification, named “video otoscopy” assists in the identification of external ear pathologies and in the removal of cerumen from the ear canal (see example 1 below).

   In addition, otoscopy allows the audiologist to determine whether or not the tympanic membrane is intact. This is of crucial importance when planning caloric vestibular testing or cerumen management and is also important for determining whether or not ventilating tubes placed in the eardrum are present and if they are patent or blocked.

   During a typical master’s or doctoral program in audiology, a student will obtain a minimum of four (4) hours of classroom work related to the anatomy of the pinna and external ear canal and tympanic membrane including discussion of otoscopy and will perform otoscopy under supervision for several hundred clients. Otoscopy is an essential part of a comprehensive diagnostic test battery.

2) When performing immittance measures, a plastic probe tip is placed into the external ear canal (Reserved Act #4), an hermetic seal is obtained, a tone is introduced and the pressure in the ear canal is changed (Reserved Act #13). The changing amount of sound pressure reflected by the tympanic membrane represents the movement of the tympanic membrane and thus the movement of the middle ear system.

Immittance testing also involves the measurement of stapedial acoustic reflexes, where intense sounds are introduced through a receiver housed in a probe assembly placed into the external ear canal. The intense sounds trigger the acoustic reflex, which in turn results in movement of the tympanic membrane.

In addition, immittance testing provides physical volume measures, which allow the audiologist to determine whether or not the tympanic membrane is intact. This is of crucial importance when planning caloric vestibular testing or cerumen management and is also important for determining whether or not ventilating tubes placed in the eardrum are blocked.

The physiological relationship of Eustachian tube function and the middle ear is widely accepted. There are several techniques that were developed for utilizing the clinical measurements of acoustic immittance to assess the ventilory status of the Eustachian tube. The audiologist has an array of procedures at his or her disposal for the clinical assessment of Eustachian tube function that are commonly accepted in the medical community.

Prior to graduation with a master's degree in audiology, a typical student completes 15 hours of classroom work in immittance measures testing and performs over 400 of these tests under supervision. Immittance measures are an essential component of a comprehensive diagnostic audiologic examination.

3) When making impressions of the ear for the purpose of creating a custom ear mold for a hearing aid or custom ear protection the pinna, external ear canal and tympanic membrane are first examined using otoscopy (Reserved Act #4) for contraindications such as the presence of anomalies of the ear canal wall, foreign objects, excessive cerumen, or perforations of the tympanic membrane. If none of these exists, the audiologist proceeds to temporarily insert a plastic or silicon material deep into the ear canal (Reserved Act #13). The tympanic membrane is protected by a cotton or foam dam inserted into the ear canal prior to the injection of the impression material (Reserved Act #4; Reserved Act #5). Extreme care must be taken in the case of mastoid cavities creating an artificially large space inside the opening of the external ear canal. Without due care, impression material can harden inside the ear canal in a way that makes removal impossible without surgical intervention. Caution must also be used in the case of external ear canal disease, tympanic membrane perforation, or the presence of a ventilation tube to prevent injury or a worsening of a medical condition.

The typical student in audiology completes an average of 6 hours of classroom work in earmold impression technique and takes over 50 earmold impressions under supervision.

4) When performing real-ear measurements a soft silicon tube is inserted in the external ear canal to within 2-3 millimeters of the tympanic membrane and may touch the tympanic membrane as proper placement is determined (Reserved Act #4). The tube is attached to a microphone which measures the acoustic characteristics of the external ear canal and output of hearing devices placed on or in the ear, thus providing an accurate measurement of the function of the hearing aid.

Audiology students typically receive six hours of classroom instruction on real ear measurements, including a laboratory exercise. During practicum, the typical student will receive approximately 20 hours of supervised training in real ear measurement.

5) When performing diagnostic testing using insert earphones foam tips are inserted into the ear canal (Reserved Act #4) for the purpose of administering acoustic stimuli. Insert tips are used in pure tone and speech audiometry and during evoked potential and otoacoustic emissions testing. In many circumstances they give more accurate readings than conventional circumaural headphones.

The use of insert earphones is a routine part of audiological diagnostic practice and is one of the diagnostic techniques taught to every audiology student.

6) When performing caloric testing during vestibular assessments, pressurized water or air of a temperature different from body temperature is introduced into the ear canal (Reserved Act #5) and washes against the tympanic membrane. This process artificially stimulates the vestibular system, thereby allowing quantification of vestibular function indirectly by measuring resulting nystagmus and other eye movements.

Audiology students typically receive academic and clinical instruction on vestibular assessment. Some audiology schools, especially those offering doctoral (Au.D) degrees, have expanded their curricula with respect to vestibular assessment, diagnosis, and treatment. Traditionally, audiologists employed in settings where vestibular diagnosis is routine have acquired additional experience and post-graduate clinical training.

7) When performing otoacoustic emissions a probe tip is inserted into the ear canal (Reserved Act #4) and acoustic stimuli are introduced. In turn, if the outer hair cells of the cochlea are intact, an otoacoustic emission is produced which is detected via a microphone housed within the probe tip.

Audiology students typically receive four hours of classroom instruction and many hours of practical experience with otoacoustic emissions testing. In many practicum settings, otoacoustic emissions testing is a standard part of the diagnostic protocol.

8) During electrocochleography an electrode and electrode gel are placed on the tympanic membrane (Reserved Act #4) in order to perform a measurement as close as possible to the cochlea without passing the tympanic membrane. Electrocochleography is used to detect endolymphatic hydrops and sometimes to provide a physiological measure of cochlear function which may reflect hearing levels.

University coursework varies for this technique, and advanced post – graduate training and supervision is available for clinicians working with this procedure.

9) When performing cerumen management, curettes, suction, syringed water or cerumenolytic chemicals are introduced into the external ear canal (Reserved Act #4 and Reserved Act #5) in order to debride cerumen or other debris. Audiologists are trained in the techniques, contraindications, and risk factors associated with these procedures. Cerumen management is an important part of the hearing health care delivery system and is often included as part of standard audiologic care. Referral to a physician for cerumen management can result in a delay in diagnosis and treatment of the audiovestibular disorder.

Audiologists have the academic training and requisite skills in order to perform cerumen management. Improved opportunities in graduate training programs and heightened awareness of the need for cerumen management by audiologists have significantly increased the number of audiologists who are practicing cerumen management routinely. The typical training for cerumen management will include education and training in otoscopy, knowledge of abnormal conditions of the ear canal and tympanic membrane, and supervised experience in cerumen removal. In order to perform cerumen management, audiologists must meet the requirements set out in the practice directions for Cerumen Management, which will be developed by the college.

Reserved Act #16

Prescribing, dispensing, or fitting a wearable hearing instrument.

DESCRIPTION OF SERVICES:

This reserved act has 3 components namely: (a) prescribing, (b) dispensing and (c) fitting a wearable hearing instrument. To determine if audiologists should be authorized to perform these reserved acts and perhaps to determine if other persons should or should not, it is necessary to examine “prescribe”, “dispense”, and “fit” separately.

Under the RHPA:

> **"prescribe"** means to issue a prescription for a dental appliance, drug, vaccine, vision appliance, or wearable hearing instrument. (« prescrire »)
>
> **"prescription"** means
>
> > (a) in respect of a dental appliance, vision appliance or wearable hearing instrument, to issue an authorization to dispense the appliance or instrument for use by the individual named in the authorization;

A prescription is an authorization to dispense the specific wearable hearing instrument for the individual named in the authorization. A prescription for a wearable hearing instrument should include the specification of the acoustic and physical parameters (i.e.: Circuitry, style, make, model, earmold specifications) of the wearable hearing instrument based on a comprehensive evaluation of auditory and communicative function.

With respect to “dispense” and “fit”; under the RHPA:

"dispense" means

d) in respect of a wearable hearing instrument, to select, prepare, alter, sell, or offer to sell it.

“fit" means

c) in respect of a wearable hearing instrument, to adapt or verify, using sound field testing or real ear measurements.

MSHA is of the opinion that the process of “prescribing”, "dispensing”, and fitting” a wearable hearing instrument are separate and distinct actions. The process of prescribing an instrument involves providing the authorization for the device and includes a specification of the make and model of the instrument and any optional features that should be included. Prescribing an instrument also includes specifying the style and material of any earmold required for the device. The act of dispensing a hearing instrument involves the ordering and invoicing of the prescribed device and may also include taking the earmold impression(s). The act of fitting the instrument involves the programming of the instrument to meet defined targets for gain and output, validating and verifying the characteristics of the instrument and making any required adjustments. Fitting also includes counseling and orientation and recommendations for follow – up. In this model, prescription provides the authorization to dispense the device as per the specifications outlined in the prescription and the fitting of the instrument is the final step in the process.

The Process of Prescribing a Wearable Hearing Instrument

A wearable hearing instrument is a device that stimulates the auditory sense and is designed to correct or minimize deficits in auditory function. The process of prescribing a wearable hearing instrument starts with a complete audiologic examination and diagnosis of an auditory disorder or dysfunction. The major domains of an audiologic assessment yield the information necessary to determine an appropriate course of intervention. Certain findings may indicate prompt medical referral, such as for possible treatment of a middle ear infection or treatable inner ear disease, further investigation of a possible otoneurological disorder such as an acoustic tumor, or exploration of possible syndromes. In the vast majority of cases, there will be a sensory hearing impairment that is medically untreatable, and audiologic rehabilitation will be indicated. The individual may be a candidate for assistive technology such as hearing aids, cochlear implants, or other assistive devices, in which case additional audiometry or other specialized measurement is usually required for proper prescription of appropriate devices. Where valid and accurate hearing tests have been obtained and medical contraindications for amplification (such as active ear infection) are absent, an individual may be a candidate for a wearable hearing instrument.

1) Candidacy Assessment

For an individual to be a candidate for a wearable hearing instrument there must be an auditory impairment in one or both ears. This impairment is necessary but not sufficient for actual candidacy. In order for there to be a reasonable prospect of significant benefit, the client must have accepted that there is a need for intervention and must have at least a minimum level of motivation to engage in the rehabilitation process. There must also be reasonable awareness of the capabilities and limitations of hearing instruments, and of the importance of strategic listening and communication behaviours that will reduce the impact of those limitations.

2) Specifying the Requirements of a Hearing Aid Prescription

Hearing instruments include hearing aids, wireless personal amplification devices (e.g. FM systems) and implantable hearing devices (cochlear implants, BAHA, etc.). Hearing aids are the most common assistive technology, but all of these devices introduce sound into an

impaired auditory system. Hearing instruments amplify sound in order to restore, as nearly as possible, the ability of a person with hearing loss to understand speech and to hear other sounds. Hearing aids are very complex devices that have a vast array of types, configurations, and electroacoustical operating parameters. Hearing aids are now based on digital technology and include embedded microprocessors with sophisticated digital signal processing algorithms intended to enhance the recognition of complex signals and/or automatically control the level of sound. There is a vast array of manufacturers and models of hearing instruments and it is the responsibility of the prescriber to specify a device which will match the client's spectrum of needs and capabilities as determined through the candidacy assessment process. For the hearing instrument to be effective at achieving this goal, the prescription must specify a device that will meet the precise electroacoustic performance targets required. Typical performance targets include precise definitions of the amplification by frequency, maximum output, and the automatic adjustment of sound level.
Like many areas in health care, research and technology have brought significant advancements to aural rehabilitation and specifically to the methodology of hearing aid prescription and fitting. This has resulted in greater potential benefit from hearing aids, but has also led to increased refinement and complexity in the prescription and fitting process and places greater demands on the audiologic expertise of those who prescribe and fit hearing instruments.

Central to the prescription process is the combined use of evidence-based principles and clinical audiologic judgment for predicting specific acoustic parameters of hearing aids. In this context, it is essential that the hearing aid selected in the prescription meets the hearing aid target performance parameters necessary for minimizing the auditory deficit.
It is equally important that the actual achievement of acoustical performance targets is verified by appropriate measurement procedures completed by a well-trained professional who is knowledgeable enough to modify the performance to accommodate the needs of the individual. This is ensured through the fitting stage of the process in which the instrument's function is verified through acoustical measurments in the client's ear.

The prescription for the prescribed hearing aid(s) should include, but not be limited to:

1. ear(s) to be fitted

2. style of hearing aid(s) or device(s)

3. manufacturer's name and model number including type of signal processing.

4. features including but not limited to, volume control, programming switch, directional microphone, telecoil, direct audio input

5. earmold style, material and specifications for modifications including venting and tubing, where applicable

6. any special applications for ear hooks, including, but not limited to, pediatric ear hooks
7. special applications, including, but not limited to, a bone conduction hearing aid, CROS/BICROS systems, where applicable

In the case of a binaural fitting, the above will be specified separately for each ear.

The Process of Dispensing a Wearable Hearing Instrument:

Dispensing is the process of filling a valid and complete prescription. That is, it includes ordering the specific aid exactly as prescribed and ensuring that the aid is set and performing as prescribed, taking an impression of the ear (if necessary) Just as it is the responsibility of the prescriber to prescribe appropriately, it is the responsibility of the dispenser to dispense appropriately. In this sense, the process is analogous to prescription and dispensing of a medication.

1) Taking an Ear Impression

In some cases, the dispenser may take an impression of the ear. This impression is then used to manufacture the specifically prescribed hearing aid or earmold. Upon completion of the manufacturing process, the hearing instrument is then set and checked according to the prescription.

An ear impression is a physical replica of the ear achieved by injecting an impression material into the ear canal and external ear cavities (concha and helix areas of the ear). Impression materials may be either liquid-powder (ethyl methacrylate) or silicone-based materials. The nature of the ear impression is defined by the presenting concern/condition of the client, and the client's ability and willingness to manage the earmold, which may be recommended by the prescriber. All components must be executed in such a way as to ensure the safety of the client and clinician by adhering to infection control practices.

2) Ensuring the Device Meets the Prescribed Specifications

The dispenser must confirm that the device meets the specifications set out in the prescription. This is done by first determining if the hearing instrument meets American National Standards Institute (ANSI) standards requirements as outlined in the manufacturers' specifications. Other features such as venting and telecoil specifications are also confirmed. Any changes to the prescribed instrument(s) must first be completed or approved by the original prescriber.

The Process of Fitting a Wearable Hearing Instrument:

Even if each and every pertinent aspect of the prescription is appropriate, their translation into the desired device and fitting to the ear(s) depends upon competent fitting procedures. Every parameter and feature specified is a potential source of error or omission. Hearing instruments are very complex devices that have a vast array of types, configurations, and electroacoustical operating parameters. Most hearing instruments are now based on digital technology and include embedded microprocessors with sophisticated digital signal processing algorithms intended to enhance the recognition of complex signals and/or automatically control the level of sound. Each and every one of these features and performance parameters must be matched carefully to the client's spectrum of needs and capabilities.

This complex task requires knowledge of acoustics (including environmental acoustics), psychoacoustics of the impaired ear, digital signal processing schemes, prescriptive rationales and validation, and training in clinical hearing instrument programming procedures. There is clear evidence that any given hearing instrument will yield different actual acoustical output in the ears of different individuals, and that different individuals with the same audiometric profile

may require different hearing instrument parameters. Therefore it is obvious that detailed instrument prescription is a necessary component of a successful fitting.

Prescriptive fitting formulas which calculate the required frequency/gain characteristics of a hearing instrument are used in the fitting process in order to ensure that the instrument matches the targets for electroacoustic performance. By using a common reference point the performance of the hearing aid can be compared directly to the client's residual auditory area. In general, if the hearing instrument output for a given input level is below the client's threshold, then the input signal may not be audible. Conversely, if the hearing instrument output for given input level is above the client's upper limit of comfort, then the input signal may be uncomfortable.

Verification of the hearing instrument performance is a critical component of the fitting process. During verification procedure, the hearing instruments are adjusted until they provide the electroacoustic performance that is deemed appropriate based on the fitting formula. The output of the hearing instrument is measured objectively across frequency and input ranges and the electroacoustic performance is documented. The verification procedures must confirm that the real-ear performance of the instrument provides output levels that are comfortable, safe and without feedback.

An additional component of the fitting process is to ensure the comfort of the device in the client's ear. During the fitting procedure the device is placed into the client's ear and checked for such issues as conformity of the hearing instrument to the ear and ear canal, comfort of the device and ability of placement and removal by the client. Any modification of the hearing instrument or earmold to improve fitting or remake procedures may be completed at this time.

Although a well-fitted hearing instrument is an excellent first step in the rehabilitation process, it represents the point of entry into the long-term rehabilitation process. There is no substitute for good counseling which should include information regarding the initial use and care of the hearing instrument as well as information regarding realistic expectations of the performance of the instrument. It is an expectation that the client will provide feedback regarding the performance of their instrument and that adjustments to the instrument will occur over time improving benefit and satisfaction.

Risks of Harm:

While the benefits of properly fitted hearing aids are significant and readily defined, the evidence of physical harm arising from improper hearing aid prescription is inherently difficult to gather. However, it is widely accepted that, for infants with hearing loss, early audiologic intervention (which includes the appropriate prescription of hearing aids) is crucial to the development of speech and language. While a likely outcome of inappropriate prescription in such cases is a failure to reach one's communicative or academic potential, such consequences do not lend themselves to empirical scrutiny.

Similarly, it may not be possible to demonstrate how many among the high rate of young offenders identified with communication and/or hearing difficulties suffer as a result of improper or inadequate audiologic care. There is no way to assess the harm to these individuals or the enormous lost opportunities and social costs.

There is no means by which to quantify clients who reject hearing aids, and "leave them in the drawer" based on negative experiences such as insufficient benefit, acoustic discomfort, or poor audibility. Clients with inappropriately prescribed hearing aids that fail to yield optimal benefit are often unaware of the potential for enhanced hearing, and typically do not present themselves at hospitals with obvious physical harms. There is again no way to assess the specific harm to these individuals or the social harm and costs. However, the risks of harm associated with hearing aid prescription are substantial. The harms may not present themselves immediately, but may manifest themselves over a number of years. These harms include not only physical harm, but also emotional, physiological, financial, social, and economic loss to the individual and society.

There are specific types of harm that are inherent to hearing instrument prescription and fitting such as:

- Overamplification resulting in further permanent damage to a client's residual sensorineural hearing sensitivity.

- Insufficient or inappropriate amplification. This results in poor audibility of sound and may further reduce communicative dysfunction.

- Inappropriate prescription of a hearing aid to an ear in need of immediate medical investigation or to an ear for which candidacy is not warranted.

- Discomfort from painfully loud sounds.

- Failure to recognize contraindications (e.g. completely-in-the-canal hearing aids improperly prescribed to diabetics and raising the risk of canal ulcers).

The following are the consequences and types of harm that may result from an improper prescription or from improper dispensing and/or fitting or from an error in audiological assessment:

- Physical harm to the client due to procedures involved in determining the actual need of a hearing aid prescription from high intensity sound energy or potentially damaging air pressure levels, or instruments being inserted into the ear canal with close proximity to the fragile eardrum.

- Physical harm or death could result from the inability of a hearing impaired person to hear warnings or recognize sounds associated with a hazardous situation, such as a train at a railway crossing, or a boiling kettle, or a fire alarm.

- Children could experience significant delays in the development of speech and language, literacy, communication skills, socialization and learning. The dropout rate of children with speech and language disorders is 43% compared to 23% in non – impaired children according to the Ontario association for Families of Children with Communication Disorders.
- Children and youth may develop inappropriate and maladaptive attitudes and behaviors that may result in actions that may cause harm to others. Over 60 per cent of young offenders have communication disorders according to The Ontario Association for Families of Children with Communication Disorders.

- Inability to maintain independent living, increased physical risk from environmental hazards, social withdrawal and isolation, increased reliance on family or institutional supports, exacerbation of cognitive decline.

- There are clear links between hearing loss and the development of clinical depression.

- Hearing impaired individuals may experience loss of vocational abilities and possible loss of jobs.

- Problems with social communication, emotional and psychological aspects of daily living resulting in frustration and poor self – image.

- Family relationships could be disrupted.

- In the special case of infants and young children, deficiencies in audiologic habilitation can have profound consequences above and beyond the possible harmful effects in an adult. In essence, ineffective amplification puts the child in a worse situation than if there had been no intervention at all. For example, with under-amplification, the child will not develop spoken language normally, and will not respond appropriately at home or at school. Yet parents and teachers will believe that all is well concerning hearing. Inappropriate behaviours or poor performance may be misinterpreted and even lead to inappropriate behavioural or psychological interventions. Conversely, the potential for ear damage due to over-amplification has been repeatedly reported.

- Physical harm to external ear and/or ear canal associated with poorly shaped hearing aid(s).

- Failure to achieve successful use of device due to poor and/or insufficient training.

- Inappropriate processing of warranties.

- Refusing to accept a return of a hearing aid that is not providing benefit.

- Failure to counsel parents about dangers of infants ingesting hearing aid batteries, resulting in exposure to toxic substances.

- Failure to counsel parents about risks of damage to devices from water, resulting in financial losses due to damage to hearing aids.

- Convincing a vulnerable elderly person to keep a hearing aid that is not providing benefit, or to purchase devices that are not needed.

Earmold impression procedures have several known risks of harm that include but are not limited to perforation and/or removal of the tympanic membrane and/or ossicles, laceration of the ear canal and painful suction upon impression removal. For example:

- If a perforation of the tympanic membrane is present, the impression material could penetrate the perforation of the eardrum, filling the middle ear cavity, requiring surgical removal.

- Deep canal impressions require taking impression of the complete canal right up to the eardrum, leading to the possibility of bruised canal walls, soreness and irritation, or damage to the eardrum.

- Injection impression material into the ear canal of a client with a mastoid cavity could require surgical removal.

EDUCATION AND EXPERIENCE REQUIRED TO PRESCRIBE, DISPENSE AND FIT HEARING INSTURMENTS

Prescribing, dispensing, and fitting hearing instruments in a manner that maximizes communicative function and minimizes risk of harm requires evaluation of a client's auditory and communicative function. In addition to the skills required to evaluate a client's auditory function, in-depth academic and clinical training in the following areas is required: 1) anatomical, biochemical and physiological qualities of the normal and disordered peripheral and central auditory system, 2) nature of language acquisition, speech perception, acoustical representation and communication strategies, 3) evidence-based protocols for determining appropriate amplification characteristics, 4) complex interactions between audiologic treatment factors such as history, onset, level, configuration, progression, etiology, site-of-lesion, acoustic and physical properties of the outer ear, and other client-specific variables such as age, language ability, emotional state, general health, socio-economic status, motivation, dexterity and attitude.

Prescribing, dispensing, and fitting hearing instruments are not simple, technical tasks; it is an individualized process that demands critical thinking and a thorough understanding of audiologic and aural rehabilitation principles. This can only occur within an established clinician-client relationship, and it is incumbent on the audiologist to personally determine the need for a hearing instrument, as well as the candidacy of the individual and to specify the acoustic and physical parameters of a hearing instrument to meet the specific client's needs.

Proper prescription, dispensing, and fitting of hearing instruments requires extensive academic and clinical training across a wide variety of areas including, for example:

- principles of aural rehabilitation and client-centered care.
- anatomy and physiology of the normal and disordered auditory system.
- speech perception.
- language development.
- acoustics and psychoacoustics.
- interpersonal communication.
- interview techniques.
- psychological effects of hearing loss.
- assessment of communication skills.
- assessment of treatment efficacy.
- signal processing.
- relevant ANSI standards.
- assessment of real ear performance (probe tube microphone use).
- anatomical, acoustic and electroacoustic effects on real ear response.
- acoustic effects of style, shape and venting of ear molds and hearing instrument shells.
- effects of noise, reverberation and distance on speech intelligibility.
- prescriptive fitting protocols.
- effects of acoustic and electroacoustic modifications on hearing instrument performance.

- electroacoustic modification procedures to alleviate residual or subjective complaints.
- alternate forms of amplification including vibrotactile aids, FM systems, frequency transposition hearing aids, etc.
- age-appropriate/modified evaluation procedures for special populations.
- promotion of effective communication strategies.
- theory-based approaches to individual, group and family counseling.

In addition, persons authorized to prescribe, dispense and fit wearable hearing instruments must have the following necessary competencies to perform the reserved act:

1. The ability to obtain a relevant case history from the client with particular attention paid to conditions and medical/surgical procedures involving the outer and middle ear.

2. Knowledge and use of examination techniques of the external ear and ear canal using an otoscope.

3. Knowledge of and the ability to identify conditions of the external ear, ear canal and tympanic membrane that would prevent an ear impression from being taken safely:

4. Knowledge of and ability to utilize ear impression techniques:

5. Knowledge of the impact of the manufacturing process on the nature of the impression:

6. Knowledge of the interaction of the earmold and the hearing instrument.

Audiologists have masters or doctoral degrees with extensive coursework and clinical placements that ensure they have the competencies to prescribe, dispense, and fit hearing instruments, verify and validate their performance, and counsel clients.

Typically audiology students are introduced to the form and function of amplification devices for persons with impaired hearing. Extensive coursework in clinical strategies for determining candidacy for these devices as well as clinical procedures for selecting and fitting amplification and evaluating performance are provided. Prior to graduation, a typical student in audiology will complete at least 50 hours of classroom work dir4ectly related to hearing devices and fit some 80 hearing aids under supervision. Much of the classroom and practicum experience provided to students relates directly to hearing aid dispensing practices, including work on case history, anatomy and physiology of the auditory system, diagnostic aural rehabilitation, central auditory processing, professional and biomedical ethics and the study of perception. In addition, students will typically receive six hours of classroom instruction and observation of work with cochlear implants. Students are exposed to cochlear implant programming techniques during practicum placements, however, advanced competency work, post graduation, in this area is required and is obtained through professional courses, workshops and peer training.

An extensive laboratory component acquaints students with the instrumentation systems and procedures that are applied in measuring the performance of hearing instruments and alternative amplification devices. Students are required to be knowledgeable in amplification-related areas including: audiometric assessment strategies for selecting amplification, advanced signal processing strategies and speech perception, electroacoustic measurement and fitting of new hearing instrument technologies, and objective and subjective measures of benefit.

Students are required to successfully complete extensive clinical practicums in order to demonstrate competence in these areas.

Audiology Courses

Certain undergraduate CSD courses are being offered to all students of UWO. CSD 4417; CSD 4411; CSD 4439 and CSD 4497

All students must take at least two electives during their two years in the graduate portion of the program. Electives will normally be graduate level seminars and must be approved by the student's academic advisor and the Chair of the Graduate Program Committee. The academic load during any term may not exceed five courses exclusive of clinical practicum.

Audiology Program Course Descriptions and Syllabi

Courses taken in Year 1 Audiology

CSD 9501. Practicum in Audiology I
Directed observation and clinical experience in audiological assessment and (re)habilitative procedures for first year students. 3 hours; Half course; one term.

CSD 9513. Hearing Measurement I
Discussion and analysis of procedures used in clinical audiology to assess lesions of conductive, cochlear and retrocochlear nature. 3 lecture hours. 1 lab hour. Half course; one term.

CSD 9517. Acoustics and Instrumentation Systems

CSD 9576. Introduction to Amplification for the Hearing-Impaired

This course introduces students to the form and function of amplification devices for persons with impaired hearing. Clinical strategies for determining candidacy for these devices as well as clinical procedures for selecting and fitting amplification and evaluating performance will be discussed. An extensive laboratory component will acquaint students with the instrumentation systems and procedures that are applied in measuring the performance of hearing aid and alternative amplification devices. 3 lecture hours, 1 laboratory hour (2 sections); half course.

CSD 9511. Aural Rehabilitation
Study of the communicative implications of hearing impairment in children and

adults. The role of audition and vision in speech communication, the assessment of speech communication abilities and needs, and manual and speech-perception enhancement rehabilitation are emphasized. 3 lecture hours. 2 lab hours. Half course; one term.

CSD 9523. Electrophysiology
Assessment of the auditory system using electrophysiological measurement techniques. 3 lecture hours; 1 lab hour. Half course; one term.

CSD 9533. Hearing Measurement II
Discussion of the procedures used in the assessment of the vestibular systems of dizzy patients. Clinical application of multiple frequency tympanograms. Results from electrocochleography with a variety of auditory dysfunctions. 3 lecture hours; 1 laboratory hour. Half course; one term.

CSD 9502. Practicum in Audiology II
Required summer placement for all graduate students. Clinical experience in diagnostic and (re)habilitative procedures. 8 hours, 40 hours per week; Half course; one term.

Courses taken in Year 2 Audiology

CSD 9503. Practicum in Audiology I
Clinical experience in diagnostic and (re)habilitative procedures for second year students. 8 hours, 40 hours per week; Half course; one term.

CSD 9521. Audiological Assessment of Children
Study of normal auditory development, causation, and audiological strategies utilized in the identification and evaluation of childhood hearing impairments and processing disorders. 3 lecture hours. Half course; one term.

CSD 9577. Advanced Topics in Amplification for the Hearing-Impaired
This course reviews the current research literature in amplification-related areas including: audiometric assessment strategies for selecting amplification, advanced signal processing strategies and speech perception, electroacoustic measurement and fitting of new hearing instrument technologies, and objective and subjective measures of benefit. 3 lecture hours, 1 laboratory hour (2 sections), half course.

CSD 9750. Counseling in Communicative Disorders
Study of contemporary theories of counseling with direct application to the field of Communicative Disorders. Counseling skill development is an integral component. 3 hours lecture, 1 hour lab. Half course; one term.

CSD 9761. Evidence-Based Practice

CSD 9504. Advanced Practicum in Audiology I
Clinical experience in audiological assessment and (re)habilitative procedures. Half course; one term.

CSD 9531. Noise and Audiology
Environmental noise; its characteristics, effects on hearing and its control. 3 lecture hours; 1 lab hour. Half course; one term.

CSD 9752. Professional Issues and Clinical Management
Study of the ethical, professional and program administration issues that affect Speech-Language Pathology and Audiology. 3 hours lecture, 1 hour lab. Half course; one term.

CSD 9505. Advanced Practicum in Audiology II
Required summer placement for clinical competency development in diagnostic and (re)habilitative audiological procedures. May receive some supervisory experience. Half course; one term.

CSD 9506. Advanced Practicum in Audiology II
Clinical competency development in diagnostic and (re)habilitative audiological procedures. May receive some supervisory experience. Half course; one term.

CSD 9507. Advanced Practicum in Audiology III
Required summer placement for all graduate students. Clinical experience in diagnostic and (re)habilitative procedures. Half course; one term.

CSD 9508. Speech-Language Pathology Practicum for Audiology Students
Clinical experience in assessment and treatment of disorders of speech and language. Half course; one term.

Graduate Seminars and Directed Studies in Audiology

CSD 9551. Seminar on Adult Group Aural Rehabilitation

CSD 9712. Seminar on Vestibular Disorders
It is the objective of this seminar to prepare students with a basic understanding of the vestibular system anatomy and physiology, its assessment and interpretation, and knowledge of appropriate patient management options

CSD 9713. Binaural Seminar
Introduction to the acoustical and physiological bases of spatial hearing, research methods, and clinical issues and applications.

CSD 9729: Seminar on Cochlear Implants
Introduction to the physiology, psychophysics, technology, and clinical practice of cochlear prosthesis

CSD 9731. Seminar on the Auditory Steady-State Response

CSD 9732. Special Topics in Hearing, Speech, or Language
Special areas of interest to faculty and students. Half course; one term. May be repeated for credit.

CSD 9734. Independent Study in Hearing, Speech or Language
Half course; one term. May be repeated for credit.

CSD 9744. Seminar on Aural (Re)habilitation
Covers special areas of interest to faculty and students in the area of aural (re)habilitation. Half course; one term. May be repeated for credit.

CSD 9745. Genetics of Hearing Seminar

CSD 9746. Seminar on DSP Technologies on Hearing Aids
Covers special areas of interest to faculty and students in the area of hearing science. Half course; one term. May be repeated for credit.

CSD 9748. Seminar on Diagnostic Audiology
Covers special areas of interest to faculty and students in the area of diagnostic audiology. Half course; one term. May be repeated for credit.

HS 9670. Research Seminar in Hearing Science (Seminar taken with special permission)