HEARING CARE POLICY ANALYSIS IN BRITISH COLUMBIA

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PROJECT SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF BUSINESS ADMINISTRATION

In the
Faculty
of
Business Administration

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SIMON FRASER UNIVERSITY

2007

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ABSTRACT

Reduced hearing is a widespread disability. One out of ten British Columbians estimated to suffer from a variable degree of hearing loss (CASLPA, 2005). It is the most common sensory impairment affecting 50 percent of Canadians over 65 (CHHA, 2005). The hearing loss problem is expected to progress from bad to worse due to demographic changes of the society and aging population.

Hearing loss problem bears serious consequences for the affected individuals and society as a whole. This paper is written for the provincial government. The paper attempts to provide an overview of the hearing loss problem and its costs to the society.

This paper proposes the “6 elements comprehensive hearing care policy” for the review of policy makers. The policy options are developed with a focus on funding sources. Policy options evaluation is based on the three goals of efficiency, equity and overcoming budgetary constraints.

Keywords: hearing loss; policy; analysis; health care; social costs

Subject Terms: hearing loss; health care costs; hearing aids; prevalence of hearing loss; policy analysis
DEDICATION

This paper is dedicated to my very special family. Their patience, love, and support made this achievement possible.
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# GLOSSARY

<table>
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<th>Definition</th>
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<tbody>
<tr>
<td>Air Conduction Hearing Aid</td>
<td>A device that amplifies sound waves being conducted to the inner ear through the external ear canal and middle ear.</td>
</tr>
<tr>
<td>Assistive Listening Devices (ALD's)</td>
<td>Technical devices that make communication easier in difficult listening environments. Are used to minimize the effects of noise, echoes, and distortion when a hard of hearing person must listen to speakers at a distance or a noisy place. <em>e.g. IR Systems, FM Systems</em></td>
</tr>
<tr>
<td>Audiologist</td>
<td>A professional with minimum of a Masters Degree in Audiology, specializing in the prevention of hearing loss and in the identification, assessment, diagnosis, management, and non-medical/non-surgical treatment (rehabilitation) of hearing and balance disorders. Includes fitting and dispensing hearing instruments.</td>
</tr>
<tr>
<td>Aural Rehabilitation Classes</td>
<td>Classes that teach communication strategies for successful Management of hearing loss. Components may include improve listening skills, speech reading instruction and information on useful technology, assertiveness and advocacy training.</td>
</tr>
<tr>
<td>Bone Anchored Hearing Aid (BAHA)</td>
<td>A hearing device that is implanted in the bone of the skull and directly stimulates the cochlea.</td>
</tr>
<tr>
<td>Bone Conduction</td>
<td>The conduction of sound to the inner ear through the bones of the skull.</td>
</tr>
<tr>
<td>Captioning</td>
<td>Text interpretation of the audio (sounds, voices) on a video or television program. Captioning may be Closed (appears when activated by a remote or other device), Open (present on screen without requiring a device to make it so), or Realtime (present on the screen with the aid of computer assisted technology)</td>
</tr>
<tr>
<td>CASLPA</td>
<td>Canadian Association of Speech-Language Pathologists and Audiologists</td>
</tr>
<tr>
<td>CHHA</td>
<td>Canadian Hard of Hearing Association</td>
</tr>
<tr>
<td>Cochlea</td>
<td>A spirally wound, tube-like structure that forms part of the inner ear and is essential for hearing.</td>
</tr>
<tr>
<td>Cochlear Implant</td>
<td>A device that electrically stimulates the hearing nerve in the cochlea (inner ear).</td>
</tr>
<tr>
<td>Conduction Hearing Loss</td>
<td>Hearing loss resulting from a lack or malfunction of the middle ear.</td>
</tr>
<tr>
<td>Conductive (Bone) Hearing Loss</td>
<td>A type of hearing loss caused by injury to, or problems with, the outer or middle ear.</td>
</tr>
<tr>
<td>Deaf (lowercase d)</td>
<td>(aka oral deaf) Term used to describe persons with early onset hearing loss who have little or no residual hearing. Their preferred mode of communication is speech and speech reading.</td>
</tr>
<tr>
<td>Deaf (uppercase D)</td>
<td>Members of a sociolinguistic and cultural group whose preferred mode of communication is sign language.</td>
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<tr>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ear Nose &amp; Throat (ENT) Doctor (Otolaryngologist)</td>
<td>A medical doctor, specializing in disorders of the head and neck, especially the Ear, Nose and Throat, including hearing loss, tinnitus and dizziness.</td>
</tr>
<tr>
<td>FM Systems</td>
<td>An assistive listening device (ALD) that functions as a mini-radio station on a broadcast frequency that brings a speaker's voice directly into the user's headset.</td>
</tr>
<tr>
<td>Hard of Hearing</td>
<td>Any person who has a hearing loss and whose usual means of communication is spoken language. This definition includes a broad spectrum of hearing loss, including those who are late-deafened and those deaf in childhood and educated orally.</td>
</tr>
<tr>
<td>Hearing Aid Dispenser (HAD)</td>
<td>Depending on where you live in Canada, they are also known as Hearing Aid Dealers, Hearing Instrument Practitioners, and Hearing Instrument Specialists. A Hearing Aid Dispenser examines clients to determine appropriate type of hearing aid; may test patient's hearing; take ear impressions; fit and adjust hearing aids; and perform follow-up examinations and readjustments.</td>
</tr>
<tr>
<td>Hearing Heath Care Provider</td>
<td>A group of professionals providing diagnostic, testing, hearing aid selection and dispensing services to persons with hearing loss. This group includes Audiologists, ENT Doctors, Speech Language Pathologists and Hearing Aid Dispensers.</td>
</tr>
<tr>
<td>Hearing Threshold</td>
<td>A measure of hearing sensitivity. It is the softest sound that can be heard by an individual 50 per cent of the time.</td>
</tr>
<tr>
<td>Infrared (IR) Systems</td>
<td>Similar to the FM System, but instead of radio frequency, IR uses invisible light to transmit sounds, requiring an unobstructed path between the source and the receiver.</td>
</tr>
<tr>
<td>Otitis Media</td>
<td>An inflammation of the middle ear</td>
</tr>
<tr>
<td>Otosclerosis</td>
<td>A condition affecting small bones in the middle ear coupled with a progressive loss of hearing in the inner ear.</td>
</tr>
<tr>
<td>Presbycusis</td>
<td>A functional decline in the ability to hear and process sound that is associated with aging and cannot be explained by the patient's genetic history, other disease or trauma to the hearing system.</td>
</tr>
<tr>
<td>Self-Report Scale</td>
<td>A series of questions designed to assess the effects of hearing loss on an individual's life (social, emotional and vocational). It indicates the areas you are having the most difficulty with in adjusting to your hearing loss.</td>
</tr>
<tr>
<td>Sensorineural Hearing Loss</td>
<td>The type of hearing loss caused by damage or problems in the inner ear or auditory nerve.</td>
</tr>
<tr>
<td>Sign Language Interpreting</td>
<td>Sign Language interpreters facilitate communication between Deaf and hearing people through their knowledge of Sign Language and Deaf Culture.</td>
</tr>
<tr>
<td>Signalling (Alerting) Devices</td>
<td>Devices used to indicate of the telephone, doorbell, or other loud sounds in the home or office by changing the auditory signal to visual or vibratory signals e.g. a door bell alarm, baby sound monitor.</td>
</tr>
<tr>
<td>Speech Discrimination</td>
<td>The ability to repeat correctly an open set of monosyllabic words at Supra-threshold intensity. Word lists are phonetically balanced meaning that the speech sounds they use occur with the same frequency as they do in the whole language.</td>
</tr>
<tr>
<td>Speech Language</td>
<td>A professional with minimum of a Masters Degree in Audiology.</td>
</tr>
<tr>
<td>Pathologist</td>
<td>specializing in identification, assessment, diagnosis, management and treatment of persons with speech, language, voice, fluency, cognitive and other related communication disorders (problems), including communication disorders that are due or related to hearing loss.</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Telephone Devices</td>
<td>Devices used to assist telephone communication such as volume amplifiers, ringer amplifiers, call display and TTY's.</td>
</tr>
<tr>
<td>Tinnitus</td>
<td>Refers to sounds, ringing and buzzing, that are heard in the head or ears. It is a sensation of sound not produced by any external source.</td>
</tr>
<tr>
<td>TTY (Teletypewriter)</td>
<td>A TTY or TTY compatible device allows users to communicate over a telephone line, using text. A special telephone operator assists with communication with hearing people.</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 High social costs of hearing loss

Hearing loss is the third most prevalent chronic disability amongst older adults (CASLPA, 2005). It is estimated that one out of ten adults in Canada has a speech, language, or hearing problem. Approximately 10 percent of the general population, 20 percent of those over 65, and 40 percent of those over 75, have hearing problems (Hearing Loss Info-Sheets For Seniors. (2006). The incidence and prevalence of hearing loss increases with age. “Adult” hearing loss can start as early as the third or fourth decade of life. The overall estimates of newborns with congenital hearing loss and deafness are between one and six per one thousand live births (Parving, 1993; Watkin et al., 1991; White & Behrens, 1993). Twenty to thirty percent of hearing impaired infants will suffer hearing loss during childhood (Joint Committee on Infant Hearing, 1995). Communication disorders in school-aged children are often misdiagnosed as learning disabilities or behavioural problems. Delays in diagnosis make treatment in later years very difficult.

Hearing loss is a chronic and often lifelong disability. Hearing loss can fundamentally limit an individual’s communication ability. In severe cases, hearing loss can completely isolate a person from society. If people are unable to hear, they risk missing important information and suffer exclusion from social interaction. Reduced or total lack of hearing can result in considerable communication handicaps both at work.
and outside of work. Social and economic consequences are significant for individuals and for society as a whole.

Hearing loss has been linked to depression and dementia (Allen et al., 2003; Mullins, 2004). Risk factors for hearing loss include exposure to excessive noise, chemicals toxic to ear, smoking, poverty, poor access to health care, poor hygiene, upper respiratory tract infections leading to otitis media (inflammation of the middle ear) and other infections such as meningitis and measles. Loss of earning power and reduced quality of life are also linked to hearing loss (Kochkin, 2007b).

The social cost of hearing loss has been estimated in a number of studies (Mohr et al., 2000; Access Economics, 2005). In the United States, each adult with severe to profound hearing loss is expected to cost society US $297,000 over the individual’s lifetime. Sixty-seven percent of these losses are due to reduced work productivity. For children, special educational resources contribute to an additional 21 percent. North American society will spend one million dollars on each pre-lingual onset of hearing loss (Northern & Downs, 1991). In Australia, the real financial cost of hearing loss in 2005 was estimated at AUS $11.75 billion or 1.4 percent of Gross Domestic Product (GDP). Currently, there are no estimates to be found for Canada or British Columbia. Comparable Australian and US evidence will be assumed to be acceptable for the evaluation purposes of this analysis.

Ninety percent of hearing losses can be treated with the use of hearing instruments. Currently, only 10 percent of hearing losses are treatable with surgery or other medical treatments. Unfortunately, only 23 percent of those who can be helped with
hearing aids, are able to, or choose to, use this form of treatment (Kochkin, 2007a). This lack of use has been linked to a number of factors which include a person’s limited understanding of the impact hearing loss has on quality of life and work. Awareness of the available solutions, and the high cost of hearing devices exacerbate the problem.

Current government programs in British Columbia provide selective provisions for hearing care. WorkSafeBC provides hearing aids to individuals with proven work related hearing losses. The Department of Veterans Affairs has provisions to cover the cost of hearing aids and their maintenance for qualified veterans. The Department of Indian Affairs has regulations that provide aids at no cost to Native Indians. In addition, a very small number of people receive government subsidies when they qualify for social assistance. However, the majority of those who need hearing aids fall outside the existing government programs.

According to Statistics Canada, seniors represent the fastest growing segment of the population. Seniors (age 65 and over) make up today 17.8 percent of the population of British Columbia or 770,200 persons (Census 2006). Increasingly, the aging population will further impose social costs which increase the need for hearing care.

1.2 An analysis of hearing care policy in British Columbia

The first purpose of this project is to review the existing hearing care policy in British Columbia. The second purpose is to develop and evaluate a number of policy alternatives that are available to the government. In order to carry out these purposes, the social costs of hearing loss will be studied using evidence from a number of countries.
1.3 The organization of this analysis

The analysis is organised as follow: Chapter 2 describes the problem of hearing loss, including a review of the types, degree, and configuration of hearing loss. Chapter 2 also describes various causes, co-morbidity, available treatments with rehabilitation, as well as hearing loss prevention. Chapter 3 reviews available data on the prevalence of hearing loss in children and adults. Most data has international origins; however, some information was available for British Columbia, as well as for the rest of Canada. Chapter 4 reviews available research on the social costs of hearing. Those costs are summarised as health system and other financial costs, including the burdens attributed to hearing loss. Chapter 5 defines the hearing loss problem in economic terms. Chapter 6 and 7 propose the appropriate government goals in alleviating the hearing loss problem, and also provide an assessment of current government programs according to these proposed goals. Chapter 8 proposes policy option components and narrows down choices. Chapter 9 assesses the suggested options. It also defines the implementation stages. Finally, Chapter 10 summarizes the analysis.
2 THE PROBLEM OF HEARING LOSS

2.1 Definition of hearing loss

Hearing loss is the “fifteenth most serious health problem” (Smith, 2004). Hearing loss is any reduction in a person's ability to detect sound. There is a diversity of definitions of hearing loss. According to the World Health Organization, hearing loss is defined as “the permanent unaided hearing threshold for the better ear of 41 to 31 dB or greater in age over 14 or under 15”. The “hearing threshold level” is taken as the better ear average hearing threshold level for the four frequencies: 500Hz, 1000Hz, 2000Hz, and 4000Hz (WHO, Geneva, 1991). The terms “hearing loss” and “hearing impairment” will be used interchangeably throughout this analysis.

2.2 The sense of hearing

Hearing is one of the five senses, and the most integral to communication ability. Hearing refers to the ability to detect sound. In humans and other vertebrates, hearing is performed primarily by the auditory system. Sound is detected by the ear and transduced into nerve impulses, which are then perceived and interpreted by the brain. The auditory system is a complex of ear structures, nerves and brain, which processes the sounds.

There are two distinctive processes that must take place for a person to be able to hear. First, sound must be processed by auditory physical structures. Second, the sound must be interpreted by the brain so that cognitive understanding takes place. Therefore, “hearing” and “listening” are two different functions. Hearing care professionals make
that distinction and test it. The success of the intervention and outcome depends on the presence of both functions.

Anatomically, the hearing system can be divided into four parts. Figure 1 shows the anatomy of the ear

**Figure 1: Hearing organ anatomy**

![Hearing organ anatomy](https://www.betterhearinginstitute.com)

Source: www.betterhearinginstitute.com

1. The *outer* ear captures the sound waves and directs them towards the eardrum.
2. The *middle* ear is an air filled cavity with three connected small bones that are activated by the eardrum’s vibrations. The bones then transmit the sound further towards the inner ear.
3. The *inner* ear consists of the cochlea and the semicircular canals. The cochlear is a spiral-shaped organ that is filled with fluid and lined with tiny hair cells that transform the sound vibrations into nerve impulses. The semicircular organ is responsible for the balance.
4. The *central auditory pathways* are a complex network of neural pathways within the brain. They are responsible for sound localization, speech understanding in
noisy listening situations and other complex sounds, including music perception (Better Hearing Institute web-site).

2.3 Types, degree and configuration of hearing losses

2.3.1 Degree of hearing loss

The degree of hearing loss refers to the severity of the loss. The range of sounds is measured in Hertz or number of sound waves per second. A normal human ear is able to hear frequencies from 20 Hz to 20,000 Hz. The intensity of a sound is measured on a scale of decibels (dB) from 0 to 140dB. Decibels are measured using logarithmic scale. A sound volume increase of 6 dB represents twice the increase in intensity.

There are five degrees of hearing loss. The numbers are representative of the patient's thresholds, or the softest intensity at which sounds are perceived:

- Normal range or no impairment 0 dB to 20 dB
- Mild loss 20 dB to 40 dB
- Moderate loss 40 dB to 60 dB
- Severe loss 60 dB to 80 dB
- Profound loss 80 dB or more

These category thresholds are those used by the American Association of Audiologists and Speech-Language Pathologists, and are somewhat different from the categories used in other countries.
2.3.2 Types of hearing loss

There are three types of hearing loss: conductive, sensorineural, and mixed. Ninety percent of hearing loss is sensorineural in nature and typically results from permanent damage to the hair cells of the cochlea (Kochkin, 2005).

**Conductive hearing loss** is caused by anything that interferes with the transmission of sound from the outer to the inner ear; therefore, both the external and middle ears are affected in cases of conductive hearing loss. This type of loss can be either temporary or permanent. The highest incidence of conductive hearing loss is caused by middle ear infection (otitis media) and a collection of fluid in the middle ear (“glue ear” in children). The level of hearing loss associated with this condition is approximately 40dB. Another common cause of conductive hearing loss is otosclerosis. Otosclerosis is a condition affecting small bones in the middle ear coupled with a progressive loss of hearing in the inner ear.

In all cases of conductive hearing loss, the ossicles of the middle ear harden and become less mobile. Also, any severe injury to the head and ear with perforation of an ear drum will lead to conductive hearing loss.

Other causes, such as wax and inflammation of the external ear are common causes of conductive hearing loss due to blockage of the external ear.

**Sensorineural hearing loss** can be either congenital or acquired. It is a dysfunction of the inner ear or the auditory nerve. Often the cause of this dysfunction cannot be determined; it is generally irreversible and permanent. It reduces the intensity of sound, as well as the clarity of speech. The treatment for sensorineural hearing loss in
90 percent of all cases is amplification through hearing aids. “Wear and tear” from the aging process is known as *presbycusis*. Presbycusis is the most common cause of the sensorineural hearing loss.

*Mixed hearing loss* is a combination of conductive and sensorineural hearing loss.

### 2.3.3 Configuration of hearing loss

The configuration, or shape, of the hearing loss refers to the extent of hearing loss at each frequency. It also reflects the overall picture of hearing loss. For example, hearing loss that only affects high frequencies would be described as high-frequency loss. Its configuration would show good hearing in the low frequencies and poor hearing in the high frequencies. On the other hand, if only the low frequencies are affected, the configuration would show poorer hearing for low tones and better hearing for high tones. Some hearing loss configurations are flat, indicating the same amount of hearing loss for low and high tones.

Other descriptors associated with hearing loss are:

- Bilateral hearing loss (both ears are affected) versus unilateral (only one ear is affected)
- Symmetrical (identical configuration of hearing loss in both ears) versus asymmetrical (different configurations of the hearing loss in each ear)
- Progressive (getting worse with time) versus sudden hearing loss (short period from norm to pathology)
- Fluctuating (changes in the impairment level) versus stable (severity of hearing loss does not change over a long period of time)

Figure 2 shows an example of an audiogram that represents sloping hearing loss. The audiogram shows mild hearing loss in low frequencies, moderate loss in mid frequencies, and severe hearing loss in high frequencies.

Figure 2: Audiogram sample

![Audiogram sample](http://www.hearingresearch.org/Dr.Ross/Audiogram/Audiogram.htm)

Source: [http://www.hearingresearch.org/Dr.Ross/Audiogram/Audiogram.htm](http://www.hearingresearch.org/Dr.Ross/Audiogram/Audiogram.htm)

### 2.4 Causes of hearing loss

Hearing loss can be either acquired or congenital. Hearing loss in half of all affected infants is of unknown ethiology (Durieux-Smith et al., 1999). In the other 50 percent, it is due to genetic or maternal infections. Hearing loss in adults can be caused
by diseases or infections, ototoxic drugs, exposure to noise, tumours, trauma, and the aging process. Hearing loss may, or may not be, accompanied by tinnitus. Tinnitus is typically described as “ringing in the ears”.

2.4.1 Main causes of hearing loss

Table 1 summarizes the main causes of hearing loss. The proportion of hearing loss refers to the prevalence rate and incidence of the particular cause. There are three causes that are responsible for the majority of hearing loss in adults and children. Ninety percent of all losses are sensorineural in nature.

Table 1: Main causes of hearing loss by proportion to burden.

<table>
<thead>
<tr>
<th>High proportion</th>
<th>Moderate proportion</th>
<th>Low proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic causes</td>
<td>Excessive noise</td>
<td>Nutritionally related</td>
</tr>
<tr>
<td>Otitis media</td>
<td>Ototoxic drugs and chemicals</td>
<td>Trauma related</td>
</tr>
<tr>
<td>Presbycusis</td>
<td>Prenatal and perinatal problems</td>
<td>Meniere's disease</td>
</tr>
<tr>
<td>Infectious causes</td>
<td>Wax and foreign bodies</td>
<td>Cerebro-vascular disease</td>
</tr>
</tbody>
</table>


2.4.2 Noise induced hearing loss (NIHL)

Noise-induced hearing loss is a cumulative process. The levels of noise and the duration of exposure are important influencing factors. At a given level, low-frequency noise (below 100 Hz) is less damaging in comparison to noise in the mid-frequencies (1000 - 3000 Hz). Noise-induced hearing loss appears to occur randomly in exposed persons. It appears that some individuals are more susceptible to noise-induced hearing loss than others. In the initial stages, noise-induced hearing loss is most pronounced at
4000 Hz. Hearing loss spreads over other frequencies as noise level and/or exposure time increases (Canadian Centre for Occupational Health and Safety). Exposure to excessive noise over the normal level of 60dB for a long time period, or very loud sounds for a short time, damages the ear irreversibly. Wilson et al. (1998) reported that 37 percent of the Australian population with hearing loss blamed their condition on excessive noise. Dobie (1993), in a study conducted in Switzerland, describes noise as a factor in 18 percent of all hearing loss cases. According to the National Institute of Health in the US, approximately 33 percent of all hearing losses can be attributed to noise exposure.

**Occupational hearing loss (OHL)**

Occupational hearing loss is the most common cause of noise-induced hearing loss (NIH, 1990). It is estimated that as many as 30 million Americans are occupationally exposed to noise levels greater than 85dB (NIDCD, 1999). At the present exposure levels, one in four workers will develop a permanent hearing loss as a result of trying to earn a living (Prince et al., 1997).

In British Columbia, 250,000 workers are exposed to enough workplace noise to cause occupational hearing loss (Harrison, 2006). According to the Annual Statistics report in 2006 made to the WorkSafeBC, the number of claims has risen in the late 1980s, and has remained steady since then. Figure 3 shows the claim trend from 1978 to 2006 in British Columbia, as well as the cost of satisfying those claims. Fluctuations between the claim and cost levels could be due to the difference in the negotiated price for hearing aids between the government and the hearing aids manufacturers. Each year, WorkSafeBC negotiates different discount rates with the hearing aid manufacturers.
Improvement in the prevention measures is the most probable cause of the stability in the claim level (see Figure 3). The key factors in the reduction of NIJ-IL are to educate the workers, to provide the necessary means of protection, and to closely monitor the noise environment.

**Figure 3: Noise induced hearing loss claims in BC.**

![Graph showing noise induced hearing loss claims over time](image)


**Recreational hearing loss (RHL)**

Available research in the area of recreational hearing loss is somewhat controversial. The controversy arose with respect to the relationship between risks and exposure levels. Morata (2007) concluded that despite the widespread concerns over the extensive use of recreational noise generators (stereo, MP3 players, etc.), the prevalence of hearing loss among a group of young adults in the United States has not significantly
increased over the last two decades. He also suggested that it may be too early to detect the effect of recent technology (Morata, 2007).

No correlation was found between the incidence of hearing loss symptoms and an increased noise dose. Certain hobbies (noisy toys, fire crackers, hunting, and woodworking) were found to cause hearing loss as well.

**Acoustic shock and acoustic trauma**

The biggest industry that suffers from acoustic shock is call centres. “Acoustic shock is broadly defined as a sudden and unexpected burst of noise transmitted through the call handler’s headset” (Lawton, 2003). One Danish study reported that as high as 22 percent of the Call Centre workers had been exposed to the acoustic shock (Hinke & Brask, 1999). Acoustic shock may result in temporary or permanent hearing loss.

Acoustic trauma is associated with sound explosions, such as bombs, localised alarm systems, or artillery fire. This type of trauma can cause permanent disruption of the middle ear’s integrity.

### 2.5 Hearing loss in adults and children

Hearing loss can strike at any time and at any age in a person’s life. The impact depends on the severity of the hearing loss, timing, and the amount of communication demands on individual’s life. Based on timing, hearing loss is distinguished as pre-lingual and post-lingual. If the onset of hearing loss occurs at birth or prior to the development of language skills, then it is defined as pre-lingual. Pre-lingual onset of hearing loss serves as a critical indicator of a child’s future. Pre-lingual hearing loss requires special technologies, extensive support services, and special educational settings for the child.
Post-lingual hearing loss occurs after the development of language skills. In such cases, an affected person will continue to use spoken language. Very few individuals are forced to make a transition into the deaf community and use sign language.

The most common hearing loss in children is congenital. Another common cause of hearing loss in children is conductive hearing loss, such as in case of otitis media. Conductive hearing loss is due to abnormalities of the ear canal or middle ear, thus blocks sound from getting through to the inner ear. Conductive losses are mostly temporary in nature. Unfortunately, conductive hearing loss can still have a profound effect on a child’s development and education.

Hearing loss in adults is mainly due to the aging process and is sensorineural in nature. Some of the contributing risk factors, such as excessive noise exposure, chemical substances and medications can be minimized. Noise induced hearing losses are largely preventable and must be the subject of governmental protection programs.

### 2.6 Hearing loss and co-morbidity

Hearing loss was announced as the fifteenth most serious health problem at the World Congress in Helsinki in 2002 (Smith, 2004). WHO estimates that disability-causing hearing impairment has increased substantially in the last 15 years. Two hundred fifty-five million people worldwide are estimated to have disabling hearing loss (Mathers et al., 2003). Of these, 192 million people have adult onset hearing loss, while 63 million have childhood onset hearing loss. This represents 4.1 percent of the world’s population and 40 percent of all people globally with hearing loss of any severity.

A number of recent studies focus on the evaluation of co-morbidities of hearing loss.
2.6.1 Radiotherapy

As a result of radiotherapy, 15.1 percent of treated patients suffer from sensorineural hearing loss (Bhandare et al., 2007). Radiotherapy is typically used for cranial head and neck tumours with curative intent. Seniors are the most vulnerable group of patients in these types of cases.

2.6.2 Ototoxic drugs

Two major classes of drugs, aminoglycoside antibiotics and platinum-based chemotherapeutic agents, can cause permanent hearing loss (Rybak & Whitworth, 2005). These drugs are highly effective in treating life-threatening infections and malignancies. Unfortunately, older people are frequently subject to both health problems and suffer a worsening of already existent hearing loss.

2.6.3 Diabetes

There is a relationship between diabetes and hearing loss. Differences in inner ear functions were found in a recent study (Frisina et al., 2006). Earlier dated research confirmed that statistically significant relationships exist for all levels of hearing loss and diabetes (Wilson, 1997).

2.6.4 Dementia

Hearing loss can induce social isolation, which can lead to disorientation. A number of research papers demonstrate an association between existing hearing loss and dementia. All patients with hearing impairment require an audiological examination (Allen et al., 2003).
2.6.5 Depression

The National Council on the Aging (1999) reports that hearing loss in older persons can have a significant negative impact on their quality of life. Those with untreated hearing loss are more likely to report depression. Hearing loss may only be one of several “co-occurring” bases for depression (Mullins, 2004). A strong statistical association was found between the threshold of a low frequency hearing loss and depression (Gurland et al., 1977).

2.7 Hearing loss treatment

2.7.1 Treatment of hearing loss in the primary care clinic

Ear wax can be identified and treated by a primary care physician. Ear wax is one of the easily treatable causes of conductive hearing loss. Ear wax can block the outer ear and prevent sounds from entering the middle and subsequently the inner ear. Ear wax is found in 30 percent of elderly patients with hearing loss (Lewis-Culinan & Janken, 1990). Deep cerumen impaction warrants a referral to an otolaryngologist for safe removal under microscopic examination. Chronic otitis media (inflammation of the middle ear) with fluid in the middle ear is a common problem in older adults. If this condition persists for weeks or months, a patient should be referred to an otolaryngologist for more aggressive treatment. Patients with sudden sensorineural hearing loss should be referred urgently to specialty care. While the ototoxicity level of some medications is well documented, ultra high-frequency audiometry should be used for early detection of ototoxicity in the adult population. In early signs, such as tinnitus (a sensation of sound which does not have an identifiable physiological or acoustical origin) or audiologic results of high-frequency loss, the treatment should be modified.
2.7.2 Treatment of hearing loss by hearing specialists

Hearing specialists are otolaryngologists, audiologists, and hearing aid dispensers. The majority of hearing loss is sensorineural. In moderate to severe hearing loss, the most effective treatment is through hearing amplification with hearing devices. Unfortunately, treatment effectiveness is not guaranteed even if a patient receives hearing aids. Non-adherence to the use of hearing aids is high. Several authors estimate that up to 30 percent of patients with hearing aids do not use their aids (Overgard & Ramstrom, 1994). However, a recent study by Kochkin found that hearing instruments left in the drawer is down to 16.7 percent (Kochkin, 2000). This improvement can be attributed to the improved technology of hearing devices.

Hearing instrument types can be divided according to a circuit (processing algorithm of a hearing aid) and a model (size). Hearing aids sold today in British Columbia, as well as in the rest of North America, mostly use digital processing. In 2006, 91.7 percent of all hearing aids sold in North America were digital (HJ Report, 2007). Programmable and analogue circuits employ older technologies and progressively are used less. Models of hearing aids are generally divided into two groups: in-the-ear (ITE) and behind-the-ear (BTE). In the ear models can be subdivided according to the size: completely-in-the-canal (CIC), in-the-canal (ITC), and in-the-ear (ITE). Conventional, or behind-the-ear (BTE) hearing aids, were recently expanded to include a new category of “open” fitting BTEs. The “open” fitting BTE has addressed mild degrees of high-frequency hearing loss that were formerly difficult to correct. The share of sold BTEs in the North American market increased tremendously due to the popularity of “open”
fittings. In the first quarter of 2007, 51 percent of all hearing instruments sold were BTE, 39 percent of which are “open” fitting products (HJ Report, 2007).

Hearing instrument adoption continues to increase slowly (Kochkin, 2005). Only 23 percent of people who would benefit from hearing aids actually purchase them (Kochkin, 2007b). Kochkin’s latest study focuses on the reasons for non-adoption. Figure 4 shows 11 out of 64 reasons which produced the top five deciles of hearing loss. Nine out of ten individuals report that the “uniqueness” of their hearing loss is the main reason why they did not purchase hearing aids. Fifty percent of those feel that their hearing loss is either “too mild” or “not severe enough” to justify the purchase of hearing aids. Kochkin concluded that people with hearing loss tend to underrate their degree of hearing loss compared to their social network. The next most significant reason for non-adoption was financial: seventy-six percent of respondents see financial constraint as a barrier to hearing aid adoption, while 40 percent of those stated that it is the main reason.

Kochkin’s study on non-user adoption of hearing aids concluded with the following: (1) the individual with hearing loss must recognise his or her hearing loss; (2) the individual must recognise that hearing loss causes them problems; (3) the cost of the problem must exceed the cost of the solution; (4) it should be recognised that there are many issues that can obstruct an individual’s movement towards a solution. Some of these obstacles are perceptual, some are real (Kochkin, 2007b).
Overall customer satisfaction with new hearing instruments is 77 percent (Kochkin, 2005). This is linked to new digital technology developments, and the size and shape of hearing aids (Bentler et al., 2003; May et al., 1990).

The treatment process consists of evaluation, selection of hearing aids by size and circuit, fitting hearing aids, and follow-up adjustments.

2.7.3 Surgical solutions of hearing loss

Only five to ten percent of hearing loss cases can be treated by surgical intervention. The most common procedure for the treatment of chronic otitis media is myringotomy. Myringotomy involves a small incision in the tympanic membrane.
combined with the insertion of pressure equalising tubes. Tympanoplasty, the surgical repair of the perforation in the tympanic membrane, is used for traumatic events.

Cochlear implants have recently gained popularity in children as well as in adults. A cochlear implant is a small and complex electronic device. The implant consists of an external portion that sits behind the ear, and an internal portion that is surgically placed under the skin. Cochlear implants bypass damaged portions of the ear to directly stimulate the auditory nerve. Signals generated by the implant travel through the auditory nerve to the brain, which recognizes the signals as sound. Hearing through a cochlear implant is significantly different from normal hearing. Cochlear implants allow individuals to recognize “warning signals”, understand other sounds in the environment, and enjoy a conversation, both in person or by telephone. According to the Food and Drug Administration’s (FDA’s) 2005 data, nearly 100,000 people worldwide have received implants. In the United States, roughly 22,000 adults and nearly 15,000 children have received cochlear implants (NIDCD, 1995).

The Bone Anchored Hearing Aid (BAHA) is used for conductive and mixed hearing loss. BAHA aids people with chronic ear infections, congenital hearing loss, and single sided deafness. The BAHA combines a sound processor with a small titanium fixture implanted behind the ear. The system allows sound to be conducted through the bone, rather than via the middle ear. This process is known as direct bone conduction. The “total external sound processor” needs replacement approximately every five years. BAHA has been implanted safely in adults and children with a 90 percent or higher success rate in most studies -- no mortality or life-threatening complications have been reported (Ontario Ministry of Health and Long Term Care).
2.7.4 Audiologic rehabilitation

Audiologic rehabilitation (AR) is the assessment, intervention, and management of communicative consequences of hearing loss (Abrams et al., 2002). Audiologic rehabilitation is necessary to create a healthy learning, working, recreational and communication environment. This environment encourages a sense of belonging, independence, generosity, and mastery for individuals with hearing loss, as well as their communication partners.

Older adults are not routinely referred for hearing healthcare services. Of those who do obtain services, only a small number follow through with the purchase and use of hearing assistive technologies. AR programs are not readily available to Canadians. Very few private practitioners offer rehabilitation programs to adults.

Most available services in Canada, and in particular in British Columbia, are focused on children. AR following cochlear implantation differs from audiologic rehabilitation for non-cochlear implant users both in the goals and outcome of the treatment.

2.8 Hearing loss prevention

Exposure to excessive noise is the major avoidable cause of permanent hearing impairment worldwide (WHO, 2004). Experts recommend that all countries implement national programs for prevention of noise-induced hearing loss, including effective hearing conservation. The United States has produced a guide to hearing conservation programs in the workspace (Franks et al., 1996).
The effects of noise are often underestimated because the damage takes place gradually. Loud noises have become a part of our culture. Traditionally, people have not appreciated the serious impact of noise-related hearing loss on their daily lives until they have been frustrated by a permanent communication problem. When an individual is exposed at work or home to harmful sounds (those that are too loud and prolonged) sensitive structures of the inner ear can be damaged. This damage is defined as noise-induced hearing loss (NIHL). NIHL is characterized by a gradual and progressive loss of high frequency hearing sensitivity over time as a result of exposure to excessive noise levels.

Occupations particularly at risk for hearing loss due to exposure to noise are as follows:

- Firefighters
- Police officers
- Factory workers
- Farmers
- Construction workers
- Military personnel
- Heavy industry workers
- Musicians
- Entertainment industry professionals

Sounds that are louder than 80dB are considered hazardous to the human ear. The amount of noise and the duration of exposure determine the noise's ability to damage
hearing. The higher the decibel level, the louder the noise. Table 2 gives examples of average decibel levels for everyday sounds.

Table 2: Average decibel levels for everyday sounds

<table>
<thead>
<tr>
<th>Type of sound</th>
<th>Loudness and examples of a sound source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painful</td>
<td>150 dB = rock music peak</td>
</tr>
<tr>
<td></td>
<td>140 dB = firearms, air raid siren, jet engine</td>
</tr>
<tr>
<td></td>
<td>130 dB = jackhammer</td>
</tr>
<tr>
<td></td>
<td>120 dB = jet plane take-off, amplified rock music at 4-6 ft., car stereo,</td>
</tr>
<tr>
<td></td>
<td>band practice</td>
</tr>
<tr>
<td>Extremely</td>
<td>110 dB = rock music, model airplane</td>
</tr>
<tr>
<td>loud</td>
<td>106 dB = timpani and bass drum rolls</td>
</tr>
<tr>
<td></td>
<td>100 dB = snowmobile, chain saw, pneumatic drill</td>
</tr>
<tr>
<td></td>
<td>90 dB = lawnmower, shop tools, truck traffic, subway</td>
</tr>
<tr>
<td>Very loud</td>
<td>80 dB = alarm clock, busy street</td>
</tr>
<tr>
<td></td>
<td>70 dB = busy traffic, vacuum cleaner</td>
</tr>
<tr>
<td></td>
<td>60 dB = conversation, dishwasher</td>
</tr>
<tr>
<td>Moderate</td>
<td>50 dB = moderate rainfall</td>
</tr>
<tr>
<td></td>
<td>40 dB = quiet room</td>
</tr>
<tr>
<td>Faint</td>
<td>30 dB = whisper, quiet library</td>
</tr>
</tbody>
</table>


According to the WorkSafeBC, Workers Compensation Act, part 7.2 “Noise exposure limits” section, “An employer must ensure that a worker is not exposed to noise levels above either of the following exposure limits:

(a) 85 dBA Lex daily noise exposure level;

(b) 140 dBC peak sound level.”

3 THE PREVALENCE OF HEARING LOSS

3.1 Data Sources

Extensive prevalence studies mostly have been conducted outside of Canada. The Canadian Hearing Society conducted a survey in 2002 with a sample of 800 people. Limited information is also available from Statistics Canada and WorkSafeBC.

Australian, British, and American scientists have done extensive research on the measured loss of hearing in adults and children. Wilson and his team conducted an extensive study in the mid to late 1990s (Wilson, 1997, Wilson et al, 1998) which employed the methodology of the renowned British Hearing Study (Davis, 1989). The yielded prevalence data was consistent with international studies. The Wilson study was on a representative population sample that consisted of “multi-staged, clustered, self-weighting, systematic area samples of persons aged 15 years or older who resided in metropolitan Adelaide and major country centres. Hotels, motels, hospitals, nursing homes and other institutions are excluded” (Wilson, 1997). It is our belief that this study can be successfully used to derive estimates in British Columbia.

The Beaver Dam Study focuses mainly on older people, and has a slight difference from other studies’ age groupings (Cruickshanks et al., 1998); however, findings in male prevalence rates are very similar to other studies. The Blue Mountain Hearing Study also focused on older adults (Mitchell, 2002).
Sergei Kochkin’s studies, which are known by the name “MarkeTrak,” examine the prevalence of hearing loss, hearing aids use and satisfaction, as well as barriers to adoption of hearing devices.

3.2 Prevalence in adults

Figure 5 shows the prevalence rates by gender and age groups in Australia. It is clear that the prevalence increases in both genders with age. This reflects in the total prevalence rate. Unfortunately, age groups in Wilson’s study are different from those quoted from Canadian sources. Thus, it is difficult to perform a precise comparison. The Canadian Hard of Hearing Association reported that over 50 percent of adults over 65 years old suffer from hearing loss. Wilson reported 58 percent for the 61-70 age group and 74 percent for those over 71 years.

Figure 5: Prevalence rate, hearing loss, adults (worse ear) (Australian Evidence)

Source: Based on Wilson (1997) data.

Figure 6 shows the results from the United States study (Kochkin, 2004).

According to the presented numbers and population statistics, over 30 percent of people
in the United States in the 65 plus age group suffer from hearing loss. This prevalence rate is lower than in Canada and Australia.

Figure 6: Hearing loss population by age group (USA evidence)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Millions of People</th>
</tr>
</thead>
<tbody>
<tr>
<td>85+</td>
<td>1.4</td>
</tr>
<tr>
<td>75-84</td>
<td>4.8</td>
</tr>
<tr>
<td>65-74</td>
<td>5.4</td>
</tr>
<tr>
<td>55-64</td>
<td>6.3</td>
</tr>
<tr>
<td>45-54</td>
<td>6</td>
</tr>
<tr>
<td>35-44</td>
<td>3.6</td>
</tr>
<tr>
<td>18-34</td>
<td>2.5</td>
</tr>
<tr>
<td>&lt;18</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Source: MarkeTrak VII, Kochkin, 2004

The "MarkeTrak VII" survey was published by the American Better Hearing Institute (BHI) in July, 2005. The findings as follows:

- 3 in 10 people over the age of 60 have hearing loss
- 1 in 6 “baby boomers” (ages 41-59), or 14.6 percent, have a hearing problem
- 1 in 14 Generation Xers (ages 29-40), or 7.4 percent, already have hearing loss
- 1.4 million children in the United States (18 or younger) have hearing problems

Both increased noise level in our environment, and voluntary exposure to loud noise, is responsible for hearing loss in the younger age group (Kochkin, 2005).
The Canadian Hearing Society reports a prevalence of deafness and hearing loss in the Canadian population for 2002. Table 3 displays these results. According to this survey, the average age of those claiming to have hearing loss in Canada is 51 years old. Seven out of ten of those who claim to experience hearing loss are under sixty years of age.

Table 3: Prevalence of deafness and hearing loss in Canada

<table>
<thead>
<tr>
<th>Age</th>
<th>General Public</th>
<th>Have experience with hearing loss/deafness</th>
<th>Have hearing loss/deafness</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>13%</td>
<td>11%</td>
<td>8%</td>
</tr>
<tr>
<td>25-59</td>
<td>6%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>30-39</td>
<td>20%</td>
<td>19%</td>
<td>12%</td>
</tr>
<tr>
<td>40-49</td>
<td>24%</td>
<td>23%</td>
<td>21%</td>
</tr>
<tr>
<td>50-59</td>
<td>18%</td>
<td>20%</td>
<td>24%</td>
</tr>
<tr>
<td>60-69</td>
<td>12%</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>70+</td>
<td>8%</td>
<td>8%</td>
<td>14%</td>
</tr>
<tr>
<td>Average age</td>
<td>45</td>
<td>46</td>
<td>51</td>
</tr>
</tbody>
</table>


The Canadian Hearing Society Awareness Survey of 2002 states that almost one in four (23%) Adult Canadians report having a hearing loss, but, accurate statistics on hearing loss is very difficult to obtain. Most of the research and statistics rely on self-identification and an inconsistent use of terminology and definitions. People commonly deny their hearing loss. Many hard of hearing people who have adapted well to their hearing loss, their hearing aids, and other assistive listening devices, may report that they have no difficulties hearing. In these cases, they are excluded from the statistics. The
Canadian Association of the Deaf uses the traditional “one in ten” formula for estimating statistics, with strong disclaimers. This formula concludes that there are 310,000 culturally Deaf Canadians and 2.8 million hard of hearing Canadians.

It is the opinion of the Canadian Association of the Deaf that no fully credible census of deaf, deafened, and hard of hearing people has ever been conducted in Canada.

The 1991 Health and Activities Limitations Survey (HALS) states that one out of every 25 Canadians (1:25) has “impaired hearing” -- a total of 1,022,220 people. A subsequent survey reported the ratio at 1:15, for a total of 2,000,000 people. A third survey came up with two ratios: a 1:8 ratio (3,875,000 people), and a 1:22 ratio (1,409,090 people).

People over 55 years old have the highest prevalence of hearing loss. According to Statistics Canada, seniors represent the fastest growing segment of the population in Canada. This segment is expected to make up ¼ of the population, i.e. 9.2 million Canadians, by 2041.

British Columbia has one of the most rapidly aging populations in Canada (A Profile of Seniors in British Columbia, 2004). The number of people over the age of 65 has been growing at an average rate of 2 percent over the last 10 years. This growth is almost twice the rate of the general British Columbia population. Between 1991 and 2001, the number of seniors aged 80 and over increased from 87,065 to 134,175. This represents a 54 percent increase and the highest level of growth amongst all provinces (Statistics Canada, 2002). Seniors currently make up 17.8 percent of the population of British Columbia (Appendix A).
By 2031, seniors will make up 24 percent of the population (Appendix B). British Columbia is currently home to about 588,100 seniors. By the year 2031, the seniors' population will more than double to 1,303,000. Based on this projection, 482,147 seniors will suffer from hearing loss in 2031, provided the prevalence rate stays at 37 percent.

In 2006, British Columbia estimated that there were 217,620 hard of hearing persons in this age group. As 56 percent of seniors are women and 44 percent are men, this translates into 65,867 hard of hearing women and 51,753 hard of hearing men. Therefore, between 2006 and 2031, British Columbia may see a 220 percent increase in the number of hard of hearing seniors.

Currently, the total number of people who suffer from hearing loss in all age groups in British Columbia is conservatively estimated to be over 431,000 (1 out of 10 formula).

Only 37 percent of the population with hearing loss are of retirement age (Kochkin, 2005). CHHA reports 50 percent of people with hearing loss older than 65 in Canada. The newest data was reported by WorkSafeBC on working adults. Figure 7 depicts the percentages of found hearing losses in working adults in 2006 versus the percentage in 1994. 23.4 percent of all those exposed to a noise in a workplace were found to have hearing loss. Ten percent of workers over 50 years old, who were not exposed to excessive noise, were also found to have hearing loss. No data on the degree of loss was reported.
3.3 Prevalence in children

Table 4 reports the prevalence rate of measured hearing loss in children from a range of studies. Unfortunately, no prevalence studies of hearing loss in children could be found in Canadian medical literature.

The results presented in Table 4 are somewhat comparable. It must be noted that no mild hearing loss was included in the studies. Australian studies include reports of children serviced by the country’s National Service for Children with Hearing Loss (Australian Hearing, 2005; Uphold and Ispey, 1982). This data covers all children who use any type of hearing device. Children with mild hearing loss, if not using any device, are included in the data as well. Children were grouped from 0 to 15 years old. Pre-lingual prevalence (0-4 years) of hearing loss is 1.2 for every 1,000 live births. For post-lingual hearing loss (4-14 years), prevalence increased to 3.2 for 1,000 live births.
Table 4: Studies of hearing loss prevalence rates in children

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Scope</th>
<th>Rate of hearing loss new births/1,000</th>
<th>Rate of hearing loss in children/1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upfold and Ipsey</td>
<td>Australia</td>
<td>Longitudinal</td>
<td>N/A</td>
<td>2.6</td>
</tr>
<tr>
<td>Australian Hearing</td>
<td>Australia</td>
<td>Longitudinal</td>
<td>1.2</td>
<td>2.5</td>
</tr>
<tr>
<td>Yoshinaga-Itano et al</td>
<td>USA</td>
<td>New births</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Mehl and Thompson</td>
<td>USA</td>
<td>New births</td>
<td>1.54</td>
<td>N/A</td>
</tr>
<tr>
<td>Fortnum et al</td>
<td>United Kingdom</td>
<td>Longitudinal</td>
<td>0.91</td>
<td>2.1</td>
</tr>
</tbody>
</table>


The American studies are limited because they only report data on neonates (Mehl & Thompson, 1998; Yoshinaga-Itano et al, 1998). American studies also do not include children with “late onset of hearing loss”.

The United Kingdom study estimates the prevalence of hearing loss at 2.05 for 1,000 live births (Fortnum et al, 2001). This study, however, does not include children suffering from mild hearing loss.

Table 5 reports studies of hearing loss amongst children graded by the degree of loss. Some studies report mild and moderate hearing loss together. The reported rate for mild to moderate hearing loss is around 60 percent. Subsequently, cumulative severe and profound losses are close to 40 percent.
An Australian study (Australian Hearing, 2005) and an American study (Stredler & Brown, 2003) report mild loss at 36 percent and 30 percent, and moderate hearing loss at 38 percent and 30 percent. The Australian Hearing data report much lower rates for severe and profound hearing losses (13% and 12% respectively). The data include otitis media cases in Aboriginal children and children with unilateral hearing loss.

**Table 5: Degree of hearing loss in children (% of total)**

<table>
<thead>
<tr>
<th>Study</th>
<th>Mild</th>
<th>Moderate</th>
<th>Mild-moderate</th>
<th>Severe</th>
<th>Profound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upfold and Ipsey; 1982</td>
<td></td>
<td>59</td>
<td>24</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Australian Hearing; 2005</td>
<td>36</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stredler Brown; 2003</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Fortnum et al; 2001</td>
<td></td>
<td></td>
<td>59</td>
<td>20</td>
<td>21</td>
</tr>
</tbody>
</table>


Gender based data is not available from any found studies.

Significant hearing loss is one of the most common of the major conditions present at birth (Mehl & Thompson, 1998). Hearing loss occurs more frequently than any other condition that requires newborn screening. Several studies indicated variance in the prevalence of newborns with congenital hearing loss. The overall estimates range from 1.5 to 6.0 per 1000 live births (Parving, 1993; Watkin et al., 1991; White & Behrens,
1993). In British Columbia, 200 deaf babies are born each year (BCMA, 2005). Most children with congenital hearing loss have hearing impairment at birth, and are identified by newborn and infant screening. In some cases, however, congenital hearing loss may not become evident until later on in childhood (American Academy of Pediatrics, 1999).

Approximately 14.9 percent of US children (6-19 years old) have low or high-frequency hearing loss of at least 16 dB in one or both ears (Niskar et al., 1998).

In the United States, 5,775,722 children, ages 6-21, were registered under the Individuals with Disabilities Education Act (IDEA) in 2000-2001. While 70,767 children, representing 1.2 percent, received services for hearing, the actual number of children with hearing loss and deafness is undoubtedly higher. Most students have other disabilities, but only one is registered (Department of Education, 1997).

In Canada, 20 percent to 30 percent of hearing impaired infants will acquire their hearing loss during childhood (Joint Committee on Infant Hearing, 2000).

According to the “Guidelines for the audiologic management of adult hearing impairment,” 17 out 1,000 children under the age of 18 have hearing loss (Valente et al., 2006). Based on British Columbia population statistics, this translates into 15,526 children with hearing loss (based on 2006 population count, Appendix F).
4 THE SOCIAL COSTS OF HEARING LOSS

The social costs of hearing loss include direct medical and non-medical costs, productivity losses, special education services, support services, communication devices, as well as the burden of disease. Social costs also include “deadweight losses”. Canadian sources are scarce, rarely touching on a subject of social costs of hearing loss. Even international studies that address the social costs of hearing impairment are very limited; the most extensive research was published in Australia in 2005. Somewhat limited information on costs has also been reported in the United Kingdom and Denmark (Phillips et al., 2007, Christensen, 2006).

Australian evidence suggests that the real financial cost of hearing loss in 2005 was 11.75 billion Australian dollars, or 1.4 percent of the Gross Domestic Product (Access Economics, 2005). This represents an average cost of $3,314 per person, per annum, for each of the 3.55 million Australians who suffer from hearing loss. The largest financial component is due to productivity losses at 57 percent.

American evidence revealed that severe to profound hearing loss was estimated to cost society US $297,000 over the lifetime of an individual (Mohr et al, 2000). The magnitude of these costs depends on the onset of hearing loss. The expected lifetime cost of hearing loss for a child with pre-lingual hearing loss exceeds one million US dollars. The largest cost component is due to reduced work productivity and is equal to 67 percent of the total amount.
Danish studies focused on the 50-64 age groups. Direct medical costs were not included in the assessment. The result of the research was a staggering EUR 360 million loss in productivity per annum. These costs are the result of early retirement and the reduced productivity of people who are still in the working environment.

4.1 Health system costs

All of the undertaken research had differences in recorded categories, attributed costs either per annum or over lifetime, as well as other differences. Due to these differences, no clear comparison of costs was possible. At the same time, some elements of the studies are comparable and reach similar conclusions. The Australian study conducted by Access Economics contains the most comprehensive information about health system costs due to hearing loss. The Australian Institute for Health and Welfare (AIHW), in collaboration with the National Centre for Health Program Evaluation for the Disease Costs and Impact Study (DCIS), developed a top-down methodology (Access Economics, 2006). This methodology measures health services expenditures for specific diseases in Australia.

4.1.1 Types of health system costs

Direct medical costs for the hearing impaired include the costs of diagnosis, periodic medical visits to assess the physical status of the ear, audiological evaluation of the hearing, fitting hearing aids, as well as the costs associated with other assistive devices (Mohr et al, 2000). In estimating direct medical costs, American studies by Mohr and colleagues concluded that direct medical costs over the lifetime of a person with severe to profound hearing loss is equal to US $223,800, or 8 percent of overall costs.
The Access Economics study derived costs of AUD $70 per person with hearing loss per annum. Based on the Australian evidence, the majority, or 53 percent of health expenditures, was attributable to the services of “other” health professionals: audiologists, speech pathologists and hearing instrument specialists. In Australia, this amounts to AUD $130.2 million. Outpatient costs accounted for the second largest expenditure at 19 percent, or AUD $45.7 million. Outpatient costs included ear examinations, advanced assessment of disease, and outpatient procedures such as ear wax removal. Medical specialist expenditures were equal to 13 percent, or AUD $32.9 million, while health research amounted to 4.1 percent. Small surgeries and pharmaceuticals were similar in expenditures, and ranged from 3.5 percent to 5.3 percent. General practitioner costs, and aged care and pathology imaging, were relatively low. Figure 8 shows these costs as defined by the type of health expenditures and their relative proportions.

**Figure 8: Hearing loss, health expenditure by cost type, 2005 (%)**

It is important to note that the costs of hearing devices and cochlear implants were not included in the Australian estimates. Also, otitis media management costs were excluded.

People aged over 65 years in Australia constitute 50 percent of people with hearing loss. They, however, receive less than 1/3 of the health system expenditure. Australian society spends AUD $40 per annum on the hard of hearing over 65 years old.

Children up to the age of 14 years make up only 1 percent of the people with hearing loss. Annual expenditure per child was calculated to be around AUD $6,511 in Australia in 2005. In Canada, the cost of treating children throughout their lives was estimated to be between CAD $6,300 and CAD $126,000 per child (CASLPA).

British studies estimated the total National Healthcare System (NHS) costs of hearing care services to be around CAD $250 million dollars. This amount includes approximately $125 million Canadian dollars spent on hearing aid equipment and direct audiology staff (Phillips et al., 2007). There are 8.7 million individuals in the United Kingdom who are affected by hearing loss. This translates into NHS costs of CAD $28 per affected person per annum. Excluding hearing aids, the cost per annum is equal to $14 per person.

The considerable gap in the estimated costs per annum between Australia and the United Kingdom can be attributed to the differences of price in their health services. Ideally, we would like to know the resource opportunity costs rather than prices, which can vary widely and may not reflect costs.
4.1.2 Health expenditure comparisons

In Great Britain, public expenditure on health care currently stands at around GBP £52 billion or CAD $121 billion (Phillips et al., 2007). Out of this total expenditure, only GBP £100 million, or 0.2 percent, was spent on hearing care. Thus, the amount spent on hearing loss treatment in the United Kingdom is only 0.013 percent of its GDP.

In Australia, health expenditure on hearing loss was 0.9 percent of the total amount spent on healthcare. In 2005, AUD $287.8 million was spent on hearing care. This represents an estimated 0.034 percent of GDP.

4.1.3 Hearing aids and cochlear implants

Hearing instruments or aids, together with cochlear implants, are hearing devices used by people with hearing loss. These devices allow for hearing and the interpretation of sounds. Recent developments in digital technologies have dramatically changed the flexibility and functionality of these devices.

4.1.3.1 Hearing aid costs

Hearing aid costs are counted as “additional health system expenditure”. Once again, no Canadian data was found. In Australia, the estimated cost of hearing aids is the largest element of the health system costs. In 2005, AUD $376.7 million was spent on hearing aid purchases.

In the United States, the average cost of a hearing aid was US $1,369 (Kochkin, 2005). Out of 31.5 million hearing impaired people, only 23.5 percent purchased hearing aids. Therefore, only 6.2 million people with hearing loss use hearing aids. 74.1 percent of those are binaural users (Kochkin, 2005). This translates into 4,594,200 people who
wear 9,188,400 hearing aids. The rest are monaural users representing 1,605,800 people. Thus, the total hearing aid market in the US is estimated to be worth US $14.8 billion (based on the 2004 average price per hearing aid, Kochkin, 2005).

Hearing aids intervention includes hearing evaluation, ear impressions, ear moulds for custom hearing aids, fitting, and follow-up adjustments. In British Columbia, two types of specialists provide these services: audiologists and hearing instrument specialists. A limited number of services are provided by hospitals. Typically, a hearing instrument consultant works in a private clinic. Audiologists practice in private clinics and public hospitals.

British Columbia Medicare will finance, if necessary, services and the purchase of hearing aids for children up to 18 years of age. Working adults, if qualified, receive hearing aids free of charge through WorkSafeBC. With the exception of a very limited number of cases that involve adults who are on social assistance, non-working adults are neither screened, nor receive financial assistance.

4.1.3.2 Cochlear implant costs

Cochlear implants have become a routine treatment option for children and adults with severe to profound hearing loss (Fitzpatrick et al., 2006). Studies on the effectiveness of cochlear implants show that a child’s abilities to acquire spoken language are greatly improved with the implants (O’Donogue et al., 2000; Waltzman et al., 2002). The cost of cochlear implants is considerably higher than traditional amplification devices, which leads to restrictions and the allocation of the devices on a quota basis in Canada.
Public demand for new technology continues to grow. Increased demand prompted studies on the cost-effectiveness of pediatric cochlear implants (Cheng et al., 2000; Severens et al., 1997; Summerfield et al., 2003).

The Cheng (2000) study reports that cochlear implants improve the quality of life in children with profound deafness. Cochlear implants also reduce the costs of “childhood deafness” for society. A shift towards bringing childhood deafness into the educational mainstream allows for the reduction of resources spent on a child otherwise requiring education in specialised classes. These reduced education costs amounted to US $65,555 per child (1999). It is not known if special educational services in Canada would be reduced in a similar fashion (Fitzpatrick et al., 2006).

Research on the cost-effectiveness of cochlear implants in adults allowed for deriving cost-utility ratios (cost per quality of adjusted life years- QALY). Cochlear implants compare favourably to other medical and surgical interventions (Cheng & Nipalko, 1999; Harris et al., 1995; Wyatt et al., 1999). “Cost-utility analysis relates the net cost of an intervention to the net gain in quality of life resulting from the program or services” (Fitzpatrick et al., 2006). The majority of adults who received cochlear implants benefited in their communication functions almost immediately. The benefit is apparent because most adult hearing loss onset is post-lingual, thus taking place after the development of language ability.

The prices and costs of cochlear implant vary from country to country. It is difficult to directly compare costs for cochlear implants. Countries differ in healthcare system, cost of services, health and educational delivery models. A multi-centre study in
the United Kingdom showed a range of €69,482 to €147,173 over a 73 year life span. Despite the multi-centre studies, the delivery of services was conducted through the centralised cochlear implant services (Barton et al., 2003). The US study reports the costs of €50,257 per cochlear implant (Cheng et al., 2000). The Netherlands, at the same time, reported €124,350 per implant (Severens et al., 1997).

In Canada, the total direct medical costs in 2004 were estimated at CAD $64,172 dollars, on average, per child with cochlear implant (Fitzpatrick et al., 2006). This estimate was based on calculations from the pilot study conducted in Ontario. The cost per child varied due to the differences in required procedures; either pre- or post-surgery. Pre-assessment procedures can be as extensive as numerous visits prior to the surgery, sedation, computer tomography scanning (CT scan), and/or magnetic resonance imaging (MRI). Post-implant follow-up includes clinic visits, ongoing programming and adjustment sessions, speech perception testing, and rehabilitation. Pre-school children generally had more sessions than those of school age.

4.1.4 Economic efficacy of hearing devices

An evaluation of the efficacy of intervention is an important factor in the decision making process. There are a number of tools available to assess the cost-utility of hearing instruments. For example, SF-36 (36 item short-form health survey) and Health Utility Index (HUI) are used to define the cost-utility of hearing devices (Feeny et al., 1996; Ware & Sherbourne, 1992). Abrams et al. (2002) concluded in his investigation that the use of hearing aids, with or without audiological rehabilitation, produces significantly positive results. In order to compare results, the World Health Organization separately
defines “cost-effective” and “very cost-effective” interventions. *Hearing aids and cochlear implants yielded significant results with relatively low investments.*

1. Cost-effectiveness is one to three times the Gross Domestic Product per capita to avert one lost disability adjusted life year (DALY)

2. Very cost-effective is less than the GDP per capital to avert one lost DALY

Table 6 shows the results of different studies on the cost-effectiveness of hearing aids and cochlear implants.

**Table 6: Cost-effectiveness of hearing aids and cochlear implants ($/QALY)**

<table>
<thead>
<tr>
<th>Study</th>
<th>Device</th>
<th>Measure</th>
<th>$ per QALY</th>
</tr>
</thead>
</table>

Source: Access Economics, 2005

**4.2 Other financial costs**

Other financial costs refer to all costs excluding direct medical and intangible costs. It is also important to make a clear distinction between real (incremental) costs and transfer payments between individuals which are not net social costs.
Real costs use up real resources. Real resources are capital or labour. Use of real resources reduces the economy’s capacity to produce goods and services.

Transfer payments include payments from one economic agent, for example government, to another agent, and do not involve real resources. Examples of transfer payments include welfare, unemployment insurance, and taxation revenue. Transfer costs are important when adopting a government finance approach to policy formulation and budgeting because they may involve government outlays even though there are no net social costs (Access Economics, 2005).

4.2.1 Productivity losses

Several studies address the issue of productivity losses. In fact, it is probably the most well researched area with respect to the social costs of hearing loss. Hearing loss can have an impact on the person’s capacity to perform work or specific tasks. Reduced employment rates for people with hearing loss represent a significant cost to any country’s economy.

The Canadian Association of the Deaf conducted a survey and data collection project in 1998 on the employment and employability of Deaf Canadians. This survey concluded that only 20.6 percent of deaf Canadians are fully employed; 41.9 percent are under-employed; and 37.5 percent are unemployed. By comparison, 60.9 percent of all Canadians are employed, and only 8.1 percent are unemployed. Although there are differences in the employment rates of men and women, and between the various age groups, unemployment and under-employment are consistently high for all.
In Australia, people with hearing loss are 25 percent less likely to earn a high income than people without hearing loss (Access Economics, 2005). 72.1 percent of people with hearing loss in paid work report income greater than AUD $40,000 per annum. This is less than 77.9 percent of people without hearing issues, with a net difference of 5.8 percent. Employment opportunities may be affected by age, gender, and by level of disability.

Table 7 shows Australian findings for paid work by those aged 15-44 years, and is delineated by basic hearing ability and gender. There is a marked difference between males in paid work who have hearing problems and those who are not in paid work. With females, there is only a borderline difference.

Table 7: People in paid work aged 15-44 years, by hearing problems and gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Hearing problem or not</th>
<th>In paid work</th>
<th>Not in paid work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Hearing problems</td>
<td>79.6%</td>
<td>30.4%</td>
</tr>
<tr>
<td>Male</td>
<td>No hearing problems</td>
<td>74.9%</td>
<td>25%</td>
</tr>
<tr>
<td>Female</td>
<td>Hearing Problems</td>
<td>50.6%</td>
<td>49.4%</td>
</tr>
<tr>
<td>Female</td>
<td>No hearing problems</td>
<td>54.7%</td>
<td>45.3%</td>
</tr>
</tbody>
</table>

Source: South Australian Health Omnibus Data Males, Access Economics, 2005

Table 8 shows age-standardised employment rates for the 45-64 years old group. Males with hearing loss are more than 20 percent less likely to be in paid jobs than those without hearing loss.
Table 8: People in paid work ages 45-64, by hearing problems and gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Hearing problem or not</th>
<th>In paid work</th>
<th>Not in paid work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Hearing problems</td>
<td>47.4%</td>
<td>52.6%</td>
</tr>
<tr>
<td>Male</td>
<td>No hearing problems</td>
<td>67.9%</td>
<td>32.1%</td>
</tr>
<tr>
<td>Female</td>
<td>Hearing Problems</td>
<td>30.2%</td>
<td>69.8%</td>
</tr>
<tr>
<td>Female</td>
<td>No hearing problems</td>
<td>46.7%</td>
<td>53.3%</td>
</tr>
</tbody>
</table>

Source: South Australian Health Omnibus Data Males, Access Economics, 2005

According to Australian data, if people with hearing loss were employed at the same rate as people with no hearing disability, then an additional 158,876 persons would be employed. Therefore the annual cost of lost earnings due to the workplace separation and early retirement from hearing loss is AUD $6.7 billion for Australia (Access Economics, 2005).

According to the Beaver Dam study, people with hearing loss are twice as likely to earn less than US $30,000 per annum (Cruickshanks et al., 1998).

The Denmark study was based on the 50-64 age groups (Christensen, 2006). The human capital approach was used to measure lost productivity, which is the most common approach in determining cost illness analysis (Rice, 1966, 2000; Becker, 1964). The study defines productivity as a measure of the rate of employment multiplied by an adequate rate of pay. Thus, this approach allows for measuring the effect of the hearing problem in relation to the disability pension, early retirement, and the rate of unemployment. The study estimates that the indirect cost of early retirement and disability pensions for Denmark is €112 million in a single year. Labour market losses
are €360 million. Further conversion of costs into lost full-time jobs reveals 11,234 lost jobs on a national basis. This estimate does not take into account newly created jobs or other age groups.

There are several studies based on United States data samples. Mohr et al. (2000) calculated the lifetime losses of severe to profound hearing loss for adults based on the hearing loss onset (Appendix F). Lifetime costs due to lost productivity are the highest in the 45-65 years age group (87 percent from the total costs). The second highest was the 18-44 age group, which is 85 percent of the total costs (Mohr et al., 2000). Prevocational and pre-lingual hearing losses are characterised by 48 percent and 42 percent respectively, representing loss productivity cost share. Kochkin estimates US $122 billion in lost earnings due to untreated hearing loss (Kochkin, 2007b).

*Taxation revenue* will be affected in any number of ways. First, reduced earnings due to reduced workforce participation and premature death have a negative effect on taxation revenue collected by government. Second, forgone personal income taxation will decrease collected revenue. Finally, the decrease in indirect (consumption) tax further reduces collections. Lower income families or individuals have less disposable income; therefore, they spend less on the goods and services.

Access Economics estimates that in 2005, AUD $2 billion of potential tax revenue was lost in Australia (Access Economics, 2005). Out of the total amount, AUD $1.33 billion, or 67 percent, is lost income tax, and AUD $0.67 billion, or 33 percent, is lost consumption tax.
Lost tax revenue is considered a transfer payment. However, raising additional taxation revenue imposes real efficiency costs, and is known as deadweight loss or social loss. Access Economics estimated the deadweight loss to be approximately AUD $0.58 billion in 2005 in Australia.

Table 9 shows a macroeconomic model of lost earnings and taxation revenue due to hearing loss in Australia in 2005.

Table 9: Lost earnings and taxation revenue due to hearing loss, 2005

<table>
<thead>
<tr>
<th>Potential earnings lost</th>
<th>$6.67 billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average personal income tax rate</td>
<td>20.0%</td>
</tr>
<tr>
<td>Potential personal income tax lost</td>
<td>$1.33 billion</td>
</tr>
<tr>
<td>Average indirect tax rate</td>
<td>15.3%</td>
</tr>
<tr>
<td>Potential indirect tax lost</td>
<td>$0.67 billion</td>
</tr>
<tr>
<td>Total potential tax revenue lost</td>
<td>$2.00 billion</td>
</tr>
<tr>
<td>Deadweight loss from additional taxation</td>
<td>$0.58 billion</td>
</tr>
</tbody>
</table>

Source: Access Economics (macroeconomic model), 2005

Kochkin estimates that non-realised federal taxes due to untreated hearing loss in the United States are US $18 billion (Kochkin, 2007b).

4.2.2 Education and support services costs

People with hearing loss have poorer educational and employment success than the rest of the population (Hogan et al., 1999). Table 10 relates the degree of hearing loss
to the education level. Less than half of people with severe hearing loss complete trade or higher education than that of the general population.

Table 10: Educational outcomes by degree of hearing deafness

<table>
<thead>
<tr>
<th>Education</th>
<th>Implant</th>
<th>Very deaf</th>
<th>Mod deaf</th>
<th>Mild</th>
<th>Not deaf</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High school or less</td>
<td>68.3%</td>
<td>78.6%</td>
<td>52.1%</td>
<td>56.5%</td>
<td>57.5%</td>
<td>57.9%</td>
</tr>
<tr>
<td>Trade or higher</td>
<td>31.7%</td>
<td>21.4%</td>
<td>47.9%</td>
<td>43.5%</td>
<td>42.5%</td>
<td>42.1%</td>
</tr>
<tr>
<td>Total</td>
<td>4.0%</td>
<td>0.9%</td>
<td>3.1%</td>
<td>11.4%</td>
<td>80.7%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Hogan et al., 1999

Early intervention is the key for the pre-lingual onset of hearing loss. Intervention can include the following: (1) neonatal screening services; (2) early intervention for children under 3 years old; (3) pre-school education programs either at a specialised centre, or at visiting services at existing schools.

British Columbia began a neonatal screening program in 2005. Other provinces and 35 states in the US followed suit.

Available data from Mohr et al. explains that costs range from US $6,100 per year for a resource room, to US $53,200 for placement in a residential facility (Mohr et al., 2000). 80 percent of children ages 13-17 years, who are not in a residential facility, require an average of 174 hours per year on auditory training and speech-language pathology.
Table 11 demonstrates the details of education resources costs in the United States (Mohr et al, 2000).

Table 11: Cost of education resources (US $)

<table>
<thead>
<tr>
<th>Component</th>
<th>Best estimate</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of residential school (per year)</td>
<td>$53,200</td>
<td>$37,000-$90,000</td>
</tr>
<tr>
<td>Cost of day school (per year)</td>
<td>$28,200</td>
<td>$1,392</td>
</tr>
<tr>
<td>Cost of self-contained classroom (per year)</td>
<td>$14,500</td>
<td>$7,800-$15,200</td>
</tr>
<tr>
<td>Cost of resource room (per year)</td>
<td>$6,100</td>
<td>$5,200-$6,700</td>
</tr>
<tr>
<td>Regular mainstream education</td>
<td>$5,030</td>
<td>N/A</td>
</tr>
<tr>
<td>Cost of vocational rehabilitation</td>
<td>$2,187</td>
<td>$1,588-$2,787</td>
</tr>
</tbody>
</table>

Source: Extracted from Table 4 at Mohr et al, 2000

Although these costs may not be directly comparable to Canada and British Columbia, the nature and range of services appear to be similar.

In Australia, the total incremental cost of education for children with hearing loss was estimated at AUD $157.2 million for 2005 (Access Economics, 2005).

Other services for the hearing impaired include interpreter services, captioning, and those that are specific to the deaf community. The actual cost for interpreting services was not available for Canada. International studies report that Australia allocated AUD $4.6 million in 2005 for interpreter services. The costs for captioning were not
found for Canada, but for Australia the reported captioning costs were AUD $18 million per year.

There are special services available to the deaf community. They include interpreting and note taking, audiology, central administration of disability services, and specific social services. In Australia, annual expenditures for special services for deaf people are AUD $13.6 million.

4.2.3 Communication aids and devices

The costs of communication aids and devices are mainly due to special telecommunication equipment for deaf and hearing impaired people. In Australia, AUD $13.8 million was spent in 2005 on these devices. This amount excludes hearing aids and cochlear implants.

Recent advances in internet and computer-based technology are bringing general communication to a new level. The following technologies are used today: wireless communication, internet-based communication, and stand-alone technologies. However, in order to benefit all Canadians with hearing loss, they still require full integration into the North American culture. Table 12 shows the different types of technologies based on wireless communication, internet-based communication, and stand alone technologies.

Canadian data on costs in telecommunication was not available. In Australia, AUD $10.5 million was spent in 2005 (Access Economics, 2005). In the United States, the lifetime cost of telecommunications and other devices was estimated at US $11,226 dollars per person with hearing loss.
Table 12: Key telecommunication technologies for hard of hearing in North America

<table>
<thead>
<tr>
<th>Wireless Communication</th>
<th>Internet-based Communication</th>
<th>Stand-alone Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellular Phones</td>
<td>Web/Video-Conferencing</td>
<td>Assistive Listening Devices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Portable Induction Loops</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enjoying Concerts</td>
</tr>
<tr>
<td>Personal Data Assistants</td>
<td>Internet Meetings</td>
<td>CapTel Relay Services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Not available in Canada)</td>
</tr>
<tr>
<td>Wireless-TTY compatibility</td>
<td>Speech Recognition technology in telephone relay services, conferences, television</td>
<td>Speech Recognition technology at staff meetings, workshops, classrooms</td>
</tr>
<tr>
<td>Highway TTYs (Not available in Canada)</td>
<td>Internet-Protocol (IP) Relays (Not available in Canada)</td>
<td>Voice over the Internet Protocol (VoIP) (Not available in Canada)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Public TTY Pay Phone</td>
</tr>
<tr>
<td>ITTYs - Interpreter Type Systems</td>
<td>VRS (Sign Language phone calls via video relays) (Not available in Canada)</td>
<td>Cochlear Implants</td>
</tr>
<tr>
<td>Wireless CART</td>
<td>Remote CART for teleconferences and meetings</td>
<td>Computer Assisted Real-time Translation (CART)</td>
</tr>
</tbody>
</table>

4.2.4 Caregivers

People with hearing loss may require informal care which is costly whether it is borne as wages or opportunity costs. Informal care examples include repeating what has been said, buying a flight ticket, making telephone calls, and assisting in communication with medical personnel. Close friends or relatives would typically provide informal care.
Economic costs arise from the understanding that while providing informal care, the caregiver is not able to do paid jobs or engage in other activities, in other words, it involves opportunity costs. According to Wilson (1997), people with hearing loss were more than twice as likely to require help with managing communication difficulties.

The amount of care required depends on the severity of hearing loss. It is reasonable to assume that people with more severe losses would require more assistance from a caregiver. Three methods can be employed to evaluate the time forgone by caregivers.

- Opportunity costs, which are the value of lost wages forgone by the caregiver

- Replacement valuation, which is the cost of buying a similar amount of services from the formal care industry

- Self-valuation, which is the amount a caregiver feels they should be paid

The Australian study by Access Economics has adopted “replacement valuation”. The total value of family and other informal caregivers provided to Australians with hearing loss in 2005 was estimated at AUD $3.17 billion (Access Economics, 2005).

4.2.5 Transfer costs

4.2.5.1 Welfare and income support

The only source of statistical information on welfare and income support was found in the Australian study (Access Economics, 2005). For hearing disabled people
who were receiving work related benefit, the disability support pension was the main source of income. The value of welfare payments in Australia due to hearing loss was estimated at AUD $1,328 million (Access Economics, 2005).

4.2.5.2 Deadweight losses

Welfare payments, as well as taxation revenue losses, are in reality a financial transfer from tax payers to support recipients. The real resource cost of these transfer payments is only the deadweight loss caused by taxation needed to finance the welfare payments (otherwise known as “the marginal excess tax burden”). The total deadweight losses for people with hearing loss amounted to AUD $1,048 million in 2005 (Access Economics, 2005).

4.2.6 Summary of financial costs

International and Canadian data somewhat differ in regards to actual costs. A direct comparison of findings is difficult due to different characteristics of the data sample or the approach used. At the same time, there were no principal differences in the main components of the financial costs. The relative representation of costs is quite similar in value. Therefore, it is justifiable to use the Australian study to summarise the financial costs of hearing loss to the society.

Figure 9 shows the percentage of different components of the financial costs. The largest cost is due to productivity losses. The second largest cost is due to carers. Deadweight cost is next in significance, and accounted for 8.9 percent of the total financial costs. Health costs are 5.7 percent while education support with aids is 1.6 percent.
Figure 9: Hearing loss, financial costs summary, 2005 (% total)

In Australia, AUD $3.314 is the annual costs per person with hearing loss. Unfortunately, no other found study defined annual costs for all age groups with hearing loss.

4.3 Estimating the burden of disease from hearing loss

In 2001, the World Health Organization’s World Health Report (WHO, 2004) included adult-onset hearing loss in the tables of the global burden of disease. The causes of the global burden of disease were assessed according to the percentage of total disability adjusted life years (DALY) in the world as attributable to each cause. DALY is a measure of the years of healthy life lost (YLL) due to premature mortality and the years lived in disability (YLD). Adult onset hearing loss was ranked in 15th place in 2002. If mortality impacts were excluded, then hearing loss ranks second after depression (Smith, 2004). The total global YLD for hearing loss is estimated to be 24.9 million, or 4.7 percent of total YLD due to all causes.
Figure 10 compares DALY’s lost due to hearing loss relative to other national health priorities and disease groups in Australia. This proportion is similar to that reported in the Global Burden of Disease Study.

Figure 10: Comparison of DALYs with national health priorities

5 WHY THE GOVERNMENT SHOULD GET INVOLVED?

Hardly any economic activity is free from government intervention (Folland et al., 2007). Government intervention comes through three main activities: (1) provision of goods and services; (2) redistribution; and (3) regulations.

The health care system in British Columbia and the rest of Canada is a public monopoly for many services. The provincial government funds these services with assistance from federal cash and tax transfers. The problem of hearing loss is addressed by the public system mainly for children. Adult hearing care falls outside the scope of the Medical Services Plan of British Columbia. The private market almost exclusively provides services for the adults who require hearing care services.

The government’s foremost role in administering health care is to protect patients. Also, the government assists in monitoring and administering service delivery.

The following review of the market situation provides economic justification for government intervention in the case of hearing care. We also review in greater detail why the government should get involved, and the factors influencing this involvement in the case of hearing care.

5.1 Market circumstances

Market failure is a situation for which no efficient allocation of goods exists. The understanding of why the market fails, and why it cannot attain efficiency, is a very important step in the development of public policy. The four traditionally recognised
market failures are: public goods, externalities, natural monopolies, and information asymmetries (Weimer & Vining, 2004). These market failures provide economic rationales for government intervention.

“Merit goods,” (a form of public goods), externalities and information asymmetry are the three market failures present in hearing care services.

5.1.1 Hearing care services as “merit goods”

Health services belong to a class of goods commonly referred to as “merit goods” (Deber, 2000; Richards, 1997). Merit goods combine efficiency and equity rationales for government supply. Merit goods also imply that society is prepared to insist that the supply exists regardless of individual preferences. Similar to any other merit goods, hearing care services provide benefits that exceed the private benefits and generate positive externalities. When an individual is aware of the impact of hearing loss and is able to obtain help, society as a whole benefits by enabling that individual to continue to work and generate goods and services.

Merit goods generate positive externalities. However, if left wholly to the private market, it is likely that merit goods would be under-consumed. The under-consumption is apparent in the low adoption rate of hearing aids (23% in North America). Partly, this is because individuals either do not understand or value the external benefits that can result from the consumption of hearing services.

Once a medical product exists outside the public system it becomes subject to private market rules. Price influences demand for services in the private market. Demand in hearing care depends on both, price of hearing devices/services and patient needs.
Hearing devices are an expensive product which quite a few cannot afford. The perception of the severity of hearing loss and the attitude towards hearing loss are crucial to the expressed demand for each individual. It is argued, however, that even if hearing care was freely available for all, the adoption rate might never reach 100 percent. Some suggest that the shortfall in demand is due to a lack of awareness of the impact of hearing loss on quality of life.

The government often provides merit goods "free at the point of use," and then finances them through general taxation. However, this is not the case for hearing care in British Columbia. The situation is different in other provinces. In Ontario, Alberta, and Saskatchewan health care plans cover either partially or fully the cost of hearing care services, including the cost of hearing devices.

5.1.2 Positive externalities

Market failure takes place because the market only takes into account the private costs and benefits. It does not take into account the external benefits that may arise in society from everyone having equal access to hearing care services.

People with hearing loss, if left untreated, forego positive externalities (e.g., by reducing the effectiveness of their ability to communicate in society). Time and productivity losses occur as a result of reduced efficiency of interactions between the members of society. For example, a person with hearing loss may spend an extra ten minutes at each visit to the bank because he/she is forced to ask the person to repeat what has already been said several times. The prolonged length of the appointment means
other people will have to wait in line longer, thus reducing their productivity. Therefore, an untreated individual with hearing loss causes disutility for other people in society.

Universal access to hearing care will create positive externalities which are not currently captured by the users of services. Hearing aid manufacturers and service providers do not benefit from the restored productivity of those who have acquired hearing aids. However, society as a whole will benefit through improved productivity, reduced costs on carers, reduced deadweight loss and other mechanisms. Some economists refer to this externality as a “selfish” externality in order to distinguish from the “caring” externality.

The “caring” externality occurs when individuals benefit from knowing that other people are receiving medical treatment. Many people feel upset knowing that someone is suffering simply because they cannot afford medical treatment. This helps to explain why some people are prepared to pay higher taxes to fund health care for all.

The following estimates were calculated for British Columbia to define the dollar value of the forgone positive externalities.

- Real financial costs of untreated hearing loss are estimated at $14.4 million annually
- $8.2 million is the estimated cost to the province due to lost productivity (based on the evidence from Australian).

The positive externality argument can be discussed from an economic theory prospective. A market demand curve that reflects each individual’s wish to buy care for
oneself is unable to express the individual’s willingness to pay for external benefits. This means that a free market will further under-provide health care. Figure 11 graphically illustrates the demand \( D \) and supply \( S \) schedule at the market equilibrium, with increased market output \( Q_o \). Marginal social benefit \( MSB \) includes both the private and external marginal benefits. With an increase in output of quantity/time, the social surplus increases by triangle \( abd \). At this time, the hearing care market is at equilibrium, and \( abd \) represents deadweight loss.

**Figure 11: Underproduction with a positive externality**

Social surplus at \( Q_e \) relative to \( Q_o \)
Consumer surplus: smaller by \( (acd-P_0cP_e) \)
Producer surplus: smaller by \( P_0cP_e \)
Social surplus: smaller by \( abd \)

5.1.3 Asymmetry of information between a provider and a patient

Economists have generally divided goods into two categories: search goods and experience goods. A good is a search good if a consumer can judge its quality by sampling prior to purchase. An experience good is defined as a good which can be evaluated only after purchase. By nature, hearing care services have the qualities of “experience goods”. It is a highly specialised service, the quality of which can only be determined through consumption. Weimer & Vining (2004) observed that “experience goods offer the potential for serious inefficiency caused by information asymmetry”.

If both buyers and providers were equally ill-informed about the effect of a good or service, there would be no market failure and no case for public regulation. In the case of health care, it is perceived by the wider society that the seller/provider of health care services has a very large informational advantage over the patient. This asymmetry of information can precipitate the possibility of the exploitation of buyers.

Information asymmetry in healthcare takes on a special form. Most providers know much more about the technology and health issues than consumers. Typically, however, the patient (buyer of services) is better informed about what those qualities of services/product mean for him/her. In general, only experienced hearing aid users know what services are available and the benefits that can be gleaned. New patients unfamiliar with hearing services typically have no concept of hearing aids as devices and how hearing loss treatment will affect their well-being.

The well known remedies for information asymmetry are professionalization and self-regulation, together with an agency relationship between consumer and professional.
In hearing care, all professionals must obtain certification allowing them to become a provider of hearing care services. Unfortunately, certification services “guarantee” only minimum standards in services or products. Currently, a source for rating the quality of hearing care services is not available.

The following statement accurately reflects the hearing care market situation:

Nevertheless, problems are likely to remain in two sets of circumstances: first, when quality is highly heterogeneous, branding is ineffective, and agents are either unavailable or expensive relative to the full price of the good; the second, where the distribution of quality is unstable, so that consumers and agents have difficulty learning effectively. (Weimer & Vining, 2004, p.110).

The quality of hearing care services as well as the quality of hearing devices is variable. Branding is not very effective since the success of the treatment, i.e. amplification and follow-up hearing aid adjustments, depends greatly on the provider’s skills and experience. The hearing care services are also an expensive product. All of the above contribute to the information gap between provider and consumer.

5.2 Why hasn’t the British Columbia government done more?

The problem of hearing loss has only recently become a focus of research in Canada and other countries. Remarkably, almost all studies in hearing loss costs have been conducted in the last five to ten years. The prevalence of hearing loss in adults is predicted to increase with the aging population. Table 13 summarizes estimated changes of the hard of hearing population in British Columbia from 2006 to 2031.
Table 13: Estimated number of hard of hearing in British Columbia in 2006 and 2031.

<table>
<thead>
<tr>
<th></th>
<th>Total Population (current and estimated)</th>
<th>Estimated hard of hearing (based on one out of ten estimate)</th>
<th>Age &gt;60 (% and number)</th>
<th>Estimated hard of hearing in age&gt;60 (Based on 37% prevalence rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>4,310,000</td>
<td>431,000</td>
<td>588,100 (17.8%)</td>
<td>217,620</td>
</tr>
<tr>
<td>2031</td>
<td>5,588,500</td>
<td>558,850</td>
<td>1,303,100 (24%)</td>
<td>481,147</td>
</tr>
</tbody>
</table>

This data suggests that the number of seniors who would suffer from hearing loss in British Columbia in 2031 will increase by 220 percent. The expected rapid changes in the province’s demographics will aggravate the hearing loss problem.

Canada and British Columbia are not alone in recognising the issues connected to the hearing loss problem. As reported in the earlier chapters, the Australian and Danish governments have been alerted by the high costs of hearing disability to society. The United States research also indicates loss of productivity and lifetime losses to society due to hearing loss.

High social costs suggest existing market failure. There may be a number of reasons, why the government has not done more in hearing care in the presence of market failure. Political self-interest, policy myopia, and limited cost-benefit analysis are typical reasons for the delay in government intervention.
Political self-interest can play a very significant role. The problem of hearing loss has an insidious beginning, slow progression, and non-visible physical results, so it may not get the attention it warrants. Voters typically note the urgency of the current state of the emergency health care system, for example, treatments in heart surgery gain ample media attention. However, the systemic problems with hearing care go largely unnoticed. When considering the allocation of public resources, politicians are likely to go with those “vote-getting” issues in health care. It may also be that lobbying groups from other interest areas have more success than hard-of-hearing issue proponents.

“Policy myopia” is another reason for limited government involvement. “Policy myopia” refers to looking for short-term gains rather than long-term solutions. The solution to hearing loss problem requires detailed analysis in order to develop a long-term program. Hearing loss is a life-long disability and mostly permanent in nature. Hearing services must have the ability to treat all. As increasing numbers of people acquire hearing loss due to the aging population, services must expand and evolve to be in a position to help all those who require treatment.

The last factor which might influence government intervention is the lack of cost-benefit analysis on hearing loss. Absence of information on long-term costs and benefits does not provide the government with the means to properly evaluate the hearing care problem, and, therefore, the required regulation and administration changes go unheeded.

The government regulates professionals through licences, but the regulation has an indirect influence on the market. By restricting the number of qualified professionals, the government affects the supply side of services.
5.3 What should government’s goals be in evaluating policy alternatives?

In order to assess hearing care policy alternatives, the government of British Columbia must pay special attention to: 1) values which relate to *efficiency*; 2) values which relate to the *equitable distribution* of public resources; and 3) overcoming the healthcare *budgetary constraints*.

The first goal of government should be to prevent market failure through improved *efficiency* in the production and consumption of hearing care services. To reduce the social costs of hearing loss, the scarce resources available for healthcare financing must be redistributed in such a way that the least costs spent on hearing care will yield the most benefits. Two types of efficiencies can be defined: operational efficiency and allocative efficiency.

*Operational efficiency* may be interpreted as the pursuit of the maximum output for a given level of resources, or the minimum cost for a given level of output (Donaldson et al., 2005). Part of being operationally efficient involves selecting between alternative means to achieve the same ends. For instance, in hearing care, the choice may be between two types of amplification device: hearing aids and assistive listening devices. While in some cases utilizing either technology will yield the same result, it is generally known that assistive listening devices are a less effective treatment than hearing aids, but also less expensive. When one type of treatment is less costly *and* less effective,
problems can arise. Comparisons between alternative treatments in hearing care can be done through cost-effectiveness or cost-utility analysis for different types of amplification.

*Allocative efficiency* refers to what is worthwhile doing from a social perspective. It refers to a situation in which the limited resources are assigned according to the consumers’ preference. The social perspective is fundamental to allocative efficiency. Commodities in hearing care include: hearing devices, special rehabilitation services, telecommunication services, and hospital audiology department services. Government’s goal in this context must be to find the “optimal mix” of commodities.

The second goal is to achieve a more *equitable* distribution of hearing care. The current British Columbia situation is quite inequitable. The most vulnerable group of patients, the elderly, are not being included in a provision for hearing care in British Columbia, yet they are the neediest group (see Chapter 3). Equal access for equal needs simply provides individuals with the opportunity to use required health services. Unfortunately, widening health inequality is a common dilemma in the implementation of public policy as suggested by a number of policy analysts.

Some economists distinguish between horizontal and vertical equity. Horizontal equity is concerned with the equal treatment of equals for equal needs (Mooney & Olsen, 1991). Vertical equity addresses the extent to which individuals who are unequal in society should be treated differently. This principle, however, is difficult to put into operation.

The third goal is to *overcome budgetary constraints*. Health expenditures have been growing steadily over the last few decades; however, the demand for hearing care
services has been growing at a faster pace (Evans, 2007). This trend posed a serious
challenge for the financing of health care. The government’s goal is to prioritise amongst
various health care needs.

5.4 An assessment of the current government programs in British
Columbia related to the government goals

5.4.1 British Columbia government programs available to children

“Newborn hearing screening” was introduced on March 4, 2004. This brought
British Columbia on par with other Canadian provinces and 34 states in the United States.
This program serves the government goals for efficiency and equity. The “newborn
hearing screening test” is conducted in less than five minutes, with valid and reliable
cost-effective technology. The expenditures on screening are directly offset by reduced
expenditures on special education and support programs (Mehl & Thompson, 1998).
Thus, the third goal for government to limit expenditures is served as well. Unfortunately,
the scope of this analysis, and the scarcity of information at the provincial level, do not
allow for the exact calculation of savings. However, other research recognizes that delays
in diagnosis represent a cost to society, as well as to the affected children and their
families (Durieux-Smith et al., 1999).

Statistical evidence (see Chapter 3) shows that 20 to 30 percent of children will
acquire hearing loss during childhood in addition to those born deaf. According to the
report by Dana Branelsen, (Provincial Advisor Infant Program Development of BC),
routine universal screening for young children is not available in BC. She stated that not
only are children with mild to moderate hearing loss often not diagnosed until school age,
but some children with more severe hearing loss are left undiagnosed (Branelsen, 2002).
Hearing aids are now covered by the medical plan for children; therefore, the financial burden has decreased on those families who cannot afford to pay for hearing devices. Thus, social efficiency is partially achieved by providing hearing aids, but the larger issue requires attention.

Access and supply of audiologic and speech-language pathology services are limited. This limitation is due to a smaller than needed number of specialists who are allowed to service children. The absence of universal screening implies that many children inevitably depend on their parents' and teachers' knowledge and understanding to get them help when needed.

The Ministry of Education has a special provision for “Special Educational Services,” including services for the deaf and hard of hearing (British Columbia Ministry of Education, 2006). The scale and scope of services for the deaf and hard of hearing depends on the degree of educational difficulties. The services include: identification and assessment; planning and implementation of services; and subsequent evaluation and reporting. The policy also specifies the requirements for the teachers, visual language interpreters, and teachers’ assistants. School boards determine what auditory training equipment students need, and the Ministry of Education provides equipment for classroom use. This program is vital for children with hearing loss to have an independent future. In this context, the program improves efficiency. It is questionable whether equity is achieved with this program. Special audiologic services are mostly available in the urban centres. This means that children in rural or aboriginal places have no access to these special services.
5.4.2 British Columbia Government programs available to adults

The Medical Service Plan (MSP) in British Columbia does not cover hearing aids. An extract from the MSP rules is as follows:

“Services Not Covered by MSP
MSP does not provide coverage for the following:

• services that are deemed to be not medically required, such as cosmetic surgery;
• dental services, except as outlined under benefits;
• routine eye examinations for persons 19 to 64 years of age;
• eyeglasses, hearing aids, and other equipment or appliances;”

However, on March 15, 2007, new eligibility criteria were approved and published (see Appendix G). According to these criteria, “hearing aids and related items are provided only to eligible recipients who lack financial resources to meet the need and for whom failure to provide a hearing aid represents a direct barrier to employment”. The ministry pre-approves the hearing aids for eligible recipients. This addition to the MSP coverage of hearing care services is a substantial improvement of the situation from the equity prospective.

Three other hearing care provision programs are available to adults in British Columbia in addition to provincial ministries’ programs: WorkSafeBC, Veteran Affairs Canada and The First Nation and Inuit health program. We review briefly each program.

The Workers Compensation Board in British Columbia known under the name of WorkSafeBC, has a program “Sound Advice”. “WorkSafeBC” is an independent provincial statutory agency funded by registered employers’ insurance premiums. WorkSafeBC administers the Workers Compensation Act; however, it remains separate
from the government. While WorkSafeBC regulations set limits for noise exposure in British Columbia, employers are responsible for introducing a hearing loss prevention program.

The goal of the hearing loss prevention program is to reduce the noise exposure of workers to a safe level and prevent occupational hearing loss. The hearing loss program must address the following: (1) noise measurements; (2) education and training; (3) engineered noise control; (4) hearing protection; (5) the posting of noise hazard areas; (6) hearing tests; and (7) an annual program review (Sound Advice, 2006). According to this program, workers undergo industrial hearing testing and, if required, are fitted with hearing devices. The program allows for a new hearing device every five years. WorkSafeBC determines the eligibility of the candidates for the hearing aids. This obviously applies only to people who worked and lived in BC at the time of the exposure to a noise source.

Figure 12 shows abnormal hearing discovered in different age groups in 1980, 1991, 2006 and expected projections. It is obvious from the reported information that the WorkSafeBC hearing prevention program has had a profound effect on the number of work related hearing losses. In the most affected age group (51-65 years), the number of workers with hearing loss was reduced by almost half (20% difference) between 1980 and 2006.

According to general statistics from 2006 provided by WorkSafeBC, 149,942 workers were tested in 2006 by 300 active industrial audiometric technicians. There are 86 in-house programs, 21 mobile, and 23 fixed contractors in British Columbia.
WorkSafeBC processed 613 claims for hearing aids in 2006 (Harrison, 2006). Each claim is processed for one worker. Assuming that binaural fitting was required in 100 percent of the cases (typical of NIHL), 1,226 hearing aids were dispensed under this program in 2006.

Based on the data from the Canadian Association of Hearing Aid Manufacturers, 42,450 hearing aids were sold in British Columbia in 2006. WorkSafeBC provided only 2.9 percent of all hearing aids sold in the province.

**Veteran Affairs Canada (VAC)** is another program available to adults in British Columbia. VAC is federally funded and applies to those British Columbians who fit the
eligibility criteria. VAC offers 14 kinds of health benefits, including medical, surgical and dental care, prescription drugs, and hearing and vision aids. The ability to access health benefits depends on the veteran’s eligibility, health needs, and whether these services are available where the veteran resides.

Hearing care is a part of the health benefits for veterans. Examples of covered benefits are: analogue hearing aids, basic digital hearing aids, basic programmable analogue aids, telephone amplifiers, infrared devices, hearing aid accessories (e.g. batteries), dispensing and fitting fees. The provision for other models of programmable and digital hearing aids is considered by VAC on an exceptional case basis. VAC will provide $2000 per pair of hearing aids every four years for eligible veterans.

*The First Nation and Inuit health program* covers certain medical supplies and equipment in accordance with the program policies. Hearing aids are included in this category. Eligible candidates must obtain a prescription from a physician or a licensed audiologist, and then receive approval from the regional office. Following approval, he/she will be provided with a hearing device.

The First Nations and Inuit client population is relatively young, with almost three-quarters (69.7 percent) under the age of 40 and 38.1 percent are under the age of 20. Seniors (clients 65 years of age and over) represent only 5.6 percent of the total population. Hearing loss issue in this population mostly concerns children. A condition called, otitis media is the main cause of hearing loss in aboriginal children. Concern about this situation became the basis for many recent inquiries into the legitimacy of hearing screening in younger children.
It is difficult to estimate the role both programs play (VAC and the First Nations and Inuit) in providing hearing care services to British Columbians. The data was not available on the number of hearing aids and services provided under these programs.

The budgetary expenditure on hearing care in British Columbia was not specified as it falls under medical supplies.

In conclusion, government coverage for children and adults with hearing loss in British Columbia is somewhat limited. The private market of hearing care is subject to market failure. Although the goals of perfect efficiency cannot be achieved, the attempt to improve efficiency should be made. The equity in the services available to all hearing-impaired people in British Columbia is less than optimal. Seniors and aboriginal people are the most under-served groups of the hearing care population.
6 BUILDING THE POLICY OPTIONS FOR HEARING CARE IN BRITISH COLUMBIA

6.1 What should a policy on hearing care accomplish?

Canada Health Act (Department of Justice, n.d.) C-6 declares that for any provincial program to qualify for funding, it must adopt the following criteria of administration: (1) public administration; (2) comprehensiveness; (3) universality; (4) portability; and (5) accessibility.

Working at a federal level, the Canadian Working Group on Childhood Hearing (CWGCH) (Bartholomew, 2005) pronounced guiding principles for Early Hearing and Communication Development. We consider these principles are also applicable to the adult hearing care policy.

The hearing care policy must have an evidence-based approach. This approach involves the systematic and critical review of currently available research and program information.

The family-centred approach provides the basis for an integrated strategy that takes into account the physical, emotional, mental, and psychological aspects of hearing impaired individuals’ functions. The hearing care policy requires the partnership and collaboration of various stakeholders, including federal, provincial and territorial governments, professional associations, consumers and relatives, experts in
Otolaryngology and Audiology, child health, senior health, nursing, general practitioners and public health.

### 6.2 Policy option components

#### 6.2.1 Suggested components of the comprehensive hearing care policy in British Columbia

Various research sources identified areas of hearing care policy; however, the most comprehensive proposal was found in Australia (Smith et al, 2005). Consolidated findings from studies and discussions suggest the inclusion of five elements in the policy, as presented below. The additional sixth element of the policy we propose is based on the recent presentations to the government of British Columbia by various professionals in health care (The Premier’s Council on Aging and Seniors’ Issues, 2006).

The “6 elements comprehensive hearing care policy” for British Columbia must cover the following areas:

1. Early intervention
2. Hearing aid expense
3. Use of assistive listening devices (ALD)
4. Counselling and rehabilitation programs
5. Screening and education programs
6. Hearing access technology for public places
Some of these elements are already addressed by the government, but to a limited extent. We would like to review each suggested area in detail to prove the legitimacy of including these elements in the hearing care policy.

### 6.2.1.1 Early intervention

**Adults:** It is discovered that hearing impaired persons wait on average from five to seven years before they seek help (Milstein & Weinstain, 2003). Early intervention in hearing loss (any onset) is key in avoiding auditory deprivation and reduced auditory stimulation. Once delayed, auditory processing by the brain is only partially recoverable (Arlinger, 2003). Early intervention can be administered through the provision of hearing rehabilitation and/or hearing aids/cochlear implants (Davis, 2003). If the hard of hearing start using hearing aids at an earlier stage, they gain greater benefit from the device (Cohen et al., 2004). Persons with hearing loss also have less difficulties managing hearing aid care if they acquire fine motor skills earlier in life (Erber, 2003). Managing hearing aids requires handling small knobs and changing small sized batteries. Early intervention will also minimize the damage to social and family relationships (Kochkin & Rogin, 2000).

**Children:** The early intervention for hearing loss in children is of paramount importance. The timing of the intervention carries high significance for the outcome of treatment and rehabilitation. Universal newborn screening has been adopted in British Columbia in 2005. Yoshinaga-Itano et al. (1998) found that the most significant factor in the ultimate level of language achievement is the time of intervention. Intervention is proved to be more effective if initiated in the first six months of life.
6.2.1.2 Hearing aid expense

Kochkin (2007b) reported that 64 percent of those in need of hearing aids felt that they could not afford hearing devices. These findings are based on the result of “MarkTrak” research conducted in the United States.

We also conducted a survey in British Columbia on hearing aids cost. Table 14 summarised our survey results. Please note, that the price includes both, hearing devices and hearing care services.

Table 14: Hearing aid retail prices in British Columbia

<table>
<thead>
<tr>
<th>Types of hearing aid (based on functionality and features)</th>
<th>Average price to consumers In Canadian dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-end digital/analogues/programmable</td>
<td>$799-1200 per aid</td>
</tr>
<tr>
<td>Mid-range digital devices</td>
<td>$1500-1900 per aid</td>
</tr>
<tr>
<td>High-end digital devices</td>
<td>$2000-3500 per aid</td>
</tr>
</tbody>
</table>

Sources: based on author’s survey of 5 BC based hearing dispensing clinic chains.

Furthermore, Kochkin (2007b) discovered that those who cannot afford assistive devices were below the national household income level. 40 percent of these people responded affirmatively to the suggestion that they purchase hearing aids with tax credit. Australia, similarly to BC, does not cover the cost of hearing aids with Medicare. Cost is also an obstacle when purchasing two hearing aids for binaural hearing losses (Ching et al., 2000). Unfortunately, monaural fitting is less effective and associated with greater risk of auditory deprivation.
6.2.1.3 Use of assisted listening devices (ALD)

Depending on the degree of hearing loss, individuals may benefit from a variety of assistive hearing devices. Sometimes the use of hearing aids alone cannot address the issue (Lesner, 2003), and the value of other strategies must be taken into account (Lind, 1996).

A number of comprehensive sources of information for ALD were found. One of the most complete and easy to use was produced by The Michigan Department of Labour & Economic Growth-Rehabilitation Services (2005). The “Hearing assistive technology online guide” suggests following three steps to determine the most useful assistive technology. The first step is to identify and record communications difficulties, such as conversations, telephone use etc. The second step is to define the level of hearing loss. The third is to determine the most useful assistive technology. This guide provides detailed information on more than twenty ALDs. Some of the more familiar devices are: personal frequency modulation systems (FM), infrared systems, induction loop systems, and amplified telephones.

Currently, most British Columbians have to pay out of their own resources for the purchase of ALDs.

6.2.1.4 Counselling and rehabilitation programs

Citron (2000) stated that counselling is “the most overlooked aspect of the process of fitting amplification and at the same time is the most important service”. According to “Guidelines for the Audiologic Management of the Adult Hearing Impairment” (Valente et al., 2006), successful management of hearing loss requires comprehensive counselling
to help patients adjust to their hearing devices and augment the assistance they receive from partners. Counselling assists patients to “unlearn” their “maladaptive compensatory behaviours and learn new strategies to ensure” success with amplification.

Rehabilitation programs must be administered prior to and after amplification (Chisolm et al., 2003). Prior to the time of the fitting of hearing aids, the patient must be instructed on the hearing aid features, insertion, battery change and size, care and cleaning, telephone use, and warranty. As a part of the post-fitting adjustments, the listening strategies for several environments must be discussed with every patient (Erber, 2003). Information about other assistive listening devices must be delivered to the patient at the same time to ensure the maximum benefit from the available technology (Lesner, 2003).

It is imperative to include in the rehabilitation and counselling process families and friends or nursing home staff (Tolson & Stephens, 1997). Counselling can be provided on a one-on-one basis, but it can also be effective in small group settings (Abrams et al., 2002).

Abrams et al. (2002) conducted the first known research on the cost-utility analysis of the hearing aids used in conjunction with audiologic rehabilitation. His study statistically confirmed significant improvement of the results of amplification when provided in conjunction with audiologic rehabilitation and audiologic amplification. Cost utility analysis revealed that the hearing aid treatment costs $60 per quality adjusted life year (QALY) gained, while hearing aids and audiologic rehabilitation together cost only
$31.91 per QALY. These findings confirmed that the latter is the more cost-effective treatment.

Rehabilitation is free in British Columbia for those between zero and twenty years of age. However, rehabilitation services are difficult to access due to a limited number of audiologists providing these services (Kazanjian et al., 2002). In short, a special report to the Health Human Resources Unit, BC revealed serious issues with the supply of audiologic services to British Columbians, including audiologic rehabilitation services.

6.2.1.5 Screening and education

Screening and case-finding programs increase the effectiveness of early intervention. In 2005, British Columbia introduced a newborn screening program, “Sound Start” (BCMA, 2005). This program will ensure that congenital deafness is picked up immediately after birth and that treatment starts prior to six months of age. The program will greatly influence the outcome of the hard of hearing child’s language development and will subsequently affect his/her educational and professional abilities.

The Public Health Agency of Canada recommends that adults have a hearing evaluation every two years. Currently, British Columbia does not have a universal screening program. There is also evidence (Holland et al., 2001) that case-finding is more cost-effective than population screening programs. In working environments, employers are responsible for hearing testing and hearing protection.

Education plays a significant role and must be included in the hearing care policy. It needs to be two-fold: at the community level and at the level of an individual. In both cases, facts about hearing loss, its impact on the quality of life, its connection with other
disorders, the available treatments, and the effectiveness of the hearing aids and other assistive devices must be clearly and reasonably presented. Medical professionals and volunteers should unite their forces and conduct educational campaigns on the subject.

**6.2.1.6 Hearing access technology for public places**

This part of the hearing care policy refers to the government's influence to change building codes and requirements for public spaces to incorporate new technology systems. Special systems will make communication easier for hearing impaired people fitted with hearing aids.

There are several types of systems that can be used depending on the environment, the need for privacy, and how the user will interface with the system. There is no one system that is good for all environments. Each system has pros and cons regarding its uses and features. Assistive listening device technology can be integrated into an existing standard public address (PA) or sound amplification system to transmit the sound signals directly to a person. There are four general types of systems: induction loop (IL), FM (frequency modulation), infrared (IR), and sound field amplification systems.

These systems could be installed in all public places, such as hospitals, libraries, churches, shopping malls, and senior centres.

To give an example, FM systems gather speech at the source (via a separate microphone/transmitter) and transmit the sound clearly and directly to the hearing instrument in the person's ear. A person with hearing aids will have no problems
communicating in the environment equipped with FM system even with significant levels of background noise.

6.2.2 The government role

The government’s policy should be aimed at restoring the ground rules and promoting the conditions for an effective market (Blumstein & Zubkoff, 1973). Government could justify the support of actual care and preventative measures. Market failure gives legitimacy to the need for government intervention. Achieving each of the defined goals of efficiency, equity, and finding financial sources is the government’s role.

The government is instrumental in the provision of medical care to vulnerable segments of the population: children, the elderly and aboriginals. The legal framework is already in place through the principles set by Medicare.

Government intervention to remedy market failures can arise in various forms: regulation, public subsidy, insurance, private charity or taxation (Blumstein & Zubkoff, 1973).

The government’s regulatory role is already partially served with the legislation and regulation of professional bodies for the providers of hearing care. However, the professional legislation has inherent “monopoly” features that are manifested through restrictive access to the profession, thus the supply side of services. In hearing care, demand is fairly low (as based on evidence presented in Chapter 3). Hypothetically, if hearing impaired people realised the impact of hearing loss and its importance on their lives, the dramatically increased demand would be unmatched by the current level of supply.
Public subsidies have been directed at children and were only recently introduced in British Columbia. Seniors remain the largest needy group for hearing care outside of the subsidy provisions. The Medical Service Plan does not cover provision for hearing devices, except in the case of a small number of eligible individuals.

Private insurance currently allows limited provisions for hearing care, typically around CAD $500 per hearing aid every five years. This amount barely covers 1/3 of the retail cost of one hearing aid.

Private charity provision is virtually unknown in hearing care for British Columbia. The only known not-for-profit organization in British Columbia that has a hearing aid program, The Western Institute for the Deaf and Hard of Hearing, offers the “Lend-An-Ear” Loaner Hearing Aid service for those most in need. The institute provides a reconditioned hearing aid at a nominal cost to the individual. Currently, however, the donated hearing aid stock is very low, while the waiting list for this program is growing. In short, the government role in hearing care is of paramount importance, and the implication of the intervention has a long-term impact on the individuals and on society as a whole.

6.3 Policy options

We suggest considering three policy options: status quo, comprehensive funding of hearing care services, and a co-payment system for the funding of hearing care services.
The first option, status quo, implies that no changes to the existing regulations and programs will be made. The program will continue as is, and be subject to all future environmental and demographic influences.

With regard to the second and third policy options, the government will assume overall responsibility for the hearing care policy in British Columbia. Government is well placed to design, develop and implement a comprehensive new hearing care policy with the discussed six elements. The main difference between the second and third policy option is a funding source.

Funding in health care, overall, requires answers to complex questions (Donaldson et al., 2005). Some of these questions are presented below:

- How should funds be raised?
- What out-of-pocket payments are made by the consumer at the point of use?
- How should professional providers be paid?
- How should the market be organized?
- To what degree should competition and equity be used?

Important consideration should also be given to the complicated nature of the public/private mix in finance and provision. Figure 13 simplifies possible combinations.
Figure 13: Public/private mix in health care financing and provision

Notes: (1) Public finance and public provision; (2) Public finance and private provision, (3) Private finance and public provision, (4) Private finance and private provision.

Source: Donaldson et al., 2005, 57.

6.3.1 Option one: status quo

We consider “status quo” in hearing care policy as option one. Despite the market failure, the hearing care market has been in existence for a number of years. Hearing technology continues to be developed. New products and services are introduced to the market approximately every six months. The next generation of people with hearing loss (“baby-boomers”) may be more conscious of their hearing needs. The Canadian Hard of Hearing Society and the Canadian Association of Speech-Pathologists and Audiologists have made steady progress in educating consumers.

The status quo position will continue to bring high social costs to society due to the inefficiencies of the private market. Also, the inequalities will continue to exist.
Financial pressure on government would be limited to the current level because the provision for hearing aids and services is concerned primarily with children.

The status quo also allows political decision makers to focus on other areas of healthcare, forgoing the interests of the hearing impaired. The opportunity cost in this case should be weighed against other possibilities of spending public money on health care.

6.3.2 Option two: comprehensive funding of hearing care services

The comprehensive funding of hearing care services will include partial control over the supply side in terms of quantity, cost and allocation. Intervention on the supply side through subsidies can be justified by the presence of the externalities discussed earlier. Control over the demand side cannot be fully exercised, however it can be greatly influenced by providing correction to the information asymmetry between provider and consumer.

The source of comprehensive funding is public resources. The main question in this case is to whether the public interest is best pursued through this mode of funding. Essentially this means that those who will never need hearing care services sacrifice their resources for other member of society.

Estimated calculations of the required funding can be done based on the Australian evidence found with proportionate adjustments for the population and prevalence rate.
6.3.3 Option three: co-payment systems for the funding of hearing care services

The co-payment systems for funding of hearing services are consistent with good health care and tax policies (Aba et al., 2002). Arguments that private financing of health care contributes to reduced access to publicly financed health care receive little support (Globerman & Vining, 1998). Public financing of health care does not encourage users and providers to be accountable for the economic benefits and costs of services. There is no clear connection between the individual’s contribution to health care and usage of health care services. The co-payment systems would allow this connection to be realised.

The co-payment system must be flexible and cost efficient. The other condition of the system is that it could be fairly easily administered through the existing provincial tax or MSP plan.

The co-payment system should include the following elements:

- Users of hearing care services would pay a contribution that is related to the cost of the services they use
- The contribution should not be a burden on individuals whose incomes are inadequate to cover the cost of the services they use
- The system should not incur unnecessary administrative and compliance costs

The co-payment system can either address the supply side or the demand side of the market. On the supply side, tax expenditures and matching grants may be used. On the demand side, in-kind subsidies and vouchers may be used (Weimer & Vining, 2004).
The supply side: Matching grants will allow distributional issues to be addressed. For example, in hearing care, matching grants can be provided for seniors and low-income working adults. Since this measure is on the supply-side, hearing care providers would be stimulated to reduce prices for people older than 65 and those on fixed income. A reduction in price would allow more seniors to afford hearing care services.

Tax expenditures are another common form of the supply side subsidies which can be used in a co-payment system. Revenue earned from the services to the senior population could qualify as tax deductible for the provider, thus allowing for a reduction in retail prices to this group of patients.

The demand-side: In-kind subsidies subsidize the consumption of specific goods. In the case of hearing care, hearing devices or assistive listening devices, it is a direct form of provision of a commodity to consumers.

Another demand side subsidy is vouchers. Vouchers can be distributed to the patients on a low income and allow them to purchase hearing services and goods at reduced prices. If vouchers were distributed in large quantities, it may stimulate demand. This particular element is very beneficial for hearing care, where the demand for services is under-recognised.
7 Assessment and recommendation

7.1 Comparing the performance of the options

Table 15 summarises the comparison between the discussed options in Chapter 6.

Table 15: Summary of policy options in terms of policy goals

<table>
<thead>
<tr>
<th>Goals</th>
<th>Criteria</th>
<th>Policy options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Status Quo</td>
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</tr>
<tr>
<td>Efficiency</td>
<td>Impact on the social costs reduction</td>
<td>Low (1)</td>
</tr>
<tr>
<td></td>
<td>Operational efficiency level</td>
<td>Low (1)</td>
</tr>
<tr>
<td></td>
<td>Allocation efficiency level</td>
<td>Low (1)</td>
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<tr>
<td>Equity</td>
<td>Horizontal equity level</td>
<td>Low (1)</td>
</tr>
<tr>
<td></td>
<td>Vertical equity level</td>
<td>Low (1)</td>
</tr>
<tr>
<td>Overcoming budgetary constraints</td>
<td>Financial pressure</td>
<td>High (3)</td>
</tr>
<tr>
<td></td>
<td>Financial pressure is low thus the benefit is high</td>
<td></td>
</tr>
</tbody>
</table>

Total Points

8          12          15.5

Points were assigned to the degrees, i.e., Low = 1, Medium = 2, High = 3, to clearly present the value of the options. The comparison of policy options was based on the three goals and criteria applicable to each goal.
According to the weighted results, the co-payment system of funding is a slightly better option than comprehensive funding, with the status quo being the least beneficial option for society as a whole.

### 7.1.1 Option one: status quo

A comprehensive hearing care policy will not be implemented under this option. The provision of hearing care services together with funding will remain unchanged. Services will continue to be limited to seniors and working adults. Based on the summary of policy options, the status quo option scores the lowest in the rankings (8 points).

**Efficiency goal:** As discussed in earlier chapters, the high social costs of hearing loss problem are likely to increase even more in the status quo option. Thus society will continue to pay dearly for ignoring the hearing loss problem. The influence on the operational and allocation efficiency will be minimal as it is currently observed.

**Equity goal:** Horizontal equity will continue to be “low”. Patients with equal needs, such as sensorineural hearing loss, who require hearing devices, will continue to receive unequal treatment due to the unequal ability to privately fund services. Horizontal equity is also influenced by the availability of services. Private clinics are not being set up in many towns, remote parts of the Interior and Northern parts of British Columbia.

Vertical equity in the status quo option will require more analysis. Based on available information, unequal individuals, such as children compared to adults, are treated differently through financial and provisional prospective. However, the extent of this unequal treatment should be investigated further to define the optimal distribution of
services and funds. The impact of the status quo option on the equity goal is also considered to be “low”.

**Budgetary constraints:** Since no changes to the policy in this option are expected, the budgetary constraint will not be increased beyond the existing limits. This we consider to be a low financial pressure situation and to score high in evaluation of desirability.

### 7.1.2 Option two: comprehensive funding of hearing care services

This option suggests the full-scale development and implementation of the “six elements comprehensive hearing care program” that was proposed and discussed earlier.

**Efficiency goal:** Comprehensive funding would include among others: the increased cost of the provision of services and supplies of medical specialists; full coverage of hearing care, including hearing aid costs; financing of the preventative measures; and education of the general public. The direct expenditure will undoubtedly increase; however, the reduction in productivity losses, and other costs to society, is expected to offset the increased spending. The impact on social costs is estimated to be “medium”.

Operational efficiency is estimated to be “high”. This evaluation is based on the ability to provide the best option for the patient to choose the most beneficial hearing care service and technology. Allocation efficiency needs further analysis mainly in relation to newly developed technologies. Potentially, government could get involved in the cost-benefit analysis of the new technologies in digital processing. At this time, manufacturers are fully subsidising research in this area. However, the results might be distorted to suit
the interests of the manufacturer. Government, as a neutral and an independent agency, could facilitate brand-independent research with more reliable results and conclusions. However, efficiency will still be impaired since neither hearing care providers nor patients would be able to see the connections between the benefits of the services and the cost of providing these services.

_Equity goal:_ The comprehensive funding option will allow for restoring a more equitable distribution of hearing care services as a good. Horizontal equity will be served at the highest level. Through careful development policy and implementation, vertical equity can be changed from an estimated “low” to a more optimal level.

_Budgetary constraints:_ Financial pressure on government will be high with this option, thus evaluated as the least desirable state or “low”. All funding is expected to come from public sources. In essence, the budget on healthcare would have to be either increased to include a provision for hearing care or re-allocated from other areas to hearing care. It is difficult to assume that redistribution will be acceptable or even possible. The most likely solution is to increase the budget allocated to hearing care. A possible remedy for the impact of the budgetary increase would be a stage-based implementation of the new hearing care policy to ease the financial burden on the government. For example, a step-wise introduction of services over a five-year time period might be a more acceptable solution than a single year increase in the health care budget.
7.1.3 Option three: co-payment systems for the funding of hearing care services

This option assumes a full scale implementation of the proposed "6 elements comprehensive hearing care policy". However, the main difference between option three and option two is a funding source. Co-payment system suggests that the cost of services is split between the public funded sources such as in MSP in British Columbia and the private funds of people who need services. Depending on the co-payment system, the amount contributed from each side may vary.

Efficiency goal: The overall impact on effective use of resources is expected to be the most significant, compared to other options. The co-payment system will allow both, provider and patient to take an active role in the management of hearing loss. The expenditure on services from public sources will be higher than in option one but expected to be considerably lower than in option two. The danger of over consumption of services is minimal, in contrast to option two. A well-known inherent problem in "free services" is over-utilization. However the use of nominal charges may provide an incentive to a patient to restrain demand, especially trivial demand (Donaldson et al., 2005).

Social costs as described in Chapter 4 are due to productivity losses in 67 percent of the total costs. In the co-payment policy option, these costs are expected to decrease dramatically. This is due to availability of a comprehensive system for treatment of hearing loss and increased affordability of the services.

Operational efficiency will be “high”, as choices will be partly controlled by patients themselves. In this case, the responsibility for the outcome of the chosen
alternative is shared. Allocative efficiency will also be “high” due to maximization of satisfaction for the greatest number of individuals who collectively form a society.

*Equity goal:* Horizontal equity will be improved from the current situation but still be dependant on the financial ability of an individual to participate in the program. Vertical equity will be served in the most beneficial way, provided the policy correctly determines the principle of treatment of different individuals. This task might prove to be time-consuming and labour intensive; however the end-goal may outweigh the costs. Hearing care program is a long term program therefore long-term consequences may have a significant impact on costs if set up inappropriately.

*Budgetary constraints* In the co-payment funding option, the shared financial responsibility will have “medium” effect on the budget. Government will have the flexibility of monitoring and adjusting the financial burden according to the indicators set up in the process of formulating the hearing care policy.
8 SUMMARY

The affordability of health care has had a tremendous impact on society. The scarcity of resources forces policy-makers to constantly review and evaluate the cost-benefit of services and products available under the public provision of healthcare. Government involvement in health care is mandated by the political and economic pressure to provide the best possible results at the least possible cost.

Hearing loss problem represents a “hidden” issue in health care. The nature of hearing loss and the stigma attached to this disability play a serious role in the attention society pays to this health issue.

Unfortunately, the hearing loss problem will intensify over the next few decades for the developed world and for British Columbia in particular. Changing demographics in the population will increase the prevalence of hearing loss.

Presented evidence from other countries points to the high social costs of untreated hearing loss. Mostly social costs are due to productivity losses and losses due to care giving. Much smaller costs are attributed to medical costs and special education, as well as the cost of hearing devices.

Ineffective private market provisions for hearing care warrant government involvement. Government goals in correcting the current hearing care situation must aim
for three goals: improving efficiency, optimising equity of the distribution of services and overcoming budgetary constraints.

Recently, the government of British Columbia introduced a very important “newborn hearing screening” program. Very recently, MSP included a provision for hearing care services for children. These additions to health care are very positive signs that the severity of this issue is being recognised by society. Unfortunately, these changes do not affect the majority of hearing loss sufferers. The most vulnerable group of patients, seniors, remains outside of the MSP plan. The private market dominates hearing care products and services for adults; however, its distribution of products and services is subject to inefficiencies and inequities.

Based on the evidence found in available literature, this paper proposes a new comprehensive hearing care policy for British Columbia.

Three policy options were developed and evaluated: status quo, comprehensive funding, and co-payment funding. The last two options assume the implementation of a new comprehensive hearing care policy. Several criteria were used to evaluate the policy options. The third option scores the highest in terms of evaluated goals and thus would be recommended for further analysis and scrutiny. The status quo was evaluated as the least desirable policy option for resolving the problems with hearing care.

The distance is great between showing a problem exists and implementing effective solutions to that problem. The policy on hearing care can be implemented in three steps: (1) the design, (2) the plan, and (3) the implementation.
Proposed hearing care policy elements in Chapter 6 can be the basis for the design of the new policy. Various stakeholders including medical professionals, consumer associations and government must review and scrutinise the proposed policy. Evidence from other provinces and countries must be taken into account to project the potential benefits and costs of the future policy.

Once the design is approved, a process of planning must take place. The plan should take into account all various components of the implementation stages to ensure smooth introduction and maximum effectiveness of the new hearing care policy. Economists and financial specialists should be involved at this stage to produce detailed estimates of the costs and benefits.

The implementation stage is the key to the success of the new policy. Public awareness of the effort to tackle the hearing loss problem is of paramount importance. Information sources must be utilized to involve consumer groups in promoting hearing health.
**Appendix A. BC Level Population Charts and Graphs**

**Forecast 05/04**

**British Columbia Total Population**

- **Estimated**
- **Forecast**

**Percent Change**

**Year**


**Components of BC Population Change**

- **Historical**
- **Projected**

**Source:** BC Stats, The Ministry of Labour and Citizens Services, British Columbia-Level Population Projections (Proj 06/12): [December 2006]
Appendix B. BC Level Population Charts and Graphs (page 5)

Forecast 05/04

B.C. Population 0-4

B.C. Population 5-17

B.C. Population 18-24

B.C. Population 25-44

B.C. Population 45-64

B.C. Population 65+

Appendix C. BC Level Population Charts and Graphs (page 6)

Forecast 05/04

B.C. Population 80+

B.C. Population 5-12

B.C. Population 13-17

Appendix D. Quick facts about seniors in British Columbia.

- British Columbia is currently home to about 588,100 seniors. By the year 2031, the seniors' population will more than double to 1,303,000.
- British Columbia has one of the most rapidly aging populations in Canada -- the number of people over the age of 65 has been growing at an average rate of two percent over the last 10 years, almost twice the rate of the general B.C. population. Seniors currently make up 14 percent of the population of British Columbia; by 2031 seniors will make up 23 percent of the population.
- Most seniors report that their health is excellent, very good, or good.
- The life expectancy of British Columbians is the highest in the country. In 2004, life expectancy averaged 79 years of age for men, and 83 years of age for women. Seniors of the future will likely be even healthier than seniors of today with a lower prevalence of heart disease, hypertension, arthritis, and functional limitations than previous generations.
- About one-third of people 65 years of age and over participate in daily physical activity.
- About 60 percent of seniors maintain a household. Most seniors live in private households and in single, detached houses.
- Seniors make up nine percent of the total volunteer force but contribute 18 percent of all volunteer hours in British Columbia.
- About seven percent of people aged 65 and older were employed in 2004 compared to five percent 10 years ago so that even though more people are retiring earlier, at the same time more are continuing to work after 65. The age of retirement is less clear cut.
- One in four seniors aged 65 to 74 and one in ten over the age of 75 received employment income in 2002.
- In 10 years, visible minority seniors will increase from 13 percent to approximately 20 percent of the total seniors' population.
- One in five Internet users in British Columbia is 60 years of age or older, the highest rate in Canada.

Source: BC Stats, A Profile of Seniors in British Columbia, Ministry of Health publication, 2004
## Appendix E. British Columbia Population Forecast-06/12. Table 3: Selected Age Groups

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<thead>
<tr>
<th>Year</th>
<th>0-15 ('000)</th>
<th>15-64 ('000)</th>
<th>15+ ('000)</th>
<th>25-44 ('000)</th>
<th>45-64 ('000)</th>
<th>65+ ('000)</th>
<th>80+ ('000)</th>
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<td>521.6</td>
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<td>3,418.7</td>
<td>4,469.3</td>
<td>1,442.4</td>
<td>1,459.9</td>
<td>1,050.6</td>
<td>249.9</td>
<td>5,193.0</td>
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<td>3,427.7</td>
<td>4,515.0</td>
<td>1,449.6</td>
<td>1,461.9</td>
<td>1,087.3</td>
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<td>5,243.0</td>
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<td>2023</td>
<td>463.1</td>
<td>3,437.2</td>
<td>4,560.3</td>
<td>1,453.8</td>
<td>1,465.8</td>
<td>1,123.1</td>
<td>268.1</td>
<td>5,291.5</td>
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<tr>
<td>2024</td>
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<td>3,445.3</td>
<td>4,604.8</td>
<td>1,454.7</td>
<td>1,470.7</td>
<td>1,159.4</td>
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<tr>
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<td>3,453.5</td>
<td>4,648.4</td>
<td>1,452.5</td>
<td>1,477.4</td>
<td>1,194.9</td>
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<tr>
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<td>3,462.3</td>
<td>4,691.5</td>
<td>1,446.7</td>
<td>1,487.1</td>
<td>1,229.3</td>
<td>304.4</td>
<td>5,427.3</td>
</tr>
<tr>
<td>2027</td>
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<td>3,468.3</td>
<td>4,734.1</td>
<td>1,439.5</td>
<td>1,496.0</td>
<td>1,265.8</td>
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<tr>
<td>2028</td>
<td>398.3</td>
<td>3,475.8</td>
<td>4,775.9</td>
<td>1,430.7</td>
<td>1,507.2</td>
<td>1,301.0</td>
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<tr>
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<td>4,816.9</td>
<td>1,422.2</td>
<td>1,521.9</td>
<td>1,329.9</td>
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<td>2030</td>
<td>362.9</td>
<td>3,501.8</td>
<td>4,856.9</td>
<td>1,415.0</td>
<td>1,539.0</td>
<td>1,355.1</td>
<td>368.7</td>
<td>5,588.5</td>
</tr>
</tbody>
</table>

To interpret: On July 1, 2006, there were 521,600 persons aged 0 to 15 in British Columbia.

Appendix F. Lifetime costs of severe to profound hearing loss by component

<table>
<thead>
<tr>
<th>Component</th>
<th>Pre-lingual (0-2)</th>
<th>Pre-vocational (3-17)</th>
<th>Early working age (18-44)</th>
<th>Older working age (45-64)</th>
<th>Elderly (65+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost productivity</td>
<td>$433,400</td>
<td>$444,300</td>
<td>$382,900</td>
<td>$220,300</td>
<td>$24,600</td>
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<tr>
<td>Special education</td>
<td>$504,900</td>
<td>$401,000</td>
<td>$20,200</td>
<td>-</td>
<td>-</td>
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<td>Vocational education</td>
<td>$11,500</td>
<td>$12,600</td>
<td>$6,700</td>
<td>$1,800</td>
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<tr>
<td>Medical costs</td>
<td>$70,200</td>
<td>$61,100</td>
<td>$43,200</td>
<td>$30,900</td>
<td>$18,400</td>
</tr>
<tr>
<td>Total</td>
<td>$1,020,000</td>
<td>$919,000</td>
<td>$453,000</td>
<td>$253,000</td>
<td>$43,000</td>
</tr>
</tbody>
</table>

Accessing Hearing Aids: March 15, 2007

Hearing aids and some services, such as repairs and battery replacements, may be provided either through the regional health authority or through private suppliers. Wherever possible, recipients must access the regional health authority hearing clinic. In communities where this clinic is not available, recipients should be referred by their medical practitioner to the audiology department of the nearest hospital providing this service. If health authority hearing aid services are unavailable, the recipient may access a local hearing aid supplier who is a certified audiologist or a registrant of the Board of Hearing Aid Dealers and Consultants. Recipients do not require a referral from their medical practitioner to obtain hearing services from a private supplier.

Eligibility Criteria: March 15, 2007

Hearing aids and related items are provided only to eligible recipients who lack financial resources to meet the need and for whom failure to provide a hearing aid represents a direct barrier to employment [see Related Links - Health Supplement Summary] when all of the following criteria are met:

- an audiologist or registrant of the Board of Hearing Aid Dealers and Consultants has performed an assessment to confirm the need and prescribes the hearing aid
- the ministry pre-approves the hearing aid (the ministry will not accept payment responsibility for hearing aids purchased without prior approval)
- no other resources available to the person's family unit to pay for the hearing aid

Hearing aids may be provided to eligible recipients who fit into at least one of the following categories:

- a child
- a hearing impaired parent of a dependent child
- a recipient involved in ministry-approved training or who, in the opinion of the Supervisor, requires an aid to obtain employment and where failure to provide represents a direct barrier to employment
- a recipient who is both registered with the Canadian National Institute for the Blind (CNIB) and is hearing impaired
- a person with a hearing impairment who is the sole homemaking support for an adult who is mentally challenged

Specialized Hearing Aids: March 15, 2007

Employment and Assistance Workers (EAWs) may issue for regular bilateral (two) hearing aids.

Requests for specialized hearing aids (i.e. Bone Anchored Hearing Aids (BAHA) or cochlear implants) must be approved by Health Assistance Branch.

Source: Ministry of Employment and Income Assistant (BC), online resource home, http://www.gov.bc.ca/bvprd/bc/
REFERENCE LIST


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