

Université de Montréal

**Factors that influence the use of hearing assistance
technology
by older adults who have a hearing loss**

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Université de Montréal
Faculté des études supérieures

Ce mémoire de maîtrise intitulé:

**Factors that influence the use of hearing assistance technology
by older adults who have a hearing loss**

présenté par:
Kenneth Southall

a été évalué par un jury composé des personnes suivantes:

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Résumé

L'objectif de cette recherche était de décrire et de comprendre les facteurs influençant l'utilisation des aides de suppléance à l'audition (autres que les prothèses auditives) chez les personnes âgées ayant une déficience auditive. Les résultats suggèrent qu'il y a quatre jalons dans l'utilisation des aides de suppléance à l'audition: la reconnaissance que les problèmes auditifs compromettent la participation à des activités importantes, la conscience que des solutions technologiques existent, la consultation d'un professionnel / l'acquisition des appareils, et l'adaptation à l'utilisation des aides de suppléance à l'audition et au comportement modifié. Ces jalons semblent être des étapes cruciales où les gens peuvent se diriger vers une utilisation réussie des aides de suppléance à l'audition ou peuvent être découragés de l'utilisation des aides de suppléance à l'audition. Sur la base de ces résultats, on propose un modèle axé sur l'acquisition et l'utilisation des aides de suppléance à l'audition.

Le mémoire a été écrit sous forme d'un article. L'introduction présente une revue de la littérature détaillée sur laquelle s'appuie cette recherche. Cette section fournira également une discussion de fond sur la perte d'audition relative à l'âge, comment des aides technologiques sont intégrées dans un programme audiolgique typique de réadaptation, et un examen des diverses aides de suppléance à l'audition qui existent pour les personnes qui ont une perte d'audition. L'introduction sera suivie de l'article comme tel. L'article est suivi d'une discussion élargie.

Mots clés: personnes âgées, déficience auditive, aides de suppléance à l'audition

Summary

The objective of this study was to describe and better understand the factors that influence the use of hearing assistance technology (other than hearing aids) by older adults who have a hearing impairment. The results suggest that there are four landmarks of hearing assistance technology use: recognition that hearing difficulties compromise participation in valued activities, awareness that technological solutions exist, professional consultation / acquisition of the devices, and adapting to use of device and to modified behaviour. These landmarks seem to be crucial stages when people may either move toward successful hearing assistance technology use or may be discouraged away from hearing assistance technology use. Based on these results, a representative model of hearing assistance technology awareness, acquisition and utilization is proposed.

This thesis has been written in the form of an article. The introduction to the thesis will review the literature important to the research topic. This section will also provide a background discussion on age-related hearing loss, how technological devices fit into a typical audiological rehabilitation program, and an examination of the various assistive devices that exist for persons who have a hearing loss. The introduction will be followed by the article per se. A comprehensive discussion follows the article.

Keywords: older adults, hearing loss, hearing assistance technology

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List of abbreviations

HAT: Hearing Assistance Technology

CHIP : Communicaid for Hearing Impaired Persons

HBM : Health Belief Model



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Chapter 1. Introduction

This section will review the literature relevant to the use of hearing assistance technology (HAT) by older adults who have a hearing loss. The chapter opens with a brief description of age-related hearing loss. This is followed by a description of the psychosocial consequences of age-related hearing loss. In a section that describes a typical audiological rehabilitation program, emphasis is placed on the role that assistive technologies play in the audiological rehabilitation. This is followed by a description of the salient factors that influence HAT use.

Age-related hearing loss

Numerous age-related changes to the peripheral and central auditory pathways contribute to the more global diagnosis of presbycusis. A complete description of these changes may be found in the work of Schuknecht & Kirchner (1974). Transformations that occur in the outer and middle ear include the pinna losing some elasticity, the external auditory meatus narrowing, the tympanic membrane stiffening, and the ossicular chain atrophying. In the inner ear, the hair cells and the Organ of Corti are usually atrophied. Age-related changes to the central auditory pathway include fewer neurons, a reduced blood flow, and cortical atrophy. These changes combine to make hearing difficulties a common problem for older adults.

Presbycusis has become an important societal health problem. For older adults, there is a direct relationship between increasing age and an increased

prevalence of hearing loss. In Great Britain, Davis, (1989) reported that 37% of individuals in their sixties and 60% of those in their seventies had a hearing impairment. This trend was also evidenced in the United States in the research of Jerger, Chmiel, Wilson, and Luchi (1995) who found that 24% of individuals between 65 and 74 years of age, and 40% of those over 70 years had some form of presbycusis. Also from the United States, Schoenborn and Marano (1988) reported that 29.5% of individuals over 65 years of age, and 35.4% of individuals over 75 years of age had a hearing impairment. These prevalence rates vary slightly due to the criteria used to define hearing impairment

Psychosocial consequences of hearing difficulties

A hearing loss makes it more difficult for an older adult to function in social settings. These individuals may feel that their hearing-loss is bothersome (Gilhome Herbst, 1983) or that they are missing out on family conversations (Hétu, et al., 1993). These perceptions (accurate or not) may cause tensions, irritations and frustrations in social settings (Hétu, Jones, & Getty, 1993). The social consequences of presbycusis are not limited to the person who has the impairment. Communication partners of individuals who have a hearing impairment often experience frustration caused by repeated efforts to convey messages, and the belief that the person who has the hearing impairment does not value the message enough to try to understand (Hétu, et al., 1993). The transition to a life with a hearing loss can be difficult. Heine and Browning (2002) reported that this period is often accompanied by depression, anxiety, lethargy, and social dissatisfaction. Persons

who have presbycusis tend to be reluctant to acknowledge their problems (Hétu, 1990). The fear of negative consequences may lead these people to conceal the outward signs of a hearing loss. Ross (2000) noted that individuals with age-related hearing loss wait an average of 5 to 7 years before seeking help for their hearing difficulties.

Age-related hearing loss directly impacts a person's ability to fully function in daily activities. Hearing loss has been associated with isolating tendencies (Mulrow, Aguilar, Endicott, Tuley, Velez, Charlip, Rhodes, Hill, & DeNino, 1990; Magilvy, 1985). For older adults, hearing loss is most often associated with loneliness and a tendency toward anxiety and depression (Gilhome Herbst, 1983). Older adults who have a hearing-loss report a lower self-assessment of health, participation in fewer leisure activities per week, the belief that they have fewer friends relative to the past, and they experience less enjoyment (Gilhome Herbst, 1983). These findings suggest that age-related hearing loss may negatively influence quality of life (Mulrow, et al., 1990; Carabellese, Appollonio, & Rozzini, 1993). Given the pervasive nature of age-related hearing loss, an audiological rehabilitation program that addresses the individual and their environment is required. The section that follows will describe a typical rehabilitation of older adults who have a hearing impairment.

Typical audiological rehabilitation

Audiological rehabilitation involves a comprehensive program of hearing health care for persons with handicapping hearing impairments premised on the

assumption that wearing a hearing aid is only a part of the solution to communication problems and their psychosocial manifestations (Trychin, 1995). Montgomery (1991) outlined six components of a comprehensive audiological rehabilitation program: hearing aid fitting and orientation, psychosocial assessment and counselling, auditory-visual integration training, strategies training, consumer organizations, and environmental manipulation training. Communication often occurs in noisy environments that have a deleterious effect upon the perception of speech signals. With or without hearing aids, a hearing assistance technology may be used to circumvent communication problems associated with distance, background noise, and poor room acoustics.

Hearing Assistance Technology

Over the years Audiologists have used a variety of terms to describe assistive technologies (other than hearing aids) used by people who have a hearing loss. The terminology most often used is assistive listening devices. This terminology however is not broad enough to adequately represent all of the devices available to help people who have a hearing loss (Sandridge, 1995). In addition to all of the devices designed to help people hear better, there are also devices that use visual and/or tactile stimulation to help people monitor their acoustic environments. Given that non-auditory modalities of supplementary devices exist, some researchers have sought an alternative terminology to describe this classification of adaptive technologies. Ross (1997) argued that a more representative term for these devices is Hearing Assistance Technology (HAT), as it is less restrictive and categorical than

assistive listening devices. HAT is an appropriate terminology for all devices that produce auditory, visual and tactile signals to aid persons who have a hearing loss. Based on this reasoning, this text will use the term HAT, defined as any technology (other than hearing aids) that encourages effective communication in persons who have a hearing loss. For a thorough overview of the hearing assistance technologies see one of the following reviews by Compton, 2000, Sandridge, 1995, or Stach & Stoner, 1991.

One of the most common complaints from people who have a hearing loss is that they find it difficult to hear in the presence of background noise. The *primary* benefit of HAT is that they transmit sounds from the sound source to the listener in a more direct manner than sound waves (Stach & Stoner 1991). An altered mode of transmission conserves the strength of the (desirable) auditory signal and enhances the likelihood that the signal will arrive at the ear more prominently than (undesirable) background noise. There are typically three components to a HAT: a component to pick-up sound, a component to transmit sound, and an output component. The output component takes the form of an auditory, tactile, or visual stimulation. Given that most HAT use this classic sound pick-up-transmission-output sequence, these varieties of systems will be described first. The HAT that do not use this sequence will be described later.

A HAT may utilize among four different varieties of sound transmission. First, a hard-wired system utilizes a direct wire connection between a user-held microphone/amplification unit and the sound-source. Someone using a hard-wired system will typically place the microphone/amplifier unit close to the sound source

then wear headphones to access the audio signals. A personal listening device is a good example of a hard-wired set-up that makes sound signals more accessible for the user. Another example of hard-wired device is a telephone amplifier. These are small units that are connected between the base of the telephone and the telephone handset. Hardwired devices typically provide good sound quality at a reasonable price. A disadvantage of this technology is that users are limited in their mobility due to the fact that the person is normally holding a handheld device that is connected to a stationary object.

The second mode of transmitting signals is frequency modulation (FM). A FM system is composed of two units. Placed close to the sound source, the microphone/transmitter unit picks up the audio signal, converts it to a radio wave, and sends it to the receiver/amplification unit. The receiver demodulates and amplifies the signal making it more accessible for the user. This technology may be used as a contained system for two individuals (for example, a teacher instructing a student in a classroom) or as a group listening system. The FM system's altered mode of transmission will typically give a better sound quality than a hardwired system. Naturally, FM systems are more expensive to purchase than a hardwired system.

The third variety of transmission is an induction loop system. This kind of system uses a simple wire that is connected to an amplifier/receiver. The wire is run around an area to form of a circle or loop. As auditory signals pass through this wire, a magnetic field is created. When a hearing aid (that is within this loop) is set to the "T" position, a telephone coil in their hearing aid is activated. Through magnetic

induction, the signal in the wire loop passes to the telephone coil in the hearing aid, making the signal accessible to the user. This technology can be used in a variety of ways. The neck-loop is a versatile accessory used with many HAT. This loop of wire is worn around the neck of the user, and plugs into various HAT receivers. Portable magnetic induction loops are also available for installation in a small areas (for example, around a couch to aid in television viewing or stereo listening) or in larger areas for group listening purposes.

Finally, the fourth mode to transmit auditory signals is infrared technology. For infrared systems, a microphone captures the desired sound signal, and passes it through a hardwired connection to a transmitter. The transmitter receives the audio signal, converts it to infrared light, and relays the signal to listeners who are wearing a receiver. The receiver captures the light signal and converts it back to a sound-wave. Television systems often utilize infrared technology to make auditory signals more accessible for persons who have a hearing loss. Similar to FM systems, infrared technology may be used as a contained system for two individuals or as a group listening system.

Alerting devices and special telephones are among the HAT that often do not use the sound pick-up–transmission–output sequence. Alerting devices provide a visual or tactile stimulation for a person who has a hearing loss. This altered mode of stimulation makes it easier for people who have a hearing loss to access environmental stimuli. Adapted alarm clocks flash a light or vibrate a mattress to give notification. In a similar way, doorbells, smoke detectors and telephones may be adapted so that people with a hearing loss may better monitor their environment. A

number of devices are available for the telephone. First, several companies manufacture adapted telephones for people who have a hearing loss. Adapted telephones have been modified in several ways. First, these phones ring louder than traditional telephones and flash lights to indicate that the phone is ringing. Second, the telephone's base unit normally has an adjustable volume and tone control so that the user can set the phone to a comfortable listening level. A third adaptation that can be made to traditional telephones is ID calling. This adaptation allows the person who is receiving a call to have a visual display of the name and number of the caller. Although this service is also available to people who have normal hearing, this device may be considered a HAT, as it is helpful for people who have a hearing loss to know the identity of the caller before picking up the handset. The name and number of the caller provides the person who is hearing impaired with valuable clues concerning the purpose of the phone call. Finally, other telephone devices (teletypewriters (TTY), voice carry over, hearing carry over, and telecommunication relay services) exist for persons who have more profound hearing losses. As these are designed for persons who do not meet the inclusion criterion for this study, they will not be discussed here.

In Québec, the Régie de l'assurance maladie du Québec (RAMQ) provides a variety of services to Québec residents who have a hearing loss if they meet the program specifications. To obtain any hearing device (hearing aid or HAT), first, the individual needs to consult an Ear, Nose and Throat doctor (ENT) to obtain a medical certificate that indicates that the person has a permanent hearing loss. Second, the individual needs to consult an Audiologist to evaluate the degree of their

hearing loss, and provide him or her with an audiogram. If need be, the Audiologist will provide a letter that indicates that the person needs a hearing device. Finally, if the person requires a hearing aid, he or she will consult with a hearing aid acoustician (and provide this professional with all of these documents). If the person needs a HAT he or she will consult a HAT distributor. Older adults who have a hearing loss of 35 dB HL or greater (across .5, 1, 2 and 4 kHz) in their better ear are eligible to acquire one analog hearing aid. Older adults who have a hearing loss of 55 dB HL or greater (across .5, 1 and 2 kHz) in their better ear are eligible to acquire an adapted telephone, an adapted alarm clock, an adapted system to watch television, and an environmental control system.

Although there is evidence to suggest that older adults who have hearing difficulties would benefit by using HAT, the utilization rates of these technologies remains low. Among 3000 hearing instrument owners surveyed by Kochkin (2002), approximately one quarter of the participants used amplification for the telephone, and between 1-7% used other kinds of HAT. Tomita, Mann and Welch (2001) observed that just 12 of 227 (5.3%) older adults who had a hearing impairment used assistive devices other than hearing aids. In Canada, it was estimated that only 17% of adults who had a hearing impairment and lived independently used assistive devices other than hearing aids (Statistics Canada, 1992). In Québec, Institut de la Statistique du Québec (1998) estimated that a comparable 15% of older adults who had a disability caused by a hearing loss used hearing instruments other than hearing aids. In order to design appropriate intervention programs for this population, it is essential to better understand the factors that influence the use of HAT.

Factors that influence the use of hearing assistance technology

The use of any technological device by humans is a complex affair. A device that serves one person well may be ill suited for another person. Other health service disciplines have produced theoretical models to consider the factors that influence the use and non-use of assistive technologies. The following section will describe one such model.

Scherer (1996) provided a representation of technology use in relation to disability. According to her model, each individual who has a disability may experience physical, psychological, and/or psychosocial consequences that are directly or indirectly attributable to their impairment. Scherer suggests that these consequences help to create this person's perception of "rehabilitation success", "quality of life", and "person with disability experience". These three factors, in turn influence the person, their environment, and their assistive technologies choices.

"Rehabilitation success" was described as a professional goal that "... emphasizes the strengthening of physical, mental, social, educational, and vocational capabilities and opportunities within the shortest possible time." (Scherer, 1996, p. 67). The ultimate goal or rehabilitation is improved well-being. "Success" is a subjective evaluation based on the aspirations of the individual.

"Quality of life" is influenced by numerous factors. Quality of life may be evaluated by demographics, social factors, ability to work, and functional health.

Subjective considerations contribute to the perception of quality of life. Given all of the factors that influence quality of life, Scherer suggests that it is unique to each person and highly individualized.

The final construct at this level is the “person with disability experience” (PWD). Scherer (1996) suggested that this is the sum total of the unique experiences of each individual living in society with their specific disability. This construct is a two-way personal and societal construct. That is to say, the individual who has the disability influences society, and the society influences the individual.

To recapitulate, a person who has a disability may experience consequences that are directly or indirectly attributable to their impairment. These consequences shape their perception of rehabilitation success, quality of life, and person with disability experience. All of these considerations influence the person, their environment and the choices that he or she will make about assistive technology use or non-use. Accordingly, for the review of factors that influence the use of HAT that follows, the factors are divided into personal, environmental, and technological factors.

An extensive literature review revealed a myriad of factors that influence the use / non-use of HAT. Personal factors influence older adult use of HAT. The use of hearing technologies is influenced by the perceived seriousness of the hearing impairment (Griffing, 1992; Kochkin, 2002). For example, if a person does not think that the extent of their hearing loss is serious, it is less likely that they are going to purchase a device to help themselves. However, a person who believes that their

hearing loss is serious, is more likely to seek help and use a device. An older adult is more likely to use adaptive technologies if they have accepted that they have a hearing loss (Jerram & Purdy, 2001; Ross, 2000). Secondary health issues such as reduced fine-motor control and visual capacity decrease the use of assistive technologies (Brooks and Hallam, 1998; Fino et al., 1992; Kochkin, 2000; Brooks, 1989; Mann, Hurren, Tomita and Charvat, 1995). The emotions of older adults may also influence the use of HAT. Mann et al., (1996) found that 10% of a group of older adults who were having difficulties communicating on the telephone chose not to use an amplifier out of fear. Also, there is evidence to suggest that success with amplification may be influenced by confidence (Gatehouse, 1991) and self-esteem (Gleitman et al., 1993). Physical appearances may be a consideration for older adults when they are considering use of HAT. Ross (2000) has suggested that a perceived association with aging decreases utilization rates of adaptive technologies. Griffing (1992) noted that a barrier to the use of hearing instruments is the perception that they make the person look old and handicapped. A desire to maintain social contacts motivates HAT use (Mann, Tomita, Packard, Hurren, & Creswell, 1994). Some older adults tend to be resistant to change. Ross (2000) suggested that the challenge of learning how to use a new technology presents a barrier to HAT use.

Environmental factors influence older adult use of HAT. Pressure from family members was found to be the most important factor in the help-seeking tendencies of older adults who have hearing difficulties (Mahoney, Stephens, & Cadge, 1996). For example, based on the complaints of family members that they listen to the television too loudly, a person who has a hearing loss may choose to go

to see an Audiologist. People who have a hearing loss also experience pressure from society in general. Some behaviours of people who have hearing difficulties (i.e., asking for repetitions or speaking too loudly) break societal communication norms. Ironically, the utilization of hearing aids and other body worn technologies also break societal norms by indicating age-related impairments (Hétu, Jones, and Getty, 1993). Consequently, stigma is a barrier to HAT use (Mann et al., 1994). The utilization of HAT is influenced by hearing health professionals. Several authors report that there is a general lack of knowledge about hearing instruments other than hearing aids. Fino, Bess, Lichtenstein, and Logan (1992) found that just 14% of older adults who consulted for hearing difficulties received information on technologies other than hearing aids. Likewise, Stika, Ross and Ceuvas (2002) reported that less than one third of 942 hearing aid users claimed to have received information on HAT. Although accessibility to supplementary hearing instruments seems to be a vital factor toward their successful utilization, people who have a hearing loss may not be fully informed about the existence of HAT (Ross, 2000).

Technological factors influence older adult use of HAT. Commonly cited reasons for non-use of hearing aids include lack of comfort, unwanted sounds (examples whistling or buzzing), and amplified noise (Brooks & Hallam, 1998; Kochkin, 2000; Mann & Tomita, 1998; Griffing, 1992). The physical size of a HAT may influence use. Dovidio, Major and Crocker (2000) found that the visibility of hearing aids made communication partners become anxious. Similarly, Johnson (1982) reported that larger hearing aids resulted in increased negative bias by non-hearing aid users. It is reasonable to assume that similar reactions may occur when

people use HAT, given that these technologies are typically larger than hearing aids. The extent to which an individual is at ease with the device influences utilization. Jerger, Chmiel, Florin, Pirozzolo and Wilson, (1996) found that devices that are difficult to manipulate are less likely to be used, even if they have proved beneficial. Simplicity of use is an important determinant of utilization rate (Lesner, 2003). Although some government programs provide financial assistance to acquire HAT, the monetary cost of devices remains a barrier for many older adults (Ross, 2000; Mann & Tomita, 1998; Griffing, 1992). Among all adaptive technologies, hearing aids have the highest rates of dissatisfaction reported by users (Mann et al., 1994). Kochkin, (1998) observed that the decision to purchase a hearing aid is influenced by (among other things) a combination of deteriorations in hearing and lifestyle needs. For hearing aids that have already been purchased, the five most important reasons for not using hearing aids were poor benefit, background noise, poor comfort, negative side-effects, and the cost of the devices (Kochkin, 2000). Negative opinions toward hearing aids may spill over to have a detrimental influence on the utilization rates of HAT by older adults. That is to say, negative experiences in the utilization of hearing aids may act as a barrier to the utilization of hearing assistance technologies.

Other health disciplines have investigated the factors that affect older adult use of assistive technologies. Gitlin (1995) observed that older adults would accept assistive devices that make tasks easier, that were comfortable, that provided emotional security, that improved function, and that enhanced independence. Older adults would reject assistive devices that they did not understand how to use, that

embarrassed them, that did not work, or that were contingent upon the use of another device. Hastings Kraskowsky and Finlayson (2001) advised that assistive technology training is necessary for older adults, and that professionals need to do home visits to ensure proper installation and use.

The present research

This literature review has demonstrated that there are a multitude of factors that influence the utilization of hearing instruments by older adults who have a hearing loss. There are numerous personal, environmental, and technological factors that may be taken into consideration by a perspective assistive technology user. Given that all people are unique, one can reasonably assume that the factors that influence a person's use of hearing instruments will be different for each person. A good proportion of the research from this literature review came from studies primarily interested in the factors that influence the use of hearing aids. While assuming that the factors that influence the use of hearing aids are similar to those that influence the use of HAT may be appropriate for some devices, it is not appropriate for HAT devices in general. There are some important differences between hearing aids and HAT. The most important difference is that while a hearing aid is designed for general use in most life activities, most HAT are designed for specific activities. Based on this fundamental difference, one cannot reasonably assume that the factors that influence HAT use are the same as those that influence hearing aid use. Rather, it is reasonable to assume that the factors that influence the use of HAT may be different than those for hearing aids, and unique to each person.

It is therefore necessary to adopt an exploratory approach to gain basic understanding of this phenomenon.

In considering assistive technology utilization, the opinions of the individuals who have a hearing loss has been a vital piece of the puzzle that has been missing in Audiological research. Very few qualitative studies have been carried out in Audiology (Carson, 2000). This has been an important absence in an indefinable “communication” discipline. One of the main strengths of qualitative designs is that they help us understand the relationship that individuals have with their surroundings (Denzin & Lincoln, 2000). Further, in-depth interviews help to identify the *range* of factors for any given phenomenon. A qualitative research design is an appropriate exploratory approach to investigate the factors that influence assistive technology utilization (Hastings Kraskowsky & Finlayson, 2001). We sought an in-depth account of the perspectives of persons contemplating this behaviour change. The objective of this study was to describe and better understand the factors that influence auxiliary aid use by older adults who have a hearing impairment.

Chapter 2. Article

(Manuscript submitted for publication in
the International Journal of Audiology).

Factors that influence the use of hearing assistance technology by older adults who have a hearing loss.

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List of Abbreviations :

HAT: Hearing Assistance Technology

CHIP : Communicaid for Hearing Impaired Persons

Abstract

The purpose of this study was to describe and better understand the factors that influence the use of hearing assistance technology by older adults. We were interested in adopting a methodological approach that would provide an in-depth account of individual experiences related to hearing assistance technology use. A qualitative research design was therefore selected. Audio-recorded interviews were conducted with 10 individuals 65 years of age or older, who were current successful users of hearing assistance technology. Thematic analysis was used to draw meaning from the interview transcripts. The results suggest that successful use of hearing assistance technology involves four landmarks: recognition of hearing difficulties, awareness that technological solutions exist, consultation / acquisition of devices, and adapting to device use and modified behaviour. These landmarks seem to be crucial stages when people either move toward successful hearing assistance technology use or are discouraged from hearing assistance technology use. Based on these results, a representative model of hearing assistance technology awareness, acquisition and utilization is proposed.

Technology offers older adults who have a hearing loss the opportunity to maintain participation in some activities of daily living. There is evidence that suggests that hearing assistance technology enhances the general health status of older adults who have a hearing loss (Jerger et al., 1996). Nonetheless, at the present time in North America hearing assistance technologies remain under-utilized (Ross, 1997). We interviewed older adults who had a hearing loss and were successful users of hearing assistance technology with the goal of describing and gaining a better understanding of the factors that influence the use of hearing assistance technology.

The terminology most often used to describe assistive technologies (other than hearing aids) for people who have a hearing loss is assistive listening devices. This terminology is used frequently to describe devices that help people hear better and other devices that use visual and/or tactile stimulation to help people monitor their acoustic environments. Sandridge (1995) argued that the term assistive listening devices was not broad enough to adequately represent all of the devices available to help people who have a hearing loss. Ross (1997) proposed that a more representative term for these devices is Hearing Assistance Technology (HAT), as it is less restrictive and categorical than assistive listening devices. HAT is an appropriate terminology for all devices that produce auditory, visual and tactile signals to aid persons who have a hearing loss. Based on this reasoning, we chose to use the term HAT for the purposes of this study. We defined HAT as any technology (other than hearing aids) that facilitates communication for persons who have a hearing loss.

Age-related hearing loss has become an important societal health problem. For older adults, there is a direct relationship between increasing age and an increased prevalence of hearing loss. In Great Britain, Davis (1989) reported that 37% of individuals in their sixties and 60% of those in their seventies had a hearing impairment. This trend was also evidenced in the United States in the research of Jerger et al. (1995) who found that 24% of individuals between 65 and 74 years of age, and 40% of those over 70 years had some form of presbycusis.

Age-related hearing loss can have a detrimental influence on a person's ability to function in their daily activities (Weinstein, 2000). Hearing loss has been associated with tensions, irritations and frustrations in social settings (Hétu et al., 1993) and isolating tendencies (Magilvy, 1985; Mulrow et al., 1990). For older adults, hearing loss is most often associated with loneliness and a tendency toward anxiety and depression (Gilhome Herbst, 1983). These individuals also tend to report a lower self-assessment of health, participation in fewer leisure activities per week, the belief that they have fewer friends relative to the past, and that they experience less enjoyment (Gilhome Herbst, 1983). Investigators have reported that age-related hearing loss may negatively influence quality of life (Carabellese et al., 1993; Mulrow et al., 1990).

There is some evidence to suggest that there is limited use of HAT by older adults who have a hearing loss. Among 3000 hearing instrument owners surveyed by

Kochkin (2002), only one quarter of the participants used HAT for telephone use. Just 10% of those surveyed used HAT to help listen to the television, at the movies, or at places of worship. Finally, Kochkin estimated that only 1-7% of the individuals surveyed used other kinds of HAT. Tomita et al. (2002) observed that among a sample of 227 older adults who had a hearing impairment, just 12 older adults (5.3%) used HAT other than hearing aids. In Canada, it was estimated that only 17.4% of adults who have hearing impairments and reside independently in their own households use technical aids other than hearing aids (Statistics Canada, 1992). In Québec, *L'Institut de la Statistique du Québec* (1998) estimated that a comparable 15% of older adults who had a hearing loss used HAT. In order to address the needs of this population it is essential to understand the factors that influence these health behaviours.

Factors that influence HAT use

A review of the literature revealed a myriad of factors that influence the use or the non-use of HAT. Pressure from family members was found to be the most important factor in the help-seeking tendencies of older adults who have hearing difficulties (Mahoney et al., 1996). A desire to maintain social contacts motivates the use of hearing aids and HAT (Mann et al., 1994). In addition to social pressures from family and friends, societal pressures may also act as barriers to HAT use. Ross (2000) suggested that a perceived association with aging decreases the utilization rate of adaptive technologies. The visibility of hearing aids made communication partners become anxious (Dovidio et al., 2000). Similarly, Johnson et al. (1982)

reported that larger hearing aids resulted in increased negative bias by non-hearing aid users. It is reasonable to assume that similar reactions may occur when people use HAT, given that these technologies are typically physically larger than hearing aids. Further, Mann et al., (1994) found that stigma is a barrier to HAT use. Griffing (1992) noted that a barrier to the use of all audiological technologies is the perception that they make a person look old and handicapped. Collectively, these findings suggest that physical appearance and the opinions of other people may be important considerations for older adults who are seeking help for their hearing difficulties.

The use of a HAT may be influenced by an individual's perception of their hearing loss. An older adult is more likely to use a hearing aid or a HAT if they have accepted that they have a hearing loss (Jerram & Purdy, 2001; Ross, 2000). The use of all audiological technologies is influenced by the perceived seriousness of the hearing impairment (Griffing, 1992; Kochkin, 2002). For example, if a person does not think that their hearing loss is serious, it isn't likely that they are going to seek help. However, if the person thinks that their hearing loss is serious, they may be more likely to seek help and use a device.

Several authors have reported that the clients of hearing health professionals lack sufficient knowledge about hearing instruments other than hearing aids. Fino et al. (1992) found that only 14% of older adults who consulted for hearing difficulties received information on HAT. Likewise, Stika et al. (2002) reported that less than

one third of 942 hearing aid users claimed to receive information on HAT. Although accessibility to supplementary hearing instruments seems to be a vital factor toward their successful utilization, people who have a hearing loss may not be fully informed about the existence of HAT (Ross, 2000).

There is evidence that the personality and psychological traits of a person with a hearing loss may influence his or her ability and willingness to use HAT. Ross (2000) suggested that the challenge of learning how to use a new technology presents a barrier to HAT use. Mann (1995) found that 10% of a group of older adults who were having difficulties communicating on the telephone chose not to use an amplifier out of fear. Further, the successful use of hearing aids may be influenced by confidence (Gatehouse, 1991) and self-esteem (Gleitman et al., 1993).

Previous research has indicated that the unique specifications of each device influence the use and non-use of HAT by older adults. Commonly cited reasons for the non-use of hearing aids include lack of physical comfort, amplified noise and unwanted sounds (Brooks & Hallam, 1998; Griffing, 1992; Kochkin, 2000; Mann & Tomita, 1998). Lesner (2003) found that devices that are simple to use are better for older adults. Audiological devices that are difficult to manipulate tend not to be used, even if they have proved beneficial (Jerger, et al., 1996). Collectively, these studies indicate that there are personal factors that influence the use of a device. A factor that is important to one person may not be important to another person.

Across all disabilities and among all adaptive technologies, hearing aids have the highest rates of dissatisfaction reported by users (Mann, et al., 1994). Kochkin, (1998) observed that the decision to purchase a hearing aid is influenced by a combination of deteriorations in hearing and lifestyle needs. Among hearing aids that have already been purchased, Kochkin (2000) identified the five most important reasons for not using hearing aids. They are: 1) poor benefit; 2) background noise; 3) poor comfort; 4) negative side effects; and 5) the cost of the devices. Some of these negative opinions toward hearing aids may spill over to have a detrimental influence on the utilization rates of HAT by older adults.

The existence of secondary health concerns also influences the use of HAT. Several studies have found that reduced fine-motor control or impaired visual capacity decreases the use of hearing aids and HAT (Brooks & Hallam, 1998; Brooks, 1989; Fino et al., 1992; Kochkin, 2000; Mann et al., 1995). Although third party providers (i.e. government agencies and insurance companies) defer the cost of some devices, cost remains a barrier for many older adults (Griffing, 1992; Mann & Tomita, 1998; Ross, 2000). Popelka et al. (1998) proposed that in order to design more effective intervention programs, it is essential to better understand the factors that influence adaptive technology use.

The present research

A review of the literature indicated that there are a multitude of factors that influence the utilization of HAT and hearing aids by older adults who have a hearing loss. The

use of all hearing technologies may be influenced by psychological, emotional, social, and cultural factors. Given that each person is unique, one can reasonably assume that the factors that influence the use of hearing instruments will be different across individuals. Many of the factors identified as potentially having an effect on the use or non-use of HAT were actually drawn from studies that investigated elements that either facilitated or served as an obstacle to the use of hearing aids. While assuming that the factors that influence the use of hearing aids are similar to those that influence HAT may be appropriate for some devices, it is not appropriate for other devices. One cannot necessarily assume that the factors that influence the use of hearing aids are the same as those that influence the use of HAT, because hearing aids are designed for general-purpose use and most HAT are designed for specific activities. Rather, it is reasonable to assume that the factors that influence the use of hearing aids may be different than those for HAT, and unique to each person. Given this fundamental difference between hearing aids and HAT, and the relative lacunae of research into the factors that influence HAT use, it was necessary to adopt a research design that is exploratory in nature. Qualitative research designs are appropriate for exploratory investigations, and are appropriate to examine the factors that influence assistive technology utilization (Hastings Kraskowsky & Finlayson, 2001).

Despite reports that HAT provides benefits to older adults who have a hearing loss, the use of these technologies remains low. HAT use by older adults has remained a research topic that has been investigated all too infrequently. Although different

approaches could be used to investigate this phenomenon, we opted to identify the factors perceived by persons who are current successful HAT users given that a complete examination of this subject would extend beyond the time allotted for a Master's degree. The goal of this investigation was to describe and better understand the factors that influence HAT use by older adults who have a hearing impairment.

Methodology

A convenience sample was chosen from the Communicaid for Hearing Impaired Persons (CHIP) membership list. CHIP is a non-profit community organization located in Montréal, Québec (Canada). For more than 25 years CHIP has provided programs and services to persons who have a hearing loss. Convenience sampling was appropriate given the exploratory nature of the study. From the CHIP membership list the names of 30 people thought to fit the inclusion criteria were selected. These people were mailed a letter that described the research project. This package included a response form and a self-addressed stamped envelope. We sought individuals who: were 65 years of age or older, had an average hearing loss of at least 35dB HL (at .5, 1, 2 and 4 kHz) in their better ear as evaluated by a licensed Audiologist (this criteria was chosen to match RAMQ hearing aid eligibility stipulations), were intellectually capable of engaging in a conversation, were current users of a hearing assistance technology, lived at home, and spoke English.

Of the 20 persons contacted, 12 persons indicated an interest to participate in the study. Two of these individuals were not included in the study. One individual chose

not to participate because she had only recently purchased her devices, and did not think she had firm opinions on the use of HAT. A second person misunderstood that the study sought current HAT users. This person did not meet the selection criteria.

As summarized in Table 1, the participants were four males and six females ranging in age from 73 to 92 (average = 81.3). Two participants had a severe hearing loss, four had a moderately severe hearing loss and four had a moderate hearing loss. All of the participants were hearing aid users (an average of 15 years). The participants were owners of a variety of HAT (average of approximately 3 devices per participant) for an average of 7 years. The majority of participants lived with a

Insert Table 1 about here

spouse or partner. One of the participants shared their living space with an adult child. Two of the participants lived alone. Five of the participants lived in a traditional house, while the other five participants lived in an apartment or condominium. The participants were very active both in their personal lives and in service to their community. Eight participants were volunteers for hospitals or community organizations. As a group they were open to discussing personal matters related to their hearing loss, seemed to understand some of the consequences of their hearing loss, and had the perspective required to identify hearing related needs to maintain daily functioning.

The interviews probed the experiences and factors related to the use of HAT. Investigators have reported that the Health Belief Model is an appropriate theoretical model to use for individuals who have a hearing loss and are considering the use of assistive technologies (van den Brink et al., 1996; Weinstein, 2000). The Health Belief Model (Janz & Becker, 1984) proposes that health related behaviours are dependent upon the value a person attributes to an outcome, and the belief that a behaviour will produce this outcome. Health related behaviours are determined by perceived threats of health related conditions, perceived benefits / barriers associated with engaging in a behaviour, and the belief that one is capable of successfully following a health professional's recommendations or self-efficacy. Van den Brink (1996) adapted the Health Belief Model to consider the help-seeking behaviours of older adults and their use of hearing aids. Inspired by the research reported by van den Brink (1996), a number of general interview questions were prepared (see Appendix 1). Given that the interviews were semi-structured in nature, these introductory questions were designed to open up lines of interest. Based on the interviewee's responses, follow-up questions related to the factors of use / non-use of HAT were posed. For example, an introductory question for the perceived threat of the health condition "How has your hearing loss impacted your life?". An introductory question for the benefits and barriers of device use was, "How would you describe this device to a friend?". The interviews were audio-recorded using a Marantz Cassette Recorder (PMD101). The first author who is experienced in counselling older adults in HAT use conducted all of the interviews. The interviews

were conducted in the participant's home. Prior to the interviews all participants read a consent form and were given as much time as was needed to ask questions about the study and their rights. The interviews were informal in nature and proceeded in a conversational manner. The consultations continued until both investigator and participant were confident that everything about the factors that influence HAT use was discussed. The length of the interviews ranged from 70 to 90 minutes. During the interviews the investigator kept a journal noting factual aspects of the interview (ex. "telephone call interrupted interview") and subjective interpretations (ex. "this passage seemed to be emotional for the interviewee"). These notes added a contextual account to the interview transcripts, and allowed for a more in-depth analysis.

To prepare the material for data analysis, verbatim transcriptions were prepared using a SONY Dictator/Transcriber (Model BI-85). These files were transferred onto Atlas-ti 5.0 (Atlas-ti 5.0, 2004) for coding and analysis. Atlas-ti is a software program designed for the analysis of large bodies of textual material. This program allows for a systematic selection, extraction, comparison, and reintegration of meaningful pieces of text. The following section describes the coding scheme that was devised to code the interviews.

To extract meaning from the documents of text we used thematic analysis (Boyatkis, 1998). First, interview transcript files were reduced in length by creating interview summaries. This procedure permitted the identification of interview themes to be

more manageable. Next, using the extracted themes from each interview, a coding schema was prepared. The code was applied to the full-text interview transcripts. The reliability of this schema was tested with the help of an investigator (who is knowledgeable in Audiological rehabilitation and qualitative methodologies) from outside the research unit. The external coder and the primary investigator each coded 10 pages of a randomly chosen interview transcript. The reliability of the coding schema was evaluated by calculating the number of similarly coded phrases divided by the number dissimilarly coded phrases plus the number of those similarly coded. A score of 0.8 was deemed acceptable (van der Maren, 1996). The reliability score of the first coding schema was 0.7. Alterations were made, and the reliability score of the second modified coding schema was 0.8. Having achieved the acceptable reliability score, the rest of the transcripts were analyzed using the second coding system.

Results

This section will present the coding schema and the results. Although the participants were asked to discuss the factors that facilitated HAT use, all participants also openly discussed factors that were barriers to HAT use. The barriers that were mentioned were coded for data analysis.

Coding

Codes were identified after the original transcripts were reduced to summaries. The code frequency by interview is presented in Table 2. Presented along the left vertical

axis are the codes that have been divided into the general categories, “barriers” and “facilitators”. Presented along the top horizontal axis are the participants (S1 – S10) that appear in the order in which they were interviewed. Each code is broken down by number of occurrences per interviewee, and total number of occurrences for all interviewees. Based on the content analysis summarized in Table 2, the data was further divided into five categories of factors that influence the use of HAT by older adults who have a hearing loss: Prompters, Accessibility, Attitudes, Technology, and Expected benefits / Actual impacts. Each of these categories is described below. In general, a facilitator was defined as something that made the use of HAT easier. A barrier was defined as something that made the use of HAT more difficult. The quotations are cited by interview, page in Word document, and line in Atlas-ti transcript.

Insert Table 2 about here

Prompters

The participants stated that certain key issues initiated help-seeking to limit their hearing difficulties. These factors, referred to as Prompters are presented in Table 3. The participants identified several facilitators that prompted the use of HAT. Most participants cited the severity of their hearing difficulties as one of the important facilitators that prompted them into action. “You come to that point when your hearing gets bad enough that you really feel you don't function well.” (S4, Page11, line 517) All of the participants spoke of a need to resolve the problems in their daily

lives prompting them into action. “So over the years I have had many different aids and many different problems.” (S8, page1, line 26) This need to resolve hearing related problems was identified as a strong facilitator. Some of the participants identified specific needs to be resolved. Valued leisure activities put in jeopardy served as a powerful prompter. “In the theatre, I don't hear very well at all. I don't know which theatres are... I know that the infrared at the Saidye Bronfman [author' note: a local theatre company] is good. At the Centaur [author' note: a different local theatre company], I don't know whether there has been an improvement. Because of that we stopped going a few years ago.” (S8, page 4, line 146) Similarly, almost all of the participants expressed that the maintenance of social contacts prompted use of HAT. “I mean I can't live in a quiet world, by myself. I have to be able to communicate with people, and they have to be able to communicate with me.” (S8, page 18, line 816) The participants also indicated that there were barriers that prevented them from being prompted into action. For example, most of the participants claimed that other life priorities (contextual life influences) acted as a barrier to acting earlier. “You've got to have the appropriate environment in order to benefit.” (S10, page 20, line 899)

Insert Table 3 about here

Accessibility

The participants spoke of the importance of their awareness and knowledge gathering related to technological devices other than hearing aids. These factors,

referred to as Accessibility factors are listed in Table 4. The participants identified several facilitators and barriers that influenced their accessibility to HAT. The vast majority of the participants spoke of their lack of knowledge that HAT existed as an important barrier to accessibility. “No, I never knew that a thing like that could exist.” (S10, page 4, line 147) “Maybe I am not aware of them.” (S8, page 14, line 636) “I think that there should be more publicity about these things.” (S6, page 18, line 846) Considering their lack of knowledge about HAT, it is not surprising that the participants claimed that a recommendation from a hearing health professional was a powerful facilitator of HAT use. “It is like when you go to a doctor that you really relate to, he was really super good.” (S8, page 9, line 394) Virtually all of the participants stated that monetary costs were a barrier to obtaining HAT. “Because we are aging people, and we have lived on a budget all of our life... and that right to the grave... you are certainly not going to go out and buy this or that. Or if they do it is something worth 30, or 40, or 50 bucks ...price would have been the first question mark.” (S9, page, 17 line 779) When confronted with the high price of an assistive device he was considering, S1 weighed the monetary cost against the severity of his hearing difficulties. “well I will let it go until it gets worse.” (S1, page 5, line 264)

Insert Table 4 about here

Given the general sentiment that these devices are expensive, it is not surprising that some participants spoke of government programs that subsidize the cost of HAT as an important facilitator. “He said, “You qualify for assistive living devices, listening

devices!” I said “really?... Wow!” That was the best news I ever heard.” (S1, page 5, line 220)

Attitudes

The attitudes of the participant’s family and friends, and society in general influenced HAT use. The factors that make up the Attitudes category are presented in Table 5. The participants spoke of several attitudes that facilitated the use of HAT. All of the participants identified that a positive attitude to change can facilitate successful use of HAT. “You know people don’t realize that if you change your attitude, you get a new aptitude.” (S10, page 5, line 221) “But as you get older, something is going to go. You just adjust, accept it, and participate as much as you can, and as well as you can.” (S2, page 4, line 155) The vast majority of the participants spoke of the attitudes of family members and close friends. “I don’t want them having to stop what they are doing to explain something to me again. I guess that comes from my background of being agitated as to repeating everything for my mother.” (S9, page 3, line 104)

On the other hand, many of the participants spoke of some attitudes that may act as barriers to HAT use. The next two quotations are from participants who are users of environmental control systems. In the first quotation S6 implies that confusion related to using the system made her upset, and made her consider not using it. “I was really upset about the lights. I thought I have done the wrong thing. You know. By getting these lights... I would just stand there and really intimidated. “What do I

do? Where do I go? Is it the door, is somebody at the door? Is it the phone? Is it the smoke alarm?" (S6, page 17, line 749) Other participants spoke of fears that acted as a barrier to HAT use. "You know you wake up, "ohh, something has happened." And by the time you have realized what has happened, meaning to say the phone or the door, you are frightened." (S9, page 10, line 423)

Insert Table 5 about here.

Technology

Characteristics of the specific technologies had both positive and negative influences on HAT use. These technological issues are outlined in Table 6. The interviewees spoke of a variety of technological aspects that facilitated HAT use. All of the participants claimed that HAT helped them hear what they want to hear. "Without these devices I wouldn't be able to hear the phone well, or speak to the outside world really more comfortably." (S8, page 20, line 882) The majority of participants suggested that better sound quality facilitates HAT use. "Turn up that speaker phone, and boom. That's not bad. So, you know you hang on to some of the things that sound good." (S1, page 11, line 564) "When I plugged into that thing, I could not believe how well I could hear the enunciation." (S2, page 4, line 180) Many more general comments were made to commend the various technologies. These were coded "general benefits". "The marvellous thing about the lights is they are slow. And they go about 4 times. I mean it is not like (surprising). It is like, "Oh yeah. The phone." And then I come here. Or, "Oh yeah. The door." (S9, page 8, line 341) "It is

simple. And it is not unattractive. And it is just very handy.” (S2, page 19, line 893)

“The infrared has a terrific range. You know, you don’t have to be lined up. I can even go partly out of the room and still hear it”. (S3, page 12, line 595)

Nevertheless, most of the participants referred to shortcomings in the devices that were barriers to HAT use. Many of these comments are related to the inability to hear the surrounding environment when the telecoil of their hearing aid is activated.

“The only drawback is when two people are watching. When I am watching with someone else, I’m excommunicated from there. Nobody. I can’t hear. If she wants to talk to me, she’ll punch me and I’ll take them out and then we’ll talk.” (S1, page 8, line 365)

Most participants spoke of poor benefit as a barrier to HAT use. “When face to face, I am hearing your voice. Without it being bugged around with by a system. In other words, the scratchy noises, and background noise, and static, or what have you.” (S3, page 13, line 636)

Insert Table 6 about here.

Expected benefits and Actual impacts

Expected benefits considered prior to acquisition of devices and actual impacts influenced the use of HAT. Both of these factors are presented in Table 7. The vast majority of participants suggested that the use of HAT facilitated a better quality of life. “Well I go for it. You’ve got to, your quality of life is being eroded, and what ever you can do to make it better. Go for it.” (S2, page 4, line 186) “If there was something that I really, that would make my life easier, there is no question that I would use it.” (S8, page 7, line 311) Likewise, most of the participants suggested

that the use of HAT facilitated a more autonomous life. “This (the environmental control receiver) will tell me that the phone is ringing. So that I can get to the phone. So these are really good. It makes me feel, “oh god, I’m fine”. (S1, page 11, line 526)

The participants also spoke of expected security benefits that facilitated HAT use. “The same with the smoke detector. That’s a god send. Because we are fortunate to have the alarm system that came with the house right next to the bedroom. And boy, it screams bloody murder, but still. It doesn’t do anything downstairs. It has to wait for the smoke to come upstairs, and get to the bedroom. And by that time you have lost half of your house.” (S1, page 14, line 675)

Interestingly, many of the participants spoke of using their newfound HAT knowledge to help other older adults who may be experiencing similar hearing related problems. These participants suggested that this altruistic activity makes them feel good about themselves and may increase the probability that use of the devices will continue. “We arranged this evening because I knew there were a good number of older people who didn’t hear. I talked to them and everything.” (S6, page 12, line 519)

Participants also spoke of some of their actual impacts that acted as barriers to HAT use. The majority of participants spoke of adaptations and effort required for HAT use. One woman spoke of the complications to using the movie theatre system as a strong barrier “Because I am trying to watch the movie, and trying to figure the thing out in the dark, I’ve never really sat down and studied it.” (S2, page 11, line 542)

Another person spoke of technological barriers experienced at church. “When I stood up to sing the hymn I could hear him fine, and I sat down, and he started his sermon and I didn’t catch any

of it. Or I had to strain. So it is just a matter of being in the right place. And I have to find that place.” (S3, page 7, line 313)

Insert Table 7 about here.

Discussion

The analysis of the verbatim transcriptions lead to the identification of five themes of factors. These were: prompters, accessibility, attitudes, technology and expected benefits and actual impacts. The most striking aspect of each of these themes will be discussed in the following section.

The prompters were defined as key events that initiated help-seeking. The participants identified the severity of the hearing problems as one of the most influential prompters of help-seeking. However, for many of the participants social or leisure handicaps lead to these realizations. Some participants spoke of not being able to understand at their game of bridge. For other participants the hearing difficulties were when speaking with their grandchildren. Having experienced these contextualized difficulties, the participants seemed to be motivated to find some solutions.

Accessibility was defined as the awareness and knowledge gathering related to technological devices other than hearing aids. The participants spoke of their total

lack of awareness that HAT existed. The participants explained that their hearing health professionals had not told them about these other devices. Many expressed frustration about spending years without all of the devices that could have helped them. However, most of the participants were not going to blame the Audiologists of hearing aid distributors. These professionals, the participants explained do not have enough time to tell their clients about all of the devices.

Attitudes were defined as the opinions of the participant's family and friends, and of society in general. Many of the participants spoke of the roles that family and friends played in this process of acquiring and using HAT. Some participants spoke of the role family and friends played in gaining access to HAT. Family and friends may have purchased a device or passed on knowledge about devices to the participants. Very few participants however, claimed that family and friends persuaded them to use these devices, even after family and friends learned that these devices exist. This is a departure from the current literature about hearing aids. An explanation for this difference may lie in the typical setting of device use. Hearing aids are normally worn at home and in public. Historically, people who have a hearing loss have been reticent to wear a hearing aid in public, because this device is seen by many to be an indication of disability and something that is worn by older people. For this reason, family and friends may need to persuade the hearing aid user into using the device in public. On the other hand, most HAT are designed for home use. Since the person will be using the device at home, the opinions of

strangers is not a factor, so family and friends do not need to persuade the person to use the device.

Technology referred to the characteristics of the specific technologies that had both positive and negative influences on HAT use. These factors were specific to the person's individual hearing loss and to the individual device. For some participants, the device's capacity to amplify the auditory signal was the most important factor. For other participants, the device's sound quality was the most important factor. The ultimate goal seemed to be comprehension. For other devices where comprehension is not the ultimate goal (ex. wireless doorbells or adapted alarm clocks) the goal was for the adapted device to serve its intended purpose.

Expected benefits and actual impacts referred to the opinions of the participants prior to acquisition of devices and to the actual impacts of the devices. The most striking aspect arising from this theme was the participant's desire to improve their quality of life. Our analysis of the transcripts suggest that the social and leisure handicaps experienced by the participants enabled them to understand that their quality of life could be improved upon. Many participants expected that the successful utilization of HAT may improve their quality of life.

Based on our analyses and interpretation of the results obtained, we propose and describe a series of "landmarks" associated with successful HAT use. This series of landmarks is a chronology of the process that an individual typically goes through,

from the recognition that hearing difficulties compromise the participation in valued activities to adapting to the use of devices and to modified behaviours. This rearrangement of the data facilitated a more in-depth analysis of the data and a greater understanding of the phenomenon. In the discussion that follows a variety of factors that influence a person's progression toward successful HAT use are described. We also discuss how well the proposed series of landmarks supports the existing literature on HAT use by older adults.

Landmarks of HAT use

An analysis of the interviews suggests that the successful use of HAT by older adults who have a hearing loss involves persons going through a series of steps from recognizing hearing difficulties to acquiring and making a successful transition to utilizing the device. A visual representation of this process is provided in Figure 1. Each step will hereafter be referred to as a "landmark". The section that follows will describe this model.

Insert Figure 1 about here.

Provided that a person receives necessary Audiological, emotional and social support, it is proposed that successful HAT use involves four significant landmarks. First, a person will come to recognize hearing difficulties are compromising participation in valued activities. Second, a person will gain awareness that technological solutions exist. Third, a person will consult for and acquire the

device(s). Finally, the person will adapt to using the devices and thus modify their behaviours accordingly. It is proposed that successful HAT users pass through these landmarks in a more or less chronological order.

Recognition that hearing difficulties compromise participation in valued activities

The vast majority of participants reported that they had a hearing loss for years prior to seeking help. Most participants mentioned that participation problems due to the severity of their hearing difficulties inspired help-seeking. This claim reinforces the authors who have observed that the perceived seriousness of the hearing impairment influences the use of adaptive aids (Gitlin, 1995; Kochkin, 1998; Lesner & Kricos, 1991; Ross, 2000). Although degradations in hearing typically occur over an extended period of time, as auditory deficits worsen it becomes more likely that a person will experience difficulties in his or her everyday activities. The majority of participants expressed that family and friends were an important prompter that allowed them to understand that it may be a good idea to seek help for their hearing difficulties. This result reinforces the findings of Mahoney et al. (1996) who observed that pressure from family and friends is the most important factor in the help-seeking tendencies of older adults who have hearing difficulties.

The majority of participants claimed that stressors and activities of everyday life delayed recognition of the compromised valued activities. "During that period, I had so many problems. I had a husband with Alzheimer's. And children who were still at

home. And other members of the family who were ill too. So I didn't think about my problems too much. Not unless it was related to their's...I was a little concerned when I was losing my sight and my hearing and trying to look after my husband. That scared me a bit. But otherwise, just get the best equipment you can, and cope.” (S2, page 2, line 58)

Awareness that technological solutions exist

When valued activities were put in jeopardy the participants were more inspired to find technological solutions to problems. For example, the participants specified that hearing difficulties had created problems in their social life. A desire to maintain social contacts inspired many participants to seek help. This result supports the findings of Mann et al. (1994) who reported that a need to solve problems related to leisure activities influences adaptive technology use. For example most participants expressed that they had hearing difficulties at movie theatres. This was a topic that most participants spoke of more than once in the interviews. When the first author (who conducted all of the interviews) told the participants that some movie theatres have systems to help people who have a hearing loss, all of these participants were motivated to learn more. An awareness of technological solutions enabled participants to consult movie theatres about their systems.

The most often coded barrier to becoming aware that technological solutions exist was a lack of available resources about HAT. All participants spoke of the years when they had a general lack of knowledge concerning the existence of devices other

than hearing aids. The participants claimed that they knew neither about devices for use in the home nor about systems that exist in public for group hearing purposes. These sentiments are consistent with reports that consumers generally lack knowledge concerning supplementary hearing devices (Fino et al., 1992; Ross, 2000; Stika et al., 2002).

Professional consultation / Acquisition of the devices

Once there is an awareness that technological solutions exist, certain factors facilitate the acquisition of HAT. Considering the general lack of knowledge about HAT, it is not surprising that the most often cited factor (all participants gave input) that facilitated the acquisition of HAT is a recommendation from a hearing health professional. Additionally, some participants claimed that recommendations from people who had some sort of experience with a given device were also persuasive to purchasing devices. Further, when the purchase of a device is not necessary for utilization (example, group systems in public areas) consultation with an employee of the establishment maintained participation. It is possible that knowing that a device is available is the determining factor. For example, if a person knows enough to ask a theatre employee if they have a system for people who are “hard of hearing” this may be enough consultation to convince them that it is a good idea to borrow the device. Almost all of the participants claimed that a significant barrier to acquiring HAT is the cost. Similarly, the majority of participants claimed that government sponsored programs that provide funding for technologies were positive influences

to acquiring devices. This result supports the findings of several authors (Griffing, 1992; Mann & Tomita, 1998; Ross, 2000).

Adaptation to use of device and to modified behaviour

After acquiring the HAT devices, there is a transition period during which the participants adapt (successfully or unsuccessfully) to the use of HAT. Although a positive attitude toward change is an influential factor throughout, it seems to be most influential during the transition phase. Some adaptations to successful HAT use are more difficult than others. During difficult adaptations people may experience negative emotions over these difficulties. A positive attitude tends to help a person with these negative thoughts. These findings support the results of previous studies that have found that older adult's use of adaptive devices is influenced by fear (Mann, 1996), confidence (Gatehouse, 1991), and self-esteem (Gleitman et al., 1993). Some participants mentioned adaptations and effort required for HAT use. Many participants spoke of weighing the advantages and disadvantages of device use. One person alluded to being aware that the use of HAT permitted life benefits. Also influential in the transition phase are aspects of the devices themselves. The vast majority of participants indicated that the HAT allowed them to hear what they wanted to hear. This result supports the studies of Stach (1991) who reported that the primary benefit of HAT is an improved signal to noise ratio. Further, the participants spoke of a superior sound quality, a finding that is consistent with Jerger et al. (1996). Finally, comfort was a factor that was mentioned by many participants.

Other considerations

For several reasons there may be a need for a person to go through the series of landmarks more than once. As the results indicate, there are a multitude of factors that influence use. Changes in a person's life that may seem insignificant on their own, may eventually influence device use. For example, as a person's functional health status changes there may be need for different technologies, or for the current technology to be modified. A person who once benefited from using a telephone amplifier, may need to upgrade to a more powerful adapted telephone in order to receive the same amount of benefit. Further, while hearing aids are intended for general use in everyday activities, HAT are primarily designed for specific activities that have limited carryover capabilities. Thus, a person may have multiple realizations of need, acquisition and transition as the individual discovers and begins to use the different devices. Also, a person may be successful using one device and unsuccessful using a different device. For this reason a given person could be at different landmarks for different devices.

Does this model apply to hearing aid use by older adults? The first landmark seems appropriate for all hearing instruments. After recognizing hearing difficulties, people delay on average 5-7 years before they seek help (Ross, 2000). As these people "recognize that hearing difficulties compromise participation in valued activities" people seem to be more likely to seek help to solve hearing problems. For the second landmark, the proposed model becomes more specific to the case of HAT. While for

HAT an “awareness that technological solutions exist” seems to be an important HAT, this is not the case for hearing aids. It is safe to say that the majority of people know that hearing aids are the traditional treatment for hearing loss. There may be other barriers that prevent people from acquiring and using hearing aids (i.e., denial, stigma, vanity). Consultation with a hearing health professional is likely an important landmark for both HAT and hearing aids. For HAT, a recommendation seems to be extremely important.

Implications

Considering the integral role that accessibility plays in successful use of HAT, it is recommended that hearing health professionals take advantage of all opportunities to discuss with their clients the possibilities and advantages of HAT use. Considering the individual nature of successful technology use, it is imperative to consult with clients. Garstecki, (1988) recommended that hearing health professionals receive input from the client concerning individual lifestyle needs and their ability to pay for devices. Further, a clinician may decide to adopt a policy that permits clients to borrow devices. This practice is likely to increase use and benefit of these technologies (Compton, 2000).

Conclusion

Although the utilization of HAT remains at relatively low levels, the results of this investigation are encouraging. While the HAT facilitators that the participants identified support previous research, the identified barriers to successful HAT use do

not seem insurmountable. For example, awareness of, and accessibility to, HAT seem to be barriers that could easily be addressed by hearing health professionals. Further studies of the factors that influence HAT are needed in order to design the most effective rehabilitation interventions for older adults who have a hearing loss. Specifically, exploratory investigations with non-HAT users and one-time users who have discontinued use would provide valuable information that could be used to assess the adequacy or validity of the proposed model.

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References

- Atlas-ti 5.0 (computer program). (2004). Berlin, Germany: Scientific Software Development Inc. GmbH.
- Boyatkis, R. E. ed. (1998). Transforming qualitative information: Thematic analysis and code development. California: Sage Publications Inc.
- Brooks, D. N. & Hallam, R. S. (1998). Attitudes to hearing difficulty and hearing aids and the outcome of audiological rehabilitation. *Br J Audiol*, 32, 217-226.
- Brooks, D. N. (1989). The effect of attitude on benefit obtained from hearing aids. *Br J Audiol*, 19, 3-11.
- Carabellese, C., Appollonio, I., Rozzini, R., Bianchetti, A., Frisoni, G. et al., (1993). Sensory impairment and quality of life in a community elderly population. *J Am Geriatr Soc*, 41, 401-407.
- Compton, C. L. (2000). Assistive technology for the enhancement of receptive communication. In: J. G. Alpiner & P.A. McCarthy, (eds.) Rehabilitative Audiology: Children and Adults (3rd ed.). Baltimore, Maryland: Lippincott Williams and Wilkins, pp. 501-555.
- Davis, A. C. (1989). The prevalence of hearing impairment and hearing disability

- among adults in Great Britain. *Int J Epidemiol*, 18, 911-917.
- Dovidio, J. F., Major B., & Crocker J. (2000). Stigma: Introduction and overview. *In*: T. F. Heatherton, R. E. Kleck, M. R. Hebl & J. G. Hull (eds.) The social psychology of stigma. New York: Guilford, pp. 1-28.
- Fino, M. S., Bess, F. H., Lichtenstein, M. J., & Logan, S. A. (1992). Factors differentiating elderly hearing aid wearers vs. non-wearers. *Hearing Instruments*, 43, 6,8-10.
- Garstecki, D. C. (1988). Considerations in selecting assistive devices for hearing-impaired adults. *Journal of the Academy of Rehabilitative Audiology*, 21, 153-157.
- Gatehouse, S. (1991). Factors that influence the benefit from amplification in the elderly. *Acta Otolaryngol Suppl*, 476, 262-269.
- Gilhome Herbst, K. (1983). Psycho-social consequences of disorders of hearing in the elderly. *In*: R. Hinchcliff (ed.) Hearing and balance in the elderly. Edinburgh: Churchill Livingstone, pp. 174-200.
- Gitlin, L. N. (1995). Why older people accept or reject assistive technology. *Generations*, 19, 41-46.

- Gleitman, R., Goldstein, D. P., & Binnie, C. A. (1993). Stigma of hearing loss affects hearing aid purchase decisions. *Hearing Instruments*, 44, 16-18, 20.
- Griffing, T. S. (1992). A new approach to hearing instrument candidacy. *Hearing Instruments*, 43, 23-24.
- Hastings Kraskowsky, L., & Finlayson, M. (2001). Factors affecting older adults use of adaptive equipment: Review of the literature. *Am J Occup Ther*, 55, 303-310.
- Héту, R., Jones, L., & Getty, L. (1993). The impact of acquired hearing impairment on intimate relationships: implications for rehabilitation. *Audiology*, 32, 363-381.
- Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: a decade later. *Health Education Quarterly*, 11, 1-47.
- Jerger, J., Chmiel, R., Florin, E., Pirozzolo, F., & Wilson, N. (1996). Comparison of conventional amplification and an assistive listening device in elderly persons. *Ear Hear*, 17, 490-504.
- Jerger, J., Chmiel, R., Wilson, N., & Luchi, R. (1995). Hearing impairment in older adults: new concepts. *J Am Geriatr Soc*, 43, 928-935.

Jerram, J. C. K., & Purdy, S. C. (2001). Technology, expectations, and adjustment to hearing loss: Predictors of hearing aid outcome. *Journal of the American Academy of Audiology*, 12, 64-79.

Johnson, C. E., Danhauer, J. & Edwards R. (1982). The hearing aid effect: fact or fiction? *Hearing Instruments*, 22, 10, 22-26.

Kochkin, S. (2002). Factors impacting consumer choice of dispenser and hearing aid brand; use of ALDs and computers. *The Hearing Review*, 9, 14, 18, 20, 22 and 23.

Kochkin, S. (2000). MarkTrak V: "Why my hearing aids are in the drawer": the consumers perspective. *The Hearing Journal*, 53, 34-42.

Kochkin, S. (1998). MarkeTrak IV: Correlates of Hearing Aid Purchase Intent. *The Hearing Journal*, 51, 30-41.

Lesner, S. A. & Kricos, P. B. (1991). Audiologic Rehabilitation: Candidacy, Assessment, and Management. In: D. N. Ripich (ed.) Handbook of geriatric communication disorders. Austin, Texas: Pro-ed, pp. 439-461.

Lesner, S. A. (2003). Candidacy and management of assistive listening devices: special needs of the elderly. *Int J Audiol*, 42, 2S68-2S76.

L'Institut de la statistique du Québec (1998). L'Enquête québécoise sur les limitations d'activités, Retrieved April 3, 2003 from:

<http://www.stat.gouv.qc.ca/publications/sante>

Magilvy, J. K. (1985). Quality of life of hearing impaired older women. *Nurs Res*, 34, 140-144.

Mahoney, C. F. O., Stephens, S. D. G. & Cadge, B. A. (1996). Who prompts patients to consult about hearing loss? *Br J Audiol*, 30, 153-158.

Mann, W. C., and Tomita, M. (1998). Perspectives on assistive devices among elderly persons with disabilities, *Technology & Disability*. 9, 119-48.

Mann, W. C., Hurren, D., Tomita, M., & Charvat, B. (1995). The relationship of functional independence to assistive device use of elderly persons living at home. *The journal of applied gerontology*, 14, 225-247.

Mann, W. C., Tomita, M., Packard, S., Hurren, D., & Creswell, C. (1994). The need for information on assistive devices by older persons. *Assist Technol*, 6, 134-139.

Mulrow, C. D., Aguilar, C., Endicott, J. E., Velez, R., Tuley, M. R. et al., (1990). Association between hearing impairment and quality of life of elderly individuals. *J Am Geriatr Soc*, 38, 45-50.

Popelka, M. M., Cruickshanks, K. J., Wiley, T. L., Tweed, T. S., Klein, B. E. et al., (1998). Low prevalence of hearing aid use among older adults with hearing loss: the Epidemiology of Hearing Loss Study. *J Am Geriatr Soc*, 46, 1075-1078.

Ross, M. (2000). *Redefining the hearing aid selection process*. Retrieved January 24, 2001, from www.audiology.org

Ross, M. (1997). Beyond hearing aids: Hearing assistance technologies. *Seminars in Hearing*, 18, 103-117.

Sandridge, S. A. (1995). Beyond hearing aids: Use of auxiliary aids. *In*: P. B. Kricos & S. A. Lesner (eds.) Hearing care for the older adult. Boston, MA: Butterworth-Heinemann, pp. 127-166.

Stach, B. A. & Stoner, W. R. (1991). Sensory aids for the hearing-impaired elderly. *In*: D. N. Ripich (ed.) Handbook of geriatric communication disorders. Austin, Texas: Pro-ed, pp. 421-438.

Statistics Canada (1992). Health and Activity Limitation Survey: Canadians with Impaired Hearing. Ottawa, Canada: Canadian Government Printing Office.

Stika, C. J., Ross, M., & Ceuvas, C. (2002). Hearing aid services and satisfaction: The consumer viewpoint. *Hearing Loss*, 23, 25-31.

Tomita, M., Mann, W. C., & Welch, T. R. (2002). Use of assistive devices to address hearing impairment by older persons with disabilities. *Int J Rehabil Res*, 24, 279-289.

van den Brink, W. H., Kempen G. I., & van Heuvelen M. J. (1996). Attitude and help-seeking for hearing impairment. *Br J Audiol*, 30, 313-324.

van der Maren, J. M. (1996). Méthodes de Recherche pour l'éducation (2nd ed.). Montréal: PUM; Bruxelles: De Boeck-Université.

Weinstein, B. E. (2000). Geriatric Audiology. New York: Thieme.

Table I: Participant information

Identity	Gender	Age	Degree of Loss	Hearing aid (n=yrs)	HAT (n=yrs)	HATs
S1	Ma	76	MS	Y (12)	2	IR, ECS, A, T
S2	F	73	MS	Y (7)	1	T, TA, IR
S3	Ma	92	MS	Y (15)	5	IR, L
S4	F	85	M	Y (20)	2	N, D, Th
S5	F	84	M	Y (7)	5	T, IR, Th
S6	F	82	S	Y (22)	5	T, TiD, ECS,CC, IR, A
S7	Ma	79	M	Y (5)	5	A, CC, ECS
S8	F	75	MS	Y (37)	20	T, TA, IR, Th
S9	F	84	MS	Y (10)	3	IR, ECS,
S10	Ma	83	S	Y (23)	10	TA, N, L

Ma - Male

F - Female

M - Moderate hearing loss

MS - Moderately severe hearing loss

S - Severe hearing loss

IR - Infrared for television viewing

ECS - Environmental control system

A - Adapted alarm clock

T - Telephone for persons who have a hearing loss

TA - Telephone amplifier

L - Induction loop system

N- Notification device (eg. Flashing lights)

D - Portable doorbell

Th - Theatre provided hearing device

TiD - Telephone caller identification

CC - Closed captions

Table 2: Code frequency by interview

CODES	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Total
<u>Barriers</u>											
Contextual life influences	3	1	4	0	0	0	3	0	6	2	19
Lack of knowledge	6	24	32	3	0	5	11	1	15	2	99
Stigma	8	0	0	3	0	0	0	0	0	0	11
Effort required / Adaptation required	1	7	2	3	3	1	9	4	13	0	43
Vanity	0	0	4	0	0	0	0	0	4	0	8
Denial	0	0	0	0	3	0	0	0	0	0	3
Lack of confidence	0	1	2	0	0	0	4	1	0	1	9
Fear	0	0	1	0	2	0	9	2	0	4	18
Status quo works	2	0	0	0	1	0	0	0	0	1	4
Poor sound quality	0	4	4	8	0	1	12	0	3	0	32
Shortcomings of technology	0	4	3	5	0	0	3	6	9	2	32
Cost	0	8	5	1	1	3	4	1	3	2	28
Expectations not met	0	3	0	0	0	0	4	0	3	0	10
Lack of physical comfort	0	6	4	0	1	1	0	0	0	0	12
Poor benefit	1	6	4	0	0	1	1	2	15	1	31
<u>Facilitators</u>											
Friends and family	9	7	0	3	15	10	2	3	7	8	64
Hearing health consult	8	21	17	12	27	9	10	9	37	17	167
Government programs	4	11	1	3	0	1	2	0	4	2	28
Need to resolve problems	16	6	1	8	16	5	17	10	24	4	107
Severity of hearing loss	4	1	1	0	6	0	0	0	2	2	16
Valued leisure activities	14	9	17	8	17	8	9	10	19	6	117
Valued social contacts	7	10	8	2	3	0	5	1	10	5	51
Quality of life	8	2	8	0	7	1	2	1	7	6	42
Security	0	4	0	0	7	0	1	2	4	9	27
Altruism	0	5	2	0	1	1	6	0	4	1	20
Autonomy	0	6	1	2	0	3	1	0	3	17	33
Positive attitude to change	5	7	7	6	22	2	9	5	12	8	83
Sound quality	0	6	4	0	2	3	1	2	1	1	20
Intensity	7	10	14	5	2	2	2	8	9	2	61
Technological benefits	13	23	49	7	20	16	14	20	19	13	194
Realistic expectations	0	0	3	4	0	0	0	4	0	6	17
Totals	116	192	198	83	156	73	141	92	233	122	1406

Table 3: Use of the category “prompters” by the participants

Prompters	Number of participants (max = 10)	Number of occurrences
Facilitators		
○ Need to resolve problems	10	107
○ Severity of hearing loss	6	16
○ Maintenance of valued leisure pursuits	10	117
○ Maintenance of valued social contacts	9	51
Barriers		
○ Contextual life influences	6	19

Table 4: Use of the category “accessibility” by the participants

Accessibility	Number of participants (max = 10)	Number of occurrences
Facilitators		
○ Consultation with hearing health professional	10	117
○ Government subsidiary programs	8	28
Barriers		
○ Lack of knowledge	9	99
○ Cost	9	28

Table 5: Use of the category “attitudes” by the participants

Attitudes	Number of participants (max = 10)	Number of occurrences
Facilitators		
○ Influence of family and friends	9	64
○ Positive attitude to change	10	83
Barriers		
○ Lack of confidence	5	9
○ Fear	5	18
○ Others (Stigma, vanity, denial)	negligible	negligible

Table 6: Use of the category “technology” by the participants.

Technology	Number of participants (max = 10)	Number of occurrences
Facilitators		
○ Intensity	10	61
○ Sound quality	8	20
○ General benefits	10	194
Barriers		
○ Shortcomings of technology	7	32
○ Poor benefit	8	31
○ Lack of physical comfort	4	12

Table 7: Use of the category “Expected benefits and actual impacts” by the participants

Expected benefits and actual impacts	Number of participants (max = 10)	Number of occurrences
Facilitators		
○ Quality of life	9	42
○ Altruism	8	20
○ Autonomy / Independence	7	33
○ Security	6	27
Barriers		
○ Adaptations / Effort required	9	43
○ Expectations not met	3	10

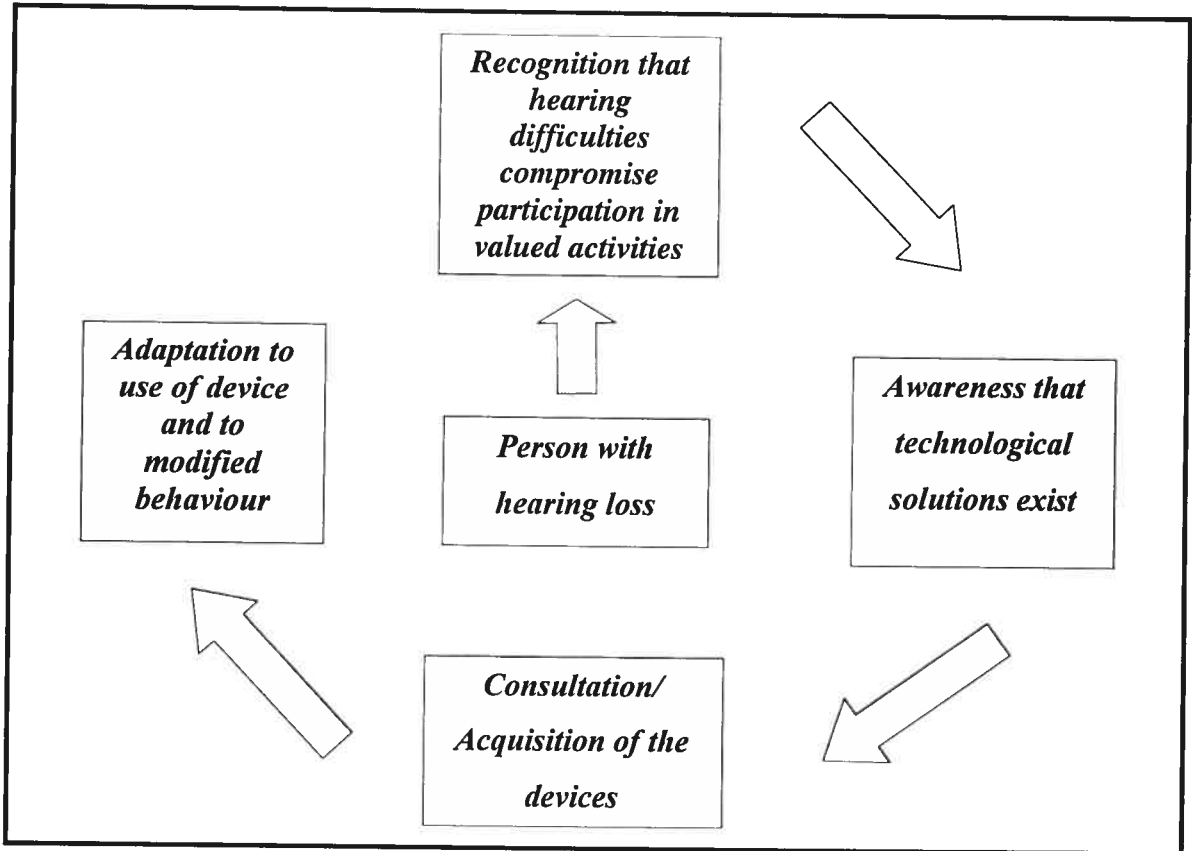


Figure 1 caption :

Figure 1: Landmarks of hearing assistance technology use. This figure depicts a series of landmarks that are associated with successful use of hearing assistance technology among older adults who have a hearing loss.

Appendix 1: General interview questions designed to solicit comments concerning the participant's perception of the factors that influenced the use of hearing assistance technology

- What is the history of your hearing-loss?
- How has your hearing-loss affected your life?
- What was your first reaction when you heard about these other devices?
- How did you come to purchase this device?
- How would you describe this device to a friend?
- What did you expect from the device?
- Has the device changed the activities of your daily life? How?
- What are the drawbacks of using the device?
- Have you ever owned a device that didn't work for you?
- What characteristics allow people to succeed in using these devices?

Chapter 3: General discussion

The general discussion that follows will provide a brief summary of the preceding article, highlighting key results and discussion points. This will be followed by a discussion of study limitations and implications.

Article summary

A thematic analysis of the interview transcripts identified several facilitators and barriers to HAT use. These factors were grouped into five categories: Prompters, Accessibility, Attitudes, Technology, and Expected benefits/Actual impacts. From these categories emerged a representative model. It was proposed that successful HAT use involves four significant landmarks. A person will come to understand that they are experiencing hearing difficulties that compromise their participation in valued activities. A person will gain awareness that technological solutions exist. A person will consult for and acquire the device(s). Finally, the person will adapt to use and modify behaviours. It is proposed that successful HAT users pass through these landmarks in a chronological way.

These results seem to fit well into the Scherer's (1996) representation of technology utilization in relation to disability. Certainly, the 10 participants expressed a range of opinions on rehabilitation success, quality of life and on the experiences of a person with disability. There is no doubt that each older adult who lives with a hearing loss has their own unique set of ideas about the impairment and how the impairment impacts their daily life.

The participants expressed that there are several personal factors that influence their use of HAT. The severity of hearing loss was an important motivator to find solutions to hearing difficulties prior to being aware that technological devices exist. The participants also mentioned a desire to maintain participation in social and leisure activities. This seemed to inspire respondents to find solutions to hearing difficulties. A positive attitude toward rehabilitation seemed to enable the participants to succeed with HAT. The participants also spoke of more global benefits that they expected from using HAT. Many participants expected that they would experience personal benefits such as an enhanced quality of life, autonomy and more secure surroundings. In general, the individuals that were interviewed were highly active and positive people. They seemed highly motivated to maintain their quality of life in spite of their hearing difficulties. This meant finding solutions so that they could continue participation in their valued activities.

The participants expressed that there are several environmental factors that influence their use of HAT. The main environmental factor to influence use of HAT was related to hearing health professionals. The participants expressed that they knew little about these technologies mostly because their ENTs, Audiologists and Hearing aid distributors did not advise them. All respondents expressed that organizations like CHIP that provide educational programs are very much needed and appreciated. For many of the respondents money was a concern. Therefore government programs that help subsidize the cost of HAT are welcome. While the opinions of other people may be an important consideration with regard to hearing aid use, this is not the case for HAT use. The participants expressed that they are

comfortable using these devices in the privacy of their own home. The opinions of others do not seem to matter.

The participants spoke of many technological factors that influence their use of HAT. Given that the severity of hearing impairment was an important factor, it is not surprising that the intensity and sound quality of the signal were influential for the participants. For example, the intensity and clarity of the signal on the telephone can determine if you are able to speak with a daughter on the phone. Again, if the maintenance of all valued activities is the person's idea of rehabilitation success, the individual will work toward that goal, and will find solutions.

Limitations

The first limitation of this study is that interviews were retrospective in nature. Participants were required to recall past experiences. The data may therefore be influenced by the participant's ability to accurately recall information. This is particularly pertinent given the age of the participants for this study. Older adults tend to have memory losses. However, one of the fundamental strengths of retrospective interviews is that it is likely to provide a holistic view of the participant's experiences in HAT uptake and use. Essentially, the interview encourages the participants to express themselves on the aspects of HAT use that is deemed important by them. Retrospective interviews reveal the participant's overall perception of an experience. For this reason retrospective interviews were the ideal choice for this study.

A second limitation is related to the evaluation of validity. The measures for validity in qualitative research designs are somewhat different than for quantitative designs. Whereas quantitative designs test validity to assess the extent results are congruous with reality, qualitative designs assume that reality is ever-changing. Qualitative researchers assume that their results are thus interpretations of reality. To test validity, qualitative researchers may check their results with participants, have their results being examined by expert or compare the qualitative study to a quantitative study that was examining the same phenomenon. Although the scope of this investigation did not allow for extensive evaluation of validity, the results of this investigation are somewhat encouraging. Two of the participants in this study (S6 and S7) were a married couple who lived together. Although, the interviews were intended to focus on the individual experiences of the interviewees, in the case of S6 and S7 it was quite natural for these participants to also speak about their spouses. Although the factors that influenced the use of HAT for S6 was not the same for S7, there were many uncodable moments (in both interviews) where one corroborated claims of the other.

A third limitation was that the primary investigator might have biased the interviews. In the case of this study, the interviewer may have influenced the course of the interviews or the interpretations toward his first field of study, leisure activities. Although there are inherent risks in semi-structured and open interview processes, the first author was well aware of these risks before the start of data collection, and efforts were made to limit this risk.

Implications

Considering the integral role that expectations play in the success of HAT use, it is recommended that hearing health professionals take advantage of all opportunities to discuss the possibilities and advantages of HAT use. When counselling older adults on the use of HAT it is imperative to give the client an opportunity to provide input as they are in the best position to know what will work in their lives and what will not work. Garstecki, (1988) recommended that hearing health professionals receive input from the client, consult audiometric information, gain insight into the individual's lifestyle, and consult with the person to determine the ability to pay for devices. Further, a clinician may decide to adopt a policy that permits clients to borrow devices for a period of time to give the individual the opportunity to experiment with the devices. This practice is likely to increase use and benefit of these technologies (Compton, 2000).

Chapter 4: Conclusion

The objective of this study was to describe and better understand the factors that influence auxiliary aid use by older adults who have a hearing impairment. While many investigations have examined the factors that influence the use of hearing aids, there have been relatively few efforts to understand and explain the factors that influence HAT. Based on the fundamental differences between HAT and hearing aids, one cannot assume that the factors that influence HAT use are the same as those that influence hearing aid use. It was therefore necessary to adopt an exploratory approach to gain a basic understanding of this phenomenon. A qualitative research design is was therefore desirable. To achieve the objective we conducted audio-recorded interviews with 10 individuals 65 years of age or older that were current users of auxiliary aids. The audio-recordings were transcribed onto Atlas-ti (Atlas-ti 5.0, 2004), a computer-based software designed for the preparation and analysis of text. Techniques of thematic analysis were used to draw meaning from the interview transcripts. The results suggested that there are four landmarks of hearing assistance technology use: recognition of hearing-related difficulties, awareness that technological solutions exist, consultation / acquisition, and adapting to use of device and to modified behaviour. These landmarks seem to be crucial stages when people can be motivated toward HAT use or be discouraged about HAT use.

These results suggest that there is much that we do not know about the utilization of HAT by older adults, and other studies are warranted. Based on the results of this investigation other studies may investigate the extent to which the Landmarks of

Hearing Assistance Technology Use model applies to older adult hearing aid users. Second, it may also be interesting to consider how this model applies to assistive devices in general. Finally, these results call for a study into the factors that influence HAT *satisfaction* by older adults who have a hearing loss.

References

- Atlas-ti 5.0 (computer program). (2004). Berlin, Germany: Scientific Software Development Inc. GmbH.
- Brooks, D. N. and Hallam, R. S. (1998). Attitudes to hearing difficulty and hearing aids and the outcome of audiological rehabilitation. *British Journal of Audiology*, 32, 217-226.
- Brooks, D. N. (1989). The effect of attitude on benefit obtained from hearing aids. *British Journal of Audiology*, 19, 3-11.
- Carabellese, C., Appollonio, I., Rozzini, R., et al. (1993). Sensory impairment and quality of life in a community elderly population. *J Am Geriatr Soc*, 41, 401-407.
- Carson, A. (2000). "What brings you here today?" Perspectives of older women on hearing, help-seeking for hearing problems, and their first Audiology appointment. Unpublished doctoral dissertation, University of British Columbia, Canada.
- Compton, C. L. (2000). Assistive technology for the enhancement of receptive communication. In J. G. and M. Alpiner, P.A. (Ed.), *Rehabilitative Audiology: Children and Adults* (3rd ed.) (pp. 501-555). Baltimore, Maryland: Lippincott Williams and Wilkins.
- Davis, A. C. (1989). The prevalence of hearing impairment and hearing disability among adults in Great Britain. *International Journal of Epidemiology*, 18, 911-917.
- Denzin, N. K., and Lincoln, Y. S. (2000). Handbook of qualitative research (2nd Ed.).

Thousand Oaks, Calif: Sage Publications.

- Dovidio, J. F., Major, B., & Crocker, J. (2000). Stigma: Introduction and overview. In: T. F. Heatherton, R. E. Kleck, M. R. Hebl, and J. G. Hull (Eds.), *The social psychology of stigma* (pp. 1-28). New York: Guilford.
- Fino, M. S., Bess, F. H., Lichtenstein, M. J., and Logan, S. A. (1992). Factors differentiating elderly hearing aid wearers vs. non-wearers. *Hearing Instruments*, 43(2), 6,8-10.
- Garstecki, D. C. (1988). Considerations in selecting assistive devices for hearing-impaired adults. *Journal of the Academy of Rehabilitative Audiology*, 21, 153-157.
- Gatehouse, S. (1991). Factors that influence the benefit from amplification in the elderly. *Acta Otolaryngologica, Supplement 476*, 262-269.
- Gilhome Herbst, K. (1983). Psycho-social consequences of disorders of hearing in the elderly. In R. Hinchcliff (Ed.), *Hearing and balance in the elderly* (pp. 174-200). Edinburgh: Churchill Livingstone.
- Gitlin, L. N. (1995). Why older people accept or reject assistive technology. *Generations*, 19, 41-46.
- Gleitman, R., Goldstein, D. P., and Binnie, C. A. (1993). Stigma of hearing loss affects hearing aid purchase decisions. *Hearing Instruments*, 44(6), 16-18, 20.
- Griffing, T. S. (1992). A new approach to hearing instrument candidacy. *Hearing instruments*, 43(3), 23-24.

- Hastings Kraskowsky, L. H. and Finlayson, M. (2001). Factors affecting older adults' use of adaptive equipment: Review of the literature. *The American journal of Occupational Therapy*, 55 (3), 303-310.
- Heine, C., and Browning, C. J. (2002). Communication and psychosocial consequences of sensory loss in older adults: overview and rehabilitation directions. *Disabil Rehabil*, 24(15), 763-773. Review.
- Héту, R., Jones, L., and Getty, L. (1993). The impact of acquired hearing impairment on intimate relationships: implications for rehabilitation. *Audiology*, 32(6), 363-381:Review.
- Héту, R., Riverin, L., Getty, L., Lalande, N., and St-Cyr, C. (1990). The reluctance to acknowledge hearing difficulties among hearing impaired workers. *British Journal of Audiology*, 24, 265-276.
- Jerger, J., Chmiel, R., Florin, E., Pirozzolo, F., and Wilson, N. (1996). Comparison of conventional amplification and an assistive listening device in elderly persons. *Ear Hear*, 17(6), 490-504.
- Jerger, J., Chmiel, R., Wilson, N., and Luchi, R. (1995). Hearing impairment in older adults: new concepts. *J Am Geriatr Soc*, 43(8), 928-935.
- Jerram, J. C. K., and Purdy, S. C. (2001). Technology, expectations, and adjustment to hearing loss: Predictors of hearing aid outcome. *Journal of the American Academy of Audiology* 12: 64-79.
- Johnson, C. E., Danhauer, J. and Edwards R. (1982). The hearing aid effect: fact or fiction? *Hearing Instruments*, 22, 10, 22-26.

- Kochkin, S. (2002). Factors impacting consumer choice of dispenser and hearing aid brand; use of ALDs and computers. *The Hearing Review*, 9 (12), 14, 18, 20, 22 and 23.
- Kochkin, S. (2000). MarkTrak V: "Why my hearing aids are in the drawer": the consumers perspective. *The Hearing Journal*, 53(2), 34-42.
- Kochkin, S. (1998). MarkeTrak IV: Correlates of Hearing Aid Purchase Intent. *Hearing Journal*, 51(1), 30-41.
- Lesner, S. A. (2003). Candidacy and management of assistive listening devices: special needs of the elderly. *Int J Audiol*, 42, 2S68-2S76.
- L'Institut de la statistique Québec (1998). *L'Enquête québécoise sur les limitations d'activités*, Retrieved April 3, 2003 from:
<http://www.stat.gouv.qc.ca/publications/sante>
- Magilvy, J. K. (1985). Quality of life of hearing impaired older women. *Nursing research*, 34(3), 140-144.
- Mahoney, C. F. O., Stephens, S. D. G. and Cadge, B. A. (1996). Who Prompts Patients to Consult about Hearing Loss? *British Journal of Audiology*, 30, 153-158.
- Mann, W. C., and Tomita, M. (1998). Perspectives on assistive devices among elderly persons with disabilities, *Technology & Disability*. 9(3):119-48.
- Mann, W. C., Hurren, D., Charvat, B., and Tomita, M. (1996). The use of phones by elders with disabilities: problems, interventions, costs. *Assistive Technology*, 8(1):23-33.

- Mann, W. C., Hurren, D., Tomita, M., and Charvat, B. (1995). The relationship of functional independence to assistive device use of elderly persons living at home. *The journal of applied gerontology*, 14(2), 225-247.
- Mann, W. C., Tomita, M., Packard, S., Hurren, D., and Creswell, C. (1994). The need for information on assistive devices by older persons. *Assist Technol*, 6(2), 134-139.
- Montgomery, A. (1991). Audiological rehabilitation - review and preview. In: G. Studebaker, F. Bess, and L. Beck (Eds.), *The Vanderbilt Hearing Aid Report II*. Maryland: York Press.
- Mulrow, C. D., Aguilar, C., Endicott, J. E., Velez, R., Tuley, M. R., Charlip, W. S., & Hill, J. A. (1990). Association between hearing impairment and quality of life of elderly individuals. *Journal of the American Geriatrics Society*, 38, 45-50.
- Ross, M. (1997). Beyond hearing aids: Hearing assistance technologies. *Seminars in Hearing*, 18, 103-117.
- Ross, M. (2000). *Redefining the hearing aid selection process*. Retrieved January 24, 2000, from www.audiology.org
- Sandridge, S. A. (1995). Beyond hearing aids: The use of HAT. In P. B. Kricos and S. A. Lesner (Eds.), *Hearing care for the older adult* (pp. 127-166). Boston, MA: Butterworth-Heinemann.
- Scherer, M. J. (1996). *Living in the state of stuck: How technology impacts the lives of people with disabilities*. (2nd Ed.). Cambridge, Massachusetts: Brookline books.

- Schoenborn, C. A., and Marano M. (1988). *Current estimates from the national health interview survey: United States 1987*. Washington DC: Government Printing Office.
- Schuknecht, H. F. and Kirchner, J. C. (1974). Cochlear otosclerosis: fact or fantasy. *Laryngoscope*, 84(5), 766-782.
- Stach, B. A. and Stoner, W. R. (1991). Sensory aids for the hearing-impaired elderly. In D. N. Ripich (Ed.), *Handbook of geriatric communication disorders* (pp. 421-438). Austin, Texas: Pro-ed.
- Statistics Canada (1992). *Health and Activity Limitation Survey: Canadians with Impaired Hearing*, Ottawa, Canada: Canadian Government Printing Office.
- Stika, C. J., Ross, M., and Ceuvas, C. (2002). Hearing aid services and satisfaction: The consumer viewpoint. *Hearing Loss*, 23(3), 25-31.
- Tomita, M., Mann, W. C., and Welch, T. R. (2001). Use of assistive devices to address hearing impairment by older persons with disabilities. *Int J Rehabil Res*, 24(4), 279-289.
- Trychin, S. (1995). Counselling older adults with hearing impairments. In: P. Kricos and S. Lesner (Eds.), *Hearing care for the older adult*. Boston: Butterworth-Heinemann.