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Key Words

Older adults
Hearing assistance technology
Assistive listening devices
Hearing loss
Qualitative research

Abbreviations

HAT: Hearing assistance
technology
CHIP: Communicaid for hearing-
impaired persons

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

Abstract

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

The terminology (other than hearing aids) most often used to describe assistive technologies for people who have a hearing loss is assistive listening devices. This term is used frequently to describe devices that either help people hear better or 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 this variety of devices. Ross (1997) proposed that a more representative term is hearing assistance technology (HAT), as it is less restrictive and categorical than assistive listening devices. Based on this reasoning, we chose to use the acronym HAT. However, for the purpose of this study, HAT stood for assistance technology for persons who have a hearing loss. HAT is an appropriate terminology for all devices that produce auditory, visual, and tactile signals to aid persons who have a hearing loss. We defined HAT as any device (other than hearing aids) that is used to enhance or maintain the functional capacities of persons who have a hearing loss.

Assistance technology for persons who have a hearing loss are typically used for specific activities when the environment makes it is particularly difficult to hear. The primary benefit of HAT is that they transmit signals in a more direct manner than sound waves (Stach & Stoner, 1991). For example, many devices used in the home may employ infrared or frequency modulated radio waves to transmit signals. This 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. HATs are often divided into five categories: a) one-to-one communicators, b) television devices, c) telephone devices, d) alerting devices, and e) group listening systems. These supplementary devices are often used in combination with an individual's hearing aid or cochlear implant, but they can also be used alone.

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) found that 37% of individuals in their sixties and 60% of those in their seventies had a hearing impairment. In the United States this trend was also evidenced in the research of Jerger et al (1995) who reported 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 impact on a person's ability to function in their daily activities (Weinstein, 2000). In social settings, hearing loss has been associated with tensions, irritations, and frustrations (Héту et al, 1993). For many individuals these strains may lead to isolating tendencies (Magilvy, 1985; Mulrow et al, 1990). Persons with age-related hearing loss also tend to report a lower self-assessment of health, participation in fewer leisure activities per week, and that they experience less enjoyment (Gilhome Herbst, 1983). Given these findings, it is not surprising that many investigators have

reported that age-related hearing loss has a negative influence quality of life (Carabellese et al, 1993; Mulrow et al, 1990).

Although there is evidence to suggest that assistance technology for persons who have a hearing loss can enhance the general health status of older adults (Jerger et al, 1996), at the present time in North America these technologies remain under-utilized (Ross, 1997). Among 3,000 hearing instrument owners surveyed by Kochkin (2002), only one-quarter of the participants used HAT for telephone use. Among those surveyed, only 10% used HAT to help listen to the television, at the movies, or at places of worship and just 1–7% of the individuals used other kinds of HAT. Tomita et al (2002) observed that among a sample of 227 older adults who had a hearing impairment, just twelve older adults (5.3%) used HAT other than hearing aids. In Canada, it was estimated that 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.

A review of the literature revealed a myriad of factors that influence the use or the non-use of HAT. Personal factors related to the users, influence older adult use of HAT. 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). The use of hearing technologies is influenced by the perceived seriousness of the hearing impairment (Griffing, 1992; Kochkin, 2002). For example, a person who believes that their hearing loss is serious is more likely to seek help and use a device than a person who does not believe that their hearing loss is serious. Secondary health issues, such as reduced fine-motor control and reduced visual capacity decrease the use of assistive technologies (Brooks & Hallam, 1998; Fino et al, 1992; Kochkin, 2000; Brooks, 1989; Mann et al, 1995). The emotions of older adults may also influence the use of HAT. Mann et al (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. There is also evidence to suggest that success with amplification may be influenced by confidence (Gatehouse, 1991) and self-esteem (Gleitman et al, 1993). Physical appearance may also be a consideration for older adults when they are considering the 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 technologies of this kind make the person look old and handicapped. A desire to maintain social contacts motivates HAT use (Mann et al, 1994). 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). 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 seek help from an audiologist. Finally, 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. People who have a hearing loss 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 body worn technologies also breaks societal norms by indicating age-related impairments (Héту et al, 1993). Consequently, stigma is a barrier to HAT use (Mann et al, 1994). The utilization of HAT is influenced by an individual's relationship with their hearing health professional. Several authors report that there is a general lack of knowledge about HAT. Fino et al (1992) found that just 14% of older adults who consulted for hearing difficulties received information on technologies other than hearing aids. Likewise, Stika et al (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 et al (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 et al (1996) found that devices that are difficult to manipulate are less likely to be used, even if they have proven 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 assistance technology for persons who have a hearing loss.

A review of the literature indicated that there are a multitude of factors that influence the utilization of assistance technology for persons who have a hearing loss. 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. One cannot necessarily assume that the factors that influence the use of HAT are the same as those that influence the use of hearing aids, because most HAT are designed for specific activities and hearing aids are designed for general-purpose 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. 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 an exploratory research design. Qualitative research designs are appropriate for exploratory investigations, and are appropriate to examine the factors that influence assistive technology utilization (Hastings-Kraskowsky & Finlayson, 2001). 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. The goal of this investigation was to describe and better understand the factors that influence assistance technology use by older adults who have a hearing impairment.

Methods

A convenience sample was chosen from a non-profit community organization located in Montréal, Québec, Canada. Communicaid for Hearing Impaired Persons (CHIP) is a well-established Montréal based organization that provides programs and services to persons who have a hearing loss. The names of twenty people thought to fit the inclusion criteria were selected from the CHIP membership list. 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, were current users of a hearing assistance technology, lived at home, and spoke English.

Of the twenty persons contacted, twelve persons indicated an interest to participate in the study. Two of these people were not included in the study, because they were not current HAT users. As summarized in Table 1, the participants included 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 fifteen years). The participants were owners of a variety of HAT (average of approximately three devices per participant) for an average of seven years. The majority of participants lived with a spouse or partner. One of the participants shared their living space with an adult daughter. 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. In general, the participants were very active. As a group they were eager to discuss the difficulties they experience related to their hearing loss and their use of assistive technologies.

Some investigators have reported that the Health Belief Model is an appropriate theoretical framework to consider the help-seeking behaviours of persons who have a hearing loss (Noh et al, 1994; van den Brink et al, 1996; Weinstein, 2000). The Health Belief Model (Janz & Becker, 1984) proposes that 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. Inspired by van den Brink 1996, a number of introductory interview questions were prepared for this investigation. For example, an introductory question concerning the perceived

threat of the health condition was '*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?*'. Based on the interviewee's responses, follow-up questions related to the factors of use / non-use of HAT were posed.

All of the interviews were conducted in the participants' homes by the first author who is experienced in counselling older adults in the use of HAT. 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 ethical rights. The interviews were audio-recorded using a Marantz Cassette Recorder (PMD101). The interviews were informal in nature and 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 took notes to add a contextual account to the interview transcripts.

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. To extract meaning from the documents of text we used thematic analyses (Boyatkis, 1998). The interview transcript files were reduced in length by creating interview summaries. From these summaries we identified interview themes. Based on these interview themes a coding schema was prepared. The code was then applied to the full-text interview transcripts. The reliability of this schema was tested with the help of an investigator (who is knowledgeable both in audiological rehabilitation and qualitative methodologies) from outside the research unit. The external coder and the primary investigator each coded ten pages of an interview transcript that was randomly chosen. 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. An acceptable score of 0.8 (van der Maren, 1996) was achieved after the coding schema was modified once. The rest of the transcripts were analyzed using the modified coding schema.

Results

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) presented 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 participant interview, page in MS Word document, and line in Atlas-ti transcript.

Table 1. 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

Prompters

Key events and issues that initiated help-seeking for difficulties due to hearing loss were referred to as prompters. All of the participants identified the need to resolve hearing problems as an important prompter. *‘So over the years I have had many different aids for many different problems’* (S8, page1, line 26). Valued leisure activities that were put in jeopardy due to hearing difficulties 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’s note: a local theatre company] is good. At the Centaur [author’s note: a different local theatre company], I don’t know whether there has been an improvement. Because of that we stopped going there a few years ago’* (S8, page 4, line 146). Similarly, almost all of the participants expressed that the desire to maintain social contacts prompted the 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. *‘... 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’* (S2, page 2, line 65).

Accessibility

The participant’s awareness of, and knowledge-gathering related to technological devices other than hearing aids were referred to as accessibility. The vast majority of the participants claimed that their lack of knowledge that HAT existed was an important

barrier to accessibility. *‘My hearing aid dealer didn’t mention anything like that to me. Which I am kind of ticked off about. ... But I wasn’t aware of this. I was thinking of myself. I have a stereo downstairs. And if I had a long cord Sennheiser thing and I could listen to music. I could still hear music if you turn it up loud enough, with a good stereo system. Didn’t know at all!’* (S1, page 4, line 183). Considering that the vast majority of participants went through a time when they had a hearing loss, but were unaware that HAT existed, 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 ... price would have been the first question mark’* (S9, page, 17 line 779). Given the general sentiment that these devices are expensive, it is not surprising that the vast majority of 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 participants’ families and friends, and of society in general were referred to as attitudes. All of the participants commented that a positive attitude 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*

Table 2. Code frequency by interview

| <i>Codes</i> | <i>S1</i> | <i>S2</i> | <i>S3</i> | <i>S4</i> | <i>S5</i> | <i>S6</i> | <i>S7</i> | <i>S8</i> | <i>S9</i> | <i>S10</i> | <i>Total</i> |
|---------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|--------------|
| Barriers | | | | | | | | | | | |
| 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 |
| Facilitators | | | | | | | | | | | |
| 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 |

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, some of the participants spoke of attitudes that may act as barriers to HAT use. The next two participants are referring to their use 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). For S9 fears 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).

Technology

Aspects of the technologies themselves were referred to as technology. All of the participants expressed 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 HAT enhanced the sound quality of the desired signal, and this facilitated 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). The participants had many general positive comments (general benefits) about the assistive technologies. *'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 also referred to shortcomings in the devices that were barriers to HAT use. Many comments were made about not being able to monitor the surrounding environment when using a HAT in combination with the telecoil of their hearing aid. *'The only drawback is when two*

people are watching television ... I'm excommunicated from there ... I can't hear. If she wants to talk to me, she'll punch me ... 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).

Expected benefits / Actual impacts

The expectations of the participants prior to acquisition of devices and the actual impacts of HAT use were referred to as expected benefits / actual impacts. 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). 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 same participant 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). Participants also spoke of some of their actual impacts that acted as barriers to HAT use. One 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).

Discussion

Based on our analyses, we propose and describe a series of landmarks associated with successful HAT use. This series of landmarks is a chronology of what an individual typically goes through, from not using HAT to using HAT. This rearrangement of the information collected, facilitated a more in-depth analysis of the data. A visual representation of this process is provided in Figure 1. It is proposed that successful HAT users pass through these landmarks in a more or less chronological order. The section that follows will describe the proposed model.

Recognition that hearing difficulties compromise participation in valued activities

The first landmark involves a person recognizing that their hearing difficulties are compromising participation in valued activities. As the results of this present study suggest, many older adults experience participation (such as social or leisure) problems due to the severity of their hearing difficulties. We suggest that there is a critical point when a person decides to find solutions to limit hearing difficulties so that they may continue participation in a valued activity. This supposition is supported by the work of many authors who have observed that the perceived seriousness of the hearing impairment influences the

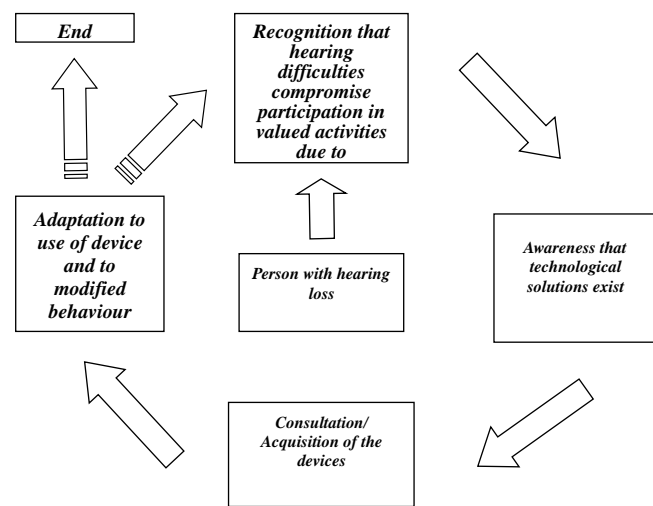


Figure 1. Landmarks of hearing assistance technology use. This figure depicts a series of landmarks that are associated with successful use of hearing assistance technology among older adults who have a hearing loss.

use of adaptive aids (Gitlin, 1995; Kochkin, 1998; Lesner & Kricos, 1991; Ross, 2000). A second factor that moves people toward the first landmark are family and friends helping older adults who have a hearing loss to understand that their hearing difficulties were impinging on their daily activities. 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. Finally, the movement toward the first landmark is slowed by stressors and activities of everyday life.

Awareness that technological solutions exist

The second landmark involves a person gaining awareness that technological solutions exist. After recognizing that valued activities are in jeopardy, a person is likely to be inspired to find solutions to these problems. For example, a desire to maintain social contacts is likely a motivation 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. All consultations that the person has with audiologists, hearing aid distributors, or other hearing health professional is likely to increase the likelihood that they will learn about assistive technologies. Reaching the second landmark is slowed by the general lack of knowledge that technological solutions exist. This is consistent with reports that consumers generally lack knowledge concerning supplementary hearing devices (Fino et al, 1992; Ross, 2000; Stika et al, 2002).

Consultation for and acquisition of the devices

The third landmark involves a person consulting for, acquiring, and installing the device(s). Once there is an awareness that technological solutions exist, certain factors helped to facilitate the acquisition of HAT. Considering the general lack of knowledge about HAT, an important facilitator is a recommendation from a hearing health professional. Recommendations from people who had some sort of experience with a given device may also be persuasive to purchasing devices. A significant barrier to

acquiring HAT is the cost of these devices. This result supports the findings of several authors (Griffing, 1992; Mann & Tomita, 1998; Ross, 2000). Consequently, programs that provide funding for technologies are obviously positive influences to acquiring devices.

Adaptation to use of device and to modified behaviour

Finally, the fourth landmark involves a person adapting to using the devices and modifying their behaviours accordingly. After acquiring the HAT devices, there is a transition period during which the participants adapt (successfully or unsuccessfully) to the use of HAT. The results of this investigation suggest that a positive attitude will help a person during difficult adaptations when individuals may experience negative thoughts about HAT use. These findings support the results of previous studies that have found that the use of adaptive devices by older adults is influenced by confidence (Gatehouse, 1991), and self-esteem (Gleitman et al, 1993). During this transitional phase some people may weigh the effort required to successfully use a device against the expected benefits. Also influential in the transition phase are the technological benefits of the devices themselves. The benefits in amplification and sound quality are likely to make people want increase utilization. This result supports the studies of Stach & Stoner (1991) and Jerger et al (1996).

Other considerations

For several reasons there may be a need for a person to go through this series of landmarks more than once. Firstly, changes in a person's life that may seem insignificant on their own, may eventually influence device use. For example, changes in functional health status may create the need for different technologies, or for the current technology to be modified. As a person's hearing loss gradually gets worse, someone 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. Secondly, while hearing aids are intended for general use in everyday activities, HAT are primarily designed for specific activities that have limited carry-over capabilities. Thus, a person may have multiple realizations of need, acquisition, and transition as the individual discovers and begins to use the different devices. Finally, 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 people recognize that hearing difficulties are compromising participation in valued activities they may be more likely to seek help (hearing aids or HAT) to resolve hearing problems. The second landmark of the proposed model may be more specific to HAT. While the awareness that technological solutions exist may be crucial for HAT, this is not to be the case for hearing aids. It is safe to say that most people know that hearing aids are a traditional treatment for hearing loss. Consultation with a hearing health professional is likely an important landmark for both HAT and hearing aids. Finally, it is reasonable to assume that there is going to be a time of transition when a person will adapt to the use of any new hearing instrument.

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 clinic 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 use 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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