RATE AND REASONS FOR HEARING AID DISUSE

IN NEW ZEALAND/AOTEAROA

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Abstract

Introduction: Despite evidence that hearing aids (HA) are effective in treating hearing impairment, many individuals who own HAs do not use them. The disuse of HAs can impact upon a person's quality of life, relationships with others, as well as their health and well-being. At present, the rate of HA disuse in New Zealand is unknown. This study aimed to quantify the current disuse rate, and investigate possible reasons for disuse in the New Zealand population.

Methods: Hearing aid owners from throughout New Zealand were recruited. Demographic, audiometric and self-report data were gathered from 129 participants using a variety of questionnaires.

Results: The rate of HA disuse ranged from five to 22% depending on definition of disuse. Audiometric and self-report variables were found to be related to HA use. Individuals who used HA more were found to report their hearing impairment as more severe, have poorer hearing thresholds and report higher HA satisfaction. HA use was also related to various health beliefs, accepted need for HAs, follow up support, perceived self-efficacy, and hearing handicap.

Conclusion: This study identified factors relating to HA disuse and tools which may be used by clinicians to help identify red flags for disuse. In doing so, clinicians can implement measures specific to each client's needs to reduce their risk of becoming a non-user.

Table of Contents

List of Abbreviations

ACC   Accident Compensation Corporation

ANCOVA   Analysis of Covariance

BEPTA   Better Ear Pure Tone Average

HA/s   Hearing aid/s

HI   Hearing impairment

HAQ   Hearing Aid Questionnaire

HBQ   Hearing Beliefs Questionnaire

HHQ   Hearing Handicap Questionnaire

IOI-HA   International Outcome Inventory for Hearing Aids

MARS-HA   Measure of Audiological Rehabilitation Self-Efficacy for Hearing Aids

NZAS   New Zealand Audiological Society

SESMQ   Self-Efficacy for Situational Communication Management Questionnaire

SESMQC   SESMQ - Confidence scale

SESMQH   SESMQ - Hearing ability scale

WEPTA   Worst Ear Pure Tone Average

WHO   World Health Organisation

List of Figures

List of Tables

Chapter One

1.1 Overview

Hearing impairment (HI) is the most common acquired communication disability in the adult population, affecting approximately one-third of people aged 65 years and over (Hickson & Scarinci, 2007; World Health Organisation, 2015). In Aotearoa/New Zealand, disabling HI affects 9% of the total population, and over a third of all males aged 65 years and over (Greville, 2005).

HI reduces an individual's ability to understand speech signals and can therefore have far-reaching effects on a person's life. HI can have significant consequences on an individual's health and, if left untreated, can severely reduce their quality of life. As well as difficulties with communication and the impact that this has on social well-being, HI has also been associated with more serious health conditions (Crandell, 1998; Lichtenstein, Bess, & Logan, 1988; Mulrow et al., 1990).

The current gold-standard in the treatment of HI is with hearing aids (HA). HA are proven to be effective in reducing hearing handicap and improving health-related quality of life (Dawes et al., 2015). Despite this, less than a third of New Zealanders who could benefit from a HA own one (Greville, 2005). Also of concern is the rate of HA disuse which has been estimated to be as high as 24% in an older Australian population (Hartley, Rochtchina, Newall, Golding, & Mitchell, 2010). At this stage, the rate of disuse in New Zealand is unknown. A primary aim of this study is to quantify the rate of HA disuse for the first time in Aotearoa/New Zealand, and investigate the possible reasons for disuse.

Given the impact that HI has on an individual's well-being, and the wide-ranging rates of HA disuse worldwide, it is important to understand why some people purchase HAs but do not wear them. In order for an audiologist to provide the best service to their clients, one must understand the reasons for HA disuse in order to identify those who are "at risk" and offer additional support for these people so that they may become successful HA wearers.

1.2 Hearing Impairment

1.2.1 Overview

Hearing impairment (HI) is the result of abnormal structure or function at any point along the auditory pathway, and is defined as the partial or complete loss of ability to perceive sound (Bess & Humes, 2009). The hearing mechanism is comprised of four sections: the outer ear, the middle ear, the inner ear, and the retrocochlear pathways. The outer ear includes the visible portion of the ear and the ear canal, and its primary role is to collect and transmit sound waves down the ear canal to the middle ear system. The sound waves cause the tympanic membrane to vibrate, and these vibrations are conducted through the middle ear system via the ossicular chain to the inner ear. The middle ear functions to transmit the sounds from the outer ear to the fluid-filled inner ear, while compensating for the loss of energy which occurs during the transition from an air-filled to a fluid-filled space (Yost, 2007). In the inner ear lie the organs of hearing (the cochlea) and balance (the vestibular system). The fluids in the inner ear are displaced by the incoming sound wave, which causes chemical changes in the hair cells lining the cochlea. This serves to transform mechanical energy into electrical signals which are carried to the auditory cortex in the brain via the auditory nerve and brainstem structures.

HI is classified as one of three types depending on the location of the abnormality along the auditory pathway: conductive, sensorineural, or mixed. Conductive HI occurs as a result of problems in the outer or middle ear which do not allow sound to be transferred effectively to the inner ear. Such problems could result from impacted cerumen, tympanic membrane perforations, otitis media, otosclerosis and cholesteatomas. Conductive HI is generally treatable with medical or surgical interventions and is therefore often considered temporary in nature. Sensorineural HI arises from damage in the cochlea and/or auditory neural pathway causing disruption to the transduction of sound to electrical signals, and is considered permanent in nature. Cochlear damage can be caused by excessive noise exposure, presbycusis or endolymphatic hydrops, for example. Damage to the auditory nerve and pathways may result from vestibular schwannoma, neuropathy or lesions within the central auditory system. HI can also be mixed in nature, when problems occur both in transmitting sound to the inner ear and to the brain.

Once HI has been identified by an audiologist, descriptors of severity and configuration are used to characterise the HI. In New Zealand, the New Zealand Audiological Society (NZAS) guidelines recommend using a scale modified from Goodman (1965) to classify the severity, or degree of HI (New Zealand Audiological Society, 2007). According to this system, HI is graded as slight (16-25 dB HL), mild (26-40 dB HL), moderate (41-55 dB HL), moderately-severe (56-70 dB HL), severe (71-90 dB HL), or profound (> 91 dB HL) using a pure-tone average (PTA) of the thresholds obtained at frequencies 0.5, 1, 2, and 4 kHz using pure tone audiometry. It is also important to describe the configuration (or shape) of the HI as it is common for the degree of HI to vary between frequencies. Some examples are a "flat" configuration, where there is little

variation in the thresholds across the frequency range, or a "sloping" HI where the HI is greater in the high frequencies than in the low frequencies.

1.2.2 Prevalence

It is estimated that 360 million people worldwide are affected by a disabling hearing loss (World Health Organisation, 2015) with 91% of these being adults. In New Zealand ("Aotearoa" in te reo Māori) approximately 9% of the total population, or 380,000 people, have HI (Statistics New Zealand/Tatauranga Aotearoa, 2013). Of the people in New Zealand with HI, 8% are children under 14 years of age, and 33% are adults between the ages of 45 and 64 years (Greville, 2005).

The prevalence of HI is well documented to increase with age. In New Zealand, for adults over 65 years of age, 34% of men and 23% of women experience hearing loss, compared to 5% of men and 3% of women aged 15 – 44 years (Statistics New Zealand/Tatauranga Aotearoa, 2013). According to the New Zealand Census, HI is 3.5 times more prevalent in those adults over 65 years of age than younger adults (15 - 64 years) (Greville, 2005). A review of age-related hearing loss in Europe (Roth, Hanebuth, & Probst, 2011) found that by age 80 years, 55% of men and 45% of women have a hearing loss of 30 dB HL or more in their better ear (McCormack & Fortnum, 2013).

1.2.3 Impact of Hearing Impairment

HI impacts people in different ways, however it has been shown to have potential far-reaching effects on the individual. As well as communication difficulties, particularly in adverse listening environments, HI has been shown to result in compromised psychosocial function (Crandell, 1998; Smaldino, Crandell, Kreisman, John, & Kreisman, 2009). There is much evidence

to show that HI is associated with poor quality of life among older people, and can lead to feelings of frustration, anger, isolation and depression (Bess, Lichtenstein, Logan, Burger, & Nelson, 1989; Christian, Dluhy, & O'Neill, 1989; Crandell, 1998; Gopinath, Wang, Schneider, Burlutsky, & Snowdon, 2009; Vesterager & Salomon, 1991).

Research has also suggested that untreated HI can affect an individual's health. People with HI tend to exhibit higher incidence of health-related difficulties including hypertension, heart disease, osteoarthritis, and reductions in activity level (Lichtenstein et al., 1988; Mulrow et al., 1990). Additionally, HI may be associated with cognitive decline and dementia. Studies examining the negative consequences of untreated HI in Germany, Japan, Italy and the United States were reviewed, and researchers found that decline in cognitive functions was significantly correlated with HI (Arlinger, 2003; Ng & Loke, 2015). A further two studies found an association between rapid cognitive decline, dementia, and HI (Gurgel et al., 2014; Lin et al., 2013). A recent study by Dawes and colleagues (2015) as part of the Epidemiology of Hearing Loss study (Cruickshanks et al., 1998) investigated the impact of treating HI with a hearing aid (HA) on health outcomes by measuring a number of factors up to 11 years after HA fitting. This study found that while HAs were shown to reduce hearing handicap and promote better physical health, there was no evidence that cognitive, social, or mental health outcomes were different between HA users and non-users at any stage throughout the study.

1.2.4 Describing hearing impairment

Hearing impairment is generally quantified using pure tone audiometry, as previously described. However, as evidenced above, HI has further consequences for the individual and audiometry appears limited in predicting the effects that it will have for that person's daily

activities and involvement in life situations (Sataloff, Sataloff, Virag, Sokolow, & Luckhurst, 2006). In order to properly manage a person's HI, consideration must be given to how it affects the individual as a whole.

The World Health Organisation (WHO) International Classification of Functioning, Disability and Health (ICF) (World Health Organisation, 2001) provides a framework to consider the effects of HI on the lives of the individual and their families (Hickson & Scarinci, 2007). The ICF identifies three levels of human functioning: at the level of (1) the body or body part, (2) the whole person, and (3) the whole person in a social context (World Health Organisation, 2002). These levels are considered in terms of structures and functions, activities and participation, and environmental and personal factors (Scarinci, Worrall, & Hickson, 2009). Disability involves dysfunction at one or more of these levels: impairments, activity limitations, and participation restrictions. Figure 1 shows how these components interact with each other.
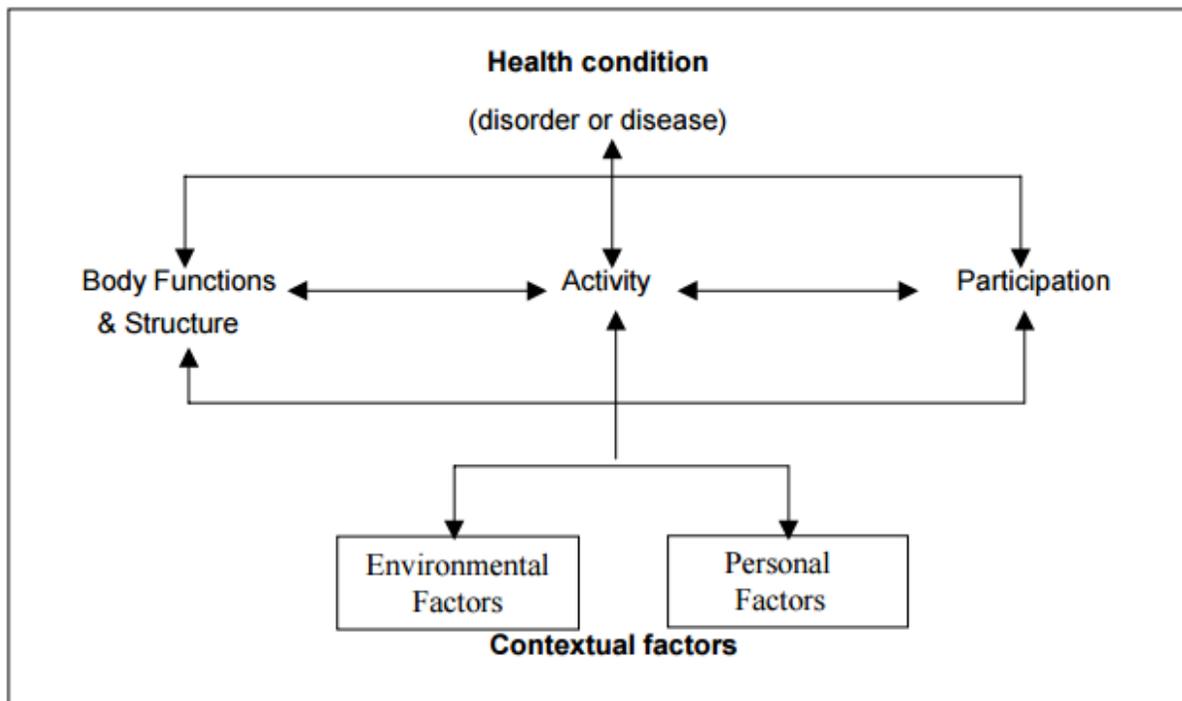
Figure 1. ICF model (World Health Organisation, 2002)

6

1.3   Treatment of HI

At present, it is not possible to restore hearing once the cochlea has been damaged. There are, therefore, a number of interventions for people with HI, such as auditory rehabilitation, education, counselling, and assistive listening devices. However, the primary management strategy is through use of one or two HAs. It is hoped that by addressing the functional impairment level of the ICF model, this will have positive effects on the activity limitations and participation restrictions experienced by the person. Indeed, research has shown that use of HAs improve speech reception and word recognition (activity limitations) as well as quality of life, general functioning and interpersonal relationships (Kelly-Campbell, Thomas, & McMillan, 2015; Vuorialho, Karinen, & Sorri, 2006). There is consistent evidence that HAs reduce hearing handicap overall (Dawes et al., 2015) and improve health-related quality of life (Chisolm et al., 2007). Kochkin (2011) found that HA use improves communication, intimacy and warmth in relationships, emotional stability, and sense of control over life events.

1.3.1   Hearing aid uptake

Despite evidence stating that HAs are effective, it is well known that many adults who could benefit from them do not own or regularly use their aids. The WHO states that only one in every five people who could benefit from a HA wears one (McCormack & Fortnum, 2013). In addition to this, it has been found that many HA owners suffered with a significant HI for up to ten years before receiving a HA, with the average age of owning a first HA being 74 years old (Davis, Smith, Ferguson, Stephens, & Gianopoulos, 2007; McCormack & Fortnum, 2013). New Zealand has a relatively low HA adoption rate compared to other developed countries. For example, in the United Kingdom, 42.7% of people who would benefit from HAs own them

(EHIMA, 2015), compared with 28% of adults with HI in New Zealand (Greville, 2005). In New

Zealand, the prevalence of HA use increases with age from only 5% of 25-44 year olds with HI to

63% of adults with HI aged 85 years and older (Kelly-Campbell & Lessoway, 2015).

1.4   Hearing Aid Disuse

Of the approximately 28% of adults with HI who own HAs (Greville, 2005), not all of

them use them consistently, if at all. The number of people who own HAs but do not wear them

ranges from 4.7% (Hougaard & Ruf, 2011) to 24% (Hartley et al., 2010). In 2010, MarkeTrak

researchers in the United States reported that 12.4% of HA owners do not use their aids at all

(Kochkin et al., 2010) while in the United Kingdom, 11% of adults do not use their aids at all,

and 19% use them less than one hour each day (EHIMA, 2015). There are no current data

describing HA disuse rates in New Zealand, however a study by Jerram and Purdy in 2001 found

that 26% of participants used their HA one to four hours per day, which is consistent with the

EuroTrak UK 2012 data (EHIMA, 2012).

Definitions of hearing aid "use" vary considerably between studies, as do the criteria

used to differentiate users and non-users. A systematic review by Ng and Loke (2015) provides

an overview of the differences in determining a HA user versus a non-user. In four cross-

sectional studies reported, the definition of a HA user included simply owning a HA, being fitted

with a HA, or using a HA. Other studies classified participants into successful or unsuccessful

owners, however "success" was defined as using their HA for at least one hour per day.

1.4.1 Reasons for hearing aid disuse

Various explanations have been suggested as reasons for HA disuse. A recent systematic review identifies both audiological and non-audiological factors which determine HA adoption and use (Ng & Loke, 2015).

1.4.1.1 Audiological factors

Severity of HI was found to predict HA use, with individuals with more severe HI as defined by the pure tone average, using their HA for more hours each day than those with less severe HI (Hartley et al., 2010). Bertoli et al. (2009) also found that non-regular use of HAs was lower among those with moderate and severe HI as compared to individuals with mild HI (Ng & Loke, 2015).

The type of HA has also been found to determine HA use. It is reported that individuals with programmable HAs with directional microphones used their aids significantly longer than those fitted with non-programmable HAs (Yueh et al., 2001). HAs with more advanced processing abilities have also been associated with a lower risk of non-regular use (Bertoli et al., 2009).

Tolerance of background noise has also been found to influence the hours of daily HA use. A higher tolerance for background noise while listening to speech was associated with more hours of use. Similarly, a recent thesis study found that HA users had significantly greater acceptable noise level scores than HA non-users (Allan, 2015).

1.4.1.2 Non-audiological factors

The most important determinant of HA use has been shown to be self-perception of a hearing problem (Solheim, Kvaerner, Sandvik, & Falkenberg, 2012). Studies using two versions of

the Hearing Handicap Inventory for the Elderly, HHIE (Ventry & Weinstein, 1982) and HHIE-S (Weinstein, 1989), have found that higher scores for the perception of hearing handicap by both the individual with the HI and their significant other were significantly associated with longer hours of HA use (Fischer et al., 2011; Hartley et al., 2010). Another study using the International Outcome Inventory for Hearing Aids (IOI-HA; Cox et al. (2000)) also confirmed that those who more strongly perceive themselves to have a hearing difficulty are more likely to use HAs for more than one hour per day (Hickson, Meyer, Lovelock, Lampert, & Khan, 2014). A large Swiss study found that almost a quarter of HA owners who wore their HAs "occasionally" or "never" reported that no perceived need was the reason for their disuse (Bertoli et al., 2009).

Another factor identified as influencing HA use is the wearer's expectations when they receive their HAs. The use of HAs has been associated with higher pre-fitting expectations (Jerram & Purdy, 2001), although unrealistic expectations have been mentioned as explanatory factors for unsuccessful rehabilitation (Solheim et al., 2012). More positive attitudes to HAs have also been found to be an important factor in successful HA ownership, as described by Knudsen, Öberg, Nielsen, Naylor, and Kramer (2010).

Poor perceived benefit was reported by Bertoli et al. (2009) to be the main reason for 23% of irregular users not wearing their HAs, and was ranked the third most common reason overall behind 'noisy disturbing situations' and 'no perceived need'. Smeeth et al. (2002) also reported that individuals who perceived they were getting "a lot" of benefit from their HAs were more likely to wear them than those who perceived they were benefitting "not at all". A review by McCormack and Fortnum (2013) indicated that no perceived benefit was the primary reason for the non-use of HAs in five separate studies (Gopinath et al., 2011; Hartley et al.,

2010; Kochkin, 2000; Lupsakko, Kautiainen, & Sulkava, 2005; Tomita, Mann, & Welch, 2001).

Satisfaction also appears to be closely linked to benefit, with a lower degree of satisfaction

being associated with increased risk of non-use of HAs (Bertoli et al., 2009).

Further risk factors or reasons for non-use of HAs are varied across the literature, but

have included: unpleasant side effects (such as itching, pain, wax build-up), poor sound quality,

difficulties with management, poor fit and comfort (Bertoli et al., 2009), being younger (Hartley

et al., 2010), being male (Smeeth et al., 2002), lower education (Fischer et al., 2011), and lower

income (Lupsakko et al., 2005).

1.4.2   Consequences of hearing aid disuse

As has been already outlined, untreated HI can have far-reaching and serious effects on

a person's health, including heart disease and cognitive decline (Lichtenstein et al., 1988; Ng &

Loke, 2015). The psychosocial consequences of untreated HI are varied, but can have a great

impact upon the quality of life for the person with HI and those around them. Difficulties with

communication can lead to social and emotional isolation, negatively impacting relationships

with significant others and family life in general (Chia et al., 2007; Kelly-Campbell & Lessoway,

2015; Mulrow et al., 1990). Left untreated, these issues may contribute to the higher reported

levels of depression, anxiety, interpersonal sensitivity, and hostility in adults with HI (Monzani,

Galeazzi, Genovese, Marrara, & Martini, 2008). This can have a profound effect on relationships

with significant others.

HAs have been shown to reverse the adverse effects of HI on quality of life (Mulrow et

al., 1990). By improving their ability to hear and communicate, HA users have been shown to

feel more in control of life events, more emotionally stable, and more mentally and physically

healthy (Better Hearing Institute, 2016). When a patient does not wear their HA, they can impact their own quality of life as well as that of their significant others, and also increase their risk of depression and anxiety (McCormack & Fortnum, 2013).

1.5   Health Belief Model

Despite the negative consequences of untreated HI and evidence that HAs are an effective intervention, HA uptake rates remain relatively low worldwide. There is strong evidence that older adults are more likely to consult a hearing professional if they have a moderate to severe HI and experience activity limitations or participation restrictions (Meyer, Hickson, Lovelock, Lampert, & Khan, 2014), however it appears that these hearing related factors alone are not enough. A study by Meyer, Hickson, Khan, Hartley, and Dillon (2011) sought to examine help-seeking behaviour among individuals who had failed a hearing screening via telephone. Five months after the screening, it was found that only 36% had sought help for their hearing, and only 50% of HA candidates had purchased HAs. In a similar study, only 28% of veterans recommended to see an audiologist had done so a year following the recommendation, and less than half of those with HI had acquired HAs (Saunders, Frederick, Silverman, & Papesh, 2013; Yueh, Collins, Souza, Boyko, & Loovis, 2010). The Health Belief Model (HBM) can help to explain the non-audiological factors which drive individuals to seek help for HI (Meyer, Hickson, Lovelock, et al., 2014; Rosenstock, Strecher, & Becker, 1988).

The HBM is a psychosocial model of health behaviour change, widely used since the 1950s to explain health-related behaviours and as a guiding framework for intervention (Champion & Skinner, 2008). The HBM contains five primary concepts that predict why people will take action to prevent, screen for, or control health conditions. In the case of HI, this would

entail deciding to seek help from a hearing professional, and to accept a treatment option such

as HAs. The concepts in the HBM are: (1) susceptibility, the belief about the likelihood of getting

a condition; (2) severity, the seriousness of leaving a condition untreated and possible social

consequences; (3) benefits, personal beliefs regarding the efficacy of the advised action; (4)

barriers, beliefs about the tangible and psychological costs of the action; (5) self-efficacy,

confidence in one's ability to take action. Figure 2 demonstrates the relationship between these

concepts.

Modifying factors   Individual beliefs   Action

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                        ┌─────────────────────────────┐
┌──────────────┐        │  Perceived susceptibility   │
│    Client    │        │                             │        ┌──────────────────────┐
│ demographics │───────▶│   Perceived severity        │───────▶│ Individual behaviours │
│              │        │                             │        └──────────────────────┘
│ Psychological│        │   Perceived benefits        │                   ▲
│characteristics│       │                             │                   │
│              │        │   Perceived barriers        │        ┌──────────────────────┐
└──────────────┘        │                             │        │    Cues to action    │
                        │   Perceived self-efficacy   │        └──────────────────────┘
                        └─────────────────────────────┘
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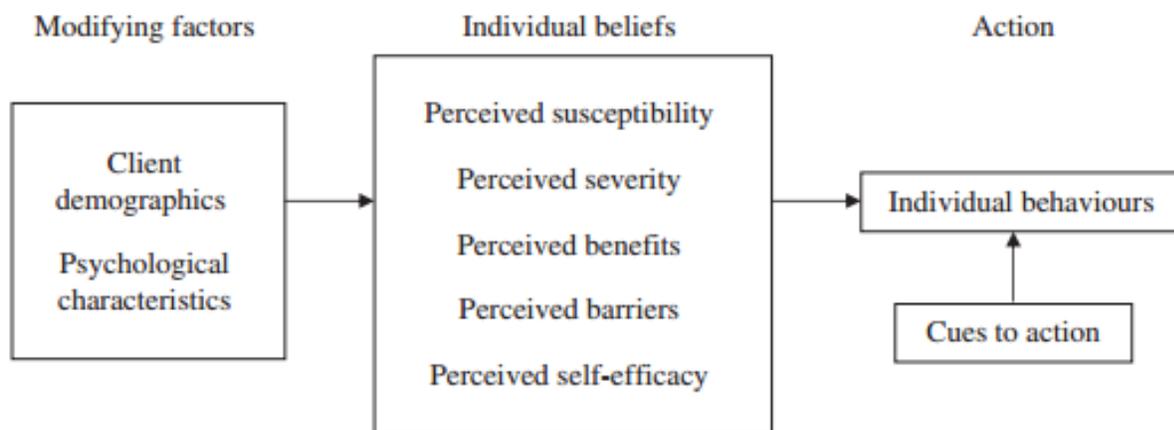
Figure 2. Health belief model (Meyer, Hickson, Lovelock, et al., 2014).

The HBM also considers cues to action, factors that support behaviour change, to be important in understanding how or why an individual seeks help (Meyer, Hickson, Lovelock, et al., 2014). These actions can include support from significant others, referral from another discipline, or seeing an advertisement on the television. Client demographics and psychological characteristics can also influence a person's behaviours or beliefs, as indicated by the modifying factors in Figure 2.

1.5.1 Self-Efficacy and Locus of Control

Perceived self-efficacy was originally developed as part of social cognitive theory (Bandura, 1977; Jennings, Cheesman, & Laplante-Lévesque, 2014). According to Bandura, (1997, p. 37) "perceived self-efficacy is not a measure of the skills one has, but a belief about what one can do under different sets of conditions with whatever skills one possesses". Self-efficacy is the belief an individual has that they can successfully carry out a certain activity. In the context of HI, a person with high self-efficacy is able to problem-solve, create and adapt coping mechanisms, therefore taking part in challenging activities rather than avoid them (Jennings et al., 2014). A person with low self-efficacy, however, may be more likely to withdraw from challenging listening situations as they cannot adapt their own or others' behaviours to suit their needs in that environment. Self-efficacy is also task-specific, therefore someone with high self-efficacy in one situation may have low self-efficacy in another (Bandura, 1977).

Self-efficacy was not explicitly included in the HBM until 1988 (Champion & Skinner, 2008), when a body of literature had developed indicating the importance of this construct in initiating and maintaining a behavioural change. In order for someone to successfully change

their behaviour and seek treatment, they must feel that they are competent enough to overcome the perceived barriers to take action.

Closely associated with this, and incorporated into the 'psychological characteristics' construct, is the influence of an individual's locus of control. Control tendencies vary with a person's ability to ensure they achieve a desired outcome, in other words, their self-efficacy (Garstecki & Erler, 1998). Individuals who have an internal locus of control perceive life events to be dependent on their own behaviour and actions, whereas those tending towards external control believe outcomes are determined by chance, fate, or powerful others. It had been shown that individuals with internal control are more likely to practice health-promoting behaviours (McLean & Pietroni, 1990). Locus of control has not commonly been investigated in terms of HA use, and is an area of interest in this study.

1.6   The Health Belief Model and Hearing Help-Seeking

While the HBM has been shown to be applicable to hearing health behaviours, it has not been widely used (Saunders et al., 2013). A review by Knudsen et al. (2010) demonstrates that HA use and satisfaction have been more widely investigated than help-seeking behaviours and HA acquisition, and that there are great differences between the predominant factors for each. It has, however, been shown that factors influencing hearing health behaviours overlap considerably with other chronic medical conditions, therefore help-seeking behaviours may be independent of a specific health condition (Saunders et al., 2013).

Perhaps the only study to look specifically at hearing health behaviours within the HBM is by van den Brink, Wit, Kempen, and van Heuvelen (1996). This study aimed to examine help-seeking for HI and understand attitude differences in 624 older people with HI by having them

complete several questionnaires. It found help-seeking was not related to sex or age, when controlled for level of HI. It was found, however, that those who sought help for their HI were generally more impaired. This supports the conclusions of Fischer et al. (2011); Meyer et al. (2011); Saunders et al. (2013) that individuals with more severe symptoms or who were concerned about their hearing were more likely to seek help. This reflects the perceived severity construct of the HBM.

These studies also provide evidence towards several other constructs of the HBM. Thirty-three per cent of participants in this study called for a hearing screening because they were curious about their hearing (perceived susceptibility) (Meyer et al., 2011). The benefits perceived by the person with HI appear to be a great influence on an individual's decision to seek help. Thinking that HAs would not help them, or hearing of poor experiences by other people have been shown to be reasons for not taking up HAs, despite being told they would benefit by a medical professional (Fischer et al., 2011; Meyer et al., 2011). van den Brink et al. (1996) reported that 60% of their participants who chose not to consult a medical professional did so because they thought a HA had little to offer them. Even if perceived benefits do exist, when these are outweighed by the perceived barriers a person will likely not seek help. Some barriers discussed in the literature include increased social stigma associated with HAs, where they are thought to draw attention to the HI. In the group of people reported by van den Brink et al. (1996) who were aware of their HI but chose not to try a HA, 52% agreed that a HA would make HI obvious, and 48% reported that a HA made them feel old. It is possible that this factor is one of the biggest influencers in HA disuse, and will therefore be investigated in the present study.

Little research has been conducted around locus of control and its relationship to HI. It has been suggested that individuals with internal control, that is, they perceive their behaviour to control life events, are more likely to practice health-promoting behaviours (McLean & Pietroni, 1990). A study by Garstecki and Erler (1998) also suggests that those with an internal locus of control are more likely to be HA users, especially in females. Given the limited research in this area and its potential for predicting HA disuse, it is also an area of interest in this study.

1.7   Study Rationale

Given the extent of HI and the problems it can cause for individuals in terms of their quality of life, relationships with others and long-term health outcomes, it is important to understand how extensive HA disuse is in New Zealand and investigate what factors can lead a person who purchases HAs to not use them. It is hoped that this information will provide guidance on important areas for clinicians to target in their interactions with clients, and identify possible risk factors for HA disuse which could help rehabilitation outcomes for the client and their family.

1.8   Aims and Hypotheses

This study aims to quantify the rate of HA disuse in New Zealand, as well as identify reasons for HA disuse. This study aimed to test three hypotheses:

1. There will be significant demographic factors associated with HA use. Specifically:

    i.   Age

    ii.   Sex

    iii. Relationship status

    iv.   Education

17

     v.   Income

    vi.   Employment

   vii.   Number of people in the home

2. There will be significant audiometric factors associated with HA use. Specifically:

     i.   Severity of hearing impairment

    ii.   Better-ear pure tone average (BEPTA)

   iii.   Worse-ear pure tone average (WEPTA)

    iv.   Satisfaction

     v.   Age of first HA fitting

    vi.   Binaural fitting

   vii.   Application for government subsidy or other funding

3. There will be significant self-reported factors associated with HA use. Specifically:

     i.   Hearing Handicap Questionnaire (HHQ)

    ii.   Hearing Beliefs Questionnaire (HBQ)

   iii.   Hearing Aid Questionnaire (HAQ)

    iv.   Self-Efficacy for Situational Management Questionnaire (SESMQ)

     v.   Measure of Audiological Rehabilitation Self-Efficacy- Hearing Aids (MARS-HA)

    vi.   International Outcome Inventory for Hearing Aids (IOI-HA)

   vii.   Levenson Scales

Chapter Two: Methods

2.1   Sample Size Analysis

Before starting the recruitment of participants, the required sample size was determined using an *a priori* power analysis. The level of significance was set at .05 and statistical power at .80, as is standard in research. To detect an effect size of at least d = .5, 160 participants were required for the multivariate analysis of variance (Lauter, 1978).

2.2   Participants

This study recruited participants from Bay Audiology clinics throughout New Zealand. Participants were determined as being eligible for inclusion in the study using the following criteria: (1) be over the age of 18 years; (2) have a hearing impairment with onset in adulthood; (3) have purchased hearing aids in the past three years; (4) be able to read and fill out the information sheet, consent form, and questionnaires in English, and (5) to return these via post or e-mail.

This study focused on adults with hearing impairment. The first criterion ensured all participants were adults, and the second that they had an acquired hearing loss. The third criterion helped the researcher to use a smaller, but still random, group of clients to invite. The fourth criterion ensured that participants were able to understand and fill out the information sheet and questionnaires, while the fifth criterion ensured that complete data sets were collected from each participant.

This study aimed to recruit both hearing aid users and non-users, with non-users being those who have bought hearing aids but do not use them. Participants were randomly selected

from a pool of clients fitted with hearing aids in the past three years. This process was completed by an associate supervisor who had access to Bay Audiology's database.

2.3 Recruitment

The goal of recruitment for this study was to reach individuals from across the country. Active recruitment began on 25 March 2015, and ran until 19 May 2015. During this time, invitation packets were sent to participants selected from the database via post. These provided participants with information about the study and directions for indicating their interest in taking part (Appendix A). Participants were given the option of responding via post, e-mail or phone and were required to provide their name, address and contact phone number.

2.4 Procedure

Participants were recruited from around New Zealand using the methods outlined above. The movement of participants through the study is shown in Figure 3. The first information packets were sent in a mail-out of 200 clients to gauge an initial response rate. Thirteen percent of those invited to participate indicated their interest. Following this, invitations were sent to a further 600 clients. The return rate for the second mailing improved to close to 23% with the inclusion of a postage-paid return envelope. When a participant responded, they were assigned an identifier number and their name, address and contact phone number were entered into a database.

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┌─────────────────────────────────────────────────────────────────┐
│           Recruitment Round 1: 200 invitations sent             │
├─────────────────────────────────────────────────────────────────┤
│                      Response rate: 13%                          │
└─────────────────────────────────────────────────────────────────┘
                                ▼
┌─────────────────────────────────────────────────────────────────┐
│           Recruitment Round 2: 600 invitations sent             │
├─────────────────────────────────────────────────────────────────┤
│                     Response rate: 22.8%                         │
└─────────────────────────────────────────────────────────────────┘
                                ▼
┌─────────────────────────────────────────────────────────────────┐
│                   164 participants enrolled                     │
├─────────────────────────────────────────────────────────────────┤
│                  Questionnaire packets sent                     │
└─────────────────────────────────────────────────────────────────┘
                                ▼
┌─────────────────────────────────────────────────────────────────┐
│                       Other responses                           │
├──────────────┬──────────┬──────────────┬───────────┬────────────┤
│19 undeliverable│5 deceased│3 responded "too│1 "ill health"│1 "nothing to add"│
│              │          │    busy"     │           │            │
└──────────────┴──────────┴──────────────┴───────────┴────────────┘
                                ▼
┌─────────────────────────────────────────────────────────────────┐
│                    129 returned  (79%)                          │
├─────────────────────────────┬───────────────────────────────────┤
│           86 male           │            43 female              │
└─────────────────────────────┴───────────────────────────────────┘
                                ▼
┌─────────────────────────────────────────────────────────────────┐
│                       9 Withdrawals                             │
├─────────────────────────────┬───────────────────────────────────┤
│        1 "ill health"       │           8 "no reason"           │
└─────────────────────────────┴───────────────────────────────────┘
                                ▼
┌─────────────────────────────────────────────────────────────────┐
│                                                                 │
│               Interviews (Part Two of study)                    │
│                                                                 │
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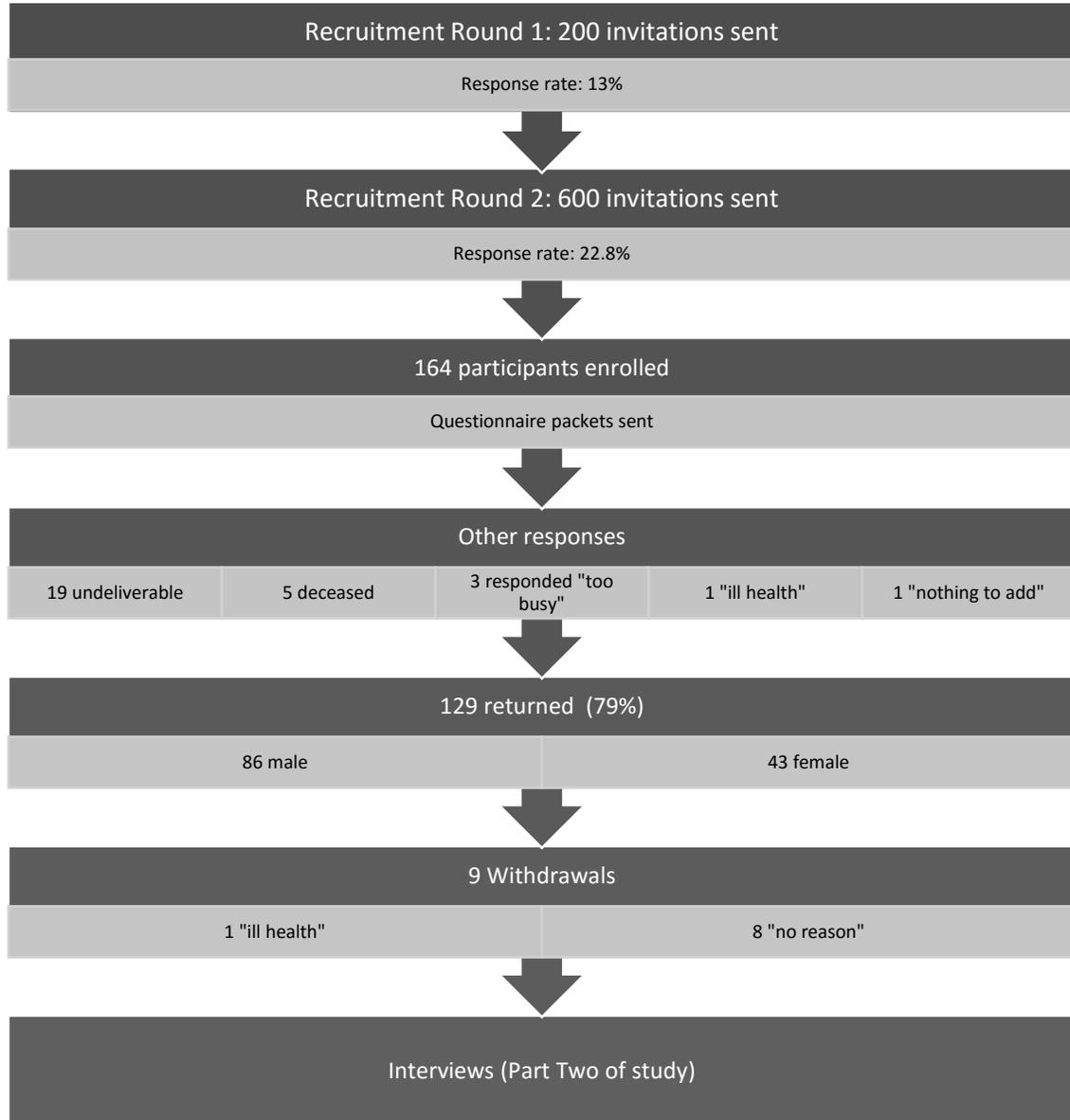
Figure 3. Flow of participants through recruitment process

Once enrolled, a second packet was sent to each participant via post. This included a consent form (Appendix B), demographic information sheet (Appendix C), questionnaires (Appendix D), and a postage-paid return envelope.

Participants were informed that once this packet had been returned to the researchers, a second researcher would be in touch to organise an interview for the second part of the study not described in this thesis. Upon return of the packet and appropriate consent given, audiological information was obtained from Bay Audiology. The questionnaires were scored according to their researchers' instructions and all data were entered into an Excel spreadsheet alongside each participant number. No identifying information was included in this data.

2.5 Measures

The questionnaires used to assess demographic, audiometric, and self-report variables are explained below.

2.5.1 Questionnaires

2.5.1.1 *Demographic questionnaire*

A demographic questionnaire (Appendix C) was included in the data packets. This included questions relating to age, gender, ethnicity, relationship status, income, education, employment, number of individuals in the home, severity of hearing impairment, unilateral or bilateral hearing aid fitting, age at first hearing aid fitting, hours of use per day, application for government subsidy and other funding for hearing aids.

2.5.1.2 *Hearing Handicap Questionnaire (HHQ)*

The Hearing Handicap Questionnaire (HHQ) measures personal and social effects of HI, and participation restrictions (Gatehouse & Noble, 2004). It was developed partly from items in

the Hearing Disabilities and Handicaps Scale (Hétu et al., 1994) and from items in an unpublished general health scale (the Glasgow Health Status Inventory; Robinson, Gatehouse, and Browning (1996)). The wording in the questionnaire has been adjusted to ask specifically about the effects of hearing impairment (Gatehouse & Noble, 2004). Psychometric testing showed that HHQ has good internal consistency (Cronbach's α = 0.93) (Hickson, Worrall, & Scarinci, 2007) and measures a single factor (Gatehouse & Noble, 2004).

The HHQ consists of 12 questions relating to their hearing. Participants were asked to respond: 'never', 'rarely', 'sometimes', 'often', or 'almost always' in response to each question. Example items include "How often does your hearing difficulty restrict the things you do?" and "How often do you feel cut off from things because of your hearing difficulty?" Answers were scored as follows: 1 for 'never', 2 for 'rarely', 3 for 'sometimes', 4 for 'often', and 5 for 'almost always'. Total scores could range from 12 to 60, with higher scores indicating greater handicap (Gatehouse & Noble, 2004).

2.5.1.3 *Hearing Beliefs Questionnaire (HBQ)*

The Hearing Beliefs Questionnaire measures hearing beliefs, including help seeking, hearing aid acquisition, and hearing aid use, within the constructs of the Health Belief Model (HBM; Saunders et al. (2013)). In order to develop the HBQ, members of the research team independently developed items which would assess each construct of the HBM. These items were then collated, discussed and amended, then shared with nine audiologists who provided feedback. Once further changes had been made to simplify the questions, five laypersons provided the final input. The final version of the HBQ consists of 26 questions measuring six constructs. These are: (1) perceived susceptibility: the feeling of being vulnerable to or at risk of

acquiring hearing loss (Cronbach's α = 0.605); (2) perceived severity: the belief in the seriousness of the consequences if affected by hearing loss, both medically and socially (Cronbach's α = 0.671); (3) perceived benefits: the belief that intervention will result in positive outcomes (Cronbach's α = 0.619); (4) perceived barriers: the barriers an individual perceives he/she needs to overcome to effectively conduct an intervention such as wearing hearing aids (Cronbach's α = 0.774); (5) cues to action: cues that prompt an individual to take action, such as symptoms of hearing impairment, or receiving information from others (Cronbach's α = 0.750); (6) perceived self-efficacy: the individual's belief in their own ability to use and benefit from wearing hearing aids (Cronbach's α = 0.234) (Saunders et al., 2013).

The HBQ was included in the participants' questionnaire packets. In order to complete the questionnaire, participants had to respond to each of the 26 items by circling a number on a 10-point scale in response to each statement, where '0' = 'completely disagree', '5' = 'no opinion', and '10' = 'completely agree'. Scores were obtained for each scale by averaging the responses for that scale. Four items were reverse scored: items 3, 10, 24 and 25.

2.5.1.4   Hearing Aid Questionnaire (HAQ)

An instrument which allows measurement of the motivational factors in hearing aid use is the Hearing Aid Questionnaire (HAQ; Solheim et al. (2012)). It was developed in Norway as a result of a lack of suitable instrument to assess these factors in individuals who own hearing aids. In order to construct the HAQ, researchers conducted six focus interviews and developed a 17-item trial questionnaire. This was then trialled with a pilot study, and after some minor changes, the HAQ was completed. Each of the 17 items addresses different aspects of experiences related to hearing aids and follow up visits.

Factor analysis suggests that the HAQ is comprised of four factors: 'accepted need', defined as the acknowledged need for hearing aids (Cronbach's α = 0.869); 'follow up support' (Cronbach's α = 0.900); 'social assessment', defined as the environment's influence on the individual's experience of hearing loss (Cronbach's α = 0.552); 'consciousness' - the participant's attitudes towards hearing loss and hearing aids (Cronbach's α = 0.505). Cronbach's alpha was low for factors 3 and 4 based on convention in research for measuring internal consistency (Field, 2013). In total, the four factors explained 68.1% of the total variance (Solheim et al., 2012).

The HAQ was included in participants' data packs. For each item, participants were required to indicate their agreement with each statement from 0 (completely disagree) to 10 (completely agree). Items were separated into the four factors for scoring. The first factor, accepted need, was comprised of eight items. The sum of these scores range from 0 to 80. Five items were summed to form the follow-up support score. These range from 0 to 50. Two items made up each of the social assessment and consciousness factors, and these scores range from 0 to 20 for both scales.

2.5.1.5 *Self-Efficacy for Situational Communication Management Questionnaire (SESMQ)*

One way to measure self-efficacy is through the Self-Efficacy for Situational Communication Management Questionnaire (SESMQ; Jennings (2005)). The SESMQ measures perceived self-efficacy for managing communication in everyday listening situations (Jennings et al., 2014). Perceived self-efficacy is "a belief about what one can do under different sets of conditions with whatever skills one possesses" (Bandura, 1997, p. 37). The SESMQ includes

items which target both public and private environments, and familiar and unfamiliar communication partners in order to sample a range of communication situations.

Psychometric analysis of the SESMQ found two factors, 'hearing ability' and 'confidence' which accounted for 46.4% and 11.6% of the variation respectively. Internal consistency measures were high, with Cronbach's α of 0.94 for the SESMQ, 0.93 for the hearing ability scale, and 0.94 for the confidence scale (Jennings et al., 2014).

The SESMQ was included in participants' questionnaire packets. In order to complete the SESMQ, participants were instructed to rate each of the 20 items on two scales: the *hearing ability scale* (SESMQH) which rates how well they can hear in the situation from 0 (not well at all) to 10 (very well); and the *confidence (self-efficacy) scale* (SESMQC) which rates their degree of confidence in managing the situation from 0 (not confident at all) to 10 (very confident). The total score on each scale ranges from 0 to 200, with higher scores indicating greater hearing ability and confidence (Jennings et al., 2014).

2.5.1.6   *Measure of Audiological Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA)*

Another way to measure self-efficacy is through a questionnaire called The Measure of Audiological Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA). The MARS-HA was designed to be used by clinicians to assist in identifying areas of low confidence which require additional training (West & Smith, 2007). Psychometric testing of the MARS-HA indicated strong internal consistency (Cronbach's α = 0.91), and good test-retest reliability for both new and experienced HA users (λ = 0.92 and 0.88 respectively) (West & Smith, 2007).

This questionnaire consists of 24 statements categorised into four subscales: basic handling, aided listening, adjustment, and advanced handling. Participants are required to

indicate how confident they are (on a scale of 0 to 100%) that they can perform specific tasks

now or in the future. Example items include "I can insert a battery into a hearing aid with ease"

and "I could understand conversation in a car if I wore hearing aids". An average score was

calculated for each subscale, with a higher score indicating higher self-efficacy in that particular

area.

2.5.1.7 *International Outcome Inventory for Hearing Aids (IOI-HA)*

The International Outcome Inventory for Hearing Aids (IOI-HA) was developed by Cox et

al. (2000) after recognising a need for an outcome measure that could be applied to many types

of investigations in different countries. The IOI-HA was composed first in English and has since

been translated into many languages. The aim was not to replace any optimal outcome measure

for a particular study, but to be a useful addition to existing measures in the research. When

used in this way, a core of data could be generated which are comparable across different

contexts, as well as gaining additional power to test the significance of treatment effects or

differences (Cox & Alexander, 2002).

The IOI-HA consists of seven items each targeting a different outcome domain. These

are: daily use, benefit, residual activity limitations, satisfaction, residual participation

restrictions, impact on others, and quality of life. The wording of items was chosen in order to

reduce literacy and cognitive demands (Cox, Alexander, & Beyer, 2003). Participants are

required to choose one of five possible responses, proceeding (left to right) from worst

outcome to best outcome (Cox & Alexander, 2002). The seven items can be grouped into two

factors. Factor one includes use, benefit, satisfaction, and quality of life, and describes the

participant's thoughts about their HAs. Factor two reflects how a person's HAs influence their

interactions with the outside world, and includes items on activity limitations, participation

restrictions, and impact on others (Cox & Alexander, 2002).

Normative data for the IOI-HA was collected by Cox and colleagues (2003). By analysing

the effects of demographic factors such as gender, HA experience, and hearing problems on a

person's responses, two sets of norms were produced: one for those who reported moderately-

severe or severe subjective hearing problems without amplification, and another for individuals

who reported mild or moderate hearing problems.

The IOI-HA was included in the questionnaire packet. Participants were required to circle

the appropriate response to each of the seven items previously described. Responses from left

to right were assigned a score of one to five, respectively. These were then added to obtain an

overall score. Scores could range from 7 to 35, with higher scores indicating more favourable

outcomes.

2.5.1.8 Levenson Locus of Control Scales

The Levenson Locus of Control scales (Levenson, 1973) were devised to measure

different aspects of locus of control in psychiatric patients. Specifically, they aim to measure

control as they relate to adjustment and clinical improvement. Psychiatric therapy tries to

encourage an internal locus of control to signify mastery of the environment and competence.

This relates to audiology by measuring an individual's locus of control in order to estimate their

acceptance of their HI and ability to become competent HA users.

The Levenson Scales are made up of three subscales: internality, powerful others, and

chance. Psychometric testing showed the internal consistency of these subscales to be

moderately high. Kuder-Richardson reliabilities (coefficient α) were 0.67 for the internality scale,

0.82 for powerful others, and 0.79 for the chance scale. This is not a surprising result given the wide variety of situations sampled in this questionnaire. Test-retest reliability was moderate for the powerful others and chance subscales (0.74 and 0.78 respectively), however it was extremely low for the internality scale (0.08). The mean score differences between all three scales were non-significant (Levenson, 1973).

The Levenson Scales were included in the participants' questionnaire packs. Participants were required to circle a number on a six-point scale from -3 (strongly disagree) to +3 (strongly agree) in response to a variety of statements. These statements did not overtly relate to hearing impairment, such as "when I get what I want, it's usually because I'm lucky." To score the questionnaire, the 24 items are separated into the three eight-item scales: internality, powerful others, and chance. Each response was summed for each scale, then 24 added to the total to give a positive number.

2.5.2 Audiometric variables

Audiometric data were gathered from Bay Audiology's database once consent had been given to do so. The degree of HI for each participant was determined using the pure tone average of the better ear (BEPTA). Better hearing is determined by lower hearing thresholds, and this was calculated by averaging the pure tone air conduction thresholds at 0.5, 1, 2 and 4 kHz. The hearing in the worst ear was also calculated in the same way, and is referred to as the worse-ear PTA (WEPTA).

2.6 Statistical Analyses

Statistical analysis for this study was performed using the Statistical Package for Social Sciences (SPSS version 22). The rate of HA disuse was estimated using descriptive statistics, and

a contingency table drawn up to include satisfaction ratings, as compared to normative data on the IOI-HA, and hours of use. Hypothesis One was tested by calculating Pearson's correlation coefficients for all continuous variables (age, number of people in the home) and analyses of covariance (ANCOVA) for all categorical variables (sex, relationship status, education, income, and employment). Hypothesis Two also used Pearson's correlation coefficients for the continuous variables (severity, BEPTA, WEPTA, satisfaction, age of first fitting) and ANCOVA for all categorical variables (binaural fitting, application for government subsidy, eligibility for other funding). Hypothesis Three used Pearson's correlation coefficients to examine the continuous variables (questionnaire and subscale scores), and Pearson's chi-square tests for categorical variables (IOI-HA and MARS-HA subscale scores as compared to normative data). Due to a misprint on the IOI-HA, participant responses for the benefit, residual participation restrictions, and impact on others scales were deemed invalid. As a result, these scales and IOI-HA total score were removed from all analyses.

2.7 Ethical Considerations

Ethical approval for this study was granted by the University of Canterbury Human Ethics Committee on 8th January 2015 (Appendix E). All procedures were carried out in accordance with this approval, and data collection did not commence until it had been received.

Chapter Three: Results

3.1 Description of Participants

A total of 164 people responded to the invitations for participants. Of these, nine people withdrew from the study, and 26 did not return their questionnaire packet. A total of 129 participants with HI took part in this study. Participants included 85 males and 42 females, ranging in age from 39 – 92 years ($\bar{x}$ = 73.7, SD = 10.16). The self-identified ethnicity for 120 of the participants was "New Zealand European". Five participants identified as "Maori", and three as "Other", which included Dutch, Irish and English. Two participants were excluded from the study: one failed to complete enough of the questionnaires to allow comparison, and the second has been a cochlear implant user for many years therefore cannot be included in the study. Both of these participants were removed from the analysis.

3.2 Defining Hearing Aid Non-use

Hearing aid non-use has been defined in many different ways throughout the literature (Ng & Loke, 2015). A possible definition is that a non-user is a participant who reports using their HA less than or equal to one hour per day. With this definition, the present study found a disuse rate of 9.4%, with 12 non-users out of 127 participants. If the criterion was extended to HA use for ≤ 4 hours per day, the disuse rate jumps to 22%.

HA non-use can also be described in other ways. Satisfaction with HAs may influence whether a HA owner is a user or non-user.

Table 1 shows that a quarter of non-users report low satisfaction with their HAs, while 75% of non-users report satisfaction within the normal range. Encouragingly, 86% of users

report 'normal' HA satisfaction. If disuse is defined as ≤ 4 hours use per day and low reported

satisfaction, the disuse rate is 5%.

From these three definitions alone, we can see that HA disuse is a complex issue which

cannot be easily defined. This will be further discussed in Chapter Four. A HA owner may report

being satisfied with their HA, however choose not to wear it regularly.

3.3   Missing data

Given the nature of questionnaires, there were circumstances where participants left

out responses to some of the questions. Where this occurred, the researcher has chosen to

ignore the missing value if the questionnaire score is obtained by averaging. However, where

the total score is obtained by summing the scores, this value has been omitted from the

analyses. For this reason, the total number of participants included in the analyses varies for

each questionnaire.

Table 1. Contingency table showing participants grouped by hours of use and normative data for

satisfaction on IOI-HA.

Below IOI-HA:

satisfaction

		Y	N	
Use ≤ 4 hours/day	Y	7	21	n = 28
	N	13	83	n = 96
		n = 20	n = 104	**N = 124**

3.4 Hypothesis One

There are three hypotheses in this study. The first focuses on the relationship between demographic factors and HA use. Hypothesis One states that there will be significant demographic factors associated with HA use. The demographic variables were: (a) age, (b) sex, (c) relationship status, (d) education, (e) income, (f) employment, (g) number of people in the home. Pearson's correlation coefficients were calculated to describe the relationship between the continuous demographic variables of age, number of people in the home and hours of HA use. Descriptive statistics for these variables are shown in Table 2. ANCOVA tests were completed for the categorical variables of sex, relationship status, education, income, and employment. Frequency counts for these variables are shown in Table 3.

3.4.1 Pearson's correlation coefficients

Hours of HA use was not found to be significantly correlated with either age ($r = .013$, $p = .889$) or the number of people in the home ($r = -.036$, $p = .690$).

3.4.2 ANCOVA

ANCOVA tests were conducted with the categorical variables of (a) gender, (b) relationship status, (c) education level, (d) income and (e) employment to determine any effects on HA use, when controlling for participant age and hearing loss (BEPTA and WEPTA). These results are presented in Table 4. It was found that there is no significant effect of gender, relationship status, education, income, or employment on HA use.

Table 2. Descriptive statistics for demographic variables.

	N	Min	Max	Mean	SD
Hours of HA use	127	0	16	9.99	5.47
Age	127	39	91	73.68	10.16
People in home	127	1	7	1.87	0.76

Table 3. Frequency counts for categorical demographic variables.

	N	In a relationship		Not in a relationship	
Relationship Status	125	90		35	
	N	Pre-secondary	Secondary-equivalent	Post-secondary	
Education	119	34	38	47	
	N	$0 – 25k	$25-50k	$50-75k	$75-100k	>$100k
Income	119	29	44	21	15	10
	N	Currently working		Unemployed/retired	
Working	125	33		92	

Table 4. ANCOVA for categorical demographic variables, controlling for age and PTA

		Sum of Squares	df	Mean Square	F	p
Gender	Between-group	98.551	1	98.551	3.526	.063
	Within-group	3410.142	122	27.952		
Relationship Status	Between-group	.090	1	.090	.003	.956
	Within-group	3476.454	120	28.970		
Education	Between-group	24.584	2	12.292	.432	.650
	Within-group	3216.234	113	28.462		
Income	Between-group	33.780	4	8.445	.293	.882
	Within-group	3194.227	111	28.777		
Working	Between-group	2.739	1	2.739	.096	.757
	Within-group	3420.20	120	28.502		

3.5 Hypothesis Two

The second hypothesis in this study states that there will be significant audiometric factors associated with HA use. Audiometric variables included (a) self-reported severity of HI, (b) BEPTA, (c) WEPTA, (d) satisfaction, (e) age at first HA fitting, (f) binaural fitting, (g) application for government subsidy or other funding for HAs. Pearson's correlation coefficients were calculated to describe the relationship between HA use and the continuous variables of severity, BEPTA, WEPTA, satisfaction, and age at first fitting. Descriptive statistics for these variables are shown in Table 5. ANCOVA tests were used for the categorical variables of binaural fitting and application for government subsidy or other funding. Frequency counts for these variables are shown in Table 6.

3.5.1 Pearson's correlation coefficients

3.5.1.1 *Significant correlations*

Hours of HA use was found to be positively related to self-reported severity of hearing loss ($r = .300$, $p = .001$). It was also positively correlated with BEPTA ($r = .242$, $p = .006$), WEPTA ($r = .232$, $p = .009$), and self-rated HA satisfaction ($r = .253$, $p = .004$).

3.5.1.2 *Non-significant correlations*

The age at which a participant was fitted with their first HA/s was found not to have a significant relationship with hours of use ($r = -.176$, $p = .54$).

Table 5. Descriptive statistics for audiometric variables.

	N	Min	Max	Mean	SD
Severity	125	1	10	6.18	1.86
BEPTA	127	15.00	100.00	45.56	16.55
WEPTA	127	17.50	120.00	55.10	20.14
HA Satisfaction	127	1	10	7.12	2.20
Age first HA	120	7	82	61.49	13.28

Note. BEPTA = Better Ear Pure Tone Average, average of .5, 1, 2 & 4 kHz in the better ear;

WEPTA = Worst Ear Pure Tone Average, average of .5, 1, 2 & 4 kHz in the worst ear; HA =

hearing aid.

Table 6. Frequency counts for categorical audiometric variables.

	N	Bilateral	Unilateral
Hearing aid fitting	126	117	9

	N	Yes	No
Government Subsidy Application	126	93	33

	N	Yes	No
Other funding application	127	34	93

3.5.2 ANCOVA

ANCOVA analyses were conducted with the categorical variables (a) binaural HA fitting, (b) application for government subsidy, and (c) eligibility for other funding to determine any effects on HA use, when controlling for participant age and hearing loss (BEPTA and WEPTA). These results are presented in Table 7. It was found that there is no significant effect of having one or two HAs, or funding method on HA use.

Table 7. ANCOVA for categorical audiometric variables, controlling for age and PTA

		Sum of Squares	*df*	Mean Square	*F*	*p*
Binaural fitting	Between-group	.012	1	.012	<.001	.984
	Within-group	3312.086	121	27.373		
Government subsidy	Between-group	.134	1	.134	.005	.946
	Within-group	3488.467	121	28.830		
Other funding	Between-group	30.261	1	30.261	1.061	.305
	Within-group	3478.433	122	28.512		

3.6 Hypothesis Three

The final hypothesis for this study states that there will be significant self-report factors associated with HA use. The self-report measures came from the subscales and total scores of the questionnaires. These included: (a) HHQ, (b) HBQ: susceptibility, (c) HBQ: severity, (d) HBQ: benefits, (e) HBQ: barriers, (f) HBQ: cues to action, (g) HBQ: self-efficacy, (h) HAQ: accepted need, (i) HAQ: follow up support, (j) HAQ: social assessment, (k) HAQ: consciousness, (l) HAQ: total, (m) SESMQ-H, (n) SESMQ-C, (o) MARS-HA: aided, (p) MARS-HA: basic handling, (q) MARS-HA: adjustment, (r) MARS-HA: advanced handing, (s) Levenson Scales: internality, (t) Levenson Scales: powerful others, (u) Levenson Scales: chance. Pearson's correlation coefficients were used to determine the relationship between these continuous variables and hours of HA use. Pearson's chi-square tests were used to examine the relationship between HA use and various categorical variables. These were based on the subscale scores from the IOI-HA and MARS-HA as compared to normative data. Contingency tables were drawn up to categorise participants according to hours of use (≤ 4 hours per day) and their scores in relation to the normative data for the IOI-HA (Cox et al., 2003) and MARS-HA (West & Smith, 2007).

3.6.1 Pearson's correlation coefficients

3.6.1.1 Significant correlations

Table 8 shows the significant Pearson's correlations found between hours of HA use and self-report measures. Twelve scales in the questionnaires were found to have significant relationships with hours of use, including: 'benefits', 'barriers' and 'susceptibility' subscales of the HBQ; 'accepted need' and 'follow up support' scales and total score of the HAQ; SESMQH score; 'aided listening', 'basic handling', and 'adjustment' scales in MARS-HA; HHQ total score.

Table 8. Statistically significant Pearson's correlations between hours of hearing aid use and self-report measures.

	HBQ benefits	HBQ barriers	HBQ susceptibility	HAQ accepted need	HAQ follow up support	HAQ total
Hours of use	.188	-.294*	.246*	.739*	.249*	.561*
	SESMQ-C	MARS-HA aided	MARS-HA basic	MARS-HA adjustment	HHQ	
Hours of use	-.185	-.182	.193	.245*	.226	
*p < .01						

3.6.1.2 Non-significant correlations

Table 9 shows the variables where no significant relationship ($p > .05$) was found with hearing aid use. This included several subscales of the questionnaires, and the entirety of the Levenson locus of control subscales. It is worth noting that the Levenson scales had a lower sample size than other scales (n = 112 for 'Internality' and 'Chance' scales; n = 109 for 'Powerful Others' scale). This was due to participants leaving out responses or choosing not to complete the questionnaire. This will be discussed further in Chapter Four.

Table 9. Non-significant Pearson's correlations between hours of hearing aid use and self-report measures.

	HBQ severity	HBQ cues	HBQ self-efficacy	HAQ social assessment	HAQ consciousness
Hours of use	-.013	.158	.122	.089	.070
	SESMQ-H	**MARS advanced handling**	**Levenson internality**	**Levenson powerful others**	**Levenson chance**
Hours of use	-.150	.130	-0.96	.031	.119

3.6.2 Pearson's Chi-square tests

3.6.2.1 IOI-HA and hearing aid use

Two-by-two contingency tables were drawn up for each of the scales of the IOI-HA,
categorising participants according to their self-reported hours of use and whether their IOI-HA
scale score fell below the norms reported in Cox et al. (2003). Chi-square analyses could not be
performed for the satisfaction or use scales due to the expected value for at least one cell being
< 5. The benefit, impact on others, and residual participation restrictions scales were also not
analysed, due to the previously mentioned error. The analyses for the remaining two scales are
reported below.

No significant association was found between HA use and residual activity limitations
($\chi^2(1) = 0.732$, *p* = .392, φ = 0.078), or quality of life ($\chi^2(1) = 1.00$, *p* = .317, φ = 0.089) as
measured by the IOI-HA. The contingency tables for these analyses are displayed in Table 10,
and Table 11 respectively.

Table 10. Contingency table showing participants grouped by hours of use and normative data for activity limitations scale of IOI-HA.

		Below normal score- IOI-HA residual activity limitations		
		Yes	**No**	Total
Use ≤ 4 hours/day	**Yes**	9 (+16.9%)	17 (-6.6%)	26
	No	24 (-4.8%)	68 (+1.9%)	92
	Total	33	85	118

Values in parentheses represent the percent deviation from the expected frequency, based on the null hypothesis.

Table 11. Contingency table showing participants grouped by hours of use and normative data for quality of life scale of IOI-HA.

		Below normal score- IOI-HA quality of life		
		Yes	**No**	Total
Use ≤ 4 hours/day	**Yes**	10 (+20.2%)	18 (-7.9%)	28
	No	25 (-5.9%)	71 (+2.3%)	96
	Total	35	71	124

Values in parentheses represent the percent deviation from the expected frequency, based on the null hypothesis.

3.6.2.2 Self-efficacy and hearing aid use

Contingency tables were also drawn up for each subscale of the MARS-HA, categorising participants according to whether they fell below the 80% self-efficacy score suggested as adequate by West and Smith (2007). Chi-square analysis could not be performed for the basic handling subscale due to the expected value for one cell being < 5.

There was a significant association between HA use and adjustment score on the MARS-HA (χ^2(1) = 5.378, *p* = .020, φ = 0.206). Based on the odds ratio, if a hearing aid owner has low self-efficacy for adjustment, their odds of being a non-user is 2.87 times higher than if self-efficacy was within the normal range. This contingency table is shown in Table 12.

Significant associations were not found for the remaining two variables, aided listening (χ^2(1) = 0.497, *p* = .480, φ = 0.063) and advanced handling (χ^2(1) = 0.02, *p* = .884, φ = 0.012). These contingency tables are shown in Table 13 and Table 14.

Table 12. Contingency table showing participants grouped by hours of use and normative data for hearing aid adjustment self-efficacy as measured by MARS-HA.

		Below normal score- MARS-HA adjustment		
		Yes	No	Total
Use ≤ 4 hours/day	Yes	11 (+62.9%)	17 (-18.8%)	28
	No	18 (-18.0%)	80 (+5.4%)	98
	Total	29	97	126

Values in parentheses represent the percent deviation from the expected frequency, based on the null hypothesis.

Table 13. Contingency table showing participants grouped by hours of use and normative data for aided listening self-efficacy as measured by MARS-HA.

		Below normal score- MARS-HA aided listening		
		Yes	**No**	Total
Use ≤ 4 hours/day	**Yes**	18 (+6.6%)	9 (-10.2%)	27
	No	58 (-1.8%)	40 (+2.8%)	98
	Total	76	49	125

Values in parentheses represent the percent deviation from the expected frequency, based on the null hypothesis.

Table 14. Contingency table showing participants grouped by hours of use and normative data for advanced handling self-efficacy as measured by MARS-HA.

		Below normal score- MARS-HA advanced handling		
		Yes	**No**	Total
Use ≤ 4 hours/day	**Yes**	17 (-1.0%)	11 (+1.5%)	28
	No	58 (+0.3%)	40 (-0.4%)	98
	Total	75	51	126

Values in parentheses represent the percent deviation from the expected frequency, based on the null hypothesis.

3.7   Summary of Findings

The rate of HA disuse ranged from five to 22% depending on how it was defined. If disuse is defined as using HAs for less than one hour each day, the disuse rate was calculated at 9.4%. However, if less than four hours of use per day was the criteria for non-use, the disuse rate was 22%.

HA use was not found to be significantly related to demographic factors. Audiometric factors, however, were associated with hours of HA use. Increased HA use was found to be related to higher self-reported severity of HI, poorer hearing thresholds in both the better and worst hearing ears, and higher HA satisfaction ratings.

HA use was also found to be related to scores on several hearing-related questionnaires. These included the benefits, barriers and susceptibility subscales of the HBQ; accepted need, follow up support, and total score of the HAQ; SESMQ confidence scale; aided listening, basic handling, and adjustment scales of MARS-HA; HHQ total score.

Chapter Four: Discussion

The purpose of this thesis was to evaluate the rate of HA disuse in the Aotearoa/New Zealand context, and to identify demographic, audiometric, and self-reported reasons for HA disuse. A series of questionnaires were used to obtain information about the participants regarding their HA use and feelings around HAs. Demographic variables in this study included age, sex, relationship status, education, income, employment, and number of individuals in the home. Audiometric data were gathered through questionnaires and by reviewing audiograms provided by Bay Audiology. These variables included severity of HI, BEPTA, WEPTA, HA satisfaction, age at first HA fitting, unilateral or bilateral HA fitting, and use of government subsidy or other funding for HAs. Self-reported variables included the scale scores and/or total scores for the following questionnaires: Hearing Handicap Questionnaire; Hearing Beliefs Questionnaire; Hearing Aid Questionnaire; Self-Efficacy for Situational Management Questionnaire; Measure of Audiological Rehabilitation Self-Efficacy- Hearing Aids; International Outcome Inventory for Hearing Aids; Levenson Scales. Pearson's correlation co-efficients, analysis of covariance (ANCOVA) and Pearson's Chi-square tests were used to determine the relationships between variables and HA use.

4.1 Rate of HA Disuse

The present study found that the rate of HA disuse in Aotearoa/New Zealand is approximately 9.4%. This is lower than the current disuse estimates using the same definition in the United Kingdom which report that 19% of HA owners use them less than one hour per day (EHIMA, 2015). This rate, however, uses a very limited definition of disuse and may only provide an estimate of those "in the drawer" HAs which are purchased and never used. When people

48

who used their HAs for fewer than four hours each day were also included, the rate of disuse

increased to 22%. This is similar to an earlier estimate of disuse in New Zealand which found

that 26% of their participants reported using their HAs between one and four hours each day

(Jerram & Purdy, 2001). This result indicates that almost a quarter of HA owners in New Zealand

may be non-users or "situational users", meaning that they choose to wear their HAs only

where they believe they need them, such as at family dinners, group meetings, or social events.

The third way a disuse rate was estimated in this study was related to HA satisfaction.

Low reported satisfaction and use of HAs for fewer than four hours each day gave a disuse rate

of 5%. This disuse rate is considerably different to the others, since 75% of non-users reported

being satisfied with their HAs. This apparent disparity may be due to the inclusion of

"situational" users in this calculation. Bertoli et al. (2009) found that 60% of the occasional users

in their study reported being satisfied with their HAs as they used them only in communication-

demanding situations.

It is clear from the three different disuse rates described that this is not an easy concept

to define. There is a need to understand the rate of HA disuse in New Zealand so that

audiologists and other service providers can better understand how to support more successful

HA outcomes for their clients. To do this, however, there needs to be a consistent definition

used so that knowledge can be shared between researchers and clinicians, both nationally and

internationally. Success with HAs should not be determined by how many hours a day a client

uses them, given that each person's needs and experiences with their HAs are unique. As

evidenced by the present study, and supported by others, HA owners do not have to wear their

HAs all day to be satisfied with them. In fact, a high proportion of "situational" users reported

being satisfied with their HAs in this study. This finding is interesting as encouraging a client to

use their HAs only when they need them may be a more preferred option for some clients,

particularly for those with less severe HI, and therefore result in better satisfaction for many

clients. Success with HAs ought to be defined in terms of meeting needs and goals, client

satisfaction, improved quality of life, and participation in activities they may have otherwise

avoided. Satisfaction with a hearing aid, along-side hours of use, may be a better way to

quantify HA disuse.

4.2   Relationship Between HA Use and Demographic Factors

Hypothesis One stated that there would be significant demographic factors associated

with HA use, specifically: (a) age, (b) sex, (c) relationship status, (d) education, (e) income, (f)

employment, (g) number of people in the home. This study found that there were no significant

associations found for any of these variables, therefore the hypothesis is rejected.

This was an interesting finding given the indications in the literature that there are

indeed demographic differences between HA users and non-users. A recent review by Ng and

Loke (2015) reported that increased age was associated with increased use of HAs (Hartley et

al., 2010), however this study treated HA use and adoption as the same concept in the analysis.

Bertoli et al. (2009) reported that participants aged 65 to 74 years were at significantly higher

risk of disuse than those younger than 65 years, or older than 74 years. Females were also

reported to be more likely to use HAs regularly (Smeeth et al., 2002), and individuals with

higher incomes used HAs more frequently (Lupsakko et al., 2005). Education was also reported

as being associated with hearing aid use in the Epidemiology of Hearing Loss study (Popelka et al., 1998).

This study is, however, consistent with some other literature. A qualitative review of the literature by Knudsen et al. (2010) concluded that there was no influence of age, gender, employment, or living arrangement (that is, living alone or with others) on HA use. Relationship status also appeared not to differentiate HA users from non-users (Solheim et al., 2012). It is difficult to draw conclusions in this area given the conflicting reports in the literature, different definitions of HA use within the literature, and the possible limitations of the present study, which will be further discussed.

4.3   Relationship Between HA Use and Audiometric Factors

Hypothesis Two predicted that there would be significant audiometric factors associated with HA use, including (a) self-reported severity of hearing impairment, (b) BEPTA, (c) WEPTA, (d) satisfaction, (e) age at first HA fitting, (f) binaural fitting, (g) application for government subsidy or other funding for HAs. This study found that there was a significant relationship between HA use and self-reported severity of HI, BEPTA, WEPTA, and HA satisfaction. Given these results, Hypothesis Two is partially supported.

4.3.1   Significant variables

4.3.1.1   *Self-reported severity*

For participants in this study, a higher severity rating for HI was positively correlated with hours of HA use, indicating that those who reported more severe HI used their HAs more

often. This finding supports that by Cox, Alexander, and Gray (2007) which found that individuals with higher levels of self-perceived difficulties used their HAs more than those who had fewer perceived difficulties. Ng and Loke (2015) described finding that self-perceived hearing problems were a stronger predictor of HA use than actual hearing thresholds. As reflected by the WHO's ICF (World Health Organisation, 2002), activity limitations and participation restrictions are an essential part of the health condition, and therefore influence the individual's perception of their hearing impairment. Those who perceive more limitations are more likely to seek help, accept, and use HAs (Knudsen et al., 2010).

4.3.1.2 Audiometric thresholds

This study also found that hearing thresholds in both the better and worst hearing ears were positively correlated with hours of HA use. This means that as the PTA for each ear worsened, individuals were using their HAs for longer each day. This finding is strongly supported throughout the literature, with the 2015 review by Ng and Loke reporting that individuals with more severe HI used their HAs for more hours each day than those with less severe HI.

4.3.1.3 HA satisfaction

The final audiometric factor found to be strongly related to HA use was satisfaction with HAs. A strong correlation between use and satisfaction has also been reported by many previous studies (Bertoli et al., 2009; Wong, Hickson, & Mcpherson, 2003). In the present study, it is impossible to conclude whether high satisfaction with HAs resulted in more hours of use, or

if using HAs for longer in fact made the wearer more satisfied with them. This is discussed in the literature, with Saunders and Jutai (2004) showing that more years using HAs resulted in a higher reported satisfaction with them. Satisfaction has been described by others as "a means to an end, or an end in itself" (Ng & Loke, 2015, p. 296).

4.3.2   Non-significant variables

This study found that the client's age at their first HA fitting, bilateral or unilateral fitting, and application for government subsidy or other funding were not significantly related to hours of HA use.

Age at first HA fitting was found to be non-significant. The demographic questionnaire did not gather information on years of HA use, and being fitted with a HA does not mean it was worn regularly from that time until the present study. Data relating to HA use and age of first HA fitting has not been published in the literature, however studies have examined the relationship between daily use and lifetime use. Several previous studies have reported that the duration of a person's experience with HAs is associated with regular HA use (Brooks, 1985; Knudsen et al., 2010; Wong et al., 2003). A study by Saunders and Jutai (2004) found a significant correlation between daily HA use and total lifetime use (>10 years), and concluded that over time individuals wear their HAs for longer each day. Similarly, experienced users have been shown to be at a lower risk of non-regular use (Bertoli et al., 2009). Future studies should aim to gather information relating to experience with HAs, rather than when they had their first fitting.

It has also been reported that people fitted with two HAs use their aids for significantly longer than those fitted with one (Bertoli et al., 2009). The present study contradicts this

research, however in the study by Bertoli et al. (2009), 39% of participants owned one HA compared to this study which had only 7%. The small number of unilateral HA fittings in this study may therefore account for the non-significant finding. Another possible reason for the difference in findings is the unknown proportion of participants in the Bertoli et al. (2009) study who had one HA because they had unilateral HI. The present study had one participant who had a unilateral HI, while eight chose to have only one HA despite having bilateral HI. This may affect their pattern of use, therefore without further information from Bertoli et al. (2009) comparisons should be made with caution.

In the current study, application for a government subsidy or other funding was also found not to be significantly related to HA use. This contradicts findings of a similar study by Allan (2015) who found that individuals who had applied for a HA subsidy were more likely to be HA users. In New Zealand, the government provides $511.11 per ear, every six years, for any adult who needs HAs. Funding may also be provided through the Accident Compensation Corporation (ACC) where HI is deemed to be work- or injury-related. This is different to other service delivery models worldwide, such as in the United Kingdom where HAs are either provided by the National Health Service (NHS) free of charge, or paid for privately. It has been reported that up to 85% of HAs in the United Kingdom are obtained from the NHS. There is no published research which relates hours of HA use to subsidy applications, however studies have shown that a government subsidy was related to whether a person would choose to obtain HAs or have no intervention (Laplante-Lévesque et al., 2012).

4.4   Relationship Between HA Use and Self-Report Measures

Hypothesis Three predicted that there would be self-report factors significantly associated with HA use. This was measured by way of seven questionnaires, each with their own subscales targeting different areas of HA use and beliefs around HAs. These included: (a) HHQ, (b) HBQ, (c) HAQ, (d) SESMQ, (e) MARS-HA, (f) IOI-HA, (g) Levenson Scales. This study found the following eleven factors to be significantly correlated with hours of HA use: the 'benefits', 'barriers' and 'susceptibility' scales of the HBQ; the 'accepted need' and 'follow up support' scales and total score of the HAQ; the SESMQ 'confidence' score; the 'aided listening', 'basic handling', and 'adjustment to HAs' scales in MARS-HA; the HHQ total score. This hypothesis is therefore partially supported.

4.4.1   Significant variables

4.4.1.1   HBQ

For participants in this study, perceived benefits, as measured by the HBQ, was significantly correlated with HA use, however this variable accounted for only 3.5% of the variance in hours of use. Individuals who gained more benefits from using their HAs wore them for more hours than those who perceived fewer benefits. This is in line with previous literature where perceived benefit has been shown to be crucial in HA use (Saunders & Jutai, 2004; Smeeth et al., 2002). These studies, however, used the IOI-HA to measure benefit, which was unable to be analysed for comparison in the present study. From this result, however, it is not clear whether wearing HAs causes more perceived benefit, or if having a preconceived idea of potential benefit results in wearing HAs more often. This is important to consider as early

experiences with HAs are likely to influence how often they are worn. If the wearer does not perceive benefit in those situations in which they need it most, they are likely to reject HAs. This highlights the importance of pre-fitting expectations and follow-up support in order to get the best outcome for the HA wearer.

This study also found that perceived barriers to wearing HAs was correlated with hours of HA use, and accounted for 8.6% of the variance. It showed that when an individual identifies fewer barriers to their use of HAs, they wear them for more hours each day. This is consistent with previous studies which found that the perceived barriers construct of the HBM was associated with HA use (Saunders & Jutai, 2004; van den Brink et al., 1996). Saunders et al. (2013) state that for every one-point increase on the perceived barriers scale, the odds of that individual wearing HAs regularly decreased by half. "Regular" use of HAs in that study was not defined by the researchers, and instead was left to the participants' interpretation.

A significant association was found in the present study between perceived susceptibility to a HI and hours of HA use. For participants in this study, the more they felt at risk of HI, the more they wore their HAs. Perceived susceptibility to HI explained 6.05% of the variance in HA use. The current literature shows that an individual's perceived susceptibility to a HI has been related to HA uptake (Saunders et al., 2013), however the same study found that irregular users of HAs perceived themselves to be more susceptible to HI. This was an unexpected result which has not been able to be explained and does not appear to fit with the expectations of the HBM.

4.4.1.2 HAQ

This study found that hours of HA use was significantly correlated with three factors measured on the HAQ: accepted need for HAs, follow-up support, and total HAQ score.

It was shown that higher accepted need for HAs was associated with more hours of HA use by participants. This result is supported by previous literature. The review by Knudsen et al. (2010) stated that acceptance of need for HAs before fitting was shown to positively influence HA use. Better acceptance of an individual's own hearing problems prior to HA fitting was also related to more frequent HA use than those with less acceptance (Jerram & Purdy, 2001; Wilson & Stephens, 2003).

Follow-up support was also found to be significantly associated with HA use, indicating that where follow-up support was more frequent and available, participants wore their HAs more often. The importance of follow-up support, defined as organised check-ups and accessibility to professionals, has been highlighted in the literature and was found to be significant during the development of the HAQ (Solheim et al., 2012). It is especially important to take this into consideration when working with the elderly population as using HAs requires a lengthy rehabilitation process, with sensory and physical issues impacting upon this. Individuals, especially new users, need to acclimatise to listening through their HAs which requires a period of education, counselling, and adjustment with their audiologist (West & Smith, 2007). Time for education and demonstration, and easy access to a professional, should problems occur, is essential for the successful use of HAs (Solheim et al., 2012).

The total score of the HAQ was also found to be strongly correlated with HA use, with a high score relating to more hours of use per day. The HAQ measures motivational factors

associated with HA use, therefore a higher score overall would suggest that an individual had more positive experiences with the HA process. This questionnaire may be of use in a clinical setting where clinicians would be able to easily assess how their client was feeling in terms of their experience with their HAs. A high overall score on this questionnaire could inform the clinician that their client had accepted their need for HAs and was feeling adequately supported, while a low score could highlight areas on which to focus in future appointments. It is, however, important to note that of the 17 items in the HAQ, 13 of them related to either the 'acknowledged need' or 'follow up support' scales, therefore it is hardly surprising that the total score was also found to be associated with HA use. All four scales in this questionnaire provide useful information for clinicians to gauge their clients' motivation to wear HAs (Solheim et al., 2012). Given the large effect size of the HAQ total score ($r = .561$; Cohen (1992)), this questionnaire appears useful for examining HA use with clients.

4.4.1.3 SESMQ

In terms of self-efficacy for HAs, this study found that scores on the SESMQ confidence scale were significantly negatively associated with hours of HA use, however this effect was small ($r = -.185$; Cohen (1992)). The confidence scale measures an individual's belief that they can manage different listening situations. This result suggests that the more confidence a client had in managing listening behaviours in different environments, the less likely they were to use their HAs. This supports the result found by Allan (2015). In contrast, Hickson et al. (2014) and West and Smith (2007) found that HA users were more confident in managing their HAs than non-users. This difference may be because they were investigating a different aspect of self-

efficacy. These studies reported on HA self-efficacy, which is the ability to manage the HA itself, rather than their listening behaviours. The findings of Allan (2015) suggested that HA non-users were more likely to believe they could manage different listening situations without needing HAs. This trend is similar in the present study, however it is interesting to note that results for the hearing scale of the SESMQ were not significantly related to HA use, which will be further discussed.

4.4.1.4 MARS-HA

This study found that three of the four subscales from the MARS-HA were significantly correlated with hours of HA use: aided listening, basic handling, and adjustment to hearing aids. This questionnaire required participants to rate on a 10-point scale how confident they were in completing certain tasks. The 'aided listening' subscale includes items relating to listening using the HAs. This study found a negative correlation on this subscale, suggesting that as participants reported less confidence with listening in various situations with their aids, they used their HAs for longer. The effect size, however, was small (Cohen, 1992) with 'aided listening' accounting for only 3.3% of the variance.

The basic handling subscale includes items such as inserting and removing the HA, and daily maintenance of the aid. It was found that more confidence in this area was related to more use of HAs. A review by McCormack and Fortnum (2013) cites eight studies which found that care and maintenance issues were reasons for individuals not using their HAs, including handling problems, issues changing the battery, and difficulty adjusting the volume. Low self-efficacy for the care and use of HAs has been suggested as a reason for non-use of HAs (West &

Smith, 2007). These behaviours are essential in the successful use of HAs, and could be targeted during follow-up appointments.

Adjustment to wearing HAs, as measured by MARS-HA, was found to be significantly related to hours of HA use. This study also reported that if a HA owner had low self-efficacy for adjustment, their odds of being a non-user was nearly three times higher than if self-efficacy was in the normal range. Especially for new users, getting used to wearing a HA involves adjusting to the sound quality of your own and others' voices, the physical feel of the HA in the ear, and irrelevant environmental sounds. If individuals cannot accept these changes, they may decide to stop using them. High perceived self-efficacy for overcoming these initial adjustment problems has been shown to be related to continued use of HAs, and individuals with low self-efficacy in this situation are more likely to become non-users (Smith & West, 2006). Given these significant results, administering the MARS-HA prior to fitting HAs could assist the audiologist in knowing a client's level of HA self-efficacy, enabling them to target problem areas to reduce their risk of becoming a non-user.

4.4.1.5   HHQ

The final significant relationship in this study was found between HHQ score and HA use. The HHQ measures hearing handicap, and is therefore highly useful for clinicians to give to their clients. Self-perceived hearing problems have been identified as the most important determinant of HA use (Ng & Loke, 2015). The Hearing Handicap Inventory for the Elderly (HHIE) is a widely used measure of hearing difficulties, especially throughout New Zealand as a requirement for accessing HA funding through ACC (Accident Compensation Corporation, 2008).

It has been shown that higher scores on this measure were significantly associated with longer

hours of daily HA use (Fischer et al., 2011; Hartley et al., 2010). It is therefore encouraging that

HHQ scores can also be used, especially given that the HHIE is a 25-item questionnaire whereas

the HHQ has only 12. The screening version of the HHIE is often used, with only 10 items,

however it is this researcher's opinion that the HHQ has more generic items suitable across all

age groups.

4.4.2 Non-significant variables

This study found the following variables not to be significantly associated with hours of

HA use: 'perceived severity', 'cues to action' and 'perceived self-efficacy' scale scores of HBQ;

'social assessment' and 'consciousness' scores of HAQ; SESMQ 'hearing' scale score; 'advanced

handling' score of MARS-HA; Levenson scale scores for internality, powerful others, and chance.

Perceived severity of HI, as measured by the HBQ (which focuses on the ICF's

components of activity limitations and participation restrictions), was found not to be

significantly related to HA use, however this result contradicts both the literature and the

previously discussed finding of this study that self-reported severity is very strongly correlated

with hours of HA use. A possible explanation for this difference is the way in which the question

was asked. In the demographic questionnaire, participants were asked to rate the severity of

their HI on a scale ten-point scale. This score was found to strongly correlate with hearing

thresholds, meaning that participants likely had this in mind when they rated themselves. The

HBQ requires participants to rate how much they agree with a given statement. The statements

pertaining to perceived severity include how HI limits daily activities, affects relationships with

family and friends, and negatively impacts job performance. It is likely that compensatory

strategies are employed by the person with HI in these situations, and there may be a

disconnect between their known level of HI and how they believe they manage these situations.

They may not perceive their difficulties to be as severe, or even be aware about how their HI

affects others.

The present study also found that the HBQ's cues to action scale was not significantly

correlated with HA use. Cues to action as described by the HBM can include noticing one's own

hearing difficulties, or being encouraged by a family member to investigate hearing aids. It is

therefore linked to the personal and environmental factors included in the ICF. There is limited

empirical evidence in this area, however Saunders et al. (2013) reported that that HA owners

who did not wear HAs regularly (non-users) experienced fewer cues to action than HA users. In

the HBQ, cues to action are targeted through three questions. Two of these questions, "I know

where to go to get my hearing tested" and "I know where to get hearing aids if I were to need

them," were scored a 9 or 10 by around 90% of participants for both questions (89.8% and

90.4% respectively). Given that this study recruited from Bay Audiology, these items were

scored very highly as they had all been assessed and received HAs at Bay's clinics. When

investigating HA owners, it is therefore probable that this factor will never be found to be

related to HA use.

This study also found that participants' scores on the perceived self-efficacy scale of the

HBQ were not related to hours of HA use. Self-efficacy, as previously discussed, has been

proposed as a determinant of HA use (Smith & West, 2006), therefore one might expect to find

a significant relationship with this scale. The HBQ, however, includes only three questions

relating to self-efficacy, and this scale has been deemed unsatisfactory by its creators (Saunders et al., 2013). It therefore may not reliably measure self-efficacy in relation to HA use, and a more comprehensive questionnaire, such as the MARS-HA could be used to gather this information.

The current study found no significant correlation between social assessment and HA use, as measured by the HAQ, with social assessment being defined as the environment's influence on the individual's experience with HI. This is consistent with the Solheim et al. (2012) study which also found no relationship between these factors. The ICF model includes environmental factors as a part of the health condition, and studies have shown how these can impact upon HA use. Positive support from significant others has been found to be a strong determinant of HA use (Hickson et al., 2014), however in a similar vein, pressure from others to get a HA has been cited as a reason for HA disuse (McCormack & Fortnum, 2013). This demonstrates the important role that family and friends play in the successful use of HA, and should not be underestimated in the clinical context.

This study also found no significant relationship between consciousness, that is, an individual's attitude towards HI and HAs, and hours of use. Again, this result mirrors that found by Solheim et al. (2012) when developing the HAQ. In previous research, positive pre-fitting attitudes to HAs have been associated with successful outcomes for HA use (Hickson et al., 2014). Wilson and Stephens (2003) showed that individuals with a more positive pre-fitting attitude to HAs reported more frequent use than those with negative attitudes. However, a study by Jerram and Purdy (2001) failed to find a significant correlation either before fitting or 10 weeks after. It is worth noting that people who have particularly negative attitudes towards

HA rehabilitation may be less likely to participate in a study of this kind, especially if they do not

use their HAs. Due to the small number of HA non-users recruited for this study, it is possible

that these negative attitudes are underrepresented. As previously discussed, the HAQ can

provide useful insights into an individual's thoughts and behaviours around HAs, however given

the relatively small weighting given to the social assessment and consciousness scales,

inferences cannot be made relating to HA use with these two factors alone.

This study found no significant correlation between SESMQH score and HA use. The

SESMQH measures participants' confidence in hearing in different listening situations using

their HAs. While the result was non-significant, the trend matches that found by Allan (2015)

which suggests that confidence with hearing in different environments is negatively related to

HA use. As previously suggested, HA non-users may rely on listening strategies to help them

without having to rely on HAs. This may relate to a lack of accepted need for HAs which this

study has found to be significantly related to HA use.

The advanced handling subscale of the MARS-HA was the only one not found to be

significantly related to HA use in this study. This is consistent with a study by Meyer, Hickson,

and Fletcher (2014) which found that advanced handling self-efficacy levels were low for both

unsuccessful and successful HA users. In the present study, a Pearson's chi square test of

independence was not significant for these two variables, finding no relationship between

them. Advanced handling in this questionnaire includes being able to troubleshoot a HA when it

stops working, and stopping HA feedback. Issues with feedback and the HA not working have

often been cited as reasons for HA disuse (Hartley et al., 2010; Kochkin, 2000; Tomita et al.,

2001), however the present study suggests that HA users also have difficulty managing these aspects of their aids.

Pearson's chi-square analyses were attempted for the four subscales of the IOI-HA able to be analysed. Two of these subscales, 'use' and 'satisfaction', had insufficient numbers in one area of the contingency tables and were unable to be analysed. Non-significant associations with HA use were found for the remaining two scales, 'residual activity limitations' and 'quality of life'. Low response rates for this questionnaire, given the possible confusion caused by the misprinted response scales, may have contributed to the non-significant findings.

Finally, no significant relationships were found between HA use and any of the three aspects of locus of control: internality, powerful others, or chance. This suggests that locus of control, as measured by the Levenson Scales, has no effect on a person's pattern of use, or that possessing a certain trait is a risk factor for non-use. Personality aspects, such as locus of control, have been little researched in terms of hearing health. Cox, Alexander, and Gray (2005) reported that hearing aid seekers had a significantly higher internal locus of control than a typical adult, however a follow up study (Cox et al., 2007) found that HA use was not significantly related to any personality trait, including control.

It is important to note that the Levenson Scales had the lowest completion rate of any of the questionnaires used in this study. Only 112 participants were included in the correlation analyses for internality and chance, while the powerful others scale included only 109 participants. This low number of participants, remembering that 160 were required for sufficient statistical power, is highly likely to have affected these results. Participants frequently left out items in this questionnaire, or chose not to complete it at all. Feedback received

indicated that it was not clear how the Levenson Scales related to HI or HAs, and therefore they did not wish to complete it. In order to measure this aspect more successfully, a questionnaire which includes hearing-related items may be necessary to achieve more reliable results.

4.5   Clinical Implications

The primary aims of this study were to provide the first assessment of HA disuse rates in Aotearoa/New Zealand and to add to the small amount of HA disuse literature. Now that the current situation has been evaluated, it is important to make changes to clinical practice to improve hearing aid outcomes for clients.

The results of this study suggest that reduced HA use is related to having low perceived handicap or accepted need for HAs, more perceived barriers with fewer benefits, receiving less follow up support, low confidence in managing HAs, and believing that one can manage fine without them. There is therefore clinical value in utilising a number of questionnaires to assess a client's readiness for HAs, as well as their post-fitting experiences. For example, results from this study show that perceived hearing handicap, or activity limitations and participation restrictions, is related to HA use. Since scores on the HHQ were associated with hours of HA use, it may be useful to administer this tool during a HA discussion in order to assess a client's readiness for aids. Information gained this way can then be used to help the audiologist make decisions regarding that particular client and their needs. Counselling is an effective tool in helping a client to recognise the impact HI has on their life, and then finding ways to address the consequences of it.

Once the decision to pursue HAs has been made, the MARS-HA could be used to provide information about a client's confidence that they will be able to manage HAs. Perceived self-efficacy is an important factor in success with HAs, therefore the information gathered using this tool would enable the clinician to target their counselling and education to the individual needs of that client. It could also be used for determining whether a client is in need of extra support, such as that provided by a hearing therapist.

As this study found, follow up support was strongly related to HA use, thereby emphasising the importance of this in clinics. Audiologists should ensure that clients get ample opportunity to discuss and work through any issues that arise, particularly for first-time HA users. More positive first experiences with HAs mean that a client is more likely to persevere and become a regular HA user.

4.6   Limitations and Directions for Future Research

This study has several limitations. There was a lack of demographic diversity in the study population, particularly when looking at ethnicity. While this study sampled adults throughout the country, the sample is not representative of the population and therefore may not be able to be generalised to New Zealand. Future studies should use targeted recruitment to ensure a more diverse study population.

Another limitation of this study is in the size of the sample. Low return rates for the invitations to participate and questionnaire packets limited potential subjects. Including return envelopes at the recruitment stage improved the response rate from 13% to 23%, however only 79% of the questionnaire packets sent out were returned. Given that some of these

questionnaires were not fully completed, the actual number of participants included in some analyses was as low as 109. Since this study required 160 participants, it is possible that it is underpowered. Future studies should employ follow-up phone calls to participants who left out questions or failed to return questionnaire packets to improve participant numbers.

Another factor which may have reduced participant numbers was that Part Two of this study (not reported here) required a phone interview. It is possible that a phone interview is too daunting a prospect for people with HI, judging by the indications received from several invitees that they did not enrol for this reason. It is likely that there were more potential participants for this study who felt the same, and who would have chosen to participate in the questionnaires only. In future, it would be important to make this an option when enrolling. As a consequence of this, it is possible we may have missed getting information from those people with greater hearing handicap than those who did respond.

It was disappointing to be unable to fully analyse the IOI-HA due to a misprint in the questionnaire. Examining the disuse rate alongside perceived benefit of HAs is an important area for further research as these factors have been shown to be closely associated in the literature to date (Gopinath et al., 2011; Hartley et al., 2010). Future studies should look to include this in their investigations.

Finally, the only questionnaire to target locus of control was not completed by many participants. The Levenson scales garnered frequent comments that it was not relevant and they chose not to complete it. In future, researchers should restate that all questionnaires are important to the study, and that they should be filled out as best they can. Alternatively, a questionnaire including more hearing-related items should be used to encourage higher

completion rates. Fatigue may also have been a factor in the low completion of this questionnaire, therefore future studies may consider including it earlier in the questionnaire packet.

4.7   Conclusion

The present study aimed to quantify the rate of HA disuse in New Zealand, and identify reasons for this disuse. It is important that clinicians understand why individuals become non-users in order to improve HA outcomes. This study has found a number of factors which are related to HA disuse in Aotearoa/New Zealand, and suggests a number of measures which can be employed to evaluate these. Clinicians can gain valuable information by using questionnaires such as the HHQ, MARS-HA and HAQ. These may help to identify red flags for disuse early in the process, and therefore enable clinicians to implement measures specific to each client to reduce their risk of becoming a HA non-user. Given the negative consequences of untreated HI, this is extremely important in the context of maintaining and improving adult well-being.

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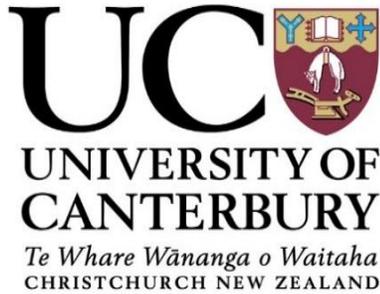
Research Information Sheet

Study Title: *Rates and reasons for hearing aid use in Aotearoa/New Zealand*

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Why have we contacted you?

You are invited to take part in the study: *Rates and reasons for hearing aid use in Aotearoa/New Zealand.*

We've invited you to participate in this study because we believe that you will be able to give a valuable perspective about the study focus.

What is the aim of the study?

- To find out the rates of hearing aid use in adults living in New Zealand.
- To find out reasons why people use or don't use hearing aids.

Who do we need for the study?

We need 2 groups of people:
- Adults who have recently gotten hearing aids
    - who use hearing aids on a regular basis.

- Adults who have recently gotten hearing aids
    - who do NOT use hearing aids on a regular basis.

What will happen in the study?

This study has two parts.

Part 1:
Hannah Blood will send you a packet in the post. It will have: (a) an information sheet so you can tell us about yourself, (b) surveys about your hearing and hearing aid use, (c) a consent form for you to fill in to agree to be in the study and have Bay Audiology send us your hearing test results, and (d) a postage-paid return envelope. It will take you about an hour to do part 1 of the study.

Part 2:
Rebekah Durrans will call you to ask you about your hearing and hearing aid use. She will record this interview. She will ask you about the problems you have with your hearing and how much your hearing aids help you. She will also ask you about things that may help or prevent you from wearing your hearing aids as much as you would like. The interview will take about 30 minutes of your time. You will be able to get a copy of your interview transcript by ticking a box on the consent form.

What are your rights?

You do not have to take part in the study – it is entirely up to you. You can withdraw from the study at any time, without giving a reason. This will NOT affect

any future interactions you have with the university or Bay Audiology. If you do withdraw, we will remove all information relating to you, as long as you let us know by 1 July 2015. After that date, we will not be able to remove your information because it will not be practical to do so.

What are the benefits of the study?

There are no direct benefits to you. But, we hope this study will help us provide better or more support for people who may be at risk of not using their hearing aids as much as they would like to.

What are the risks of the study?

There are no direct risks for you being in this study. But, you may feel distressed talking about your hearing problems. You may have whanau or a friend present to help you deal with any distress. You will also find a list of support services at the bottom of this letter.

Will your information stay private?

The results of the study may be published, but your identity will be kept private throughout the study. Information you give us will not be anonymous, but no information that could identify you will be used in any reports in the study. Only the researchers listed at the top of this letter will see any information we collect. If you would like us to share your information with your Bay Audiologist, you can let us know by ticking a box on the consent form. If you would like your Bay Audiologist to follow up with you, you can let us know by ticking a box on the consent form.

We will keep the data in a locked filing cabinet and in a password-protected computer. We will destroy the data five years after we finish the study.

This study is part of Hannah and Rebekah's Master of Audiology thesis. A thesis is a public document and will be available through the UC Library.

How do you find out about the study findings?

Please tick the box on the consent form if you want to know the study results.

Has this study been approved?

The study has been checked and approved by the University of Canterbury Human Ethics Committee. If you have a problem or complaint about this research, contact: The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (humanethics@canterbury.ac.nz (03) 364 2987 ext 45588).

What do you do next?

If you agree to take part in this study, please contact Hannah Blood by phone (03 364 2987 ext 8327), email (hlb44@uclive.ac.nz), or return the letter found on the next page via post.

Thank you for taking time to read about this study.

Who can you contact if you feel distressed?

Lifeline: 0800 543 354

Who can you contact if you want more information about hearing loss and hearing aids?

New Zealand Audiological Society: 0800 625 166

Ministry of Health Healthline: 0800 611 116

Ministry of Health Disability Support: 0800 373 664

Letter of Interest

Return this letter to Hannah Blood at the address below
Or send us the information via phone (03 364 2987 ext 8327)
Or via email to Hannah Blood (hlb44@uclive.ac.nz)

Dear researchers,

I would like to take part in this study. Please send me a packet at the postal address below.

My name is (please print): _____

My postal address is: _____

_____

_____

_____

My phone number is (so we can interview you): _____

Return this letter to:
Hannah Blood
Department of Communication Disorders
University of Canterbury
Private Bag 4800
Christchurch 8140
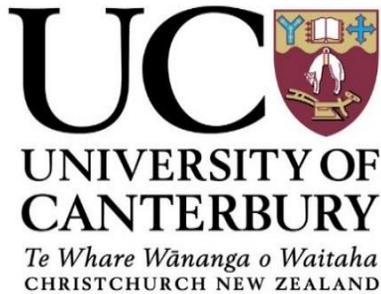
CONSENT FORM

Study title: *Rates and reasons for hearing aid use in Aotearoa/New Zealand*

The information about this research study has been explained to me to my satisfaction. I have had a chance to ask questions.

I know what I need to do if I take part in the study.

I know that I can choose whether or not I take part in this research. I know that I may withdraw from the study until 1 July 2015, without penalty. If I withdraw, my information will also be withdrawn.

I know that any information or opinions I give will be kept private to the researchers. I know that any published or reported results will not identify me. I know that a thesis is a public document and will be available through the UC Library.

I know that my interview will be audio-recorded and that only the researchers will have access to this recording.

I know that all data and the recording collected for the study will be kept in locked and secure facilities and in password protected computers and will be destroyed after five years.

I will be given a copy of this form and the Research Information Sheet.

I know that I can contact the researchers for more information. They are:
Hannah Blood: hlb44@uclive.ac.nz
Rebekah Durrans: rcd53@uclive.ac.nz
Dr Rebecca Kelly-Campbell: rebecca.kelly@canterbury.ac.nz, (03) 364 2987 ext 3619

If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz, (03) 364 2987 ext 45588).

I agree to allow Bay Audiology to give my hearing test results to the researchers.
Yes ☐ No ☐

_____

I would like a copy of the transcript of my interview.
Yes ☐ No ☐

I would like a copy of the final results of the study.
Yes ☐ No ☐

I would like the researchers to send my results to Bay Audiology.
Yes ☐ No ☐

I would like my Bay Audiologist to contact me for additional support.
Yes ☐ No ☐

By signing below, I agree to take part in this research project.

Name (please print): _____

Signature: _____   Date: _____

Appendix C
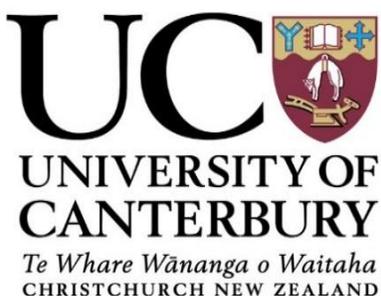
Participant Information
Please answer each question honestly and to the best of your ability

ID: _____   Date: _____

Current age: _____   Gender: _____

1. What ethnic group do you belong to?

    ☐   New Zealand European   ☐   Tongan
    ☐   Maori   ☐   Niuean
    ☐   Samoan   ☐   Chinese
    ☐   Cook Island Maori   ☐   Indian
    ☐   Other, such as Dutch,
         Japanese, Tokelauan.
         Please state: _____

2. What is your relationship status? (please tick one box)

    ☐   Single   ☐   Never married
    ☐   Married   ☐   In a committed relationship
    ☐   Widowed   ☐   Divorced
    ☐   Separated

3. What is the net annual income of your household? (please tick one box)

    ☐ $0 – $25,000   ☐ $25,000 - $50,000
    ☐ $50,000 - $75,000   ☐ $75,000 - $100,000
    ☐   more than $100,000

4. What is the highest level of education you completed? _____

5. Are you currently working?

    ☐   Yes   ☐   No
    If so, what is your occupation?
    _____

6. How many adults live in your home? _____

7. How many children live in your home? _____

8. On a scale of 1 to 10, how would you describe the severity of your hearing problem (1 = not at all severe, 10 = very severe)? _____

9. Have you ever worn hearing aids (if no, go to question …)?

    ☐   Yes   ☐   No

10. Do you wear hearing aids in one or both ears?

    ☐   One   ☐   Both

11. At what age did you start wearing them? _____

12. How many hours a day do you wear your hearing aids? _____

13. In what situations do you wear your hearing aids? _____
    _____
    _____
    _____

14. On a scale of 1 to 10, how would you rate your level of satisfaction with your hearing aids (1 = not at all satisfied, 10 = very satisfied)? _____

15. Have you ever applied for a hearing aid government subsidy?

    ☐   Yes   ☐   No

16. Have you been eligible for any other hearing aid funding?

    ☐   Yes   ☐   No

    If so, please list other funding sources: _____

Appendix D

UC
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND
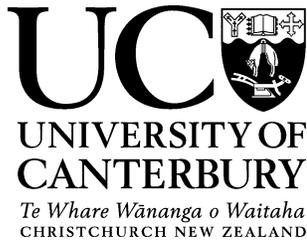
BAYAUDIOLOGY®

Communications Disorders Department
Private Bag 4800
Christchurch 8140
New Zealand
Email: hlb44@uclive.ac.nz;
rcd53@uclive.ac.nz

PO Box 100260
Northcote
Auckland 0745
New Zealand
Email: anna.mcmillan@bayaudiology.co.nz

HEARING HANDICAP QUESTIONNAIRE (HHQ)

These questions ask about your experiences with hearing loss. Please circle the response that best answers the following questions.

1. How often does your hearing difficulty restrict the things you do?

   never   rarely   sometimes   often   almost always

2. How often do you feel worried or anxious because of your hearing difficulty?

   never   rarely   sometimes   often   almost always

3. As a result of your hearing difficulty, how often do you feel embarrassment when in the company of other people?

   never   rarely   sometimes   often   almost always

4. How often is your self-confidence affected by your hearing difficulty?

   never   rarely   sometimes   often   almost always

5. How often does your hearing difficulty make you feel nervous or uncomfortable?

   never   rarely   sometimes   often   almost always

6. How often does any difficulty with your hearing make you feel self-conscious?

never   rarely   sometimes   often   almost always

7. How often does your difficulty with your hearing affect the way you feel about yourself?

never   rarely   sometimes   often   almost always

8. How often are you inconvenienced by your hearing difficulty?

never   rarely   sometimes   often   almost always

9. How often do you feel inclined to avoid social situations because of your hearing difficulty?

never   rarely   sometimes   often   almost always

10. How often do you feel cut off from things because of your hearing difficulty?

never   rarely   sometimes   often   almost always

11. How often does your hearing difficulty restrict your social or personal life?

never   rarely   sometimes   often   almost always

12. How often do you feel tense and tired because of your hearing difficulty?

never   rarely   sometimes   often   almost always

HEARING BELIEFS QUESTIONNAIRE (HBQ)

These questions ask you about your hearing health behaviours. _They do not assume you have hearing impairment or that you wear hearing aids._ Please read each statement. Then, circle the number that reflects your opinion about that statement.

0 = Completely Disagree
5 = No opinion
10 = Completely Agree

1. My hearing will likely get worse in the future.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

2. It is possible that I will lose my hearing.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

3. I am not likely to lose my hearing because hearing loss doesn't run in my family.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

4. I've heard you should get your hearing tested now and then.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

5. Having a hearing loss would limit my daily activities.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

6. When people have hearing loss, their relationships with family and friends suffer.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

7. Having a hearing loss negatively impacts a person's job performance.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

8. The benefits of using hearing aids would outweigh the costs.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

0 = Completely Disagree
5 = No opinion
10 = Completely Agree

9. I would worry if I had a hearing loss.

   0   1   2   3   4   5   6   7   8   9   10

10. I don't go out much so having a hearing loss wouldn't be a big problem for me.

   0   1   2   3   4   5   6   7   8   9   10

11. If I had a hearing loss, I would worry about missing important information during visits with my doctor.

   0   1   2   3   4   5   6   7   8   9   10

12. It would be stressful to have a hearing loss.

   0   1   2   3   4   5   6   7   8   9   10

13. I am too young to have a hearing loss.

   0   1   2   3   4   5   6   7   8   9   10

14. It would be uncomfortable to wear hearing aids.

   0   1   2   3   4   5   6   7   8   9   10

15. Hearing aids aren't worth the trouble.

   0   1   2   3   4   5   6   7   8   9   10

16. Hearing aids make people look old.

   0   1   2   3   4   5   6   7   8   9   10

17. Most people say hearing aids don't work well.

   0   1   2   3   4   5   6   7   8   9   10

18. Hearing aids are ugly.

   0   1   2   3   4   5   6   7   8   9   10

0 = Completely Disagree
5 = No opinion
10 = Completely Agree

19. I usually notice when someone is wearing hearing aids.

   0   1   2   3   4   5   6   7   8   9   10

20. If I had a hearing loss I would do everything I could to avoid wearing hearing aids.

   0   1   2   3   4   5   6   7   8   9   10

21. I have heard good things about hearing aids

   0   1   2   3   4   5   6   7   8   9   10

22. I know where to go to get my hearing tested.

   0   1   2   3   4   5   6   7   8   9   10

23. I know where to get hearing aids if I were to need them.

   0   1   2   3   4   5   6   7   8   9   10

24. Once you have hearing loss there's not much you can do about it.

   0   1   2   3   4   5   6   7   8   9   10

25. It would be difficult to use hearing aids because they are so small.

   0   1   2   3   4   5   6   7   8   9   10

26. Hearing aids are easy to lose.

   0   1   2   3   4   5   6   7   8   9   10

HEARING AID QUESTIONNAIRE (HAQ)

These questions ask your opinion about hearing aids. _They do not assume that you currently wear hearing aids._ Please read each statement. Then, circle the number that reflects your opinion about that statement.

0 = Completely Disagree
5 = No opinion
10 = Completely Agree

1. I need to use my hearing aid every day.

   0   1   2   3   4   5   6   7   8   9   10

2. I benefit from my hearing aid.

   0   1   2   3   4   5   6   7   8   9   10

3. My hearing aid is a part of me, i.e. I have accepted that I need it.

   0   1   2   3   4   5   6   7   8   9   10

4. My aim has been to use my hearing aid the whole day, even when I'm by myself.

   0   1   2   3   4   5   6   7   8   9   10

5. My hearing aid has made it easier for me to communicate with other people.

   0   1   2   3   4   5   6   7   8   9   10

6. I have adapted to my hearing loss emotionally.

   0   1   2   3   4   5   6   7   8   9   10

7. I got used to my hearing aid relatively quickly.

   0   1   2   3   4   5   6   7   8   9   10

8. I have shared my experiences about using a hearing aid with other people.

   0   1   2   3   4   5   6   7   8   9   10

0 = Completely Disagree
5 = No opinion
10 = Completely Agree

9. I had enough time for education, training and questions at the hearing aid clinic.

   0   1   2   3   4   5   6   7   8   9   10

10. It was easy to get in touch with the hearing aid clinic when I needed help.

   0   1   2   3   4   5   6   7   8   9   10

11. I was followed up with regard to using and operating my hearing aid.

   0   1   2   3   4   5   6   7   8   9   10

12. My hearing aid has been relatively easy to operate.

   0   1   2   3   4   5   6   7   8   9   10

13. My expectations about getting a hearing aid have been fulfilled/met.

   0   1   2   3   4   5   6   7   8   9   10

14. It has not been socially embarrassing for me to use a hearing aid among other people.

   0   1   2   3   4   5   6   7   8   9   10

15. My impression is that people of my age are satisfied with their hearing aids.

   0   1   2   3   4   5   6   7   8   9   10

16. Pressure from relatives is the main reason for providing hearing aids.

   0   1   2   3   4   5   6   7   8   9   10

17. I am well informed about the cause of my hearing loss.

   0   1   2   3   4   5   6   7   8   9   10

SELF-EFFICACY FOR SITUATIONAL MANAGEMENT QUESTIONNAIRE (SESMQ)

We are interested in **how well you believe that you can hear** and **how confident you are that you can manage communication** in the following 20 situations today when wearing your hearing aid or another assistive listening device.
Please read each of the following situations.
For each situation, please rate **how well you believe that you can hear** and **how confident you are that you can manage communication** by circling the number that best applies to you.

1. You are having a conversation with a friend or family member in your home. The room is dark because the curtains are partially closed and the light is off.

How well can you hear in this situation?

     0   1   2   3   4   5   6   7   8   9   10
Not well at all   Moderately well   Very well

How confident are you that you can manage this situation?

     0   1   2   3   4   5   6   7   8   9   10
Not confident at all   Moderately confident   Very confident

2. Your friend/family member is trying to talk to you when she/he is in another room.

How well can you hear in this situation?

     0   1   2   3   4   5   6   7   8   9   10
Not well at all   Moderately well   Very well

How confident are you that you can manage this situation?

     0   1   2   3   4   5   6   7   8   9   10
Not confident at all   Moderately confident   Very confident

3. You are at a party where the conversation is noisy. Someone who you have never met before comes over to speak to you.

How well can you hear in this situation?

     0   1   2   3   4   5   6   7   8   9   10
Not well at all   Moderately well   Very well

How confident are you that you can manage this situation?

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					Moderately confident					Very confident

4. You are at the doctor's office. The receptionist calls you from across the room to let you know that it is your turn to see the doctor.

How well can you hear in this situation?

0	1	2	3	4	5	6	7	8	9	10
Not well at all					Moderately well					Very well

How confident are you that you can manage this situation?

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					Moderately confident					Very confident

5. You are watching television at home. The actors speak amid the background music.

How well can you hear in this situation?

0	1	2	3	4	5	6	7	8	9	10
Not well at all					Moderately well					Very well

How confident are you that you can manage this situation?

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					Moderately confident					Very confident

6. You hold a card party in your home. You are seated at a table with people you do not know very well.

How well can you hear in this situation?

0	1	2	3	4	5	6	7	8	9	10
Not well at all					Moderately well					Very well

How confident are you that you can manage this situation?

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					Moderately confident					Very confident

7. You are at home watching television with a family member. She/he turns and speaks to you.

How well can you hear in this situation?

0	1	2	3	4	5	6	7	8	9	10
Not well at all					Moderately well					Very well

How confident are you that you can manage this situation?

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					Moderately confident					Very confident

8. You are going to a public lecture. There are no seats available near the speaker.

How well can you hear in this situation?

0	1	2	3	4	5	6	7	8	9	10
Not well at all					Moderately well					Very well

How confident are you that you can manage this situation?

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					Moderately confident					Very confident

9. You are waiting for a train/plane at a busy station. Your friend is sitting beside you and says something without looking at you.

How well can you hear in this situation?

0	1	2	3	4	5	6	7	8	9	10
Not well at all					Moderately well					Very well

How confident are you that you can manage this situation?

0	1	2	3	4	5	6	7	8	9	10
Not confident at all					Moderately confident					Very confident

10. You hold a party in your home. Someone you do not know very well starts up a conversation. She/he puts one hand over her/his mouth when they are speaking.

How well can you hear in this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not well at all						Moderately well					Very well

How confident are you that you can manage this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not confident at all						Moderately confident					Very confident

11. You are having a family dinner in your home. There is more than one conversation occurring at a time.

How well can you hear in this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not well at all						Moderately well					Very well

How confident are you that you can manage this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not confident at all						Moderately confident					Very confident

12. You are at a wedding reception with 200 guests. Your friend/family member starts talking to you.

How well can you hear in this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not well at all						Moderately well					Very well

How confident are you that you can manage this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not confident at all						Moderately confident					Very confident

13. You are in a restaurant with a family member or friend. You are seated in a dim and noisy spot.

How well can you hear in this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not well at all						Moderately well					Very well

How confident are you that you can manage this situation?

```
  0     1     2     3     4     5     6     7     8     9     10
Not confident at all            Moderately confident            Very confident
```

14. You telephone a family member/friend using a pay phone. There is a lot of noise from people passing behind you.

How well can you hear in this situation?

```
  0     1     2     3     4     5     6     7     8     9     10
Not well at all                  Moderately well                  Very well
```

How confident are you that you can manage this situation?

```
  0     1     2     3     4     5     6     7     8     9     10
Not confident at all            Moderately confident            Very confident
```

15. You are at home. The telephone rings. You do not recognize the caller's voice and cannot understand what she/he is saying.

How well can you hear in this situation?

```
  0     1     2     3     4     5     6     7     8     9     10
Not well at all                  Moderately well                  Very well
```

How confident are you that you can manage this situation?

```
  0     1     2     3     4     5     6     7     8     9     10
Not confident at all            Moderately confident            Very confident
```

16. You answer the door. The postal carrier hands you a package and asks you a question.

How well can you hear in this situation?

```
  0     1     2     3     4     5     6     7     8     9     10
Not well at all                  Moderately well                  Very well
```

How confident are you that you can manage this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not confident at all						Moderately confident					Very confident

17. You attend a meeting with 3 other persons. You have attended this meeting on a regular basis.

How well can you hear in this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not well at all						Moderately well					Very well

How confident are you that you can manage this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not confident at all						Moderately confident					Very confident

18. You are in the grocery store. The person at the checkout tells you the total of your bill.

How well can you hear in this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not well at all						Moderately well					Very well

How confident are you that you can manage this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not confident at all						Moderately confident					Very confident

19. You are at home watching television with a friend/family member. The volume on the television is too soft.

How well can you hear in this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not well at all						Moderately well					Very well

How confident are you that you can manage this situation?

	0	1	2	3	4	5	6	7	8	9	10
Not confident at all						Moderately confident					Very confident

20. You are in the bank. You go to the teller to ask about your bank balance.

How well can you hear in this situation?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Not well at all   Moderately well   Very well

How confident are you that you can manage this situation?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Not confident at all   Moderately confident   Very confident

MEASURE OF AUDIOLOGIC REHABILITATION SELF-EFFICACY (MARS-HA)

These questions ask about your ability to do certain things with a hearing aid, and about your ability to hear in certain situations. If you have never been in these situations, then make your best guess about how well you could do. Indicate how confident you are that you could do the things described here.

> **0% = Cannot do this at all.**
> **50% = Moderately certain I can do this.**
> **100% = I am certain I can do this.**

1. I can insert a battery into a hearing aid with ease.

    0%   10   20   30   40   50%   60   70   80   90   100%

2. I can remove a battery from a hearing aid with ease.

    0%   10   20   30   40   50%   60   70   80   90   100%

3. I can tell a right hearing aid from a left hearing aid.

    0%   10   20   30   40   50%   60   70   80   90   100%

4. I can insert hearing aids into my ears accurately.

    0%   10   20   30   40   50%   60   70   80   90   100%

5. I can remove hearing aids from my ears with ease.

    0%   10   20   30   40   50%   60   70   80   90   100%

6. I can identify the different components of a particular hearing aid.

    0%   10   20   30   40   50%   60   70   80   90   100%

7. I can operate all the controls on a particular hearing aid appropriately.

    0%   10   20   30   40   50%   60   70   80   90   100%

8. I can stop a hearing aid from squealing.

    0%   10   20   30   40   50%   60   70   80   90   100%

9. I can troubleshoot a hearing aid when it stops working.

0%   10   20   30   40   50%   60   70   80   90   100%

10. I can clean and care for a hearing aid regularly.

0%   10   20   30   40   50%   60   70   80   90   100%

11. I can name the make or model of a particular hearing aid.

0%   10   20   30   40   50%   60   70   80   90   100%

12. I can name the battery size needed for a specific hearing aid.

0%   10   20   30   40   50%   60   70   80   90   100%

13. I could get used to the sound quality of hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

14. I could get used to how a hearing aid feels in my ear.

0%   10   20   30   40   50%   60   70   80   90   100%

15. I could get used to the sound of my own voice if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

16. I could understand a one-on-one conversation in a quiet place if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

17. I could understand conversation in a small group in a quiet place if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

18. I could understand conversation on a standard telephone if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

19. I could understand television if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

20. I could understand the speaker at a meeting or presentation if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

21. I could understand a one-on-one conversation in a noisy place if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

22. I could understand conversation in a small group while in a noisy place if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

23. I could understand a public service announcement over the loudspeaker in a public building if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

24. I could understand conversation in a car if I wore hearing aids.

0%   10   20   30   40   50%   60   70   80   90   100%

INTERNATIONAL OUTCOME INVENTORY – HEARING AIDS (IOI-HA)

These questions ask about your experiences over the past two weeks. Please circle the response that best answers the following questions.

1. Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?

   none   less than 1 hour   1-4 hours   4 to 8 hours   more than 8 hours

2. Think about the situation where you most wanted to hear better, before you got your present hearing aid(s). Over the past two weeks, how much has the hearing aid helped in that situation?

   not a lot   slightly   moderately   quite a lot   very much

3. Think again about the situation where you most wanted to hear better. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?

   very much   quite a lot   moderate   slight   no difficulty

4. Considering everything, do you think your present hearing aid(s) is worth the trouble?

   not at all   slightly   moderately   quite a lot   very much

5. Over the past two weeks, with your present hearing aid(s), how much have your hearing difficulties affected the things you can do?

   very much   quite a lot   moderately   slightly   not very much

6. Over the past two weeks, with your present hearing aid(s), how much do you think other people were bothered by your hearing difficulties?

   very much   quite a lot   moderately   slightly   not very much

7. Considering everything, how much has your present hearing aid(s) changed your enjoyment of life?

   worse   no change   slightly better quite a lot   very much better
                                                          better

LEVENSON SCALES

Below are a series of attitude statements. Each represents a commonly held opinion. There are no right or wrong answers. You will probably agree with some items and disagree with others. We are interested in the extent to which you agree or disagree with such matters of opinion.

Read each statement carefully. Then indicate the extent to which you agree or disagree by circling the number following each statement. The numbers and their meanings are indicated below:

+ 3 = agree strongly	**- 1 = disagree slightly**
+ 2 = agree somewhat	**- 2 = disagree somewhat**
+ 1 = agree slightly	**- 3 = disagree strongly**

First impressions are usually the best. Read each statement, decide if you agree or disagree, and the strength of your opinion, and then circle the appropriate number. If you find that the numbers do not adequately reflect your own opinion, use the number that is closest to the way you feel. Thank you.

1. Whether or not I get to be a leader depends mostly on my ability.

 -3 -2 -1 1 2 3

2. To a great extent my life is controlled by accidental happenings.

 -3 -2 -1 1 2 3

3. I feel like what happens in my life is mostly determined by powerful people.

 -3 -2 -1 1 2 3

4. Whether or not I get into a car accident depends mostly on how good a driver I am.

 -3 -2 -1 1 2 3

5. When I make plans, I am almost certain to make them work.

 -3 -2 -1 1 2 3

6. Often there is no chance of protecting my personal interests from bad luck happenings.

 -3 -2 -1 1 2 3

+ 3 = agree strongly	- 1 = disagree slightly
+ 2 = agree somewhat	- 2 = disagree somewhat
+ 1 = agree slightly	- 3 = disagree strongly

7. When I get what I want, it's usually because I'm lucky.

-3   -2   -1   1   2   3

8. Although I might have good ability, I will not be given leadership responsibility without appealing to those in positions of power.

-3   -2   -1   1   2   3

9. How many friends I have depends on how nice a person I am.

-3   -2   -1   1   2   3

10. I have often found that what is going to happen will happen.

-3   -2   -1   1   2   3

11. My life is chiefly controlled by powerful others.

-3   -2   -1   1   2   3

12. Whether or not I get into a car accident is mostly a matter of luck.

-3   -2   -1   1   2   3

13. People like myself have very little chance of protecting our personal interests when they conflict with those of strong pressure groups.

-3   -2   -1   1   2   3

14. It's not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune.

-3   -2   -1   1   2   3

15. Getting what I want requires pleasing those people above me.

-3   -2   -1   1   2   3

+ 3 = agree strongly	- 1 = disagree slightly
+ 2 = agree somewhat	- 2 = disagree somewhat
+ 1 = agree slightly	- 3 = disagree strongly

16. Whether or not I get to be a leader depends on whether I'm lucky enough to be in the right place at the right time.

      -3   -2   -1   1   2   3

17. If important people were to decide they didn't like me, I probably wouldn't have many friends.

      -3   -2   -1   1   2   3

18. I can pretty much determine what will happen in my life.

      -3   -2   -1   1   2   3

19. I am usually able to protect my personal interests.

      -3   -2   -1   1   2   3

20. Whether or not I get into a car accident depends mostly on the other driver.

      -3   -2   -1   1   2   3

21. When I get what I want, it's usually because I worked hard for it.

      -3   -2   -1   1   2   3

22. In order to have my plans work, I make sure that they fit in with the desires of people who have power over me.

      -3   -2   -1   1   2   3

23. My life is determined by my own activities.

      -3   -2   -1   1   2   3

24. It's chiefly a matter of fate whether or not I have few friends or many friends.

      -3   -2   -1   1   2   3

Appendix E

Ref: HEC 2014/164

8 January 2015

Hannah Blood & Rebekah Durrans
Department of Communication Disorders
UNIVERSITY OF CANTERBURY

Dear Hannah and Rebekah

The Human Ethics Committee advises that your research proposal "Rate and reasons for hearing aid non-use in Aotearoa/New Zealand" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 5 January 2015.

Best wishes for your project.

Yours sincerely

Lindsey MacDonald
Chair
University of Canterbury Human Ethics Committee