
**RATE AND REASONS FOR HEARING AID NON-USE
IN AOTEAROA/NEW ZEALAND**

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Abstract

Background: It has been estimated in overseas studies that between 1% and 40% of hearing aids dispensed are not used (Dillon et al, 1999; Kochkin, 2005; Lupsakko & Kautiainen, 2005; Parving & Sibelle, 2001; Smeeth et al, 2002; Stark & Hickson, 2004). Hearing aid non-use has not been evaluated in the New Zealand context, so it is the aim of this study to determine the rate of hearing aid non-use in New Zealand and to investigate factors that may predict whether hearing aid adopters go on to be successful hearing aid users.

Methods: Participants engaged in a phone interview that was conducted to investigate factors affecting hearing aid use. The interview questions were related to the Health Belief Model and thus focused on perceived susceptibility, perceived severity, perceived barriers, perceived benefits and self-efficacy of hearing aid use. Descriptive qualitative analysis was then applied to analyse themes from the interviews.

Results: Ten barriers and nine facilitators to hearing aid use in New Zealand were found. Perceived severity and self-efficacy were also studied in relation to hearing aid use. It was found that perceived severity did affect hearing aid use, with those who perceive their hearing severity to be worse, wearing their hearing aids more than those who perceive no or little hearing difficulty. Whereas self-efficacy of hearing aid management did not have a significant relationship with hearing aid use.

Conclusion: The results from this study highlight reasons why hearing aid adopters become successful or unsuccessful hearing aid users. It is hoped clinicians

will be able to provide additional support to those who are considered unsuccessful users or at risk of becoming an unsuccessful user.

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Definitions

The term hearing impairment will be used instead of hearing loss throughout this thesis. Hearing impairment is consistent with the World Health Organization's International Classification of Functioning, Disability and Health (WHO ICF), which acknowledges that a limitation in auditory sensitivity will have unique, multi-faceted consequences for an individual.

List of Abbreviations

CI	Cochlear Implant
dB HL	Decibel Hearing Level
HAs	Hearing Aids
HATs	Hearing assistive technology system
Hz	Hertz
ICF	International Classification of Functioning, Disability, and Health
kHz	Kilo-Hertz
PTA	Pure-tone Average
WHO	World Health Organization

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Introduction

1.1 Overview

Being able to hear is crucial for communication, activities of daily life, joining in social gatherings and for safety. Hearing Impairment (HI) can cause breakdowns in communication, misunderstanding of spoken words, frustration and an inability to have proper conversations with those around you. Comprehending speech and communicating with others can be especially hard in difficult listening environments, such as in a crowd or at a noisy party (Arlinger, 2003). HI can also lead to not being able to detect and localise warning sounds and alarm bells quickly and reliably, putting a person's safety at risk, (Arlinger, 2003). Many individuals with HI are not aware of the social, functional and psychological consequences of the impairment, and when HI is uncorrected many studies have found that it can lead to social isolation, depression and seriously impact a person's quality of life (QOL), (Arlinger, 2003; Howarth & Shone, 2006; Scherer & Frisina, 1998).

HI impacts a large number of individuals globally. In 2005 the World Health Organisation (WHO) estimated that 642 million people worldwide are living with a HI of 25 dB HL or greater (World Health Organization, 2006). With a prevalence of nearly 10% of the population, HI is one of the most prevalent chronic human health conditions worldwide (Danermark et al., 2010). The number of people reporting HI has increased 3.6% between 1984 and 2008 in the United States of America (USA); this is equivalent to the HI population increasing at 160% of the growth rate of the USA population in general (Kochkin, 2009). This may be due to both increasing life expectancy in the USA, as well as the increasing number of people in the baby boom generation entering later stages of life. As life expectancy lengthens, an increase in

people with age-related HI (presbycusis) is expected. An increase in the prevalence of HI worldwide is also expected to rise due to rapid population increases and higher risk factors for HI in developing countries (Danermark et al., 2010).

Presbycusis is the cumulative effect of aging on hearing ability (Gates & Mills, 2005), and by far the most common form of HI for older adults. Age-related changes typically occur in the sensory, neural and supportive structures within the inner ear (Howarth & Shone, 2006). The audiometric patterns observed may vary between individuals and depend on the type of pathophysiology causing the presbycusis. However, hearing in the higher pitches is generally affected first and to a greater degree than the lower pitches are (Howarth & Shone, 2006). Risk factors of presbycusis include: noise exposure, smoking, ototoxic medication, family history and cardiovascular or metabolic disorders (Gates & Mills, 2005). Complaints are often of bilateral tinnitus, difficulty hearing speech (particularly in noise) and HI which has gradually progressed (Gates & Mills, 2005).

Hearing aids (HA) are designed and fitted to lessen the specific problems faced by HI people and to improve their QOL (Dillon, 2012). Both HA adoption (the uptake of HAs) and HA use are not occurring in rates relative to the rates of HI. HA use is commonly thought of as owning HAs and wearing them on a frequent basis to aid in communication. It has been estimated that HI affects between 35% and 45% of adults aged 50 years or older (Cruickshanks et al., 1998; Gates, Cooper, Kannel, & Miller, 1990; Reuben, Walsh, Moore, Damesyn, & Greendale, 1998) however the prevalence of HA use is just over 4% of adults aged 50-59 having purchased HAs,

and just over 20% of adults between 80-89 having purchased HAs (Chien & Lin, 2012) in Western populations.

This study looks at the rate of HA use and reasons for HA non-use in Aotearoa/New Zealand. HA non-use has been researched in many other countries, but never in New Zealand. The study is qualitative in nature, aiming to get in depth knowledge of reasons for HA non-use in Aotearoa/New Zealand as well as facilitators for HA use.

1.2 Hearing Impairment

The ear is the body's organ of hearing and balance. The ear has four portions, the outer, middle and inner ear and the auditory neural system. The outer ear is called the pinna and is made of cartilage covered by skin. Sound funnels through the pinna into the external auditory canal, a short tube that ends at the tympanic membrane. Sound causes the tympanic membrane and the tiny attached bones, called ossicles, in the middle portion of the ear to vibrate. The vibrations are sent to the nearby cochlea of the inner ear and processed in the Organ of Corti, which is the sensory organ of hearing. There are 12,000 outer hair cells and 3,500 inner hair cells on the Organ of Corti. Pressure changes in the cochlea make the tectorial membrane (the upper part of the Organ of Corti) vibrate, transmitting bending and shearing movement to the hair cells. This stimulates them to produce a nerve signal, which is carried to the brain by the cochlear nerve. Sound at any particular frequency makes some parts of the membrane vibrate more than others, stimulating a specific group of hair cells so that the sound can be recognized. The amplitude of the movement depends on the loudness of the sound. The inner ear also includes the organs of balance known as the

semi-circular canals. When parts of the outer ear, middle ear, inner ear or auditory neural system are impaired or not working properly, it can cause HI and balance problems.

Pure-tone audiometry is considered the gold standard for determining hearing sensitivity. The purpose of pure-tone audiometry is determining a person's hearing threshold (the softest sound they can hear) across the frequency range. It is recommended that pure-tone audiometry be done in a quiet environment, so outside noises do not affect results. A pure-tone of a specific frequency, measured in kilohertz (kHz) is presented to each ear separately, at various intensities until the sound intensity level is identified, at which an individual is just able to perceive the pure-tone 50% of the time. It is measured in decibels hearing level (dB HL). This sound intensity level is known as the pure-tone threshold for that ear and frequency. A graphical display of pure-tone thresholds as a function of frequency is known as an audiogram and provides a representation of a person's ability to perceive sounds across the frequencies important for speech understanding. The audiogram plots the configuration, degree and type of a HI. The current standard for determining a person's threshold is the Hughson-Westlake technique (Hughson & Westlake, 1944) as modified by Carhart and Jerger (1959), which uses frequency specific, pure-tone stimuli in a descending/ascending pattern of 10/5 dB HL respectively.

Pure-tone audiometry uses both air conduction testing, where auditory stimuli travels through the outer and middle ear before reaching the cochlea, and bone conduction testing where a vibratory device is placed on a person's mastoid bone and sound travels directly through the mastoid bone to the cochlea, essentially bypassing

the middle and outer ear. This helps to determine the type of the HI. The three main types of HI are sensorineural HI, conductive HI and mixed HI.

Sensorineural HI (SNHI) occurs when there is damage to the inner ear or the auditory nerve. Examples of abnormalities within the cochlea, which can cause SNHI, include presbycusis, noise-induced HI (NIHI), endolymphatic hydrops, or any third window disorders. Examples of neural abnormalities include vestibular Schwannoma, auditory neuropathy, Bell's Palsy, or lesions in the central auditory pathway. Surgical management of SNHI is possible for some cases such as removing a vestibular Schwannoma, however the large majority of cases are permanent in nature. The pure-tone audiogram results for a SNHI show less than a 11dB HL difference between air and bone conduction results (Katz, 2009).

Conductive HI occurs when there is a lesion in the middle ear cavity, tympanic membrane, external auditory canal or the pinna. In these cases there is an interruption in conducting auditory stimuli through the ear to reach the cochlea. Sound waves cannot reach the inner ear due to a blockage in the middle ear. Examples of conductive HI include otosclerosis, aural atresia, ossicular discontinuity, otitis media with effusion ("glue ear"), cholesteatoma, or a perforation of the tympanic membrane. HI arising from conductive origins can often be treated via surgical means (e.g. inserting ventilation tubes to drain effusion following otitis media or replacing sclerosed ossicles with prosthesis). In many cases hearing improves following surgical intervention or over time, so many conductive HIs are temporary. The pure-tone audiogram results for a conductive HI show more than a 10dB HL difference between the air and bone conduction results (Katz, 2009), with bone conduction being

significantly better than air conduction, as bone conduction is bypassing the lesion in the outer or middle ear. Mixed HI has both sensorineural and conductive components to it, and occurs when there is damage to both the inner and middle ear.

Pure-tone audiometry also reveals the degree of a person's HI. Routine audiometric testing establishes thresholds at octave frequencies starting at 0.25 kHz and progressing to 8 kHz, as this is the frequency range needed for speech sounds. The perceptual correlate of frequency is pitch, where any given frequency of a pure-tone may be perceived as positioned within a musical scale (Moore, 2012). A pure-tone average (PTA) of thresholds using either 3 frequencies (0.5, 1 and 2 kHz) or 4 frequencies (0.5, 1, 2 and 4 kHz) is often used to classify the degree or severity of the HI. Numerous authors have published schema for the classification of HI based on the PTA of 3 frequencies. Based on the classification system one uses, the degree of HI will be considered marginally different. For example Northern and Downs (2002) suggest using 15 dB HL as the upper limit for normal hearing and 70 dB HL as the lower limit of profound HI and Goodman (1965) suggests using 25 dB HL as the upper limit for normal hearing and 90 dB HL as the lower limit of profound HI. See Table 1 below, which compares the published schemas for the classification of HI by Goodman (1965), Jerger and Jerger (1980) and Northern and Downs (2002), (Katz, 2009).

Degree of Loss	Goodman (1965)	Jerger & Jerger (1980)	Northern & Downs (2002)
None	<26	<21	<16
Slight			16-25
Mild	26-40	21-40	26-30
Moderate	41-55	41-60	30-50
Moderately severe	56-70		
Severe	71-90	61-80	51-70
Profound	>90	>80	>70

Table 1. Classifications of Hearing Impairment

The configuration of HI refers to the shape of the audiogram, formed by thresholds at each frequency. The configuration of an audiogram can be flat, gradually falling, steeply falling, precipitously falling, rising, peaked/saucer, trough or notched (Carhart, 1945; Lloyd & Kaplan, 1978)

1.2.1 Prevalence

In 2005 WHO estimated that approximately 642 million people worldwide have HI greater than 25dB HL, (World Health Organization, 2006). Estimations of the prevalence of HI have been shown to vary across literature, depending on many factors such as whether subjective or objective methods were used, how HI was defined in the study, the age and gender of the population assessed and the location of the population being assessed.

1.2.1.1 Objective and subjective measures of prevalence

Literature has found objective measures of HI, such as pure-tone audiometry may result in a higher prevalence than subjective measures of HI, such as self-report, (Nondahl et al., 1998; Sindhusake et al., 2001). One population study with 1,419 participants found that audiometric data showed 34% of them had HI exceeding 30 dB HL, whereas the self-report data found that less than half of the 34% had visited

their doctor about a HI, despite 57% of them regarding their hearing as poor (Duijvestijn et al., 2003). Kiely, Gopinath, Mitchell, Browning, and Anstey (2012) found that there were moderate associations between self-reported and audiometric tested HIs. However they found that prevalence of HI was overestimated for adults below the age of 70 years and underestimated for adults above the age of 75 years. They concluded the self-report is not a reliable measure of the prevalence of HI, although may indicate perceived hearing disability. Reasons why older adults are less likely to report an audiometrically established impairment may be related to an increased acceptance of HI as a normal part of aging, fewer communication needs after leaving the workforce, and greater perceived stigma (Wallhagen., 2010).

1.2.1.2 HI and age

Prevalence of HI is known to increase with age, (Lin, Niparko, & Ferrucci, 2011) . Roth, Hanebuth, and Probst (2011) found that in Europe by age 70 years approximately 30% of men and 20% of women have a pure-tone average of 30 dB HL or greater in at least their better ear and that these percentages double by 80 years of age.

In the USA, a national survey was undertaken as part of the National Health and Nutrition Examination Survey (NHANES) from 1999-2004 to estimate the prevalence of HI. Similarly to Roth et al. (2011), survey results found that the prevalence of HI increases dramatically with age. Using the four frequency PTA, bilateral HI classified as at least a 25 dB HL doubles for every 10 years of life after the age of 50. This amounts to 13% of people between the ages of 50-59 years, 26% of those between the ages of 60-69 years (Lin, Niparko, et al., 2011), and 63.1% of those aged 70 years and older (Lin, Thorpe, Gordon-Salant, & Ferrucci, 2011). The

prevalence of high-frequency HI increases from 28% among adults 50–59 years to 38% among adults 60–69 years (Agrawal, Platz, & Niparko, 2008). When defined as an average pure-tone HI in the best ear of 35 dB or more at 1, 2, and 4 kHz, HI was found in 75% of the population older than 80 years (Abutan, Hoes, Van Dalsen, Verschuure, & Prins, 1993).

1.2.1.3 Degree and definition of HI

How HI is defined can significantly influence prevalence estimates. Prevalence can be found to be much higher when those with a mild HI are included in the total percentage. For example, the WHO estimates global prevalence of disabling HI of a moderate classification or greater (> 40 dB HL), to be 278 million people. If including mild HIs (26 - 40 dB HL) as well, that estimate rises to 642 million people, or just over 10% of the world population, of which 25 million are estimated to be present from childhood (World Health Organization, 2006). Furthermore, the classification system used to classify the degree of HI can result in different quantities of prevalence. A ‘mild’ HI is defined significantly differently depending on whether you use the Northern & Down classification system (Northern & Downs, 2002), where a mild HI is considered 15 dB HL or greater or whether you use Goodman’s classification system (Goodman, 1965) where a mild HI is considered 25 dB HL or greater.

1.2.1.4 Location of population

Worldwide it has been found that the lowest prevalence of HI among adults 15 years or older was in the Middle East and North Africa regions as well as the high-income regions. The greatest percentage of adults with HI was in the South Asian,

Eastern Europe and Central Asian regions (World Health Organization, 2006). Ethnic differences in hearing sensitivity are not well understood. Hypotheses for these differences include melanin pigmentation providing protection for loss of sensory function within the cochlea (Lin, Thorpe, et al., 2011). An array of genetic factors that control molecular pathways within the inner ear and the auditory nerve have been identified (Dror & Avraham, 2010), but to what extent genetic factors are related to ethnic differences in the prevalence of HI is not known. In the USA white men have been found to have a higher prevalence of HI than black men. Differential lifetime exposure to noise and higher blood pressure in white men has been found to play a part in this (Helzner et al., 2005).

In 2013 Statistics New Zealand estimated there are approximately 380,000 people in Aotearoa/New Zealand living with some degree of HI. This translates to roughly one in three, or up to 9%, of the population (Statistics New Zealand, 2013).

1.2.1.5 Division by sex

It has also been reported that prevalence of HI is higher amongst men than women (Agrawal et al., 2008; Cruickshanks et al., 1998; Mitchell et al., 2011). Globally, as of 2008, the estimated average HI amongst males over the age of 15 years is 12.2% whereas for females, this global average is reduced to 9.8% (Stevens et al., 2013). Though it has been posited that the higher prevalence in males may be due to occupational noise exposure (Wallhagen, Strawbridge, Cohen, & Kaplan, 1997), one study ($n = 3,753$) found that even after controlling for occupation and noise exposure, there was still a statistically significantly higher prevalence of HI amongst

males than females (Cruickshanks et al., 1998).

1.2.1.6 Socioeconomic Differences

HI also occurs along a socioeconomic gradient, such that adults with less education or lower income have a greater likelihood of impairment, a pattern that has been replicated outside of the United States in countries such as Norway and Australia (Agrawal et al., 2008; Helvik, Krokstad, & Tambs, 2009; Mitchell et al., 2011).

1.3 Impact of Hearing Impairment

HI can have a vast influence on how a person feels and one cannot predict the impact a person's HI will have on them, due to HI having different affects for everyone based on their personality, coping style, needs, abilities and lifestyle (Erdman & Demorest, 1998). The International Classification of Functioning, Disability and Health (ICF) framework, as well as the Health Belief Model (HBM) are both useful for assessing the impact a persons HI has on their ability to function and cope.

1.3.1 International Classification of Functioning, Disability and Health

The International Classification of Functioning, Disability and Health (ICF), is a framework created by the World Health Organisation (WHO) in 2001, (World Health Organization, 2001) to measure health and disability at both individual and population levels. It uses a biopsychosocial model, which integrates the previously separate medical, and the social models together. Under the medical model, disability is viewed as a problem within an individual, caused by a disease or other condition, and which requires treatment in the form of professional medical care. The social model, on the other hand, views disability as social phenomena generated by an

unaccommodating environment, thereby requiring a socio-political response within the social environment. By integrating the two models, the ICF avoids the pitfalls inherent in adopting or rejecting wholly one view or the other, though both are valid, neither is adequate (World Health Organization, 2001) The ICF uses Figure 1 to represent the nonlinear relationship between the different factors taken into consideration in the biopsychosocial model. This model was chosen with the aim of providing a “coherent view of different perspectives of health from a biological, individual, and social perspective” (World Health Organization, 2001, p. 28)

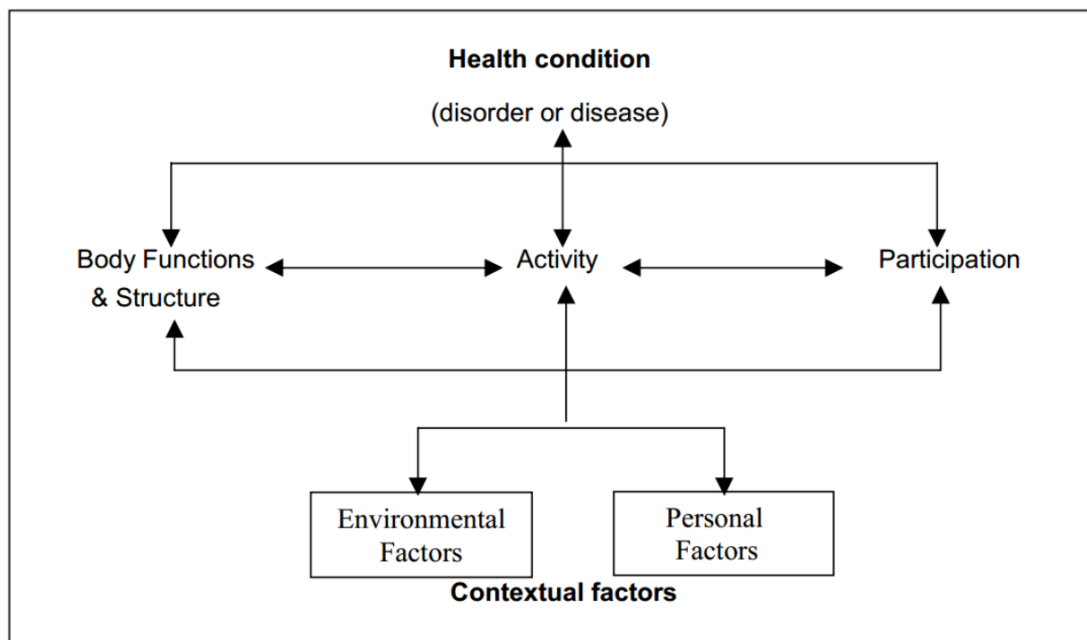


Figure 1. The WHO-ICF biopsychosocial model

The ICF focuses on the impact a person’s disability can have on their functioning in everyday lives. It is a holistic framework that can be used for assessment, goal setting, management, monitoring and outcome measurement for any disability, including HI. The ICF does not simply define “health” as the absence of a disease but as the complete physical, mental and social functioning of a person.

The ICF framework consists of two parts, the first part being functioning and disability. This part looks at the body structures and functioning of the disability. Body structures describe the anatomy and physiology and functioning looks at activity and participation factors. Activity refers to the execution of an action. The negative equivalent, referred to as an Activity Limitation, is the difficulty faced by an individual in executing that action. Participation refers to an individual's involvement in a life situation. The negative equivalent, referred to as Participation Restriction, is any restriction faced by an individual when being, or attempting to be, involved in that situation (World Health Organization, 2001).

It is well documented that HI can lead to Activity Limitation and Participation Restrictions, particularly communication difficulties, cognitive dysfunction, and social and emotional isolation (Arlinger, 2003; Dalton et al., 2003; Mulrow et al., 1990; Stumer, Hickson, & Worrall, 1996). For example, the health condition of presbycusis leads to the impairment of degeneration of hair cells, causing the Activity Limitation of being unable to distinguish speech in noisy restaurants, leading to the Participation Restriction of not attending a dinners out with family members.

The second part of the framework looks at contextual factors, which include environmental factors such as family, work, cultural beliefs and laws as well as personal factors such as race, age, gender, educational level and coping style. Environmental factors for presbycusis could lead to difficulties at work if a person is unable to hear colleagues as well as communication breakdowns within families if one member cannot engage with the other members and communicate with them properly. Personal factors for presbycusis include the likelihood of a person's HI

getting worse as they age (Lin, Thorpe, et al., 2011) and how a person is able to cope with their HI.

Barriers and facilitators are part of both the functioning and disability factors and contextual factors in the ICF. Barriers are difficulties and obstacles a person faces and can have a negative impact on HA uptake and HA use. Facilitators are something that can assist to achieve a goal and can have a positive impact on HA uptake and HA use. Barriers and facilitators to HA uptake and HA use include all parts of the ICF framework. Barriers to HA uptake might be the cost involved or the perceived judgement other people will give. Barriers to HA use might be discomfort of the HA in the ear, HA feedback issues or lack of perseverance. Facilitators for HA uptake might be encouragement from a significant other or a higher need for amplification, due to a more severe HI. Facilitators for HA use might be having a remote control you can use with them or finding that the HAs provide benefit to hearing.

HI not only affects the person who has the impairment, but those around them trying to communicate with them. This is called ‘third party disability’. Third-party disability is defined as the impairments, activity limitations, and participation restrictions experienced by a family member or significant other due to the health condition of their significant other. It was identified by WHO as an area of future development and application within the ICF (World Health Organization, 2001).

1.3.2 Health Belief Model

Although this study is looking at the specific topic of rates and reasons for HA non-use in Aotearoa/New Zealand, the research questions being addressed are related to much broader theoretical issues or principles of behaviour. In this study the broader theory that is being used is the HBM. The HBM was developed to predict participation in health prevention or detection programs (Becker, Drachman, & Kirscht, 1974; Rosenstock, 1974a, 1974b; Rosenstock & Kirscht, 1979). It is based on cognitive theories of behaviour. Cognitive theorists believe that behaviour is contingent upon: a) the value that an individual places on a desired outcome, and b) the belief that a behaviour, if performed, will result in the desired outcome (Bandura, 1977). This theory addresses the roles that psychological, social and behavioural factors play in a person's decision to purchase and use their HAs. It also addresses factors that might determine whether an individual will comply with the audiological recommendations (i.e. wearing HAs due to HI).

In this study I used the HBM to look at the HA use. The HBM suggests that a person's beliefs about their health problems, including, perceived benefits of action, barriers to action, and self-efficacy explains commitment (or lack of commitment) in health-promoting behaviour. A cue to action must also be present in order to trigger the health-promoting behaviour, in this case purchasing and using HAs. The HBM has five constructs: perceived severity, perceived susceptibility, perceived benefits, perceived barriers and perceived self-efficacy.

Perceived severity refers to an individual's subjective assessment of the severity of their health problem and its potential consequences. The HBM suggests that individuals who perceive a given health problem as serious are more likely to engage in behaviours to prevent the health problem from occurring. For HA uptake

this suggests that those individuals who perceive they have very poor hearing are more likely to buy HAs as they have a more serious problem than individuals with a milder HI. Similarly, for HA use, those individuals who perceive they have poorer hearing are more likely to use their HAs than individuals who perceive their hearing is not very severe.

Perceived susceptibility refers to subjective assessment of the risk of developing a health problem. The HBM predicts that individuals who perceive that they are susceptible to a particular health problem will engage in behaviours to reduce their risk of developing the health problem. Examples include, family history of HI or being an older adult. In contrast to this, individuals with low perceived susceptibility may deny that they are at risk for contracting a particular illness, such a person with no family history of HI or a younger adult.

Perceived benefits refer to an individual's assessment of the value or efficacy of engaging in a health-promoting behaviour to decrease risk of disease. If an individual believes that a particular action will reduce susceptibility to a health problem or decrease its seriousness, then he or she is likely to engage in that behaviour. This suggests that individuals who think that a HA will help to improve their hearing and decrease listening effort are more likely to purchase and continue wearing HAs.

Perceived barriers refer to an individual's assessment of the obstacles to behaviour change. Even if an individual perceives a health condition as threatening and believes that a particular action will effectively reduce the threat, barriers may

prevent engagement in the health-promoting behaviour. In other words, the perceived benefits must outweigh the perceived barriers in order for behaviour change to occur. For HA uptake and continued use this may be stigma or cosmetic reasons.

The HBM theorises that a cue, or trigger, is necessary for prompting engagement in health-promoting behaviours. Cues to action can be internal or external. Physiological cues (e.g. tinnitus, HI) are examples of internal cues to action. External cues include events or information from significant others, the media, or health care providers promoting engagement in health-related behaviours, such as a spouse saying that they think their partner has a HI and encouraging them to go get a hearing test.

Perceived self-efficacy was added to the four components of the HBM in 1988 (Glanz, Rimer, & Viswanath, 2008). It refers to an individual's perception of his or her competence to successfully perform a behaviour. It was added to the HBM in an attempt to better explain individual differences in health behaviours, as two individuals can have very similar circumstances but cope very differently. For example, two individuals with the same degree of HI and from similar backgrounds may have very different HA experiences due to individual differences in confidence of HA management and motivation for HA use. Figure 2 shows how the five constructs of the HBM relate and connect to each other.

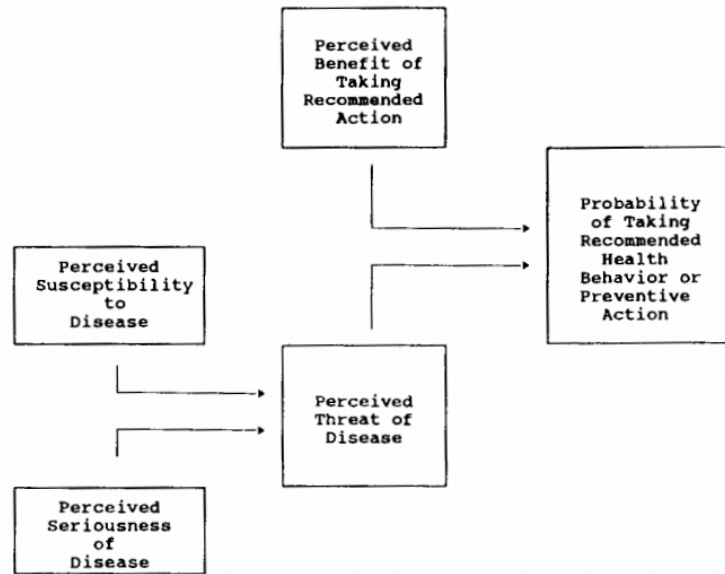


Figure 2. The HBM explaining personal health behaviour (Rosenstock, 1974b)

The HBM has been one of the most useful paradigms for investigating health-related behaviours (Janz & Becker, 1984). There has been however several important criticisms levelled against the model that should be noted. First, very little work has gone toward quantification of the relations among the variables compromising the HBM (Rosenstock, 1990). For example, there has been very little attempt to explain the precise, numerical relations among perceived susceptibility, severity, benefits, barriers and self-efficacy. Nor has there been any attempt to determine the relative power of these variables in the prediction of actual health behaviour. Secondly, the HBM focuses on perceptual factors such as beliefs, and fails to account for variance in behaviour that might be due to other relevant factors such as personal habits and social-cultural norms (Noh, Gagné, & Kaspar, 1994).

1.4 Effect of intervention on the impact of HI

Intervention for HI includes devices that amplify sound to help overcome hair cell deterioration and improve listening, including HAs and cochlear implants (CIs), which are both forms of sensory management; hearing assistive technology systems

(HATs), which are devices that help a person communicate better in daily situations; and aural rehabilitation, which focuses on a person learning to adjust and cope with their HI. Aural rehabilitation includes teaching significant others and the HI person communication strategies, exploring whether an assistive device will help, managing conversations and taking charge of communication. Aural rehabilitation leads to a person making the most of their HAs. Aural rehabilitation is not part of a standard HA fitting in New Zealand.

1.4.1 Hearing Aids

The primary intervention for people with HI is HAs. A HA is a small electronic device that sits behind or in a person's ear. It amplifies certain sounds, specific to each individual, depending on their pattern of HI and personal preference for loudness level. The audiologist fits the HA(s) using objective verification methods and subjective validation methods to ensure best-fit possible. Depending on the HI of an individual they may be fitted with one or two HAs. The majority of the time HI occurs in both ears and is symmetrical so a person is fitted with two HAs (Katz, 2009).

A HA has three basic parts: a microphone, amplifier, and speaker. The HA receives sound through a microphone, which converts the sound waves to electrical signals and sends them to an amplifier. The amplifier increases or decreases the power of the signals and then sends them to the ear through a speaker. The surviving hair cells detect the larger vibrations and convert them into neural signals that are passed along to the brain. The greater the damage to a person's hair cells, the more severe the HI, and the greater HA amplification is needed to make up the difference. However, there are limits to the amount of amplification a HA can provide. If the

inner ear is too damaged, even large vibrations will not be converted into neural signals. Other options in this situation are CIs or sign language. It is important to note that HAs and CIs do not restore normal function. Users may be given relatively full audibility of the sounds of conversational speech, but deficits of spectral and temporal resolution remain and their severity varies from individual to individual.

HAs can reduce the negative consequences associated with HI and improve a person's quality of life (Chia et al., 2007; Chisolm, Johnson, et al., 2007). This is because people will be able to participate in more activities of daily life and communicate more effectively with others; using less listening effort than before they had HAs. Despite this, only around 30% of people in the western world who could benefit from HAs actually own them (World Health Organization, 2006). It has also been estimated that as many as 40% of HAs dispensed are not used (Smeeth et al., 2002).

HAs can be a financial burden, either to the funding body, such as the government, or to the HA owner. In the USA, the lifetime costs of severe to profound HI (defined as hearing thresholds of ≥ 70 dB HL averaged across the frequencies 0.5, 1, and 2 kHz) when onset is older than 60 years, were estimated to be on average US \$43,000 (Mohr et al., 2000). Often HAs are the most effective form of intervention for SNHI, yet only a few studies have looked at the costs and effects associated with HA fitting (Parving et al., 1997; Yueh et al., 2001). Joore, van der Stel, Peters, Boas, and Anteunis (2003) found that in the Netherlands HA fitting is a cost-effective treatment on a societal level for HI when looking at costs per quality-adjusted-life-year (QALY) and the EuroQol (EQ-5) (Joore et al., 2003). Joore et al. (2003) results

were not unambiguously positive, probably because the EQ-5 lacked sensitivity for the evaluation of HA fitting. Similarly, Chao and Chen (2008) found that in the USA using the hearing-related QALY measure in US dollars that HA fitting was found to be a cost effective strategy to rehabilitate the HI elderly. These results can assist policy makers in allocating health resources appropriately and effectively.

1.4.2 Cochlear implants

A CI is a surgically implanted electronic device that provides help with hearing to individuals who have a severe or profound HI, and whose hair cells are too damaged to find benefit from HAs. It includes a surgically implanted internal component (in the mastoid bone) that consists of a receiving coil/internal processor and electrodes that deliver the electrical signal to the inner ear and external components including a microphone, speech processor, connecting cables and a transmitter coil that work to collect, analyse, process and transmit auditory information to the internal components (Katz, 2009).

A CI is very different from a HA. HAs amplify sounds so they may be detected by damaged ears. CIs bypass damaged portions of the ear and directly stimulate the auditory nerve. Signals generated by the implant are sent by way of the auditory nerve to the brain, which recognizes the signals as sound. Hearing through a CI is different from normal hearing and takes time to learn or relearn. However, it allows many people to recognize warning signals, understand other sounds in the environment, and enjoy a conversation in person or by telephone.

Not everyone is provided with benefit or success from a CI. For example, patients who lost their hearing prior to the development of speech and language skills

(prelingually deafened adults or children) typically demonstrate poorer speech perception skills than postlingual deafened adults or children (Skinner et al., 1992; Waltzman & Cohen, 1999; Zwolan, Kileny, & Telian, 1996). Postimplant changes in speech recognition scores vary greatly for prelingually deafened adults. Some demonstrate progress, while others demonstrate little or no change in scores over time, even when combined with intensive rehabilitation. Because of these factors, prelingually deafened adults demonstrate a higher device non-use rate than postlingually adults (Katz, 2009).

1.4.3 Hearing Assistive Technology systems

HATs are devices that help individuals with HI in specific listening environments. They can be used with or without HAs and CIs. Although HAs often enhance an individual's listening, there are certain situations where additional help is required for better listening performance and capability. When watching the television there are many HATs that can be used to enhance the sound quality further, such as infrared systems that use Bluetooth, or an FM system, which stream the sounds from the television directly to a person's HAs, limiting the interference background noise can have. When on the telephone HATs can be used to support communication, these include amplified telephones, captioned telephones which write out what the person on the other end is saying and HA streamers which use Bluetooth to directly transfer the person's voice on the other line to a person's HA. There are also loop systems, which work in HAs with a telecoil (a small coil inside some HAs). The coil acts as a small receiver, which picks up signals from a loop system, which acts as a electromagnetic field. HAs with an activated telecoil can convert this electromagnetic signal into a sound signal (Dillon, 2012). Other examples of HATs include vibrating and flashing alarms that make a person more aware of environmental sounds such as

the doorbell ringing, telephone ringing or smoke alarm. These alarms are especially useful if an individual has taken their HAs out.

1.4.4 Aural Rehabilitation

Aural rehabilitation is defined holistically as “the reduction of hearing-loss-induced deficits of function, activity, participation, and quality of life through a combination of sensory management, instruction, perceptual training, and counselling” (Boothroyd, 2007, p. 63). This definition uses the terms developed by the World Health Organization (2001) in the ICF. There is a tendency for audiologists to focus on sensory management and neglect the aural rehabilitation side of intervention (Boothroyd, 2007). Often aural rehabilitation is seen as something done by someone other than the audiologist after the provision of HAs or CIs. Effective sensory management may, by itself, lead to improved activity, participation, and quality of life, but there is no guarantee that these outcomes will be automatic or optimal. In fact, there is often a disconnect between clinical measures of assisted auditory function and self-assessed benefit (Boothroyd, 2007).

Many adults with acquired HI are looking not for a significant improvement of function, but for full restoration of their hearing. It is our inability to meet this unrealistic expectation that creates the need for a holistic approach to adult aural rehabilitation that goes beyond sensory management (Boothroyd, 2007). The differences between expectation and reality can cause selective non-use or complete non-use of HAs. The immediate goal of aural rehabilitation is for the adult or child with the HI to become a “knowledgeable and effective user of the hearing device and a knowledgeable and effective controller of the communication context” (Boothroyd, 2007, pp. 64-65). The users need to know the benefits as well as the limitations of the

HAs they are purchasing as well as how to manage, operate and maintain their HAs. This includes explaining, writing and showing a person how to operate their HAs and repeating information if necessary, so the individual can therefore be a “knowledgeable and effective user”.

There are 4 components that make up aural rehabilitation:

1. *Sensory management*

The goal of sensory management is to target and enhance auditory function. Previously stated this is providing HAs, CIs and HATs to individuals.

2. *Instruction*

The goal of instruction is to increase the probability of positive outcomes from sensory management. Studies have found that formal instruction in HA management leads to increased usage and therefore, enhanced function and activity in everyday life (Abrams, Chisolm, Guerreiro, & Ritterman, 1992; Chisolm, Abrams, & McArdle, 2004)

3. *Perceptual Training*

The goal of perceptual training is to target activity, by supplementing the learning opportunities provided by everyday communication. Perceptual training does not target function; rather, its goal is better use of that function through enhancement of perceptual skills. Deficits of auditory perception may be addressed through perceptual training. The immediate goals are to enhance auditory or auditory-visual perceptual skills, the skills involved in spoken language perception. If this increases confidence and helps the client modify perceptual strategies, the expected outcomes

are faster learning and higher ultimate performance. There is evidence of improvement in communicating on formal speech perception tests (Rubinstein & Boothroyd, 1987; Sweetow & Sabes, 2006). It is however, not always clear, how much of this improvement reflects skills that are generalisable to every day communication (Sweetow & Palmer, 2005).

4. Counselling

The goal of counselling is to target issues of participation and QOL that result from residual deficits of function and activity. There is evidence of its personal short-term effectiveness as well as cost-effectiveness (Chisolm & Arnold, 2013; Hawkins, 2005; Vuorialho, Karinen, & Sorri, 2006; Wong & Hickson, 2012), but the outcomes will be highly dependent on the characteristics of the person with the HI, rapport with the counsellor, rapport with other participants (if group or couple counselling), and the content of the program (Trybus, Stika, & Goulder, 1997).

Counselling is used to explore situations in which persons with HI can discuss and come to terms with its impact on their everyday lives, discuss their feelings about this impact, and explore ways to address the practical, social, and emotional consequences. Issues for discussion might include relationships, employment, anger, shame, risk tolerance, and perceived locus of control (Noble, 1996; D. Stephens, 1996).

1.5 Hearing Aid Use Worldwide

HI represents a chronic health condition that affects between 63 – 72% of adults aged 70 years or older in Western populations (Chia et al., 2007; Cruickshanks et al., 1998; Lin, Thorpe, et al., 2011). In the United Kingdom (UK), the prevalence of

HA use increases with every decade, with just over 4% of adults aged 50-59 years having purchased HAs, and just over 20% of adults between 80-89 years having purchased HAs (Chien & Lin, 2012). It has also been revealed that individuals who purchase HAs, deal with their HI for an average of 10 years before deciding their HI is too frustrating to live with and that they want to trial HAs (Davis, Smith, Ferguson, Stephens, & Gianopoulos, 2007). In Australia, the Blue Mountains Hearing Study revealed that 39% of adults with HI over the age of 50 years do not seek professional help for HI, and 58% do not own HAs (Chia et al., 2007; Hartley, Rochtchina, Newall, Golding, & Mitchell, 2010; Schneider et al., 2010). In the USA, approximately 40% of people with moderate to severe HI, and 10% of people with mild HI, own HAs (Kochkin, 2009).

Demographic factors that have been studied in relation to HA use are age and gender. A range of studies reported to find no relationship between age and both HA use and satisfaction (Gatehouse, 1994; Hickson, Timm, & Worrall, 1999; Norman, George, & McCarthy, 1994). Contradicting these findings, respondents aged 65 to 74 years were at significantly higher risk of non-regular use compared to those aged below 65 or above 74 years (Bertoli et al., 2009). In addition, women have a significantly lower risk for non-regular use. A large survey on HI, ownership, and use of HAs in elderly people in the UK, found regular use to be more frequent in women (Smeeth et al., 2002). Other studies in Finland, Wisconsin (USA) and New Zealand have failed to show a gender effect, possibly due to the small sample size (Jerram & Purdy, 2001)/

A study by Hickson, Hamilton, and Orange (1986) with 135 participants who had all been fitted with HAs revealed that there was no difference in HA use between self-motivated HA candidates and candidates motivated by others to seek help. A similar finding was reported in Hickson et al. (1999). They did however observe a significant relationship between the source of motivation for attending a hearing clinic and the satisfaction with HAs. This study demonstrated that self-motivated persons were more satisfied than those motivated by others, but did not differ significantly in terms of HA use.

It has been found that a person's cultural identity and ethnicity can influence HA use. Bertoli et al. (2009) found that compared to the respondents from the German-speaking parts of Switzerland, the French- and Italian-speaking were more likely to use their aids regularly, and the French-speaking were more satisfied with their aids. As the procedure of HA provision is the same across the country, this difference could be related to a different cultural background in the three main language areas.

Although there is no agreed definition of success with HAs, it could reasonably be defined that a successful outcome is one in which a person with HI wears the HAs on a regular basis and reports benefit and satisfaction from them

(Hickson, Meyer, Lovelock, Lampert, & Khan, 2014). The term "satisfaction" has been used to describe a global outcome variable that encompasses the full spectrum of issues that are important to the client (Cox & Alexander, 2001). Kochkin (2000) found that a client's overall satisfaction with their HAs was strongly linked with the likelihood of repurchasing a particular brand of HA, recommending HAs to

friends and relatives, recommending a particular clinician or dispenser to others, and general QOL ratings. There have been numerous studies done on HA use all over the world, and all have found slightly different barriers and facilitators for HA use as well as different percentages of HA owners who use their HAs on a regular basis. This is not unexpected, as each country has different HA fitting procedures, funding options, rehabilitation programs and HA services.

HA use and satisfaction are closely related. Ranges of studies have demonstrated a positive association between the HA use and satisfaction, meaning the more satisfied a HA user is with their HAs the more they will use them, (Hickson et al., 1999; Jerram & Purdy, 2001; Öberg, Lunner, & Andersson, 2007; Uriarte, Denzin, Dunstan, Sellars, & Hickson, 2005). However, as is frequent in research on HA use, others studies have contradicted this and found that people who use their HAs a relatively short time per day, may be just as satisfied with them (Dillon, Birtles, & Lovegrove, 1999; Wong, Hickson, & McPherson, 2003). Some HA users choose only to wear their HAs when they perceive they are going to need them, such as when they are interacting with others or listening to the television or radio and choose not to wear them when they are in a quiet situation with no other people around such as when they are home alone, because they do not have the hearing need. Dillon et al. (1999) found that the benefit of HAs was more in quiet environments than noisy environments, but positive nonetheless.

A scoping study conducted by McCormack and Fortnum (2013) found that the results of ten studies looking at HA use differed depending on whether participants responded to pre-determined reasons, such as ticking boxes on questionnaires for non-

use or whether they gave their own answer, such as answering an open ended interview question.

It is important to look at the outcome measures used in a study, as they can help to explain the results. Currently research into HA use is contradictory and research papers frequently disagree with one another in terms of barriers and facilitators of HA use. This may be due to the outcome measure(s) used and whether they were subjective or objective, the population used in the study and how their demographic factors and audiometric factors differ, the country the study was based in and the funding schemes and HA fitting model used in the country as well as the participant number.

The rationale for this study was to look at rates and reasons for HA non-use in Aotearoa/New Zealand to see what the main barriers and facilitators were for HA use and how they compared to studies done in other countries.

1.5.1 Facilitators to wearing hearing aids

Facilitators to wearing HAs relate to the HBM constructs of perceived severity (i.e. the higher the perceived severity of the HI the more the person has a need for HAs), perceived susceptibility (i.e. the greater a persons risk of developing HI, the more likely they will be to purchase and use HAs), perceived benefits (i.e. the more the HAs are benefitting a person and improving their communication and safety needs the more likely they may be to wear HAs), cues to action and self-efficacy (i.e. the more confident a person is in their ability to manage and wear their HAs the more they are likely to use them).

When Hickson et al. (2014) looked at HA success in older adults they found that the factor associated most strongly with successful HA outcomes (using the HAs on a regular basis and reporting benefit from them) was the positive support of significant others. The findings of this study have important implications for clinical practice. First, significant others should be involved in hearing rehabilitation and their attitudes to HAs and HI should be addressed in the same way that the attitudes of people with HI are considered. Such a family-centred approach would be in line with interventions used in other areas of health care that have been found to have positive benefits for people with the disability and for their family members (Dunst, Boyd, Trivette, & Hamby, 2002). This relates to cues to action, part of the HBM, which posits that a cue or trigger is necessary for prompting engagement in health, related activities. In this study, the cue was support and encouragement from a significant other. It also relates to perceived benefit, because if the significant other notices communication improves with the use of HAs they will encourage the HA user to continue to wear the HAs for continued easier communication.

Numerous studies have found that attitudes towards HAs can affect HA use. Both Goldstein and Stephens (1981) and Hickson et al. (1999) found that attitudes towards HAs which are “strongly positive toward help” and “essentially positive” (Knudsen, Oberg, Nielsen, Naylor, & Kramer, 2010, p. 131) showed consistent use compared to those people with negative attitudes towards HAs. Similarly, Wilson and Stephens (2003) reported significantly higher use rates of HAs as well as higher satisfaction levels among those with a positive prefitting attitude toward HA rehabilitation compared to those with negative prefitting attitudes. Comparable

findings were reported by Gatehouse (1994), who observed significant positive correlations between attitude towards HAs and HA use and satisfaction.

Brooks (1989) investigated the use of HAs 4 months postfitting in relation to four questions regarding the participants' attitude to their HI. For each of the four questions, it was found that a higher degree of acceptance of own hearing problems prior to HA fitting was related to a higher amount of hours of HA use per day when measured 4 months postfitting. All of these findings regarding attitude relate to the perceived benefits and perceived barriers constructs of the HBM. Jerram and Purdy (2001) observed that those people who purchase HAs who have a better acceptance of their HI prior to HA fitting used their HAs more frequently than those with less acceptance of their HI.

Attitude relates to the perceived benefits and barriers constructs of the HBM. The more one views HA use as a positive health behaviour that will improve their life the more likely they are to wear HAs, whereas the more negative a person feels about HAs and the benefit they will provide, the less likely they will be to wear HAs. The perceived benefits have to outweigh the perceived barriers in order for an individual to engage in a health behaviour. Attitude also relates to the perceived severity construct. The more a person has accepted they have a HI and its potential consequences the more likely they are to use HAs.

Cox, Alexander, and Gray (2007) found that higher levels of self-perceived difficulties were associated with higher use and higher satisfaction. Similarly, Takahashi et al. (2007) investigated HA use and satisfaction at 6 years post fitting and

compared subjective unaided hearing difficulties with satisfaction as measured with the IOI-HA questionnaire. Significant positive correlations were seen between subjective hearing difficulties and HA use and satisfaction. Similarly, Hosford-Dunn (2001) measured the relation between HI and the amount of HA use per day as well as satisfaction. They found that those with greater hearing thresholds also reported a greater amount of HA use per day and greater satisfaction levels. These relate to the perceived severity, perceived benefits and perceived barriers construct of the HBM.

Gatehouse (1994) found that some aspects of personality had a significant association to HA use and satisfaction, as those with lower depression scores according to the Crown-Crisp Experiential Index (Crown & Crisp, 1979) scored higher on postfit HA use and satisfaction levels. This relates to self-efficacy as individuals with lower depression scores are more likely to believe in their own ability to manage and use their HAs.

Data reported by Saunders and Jutai (2004) demonstrated a significant relationship between daily HA use and total lifetime use (> 10 years), such that over time individuals wear their HAs for longer each day. It has also been found in that the duration of HA experience and degree of HI are associated with regular use (Brooks, 1985; Parving & Philip, 1991; Wong et al., 2003).

Effective HA use has also been examined by Kapteyn, Wijkkel, and Hackenitz (1997) who designed a referral pathway and a fitting program that included structured exchange of information between the general practitioner (GP) and the Ear, Nose and Throat (ENT) specialist to improve the streamlining between these professionals. The

fitting program comprised of a controlled 4-week trial period as well as a home visit by a trained volunteer. The proportion of effective use of the HA in six different listening situations was adopted as the outcome. It was found home visits had a beneficial influence on HA use. Those receiving home visits showed significantly less ineffective use compared to those not receiving home visits.

Eriksson-Mangold, Ringdahl, Björklund, and Wåhlin (1990) also reported on a fitting program that was aimed to increase HA use. The fitting program included clinic visits before and after fitting of the HAs. This fitting program covered five visits at a Hearing Centre; a more structured guidance of the client compared to the usual practice, and gave the client tasks to be completed between appointments. The program gradually increased HA use during the 1st month of training. Results of the study found that the clients participating in the program had significantly higher rates of HA use compared to the control group. In addition, they also had more positive opinions about wearing HAs and experienced greater satisfaction with sound quality.

The above studies, which looked at the difference fitting programs, provide support for the effectiveness of aural rehabilitation. They suggest sensory management alone does not lead to the best results for HA use and satisfaction. Instruction, perceptual training and counselling can increase effective HA use as well as improve satisfaction levels. Aural rehabilitation may lead to improved self-efficacy for HA management and use. The effect of just counselling with no other aspects of aural rehabilitation on HA use and satisfaction is uncertain. Short-term effects may appear significant (Kemker & Holmes, 2004), however it has not been looked at long-

term and this seems to be important to also evaluate whether these effects remain stable (Öberg, 2008).

Facilitators for HA use lead to increased rates of HA use and more satisfaction. They help people to have successful and positive HA experiences. It is important to know what helps people succeed with their HAs, so these facilitating factors and reasons can be used with people who have less successful HA experiences, in the hope that these could also improve their HA use and satisfaction.

1.5.2 Barriers to wearing hearing aids

Barriers relate to the perceived severity (i.e. in comparison to facilitators for HA use, those who perceive their HI to be more mild may be less likely to use HAs), perceived susceptibility (i.e. those who have no risk factors for HI may be less likely to get their hearing tested, purchase HAs and wear HAs), perceived benefit (i.e. those who notice less benefit in terms of listening with their HAs may be less likely to wear their HAs), perceived barriers (i.e. those that have difficulties managing their HAs or negative side effects associated with their HAs may be less likely to wear their HAs) and self-efficacy (i.e. those who are unable to motivate themselves to wear their HAs or have low confidence in their ability to manage their HAs could be less likely to use their HAs). Many studies have looked at barriers towards wearing HAs, with certain barriers being reported frequently.

Kochkin (2007) surveyed adults with self-reported HI who did not use HAs. Among the many reasons reported for not using HAs was the belief by individuals that their HI was too mild for HAs. Brooks (1989) also found that people who were the least distressed by their HI and reported that they neither wanted nor needed a HA

had the lowest rates HA use when measured after fitting. This relates to the perceived severity construct of the HBM. He also found that many people had negative attitudes toward HAs; with half the people with HI choosing not to try HAs due to stigma. Goldstein and Stephens (1981) also found attitude, which is fundamentally negative against HAs, was associated with occasional use or non-use of HAs. This relates to the perceived benefits and barriers parts of the HBM. Negative attitude to HAs have the opposite effect to what positive attitudes to HAs have, making attitude a big factor in HA use and satisfaction outcomes.

According to a Swiss survey by Bertoli et al. (2009), the most frequently reported reasons for HA non-use were: noisy disturbing situations (52%), no perceived need (24%), no or poor perceived benefit (23%), unpleasant side effects (e.g. rashes, itching, pain, earwax accumulation; 19%), poor sound quality (13%), difficulties with management (9%), and poor fit and comfort (9%). Similarly, a review conducted by Knudsen et al. (2010) looked at the predictors of HA non-use. They found that significant non-use predictors included few self-reported hearing problems, low acceptance of the HI, a negative attitude towards HAs, and manual dexterity problems. In relation to dexterity and fine motor skills, Hickson et al. (1986) observed that difficulty handling the HAs was associated with less use. These results relate to perceived benefit, perceived severity, perceived barriers and perceived self-efficacy.

Other potential predictors addressed in Knudsen et al. (2010) review included age, gender, living arrangement, hearing sensitivity, source of motivation, the HA professional, personality, and expectations. Scientific evidence for a relationship

between these factors and HA non-use was found to be either absent or inconsistent. This was interesting, as results from other studies indicate that there may be significant differences in HA use for gender and age, with women reporting a higher prevalence of daily and regular use of HAs (Stachelin et al., 2011) and younger adults being twice as likely to cite stigma as a reason to not use their HAs (Kochkin, 1993).

Hickson et al. (2014) found that on average, real-ear measures (REMs) indicated that the HAs participants wore, had lower gain than their NAL-NL1 target prescription, and that the gain was significantly lower for those in the unsuccessful HA owner group. There are two possible reasons for this finding. First, it may be that participants in the unsuccessful group were ‘ underfitted ’ initially and that is why they did not use their aids or report benefit from them. Second, it may be that they were fitted with higher gain initially but, in response to complaints about the devices, clinicians have decreased the gain levels of the HAs.

Major life events such as loss of employment, death of spouse, illness all have been found to have a negative impact on HA use (Kricos, Erdman, Bratt, & Williams, 2007).

As all the above studies have found there are many barriers for HA use. Many of the barriers for HA use relate directly to the facilitators toward HA use, the same factor can be both a barrier and a facilitator depending on how a person views it, such as attitude and perceived severity.

1.6 Study Rationale

In countries where there is access to quality audiological assessment and services, like New Zealand, it is crucial to determine why people buy HAs and then proceed to not use them. There has been no previous study in New Zealand looking at rates and reasons for HA non-use, so this study will provide New Zealand audiologists with identifying factors that affect HA usage, which will be necessary for devising appropriate rehabilitative strategies. This study fills a gap in the literature about HA non-use rates and reasons for non-use in the New Zealand population.

There will likely be various self-reported reasons for HA non-use in New Zealand. In previous overseas studies there have been numerous reasons, as summarised above, with each study finding slightly differing main reasons. It is impossible to predict what the main reason will be for HA non-use in New Zealand.

Preventing the non-use of HAs might improve the efficiency of hearing care. Two qualitative studies recently found that HA owners use their HAs when they feel disabled by their HI or when their HI limits normal participation in society (Laplante-Lévesque, Jensen, Dawes, & Nielsen, 2013; Lockey, Jennings, & Shaw, 2010). Therefore, the perceived need for improved HI intervention seems to be the key factor in HA use. Fitting HAs only to people who perceive a need for improved hearing may limit or prevent the non-use of dispensed HAs.

1.7 Aims

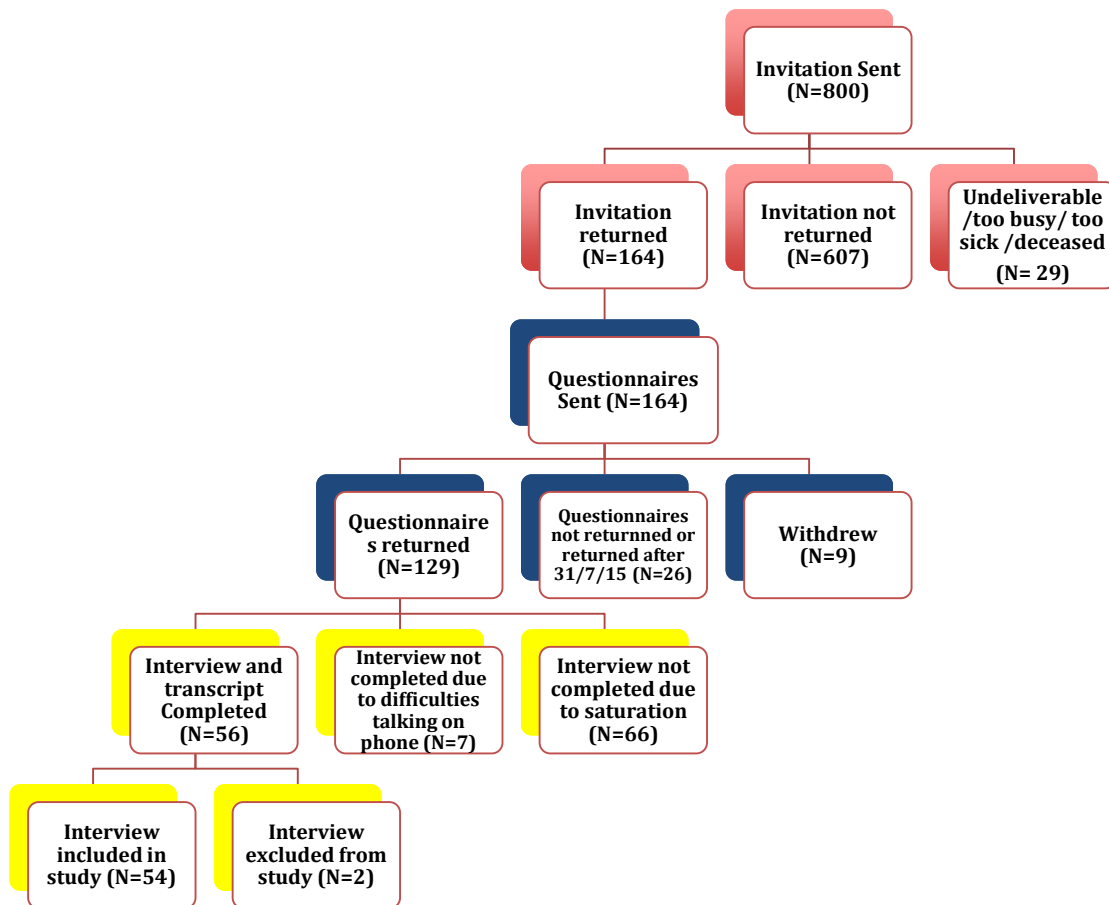
The aim of this study was to identify the main facilitators and barriers to HA use in adults throughout New Zealand via phone interviews, in order to address the main

barriers to HA use and target these to ensure a greater percentage of New Zealanders are getting benefit and use from their HAs.

Methods

2.1 Study Design

This study comprised one half of a 2-part study looking at ‘Rates and reasons for hearing aid non-use in Aotearoa/New Zealand’. One part of the study was quantitative in nature and asked participants to complete a series of questionnaires to assess factors related to HA non-use. Questionnaires include Self-Efficacy for Situational Communication Management Questionnaire (SESMQ); Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA); International Outcomes Inventory- Hearing Aids (IOI-HA); Levenson Scales Locus of Control; Hearing Handicap Questionnaire (HHQ); Hearing Beliefs Questionnaire (HBQ); Hearing Aid Questionnaire (HAQ). The other part of the study was qualitative in nature and conducted via phone interviews with participants, to delve more into specific barriers for HA non-use and facilitators for HA use with a focus on the HBM. It is important to outline obstacles, as we need to be aware of these if we want to be able to improve HA use statistics and satisfaction rates for HA owners. Both parts of the study used the same participants and recruitment methods. The part I undertook was the qualitative part. Below is a diagram showing how participants were recruited and used for each part of the study, as well as the order in which sections of the study were undertaken. The red boxes indicate how participants for both parts of the study were recruited. Both researchers were involved in the recruitment part of the study. The blue boxes indicate the quantitative part of the study, and the yellow boxes are the qualitative parts of the study, which I undertook.



2.2 Participants

Participants were recruited from the Bay Audiology database, and received an invitation from Bay Audiology to participate in the study. The requests to participate were sent to clients from Bay Audiology clinics all over New Zealand, so that we got a representative sample of New Zealand.

2.2.1 Inclusionary and exclusionary criteria

The goal was to recruit 200 participants. Eligibility of participants for the interview part of the study was assessed using the following inclusion criteria:

- (1) Are at least 18 years of age
- (2) Have been fitted with a hearing aid(s) in the last 3 years
- (3) Ability to use spoken English for communication

This study focused on adults with HI who use HAs. The first criterion attempted to ensure participants were adults. The second criterion ensured participants had been fitted with their HAs in the last 3 years and included both experienced HA users who were upgrading their HAs as well as new HA users purchasing their HA(s). Because all HAs were similar in age, technology level and HA capability was thought to be fairly similar. The third criteria ensured participants were able to communicate over the phone in English, as they would have to be able to have an interview via the phone.

Interested parties were excluded from this study if they did not meet the above requirements. As participants were able to do both parts of the study in their own time, in their own living quarters, no form of reimbursement for time or travel costs was provided.

2.2.2 Recruitment

The goal of recruitment for this study was to recruit as many clients as possible across the country. An active recruitment campaign began on 25th March 2015, and ran until the 19th May 2015 when the last of the invitations were sent out to clients. The only form of recruitment used was mail outs.

2.2.2.1 Mail Outs

As this study was in conjunction with Bay Audiology, I was able to access their database to recruit participants. A Bay Audiology clinician involved in the study was able to look up on their database clients who had been fitted with HAs between October and December 2011 and print out address labels for 800 of these clients. The labels were then stuck onto envelopes that had been enclosed with a study information sheet and a consent form, asking people to send back their consent forms if they were interested in participating in the study. The first mail out of 200 invitations did not include return envelopes with postage paid, which may have affected the response rate of 13.5%. The subsequent 600 mail outs did include the return envelope and the response rate increased to 22.8%.

There were 9 participant withdrawals in total. Eight of these withdrawals had no reason attached and one withdrawal was because the participant was too sick.

2.3 Procedures

Participants were recruited from around New Zealand using the methods outlined above. People who contacted the researchers to indicate interest in participating in the study were asked to confirm that they met the eligibility criteria. If all eligibility criteria were met, the person was asked for their full name, contact information, including mailing address and phone number, and their gender.

Following this, the participants who consented to be part of the study were sent a pack of questionnaires to fill out and send back. Once the questionnaires were returned, I contacted them via the phone at a suitable time for them, to conduct an interview to further delve into reasons for use and/or non-use of HAs. These

interviews ranged from 4 minutes 42 seconds to 1 hour and 26 minutes and 54 seconds. Interviews were carried out until saturation was reached. All phone interviews were made in a quiet, private room, and recorded and then transcribed by myself. I acknowledged that people with HI will likely have some difficulty conversing over the telephone, and I received training prior to conducting any interviews on how to communicate with people who had HI and how to repair communication breakdowns due to HI. I had never met or heard of any of the participants prior to conducting the interview.

During the phone interviews, field notes were taken by myself about common HA barriers and facilitators as well as other things I noticed that I could not predict before I started the interviews, such as questions that were harder for people to understand; people who had trouble hearing over the phone and people who had speech processing delays, as all of this was relevant when analysing the data.

Following this, I transcribed the interviews at word level. The transcripts were sent to the participants who had indicated they wanted a copy for them to look over and assess whether they were happy with the transcript or whether they wanted something they had said to be taken out and not used. No participants indicated that they had any problems with the transcripts, so all data gained in the interviews was used in the analysis. 54 of the 56 total interviews were deemed appropriate and relevant to this study and therefore included in the qualitative analysis. 2 of the 56 interviews were deemed not relevant enough to include in the qualitative analysis. The 2 interviews not included were one participant who used a CI and one participant who had drug-induced hearing loss, caused by nonsteroidal anti-inflammatory drugs

(NSAIDs) but had stopped taking the NSAIDs when he learnt about the effect they can have on a person's hearing and his hearing has since recovered to normal levels so no longer requires HAs.

Interview Questions:

Intro: Hello my name is Rebekah Durrans, and I am ringing you up about the 'Rate and Reasons for Hearing Aid Use in Aotearoa/New Zealand' study you have agreed to participate in. Thank you for agreeing to talk with me about your hearing aid experience. I want to make sure I fully understand your experience so I'm going to record this interview. It should take around 20 minutes.

1. Firstly, how much of a difficulty do you perceive your hearing loss to be in everyday life?
2. How often do you wear your hearing aids? Do you wear them as often as you would like?
3. Can you tell me about some occasions where you use your hearing aids, and where you don't? What are some reasons why you use or don't use them in these situations?
4. Do you find that wearing your hearing aids helps reduce the difficulties associated with your hearing loss? If so, how?
5. Are there any obstacles that stop you using your hearing aids as much as you would like to? If so, could you please explain?
6. Do you think that these obstacles affect how often you wear your hearing aids?
7. Is there anything that makes it easier for you to wear your hearing aids? Can you tell me about these?

8. Do you think that this (whatever facilitator(s) was/were mentioned) affects how often you wear your hearing aids?
9. How confident do you feel in your ability to manage your hearing aids? Do you have difficulties handling your hearing aids?
10. Is there anything that would help you to wear your hearing aids as often as you would like?

All interviews were recorded so that they could be transcribed afterwards. All interview information provided by the participants was treated as confidential and was not shared with Bay Audiology clinicians or anyone else.

Interviews were conducted using 'Facetime' Audio on my Apple MacBook Pro laptop, which was connected to an Apple iPhone through Wi-Fi with the recording function turned on. iPhone insert earphones were used, which had a microphone attached. At the conclusion of each call, the recordings were automatically saved on the laptop as an audio file. I then listened to the recordings and transcribed them at word level.

The point in which the interviews was stopped was when saturation was reached, meaning 2 consecutive interviews had occurred with no new information. For the regular HA users (defined as those participants who used their HAs at least 1 hour a day) this was reached after 24 interviews, however 36 HA user interviews were carried out to ensure there was enough data for quantitative analysis and also to ensure I got a thorough and complete idea of barriers and facilitators for HA users. For HA non-users, (defined as those participants who never wore their HAs OR wore

them less than once a month) and occasional HA users (defined as those who wore their HAs once-six times a week) saturation was not quite reached due to significantly less participants who fit into these groups signing up to the study. The definitions for the three participant groups (regular HA users, occasional HA users and HA non users) were data driven, as they were taken from their answer to interview question 2a (how often do you wear your HAs?).

The participants who did not require an interview due to adequate numbers being reached or could not talk on the phone were sent a letter thanking them for entering the study and explaining to them they would not need to be interviewed as sufficient numbers for the qualitative aspect of the study had been reached.

Those participants whose transcripts were included in the study had their data analysed. I made sure that participants could not be identified by quotes from the data by not including participant's names, locations and other personal information.

I also obtained each participant's 4 frequency PTA based on 0.5, 1, 2 and 4 kHz so I could include hearing level in my analysis.

2.4 Data Analysis

This study had an explorative character; therefore, a qualitative approach was chosen over a quantitative approach. A main reason I elected to perform a qualitative approach to this thesis was that knowledge about reasons for and predictors of non-use alone is not enough to come to an in-depth understanding of HA non-users. Their beliefs and feelings with regard to the non-use are important as well. Few qualitative

studies have been conducted looking at HA use and it is still largely unknown how non-users feel about their non-use.

Qualitative analysis involves searching across the interview transcripts to find meaning units, which are then given codes. The codes are quantified to reach a consensus of main ideas given. It is a flexible research tool due to its independence from theory (Braun & Clarke, 2006). Since the study aimed to identify relationships between beliefs and feelings with regard to HA non-use, thematic analysis was judged to be a useful analysis method. An inductive (data-driven) approach was considered to be most appropriate, since very little was known about the beliefs and feelings of the participants in this study.

Content analysis was undertaken on each transcript. Content analysis as a research method is a systematic and objective means of describing and quantifying phenomena (Downe-Wamboldt, 1992; Krippendorff, 1980; Sandelowski, 1995).

Content analysis allows researchers to distil words into fewer content related categories. It is assumed that when classified into the same categories, words, phrases and the like share the same meaning (Cavanagh, 1997). Content analysis is a research method for making replicable and valid inferences from data to their context, with the purpose of providing knowledge, new insights, a representation of facts and a practical guide to action (Krippendorff, 1980). Despite some criticism in the past, content analysis is an established method of analysis and can offer researchers major benefits. One of the benefits is that it is a content-sensitive method (Krippendorff 1980), the other benefit is its flexibility in terms of research design (Harwood & Garry, 2003).

The first phase of content analysis was looking for meaning units in each transcript and classifying the meaning units into smaller content categories (Weber 1990). The categories included were each interview question. A meaning unit was defined as a letter, word, sentence or portion of words that gave meaning and related to the categories chosen. For example meaning units could be “yes”, “no”, “I was embarrassed” or “I have trouble hearing in noise”. The meaning units were organised as part of a word document file. Graneheim and Lundman (2004) pointed out that the most suitable unit of analysis is whole interviews as they are large enough to be considered as a whole and small enough to be kept in mind as content for meaning units during the analysis process. No analysis of latent context (i.e. pauses, laughs, silence) was undertaken.

The next step in the content analysis was to develop a categorisation medium. It was decided that the categories would be each interview question and so meaning units that related to the different categories, were copied from a person’s transcript and pasted in the word document. Categories must be conceptually and empirically grounded (Dey, 1993). Credibility of research findings also deals with how well the categories cover the data (Graneheim & Lundman, 2004).

After categorising each transcript, common themes were found within the categories and reported on in the results section. To increase the reliability of the study it was important to make a link between the results and the data (Polit & Beck, 2004).

When analysing the questions, some questions were split into two parts (a and b). This is because some questions contained more than one theme.

2.5 Measures

2.5.1 Health Belief Model

The guiding theory used to analyse the participant's phone interviews was the HBM. In this model, the behaviour of using HAs was mediated by the five belief constructs of perceived susceptibility, perceived severity, perceived self-efficacy, perceived benefits, and perceived barriers (Champion & Skinner, 2008; Rimer & Glanz, 2005) as well as by cues to action, such as support of significant others, client demographics and psychological characteristics.

Knudsen et al.'s (2010) literature reviews indicated an association between perceived severity (i.e. self-reported hearing difficulties) and HA use, and between perceived benefits (i.e. positive attitudes to HAs) and HA use. McCormack and Fortnum's (2013) literature review suggested associations between both perceived benefits and perceived barriers of HAs (i.e. problems with the fit and comfort) and HA use.

Gatehouse (1994) found that people with lower depression scores scored higher on post-fit HA use and satisfaction levels. This relates to self-efficacy, as individuals with lower depression scores are more likely to believe in their own ability to manage and use their HAs.

Thus, evidence from previous research associates four out of five of the HBM constructs with the behaviour change of wearing HAs, suggesting the relevance of

this model to the exploration of factors associated with successful HA use in adults. Perceived susceptibility would relate more to the uptake of HAs rather than the use of HAs.

2.6 Ethical Considerations

Following a review of the application to the University of Canterbury Human Ethics Committee (UC HEC), final ethics approval was granted from this body in January 2015 (Appendix E) . The procedures carried out during the duration of this study remained in accordance with the UC HEC approval. This includes participant recruitment, inducement, consent, privacy, storage and future use of data. This study did not require approval from the NZ Health and Disability Ethics Committee.

Results

1.1 Overview

Presented in this section are tables and themes for each interview question asked. The aim of the study was to explore in depth obstacles and facilitators for HA non-use/use. Analysis of the qualitative interview with 54 participants revealed 11 different obstacles (Figure 15) and 10 different facilitators (Figure 19) for HA use as well as relevant information, such as whether HAs provided benefit and how often HAs were worn. Each of the 10 interview questions has been analysed to find themes and these are discussed below. Examples of participant quotes are provided to illustrate specific points of view or opinions within each question. Participant codes have been used to preserve anonymity.

1.2 Sample characteristics

Fifty-four participant interviews were included in the study. The demographics of the participants are outlined in the table below. Table 2 below shows the regional distribution of participants as well as their gender. The participants' ages ranged from 50-59 years old (n = 3); 60-69 years old (n = 9); 70-79 years old (n = 24); 80-89 years old (n = 15); 90-99 years old (n = 1) and unknown (n = 4). Four participants who completed the interview did not disclose their age so it is unknown. Participants were 73.3% male and 26.7% female.

Region	Gender		Total No
	Male	Female	
Northland	3	1	4
Auckland	11	1	12
Waikato	2	1	3
Bay of Plenty	5	2	7
Hawke's Bay	1	1	2
Gisbourne	2		2
Taranaki	2		2
Manawatu-Wanganui	1	3	4
Wellington	6	3	9
Nelson	3		3
Marlborough	1		1
Canterbury	2	1	3
West Coast			0
Otago	1	2	3
Southland	1		1

Table 2. Regional distribution for participants who completed the interview

Participants were from around New Zealand, with all regions being represented with the exception of the West Coast. The regions with the highest amount of representation were Auckland, Wellington and Bay of Plenty. This makes sense, as these are the regions with the largest populations. A possible reason why there were no participants from the West Coast could be because Bay Audiology does not have a clinic on the West Coast.

1.3 Definitions and Participant Groups

Below is the key showing the different colours of the three groups as well as how each group is defined. The colour codes are used in the result figures and graphs below to differentiate between the three groups.

The below definitions in the key were not predefined, but rather driven by the data. They were taken from participants' answers to interview question number 2a "How often do you wear your hearing aids?". Because of this method of defining the groups there are gaps in the groups' categorisation. The idea of the three groups was that I would be able to compare HA use in non-users to that of HA use in occasional and regular HA users, to assess if there were any differences in their perceived severity, perceived barriers, perceived benefits or perceived self-efficacy that could explain the difference in HA use.

KEY
N = number of participants
NU = non-user (defined as 'never wears HAs OR wears less than once a month')
OU = occasional user (defined as 'wears HAs once a week – six times a week OR only at events')
RU = regular user (defined as 'Wears everyday')

The majority of participants who volunteered in this study were regular HA users, therefore the three HA user groups are not even. The groups are divided using the data driven approach and the final participant count yielded 36 Regular Users (RUs); 13 Occasional Users (OUs) and 5 Non-users (NUs). In order for me to compare the three groups, I used relative percentages for each group.

Not everyone answered the questions directly, hence having less than total number of participants answering some of the questions. Also, some participants fell into more than one category or gave more than one answer for various questions, hence the total number and group numbers not adding up for some questions. Calculations were made using total participant numbers for each group, rather than

just the number of participants who answered a certain question as this was found to yield a more accurate portrayal of the sample population.

1.4 HA experience and PTA values for the three HA user groups

Mean HA Experience for 3 HA user groups

NU	10.8 years
OU	8.7 years
RU	11.9 years

Table 3. Mean HA Experience for the 3 HA user groups

	Better Ear PTA (dB HL)	Worse Ear PTA (dB HL)
Non HA User Group	44	46.75
Occasional HA User Group	36	48.1
Regular HA User Group	45.3	56.9

Table 4. Showing mean four frequency PTA for each HA group

1.5 Results from Interview Questions

1.5.1 Question 1a: How much of a difficulty do you perceive your hearing loss to be in everyday life?

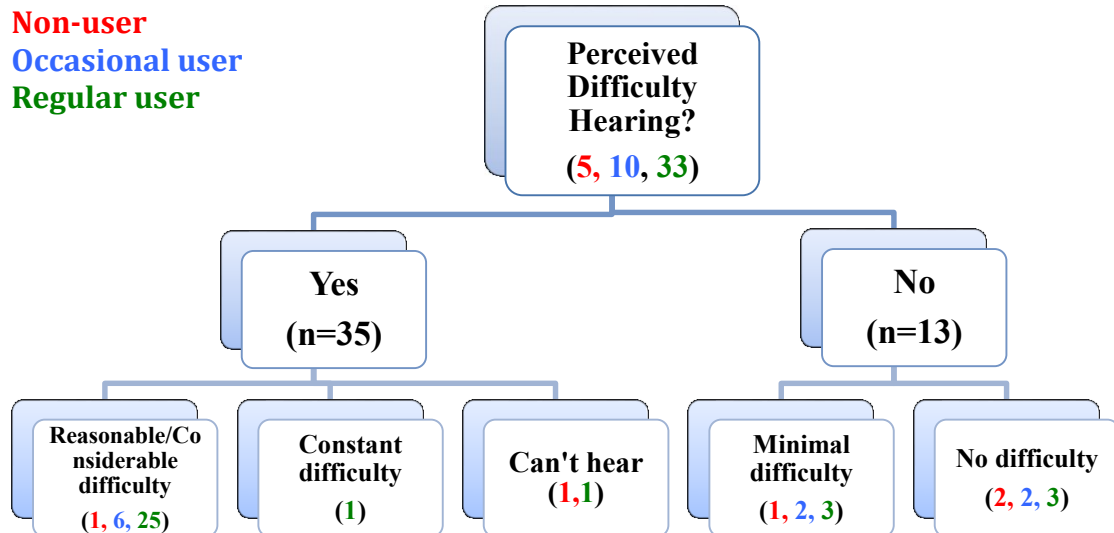


Figure 3. Diagram showing distribution of participants for question 1a

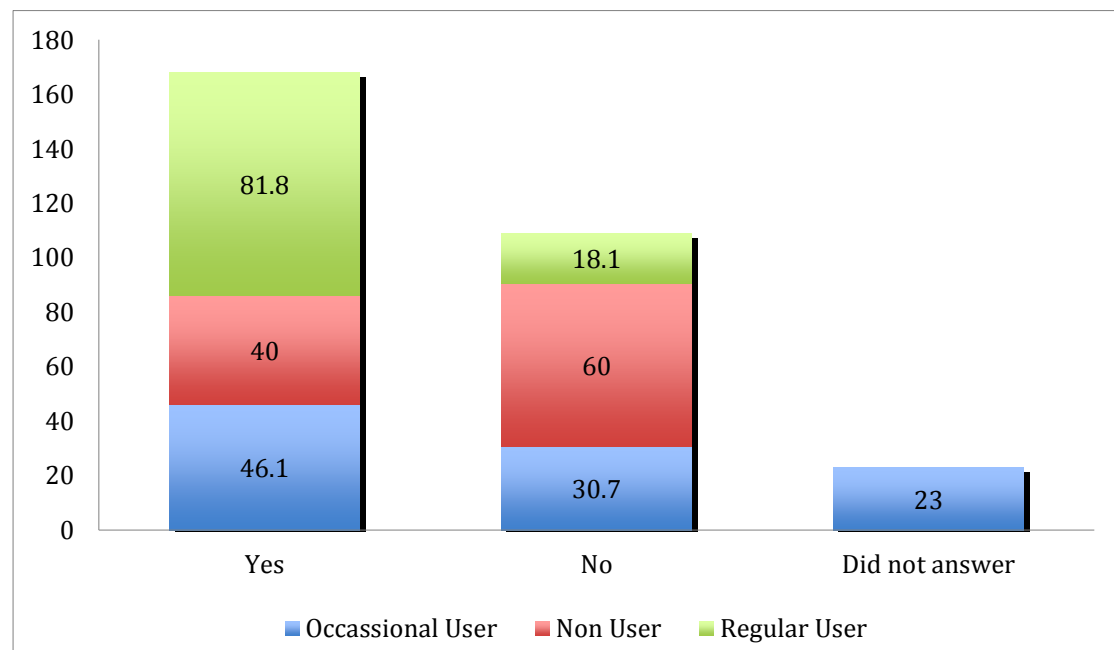


Figure 4. Column graph displaying relative percentages for the 3 HA user groups for question 1a.

1.5.1.1 Theme 1: Hearing Difficulty (perceived severity)

This question was asked to establish whether there was a trend in how much of a difficulty a person's HI was to them, or their perceived severity of their HI. As shown in the graphs above, regular HA users tended to have more difficulty with their hearing in everyday life than HA non users. It was found that 81.8% of RUs perceived their HI to be difficult in some way in everyday life compared to 40% of NUs. Whereas just 18.1% of RUs did not perceive any hearing difficulty compared to 60% of NUs. Shown below are two quotes from participants in the study in answering this question.

NU: "very, very minimal" (P4)

RU: "Probably about half difficult" (P11)

Some of the RUs did not perceive they had much of a hearing difficulty with a few stating this was due to lifestyle factors. Those individuals who have a quiet lifestyle and did not interact with other people very often found their HI less of a difficulty, as they have less of a need to hear.

RU: "With my lifestyle it doesn't inconvenience me much" (P83)

Interestingly one of the NUs indicated that he could not hear at all and that his HI "affects me all the time" (P7). This could indicate that his hearing difficulty is so severe that even with HAs he struggles and therefore may have decided they are not benefitting him enough to warrant using them.

There was less of a difference found for the OUs in terms of perceived hearing difficulty. It was found that 46.1% of OUs perceived some hearing difficulty and

30.7% did not perceive any. It should be noted that 23% of OUs did not answer this question directly, so were not included in the analysis for this question.

1.5.2 Question 1b (extra information provided): Situations that are difficult to hear in for participants

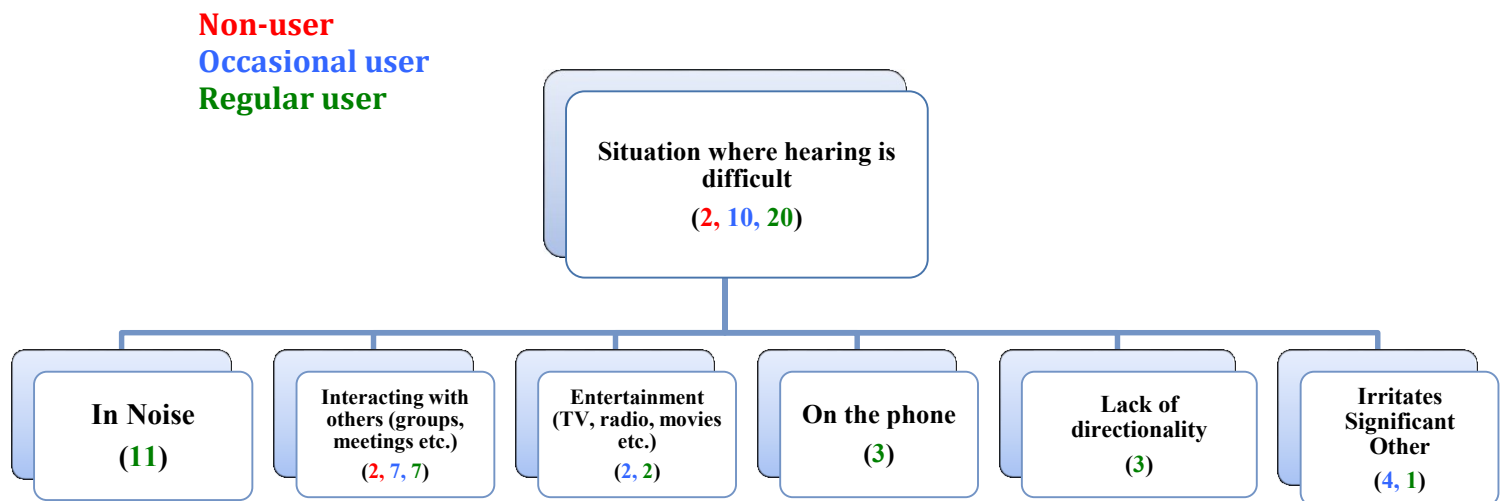


Figure 5. Diagram showing distribution of participants for question 1b

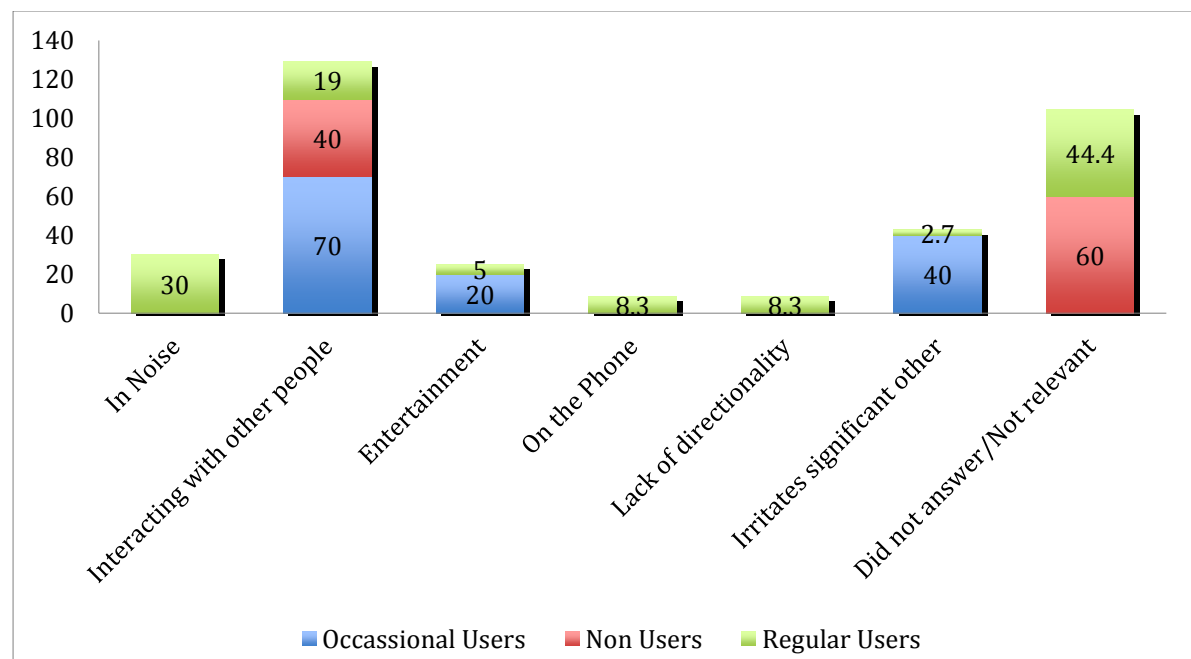


Figure 6. Column graph displaying relative percentages for the 3 HA user groups for question 1b.

1.5.2.1 Theme 2: Specific situations that HI individuals find difficult to hear in

Related to theme 1, some of the participants gave examples of specific situations where they have difficulty hearing. The answers to this question show how the three different groups can have different difficulties, potentially relating to both degree of HI and HA use, as well as situations that are found to be difficult by all types of HA users. A situation that was difficult for 30% of RUs was in noisy environments such as parties, crowds or rugby matches. No OUs stated difficulty in noise and this may be because they did not wear their HAs in noise, did not attend noisy events or they did not have difficulty in noise.

RU: “What I have real trouble with is if there is a lot of background noise...I just can’t make out what people are saying” (P18)

Interacting with other people, such as having friends over for dinner or talking to shop owners was another situation where many participants struggled. This situation was brought up by all 3 groups (40% NUs; 53.8% OUs; 19.4% RUs).

OU: “I have trouble hearing in meetings” (P1)

OU: “You know with people at home in the lounge I do battle to hear what they are saying” (P62)

RU: “If I am in a group of people it is hopeless” (P21)

A fairly common situation that was found to be difficult, especially for OUs (40%) was that their significant other gets annoyed when they do not wear their HAs and believes they should wear them more.

OU: “My wife tells me I don’t [wear them enough]. She thinks I should wear them a good deal more” (P62)

Four participants (20% OUs; 5% RUs) mentioned entertainment, including radio, television and movies as an area that is difficult for them.

RU: “It knocks out a lot of enjoyment of television because I find it difficult to hear that” (P32)

Three RUs (8.3%) stated talking on the phone was fairly difficult as well. This may be due to the fact their HI is more severe.

RU: “It is [difficult] at times especially on the phone and I can’t hear the answerphone properly when it rings”. (P21)

It should be noted that this question was not directly asked, rather many participants chose to expand on question 1a ‘*How much of a difficulty do you perceive your hearing loss to be in everyday life?*’ and gave examples. This happened so frequently that it was decided to also analyse this extra data.

1.5.3 Question 2a: How often are your HAs worn?

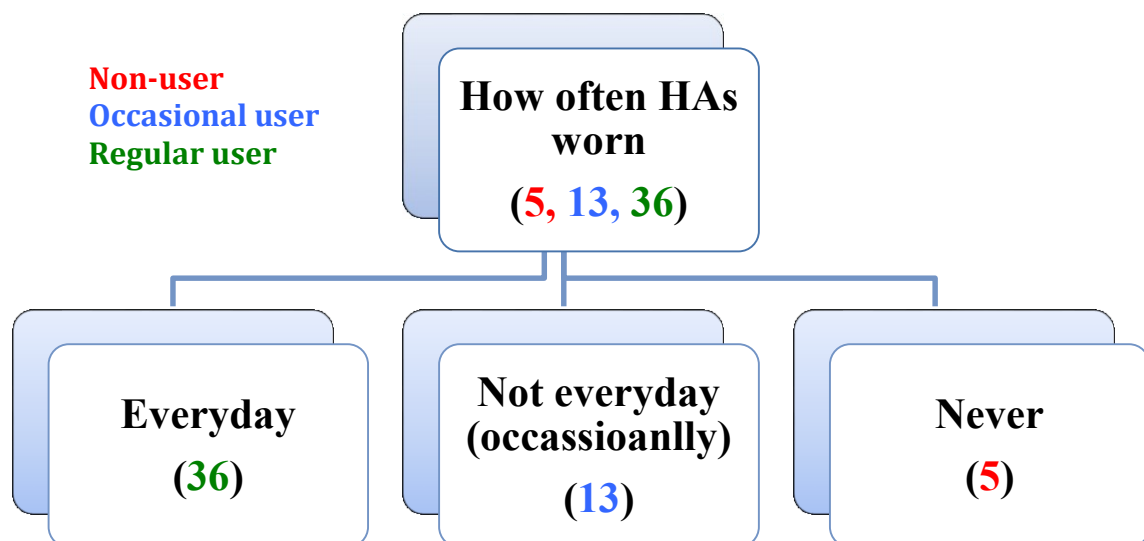


Figure 7. Diagram showing distribution of participants for question 2

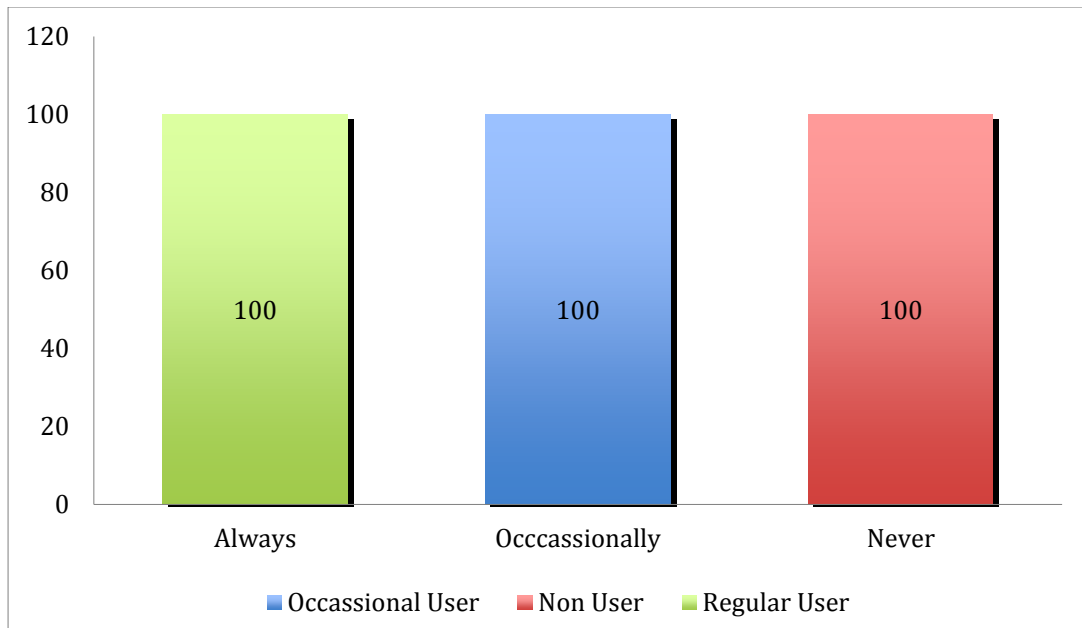


Figure 8. Column graph displaying relative percentages for the 3 HA user groups for question 2a.

1.5.3.1 Theme 3: How often HAs are worn

This question was used to determine out of the participant pool how many HA owners did not use their HAs compared to the numbers that did use their HAs.

Because HA use is not as simple as ‘yes I wear my HAs’ or ‘no I do not wear my HAs’, a continuum system of analysis was used. This allowed for a third group of HA users who stated they “sometimes” wore their HAs (the OU group). The answers to this question were used to create the 3 different HA user groups. In this study 66% of participants were RUs, 24% of participants were OUs and 9% of participants were NUs.

Some quotes from the three participant groups are below, showing clear differences in how often each group uses their HAs. RUs were defined as HA owners who wear their HAs on a daily basis.

RU: “I wear them all day everyday” (P2, P17, P20, P29, P38, P42, P48, P50, P53, P54, P76, P79, P83, P104, P108, P119, P131)

RU: “Virtually from when I get up in the morning to when I go to bed at night-time so probably on average 12-14 hours a day” (P25)

OUs were defined as HA owners who wear their HAs between 1 and 6 times a week

OR at events/specific occasions only.

OU: “Not everyday, maybe twice a week” (P18, P62, P148)

OU: “I only wear them when there are people here or when I go out” (P80)

NUs were defined as HA owners who never wore their HAs OR wear less than once a month.

NU: “I don’t wear them anymore now” (P4, P7)

NU: “I am really naughty because I do have a hearing aid but I don’t wear it”.
(P117)

1.5.4 Question 2b: Do you wear your hearing aids as often as you would like?

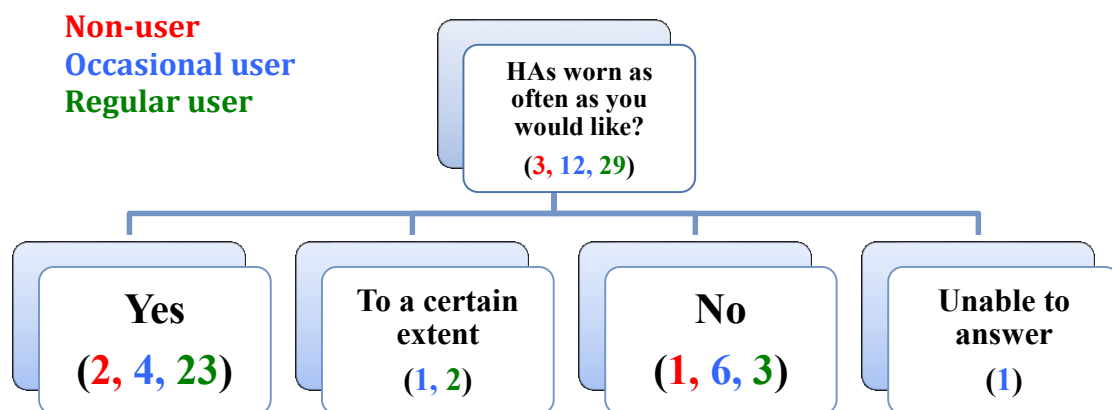


Figure 9. Diagram showing distribution of participants for question 2b

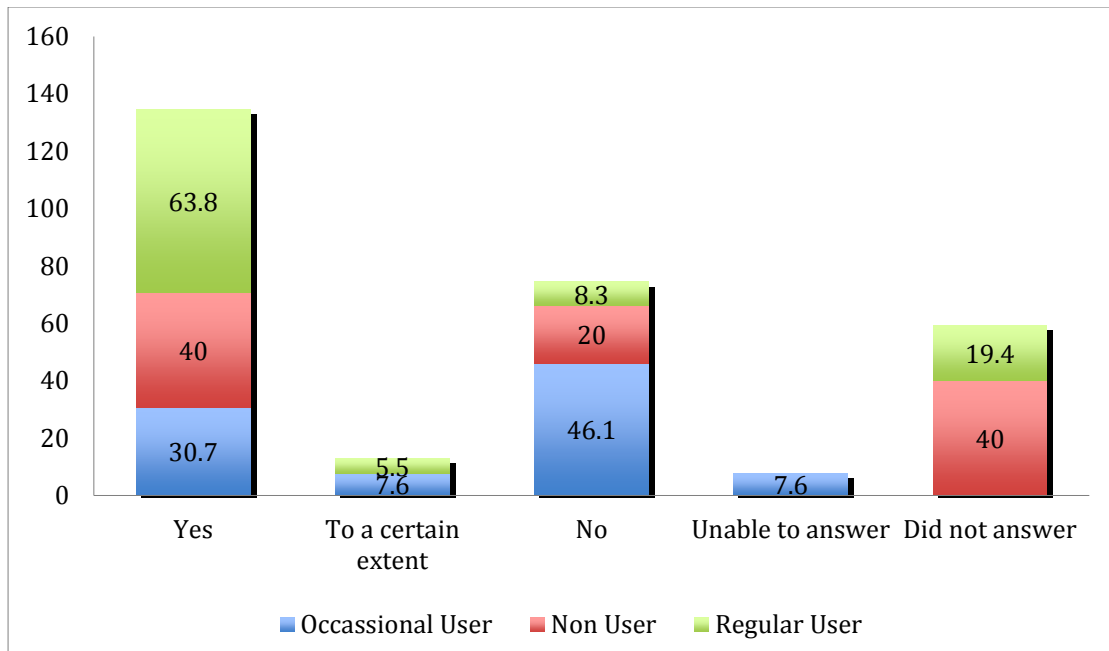


Figure 10. Column graph displaying relative percentages for the 3 HA user groups for question 2b.

1.5.4.1 Theme 4: Are HAs worn as often as liked?

This question was asked to gauge whether all three HA user groups think that their HAs are worn as much as they would like or whether they would like to wear their HAs more than they currently are. It was shown that a very low percentage of RUs (8.3%) do not wear their HAs as often as they would like compared to OUs (46.1%) and NUs (20%).

RU: “I would wear them more if I could hear better with them”. (P150)

OU: “No I am really a bit lazy on that. I know I should wear them everyday but some days I just don’t”. (P109)

The majority of RUs (63.8%) felt they wore their HAs as much as they would like to compared to 40% of NUs and 30.7% of OUs.

RU: “As often as I need to” (P8, P50, P1, P44, P64)

RU: “Yes” (P17, P20, P30, P40, P42, P48, P51, P53, P76, P79, P83, P84, P108, P119, P131)

NU: “Yes. I don’t need to wear them” (P156)

NU: “I am coping fine without it right at the moment” (P117)

1.5.5 Question 3a: Can you tell me about some occasions where you use your hearing aids?

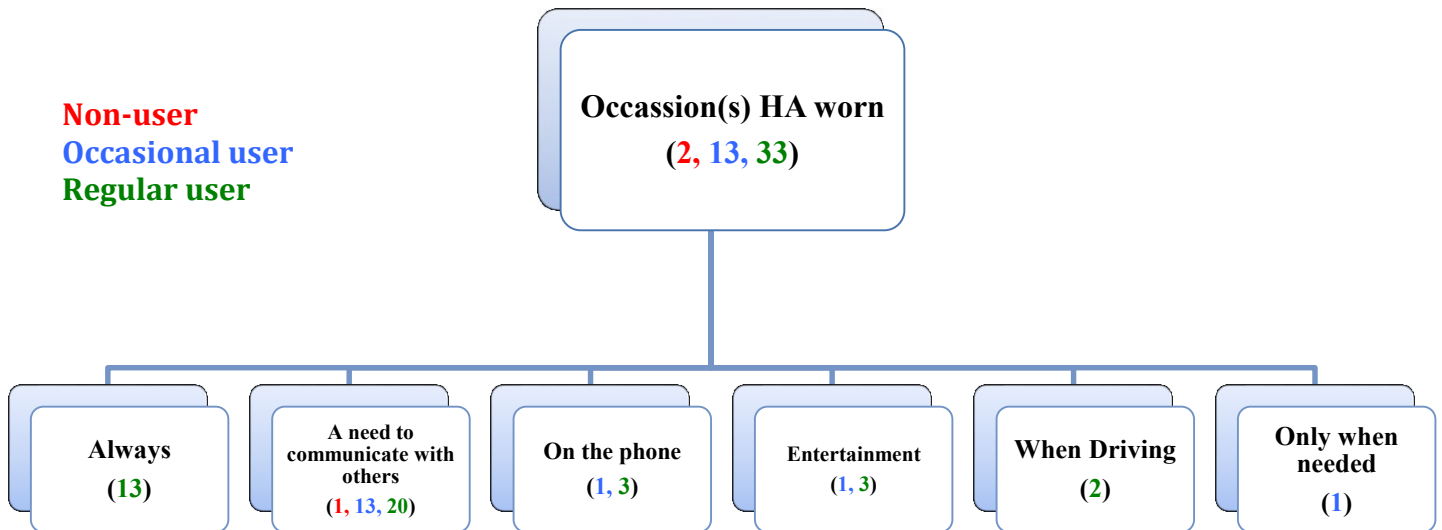


Figure 11. Diagram showing distribution of participants for question 3a

1.5.5.1 Theme 5: Situations where HAs are worn

This question asks for specific situations where HAs are worn. Eight different categories were found as common situations where HAs are needed and or worn.

Over a third of the RUs (36.1%) stated that they wear their HAs everywhere. Even though people may wear them in all situations, they may be using them in different ways (e.g., as noise abatement rather than as amplification).

RU: “I wear them everywhere” (P3, P22, P38, P42, P48, P50, P76, P79, P108, P119, P131)

RU: “If there is too much noise I turn [the volume] right down to virtually nothing but I wear them the whole time”. (P21)

Many RUs (55.5%), OUs (100%) and one NU (20%) also stated that they wear their HAs when there is a need to communicate with someone, such as talking to guests who come to the house or during meetings at work.

RU: “Anytime family come over” (P2)

RU: “When talking to people and at the shops” (P8)

OU: “Well I volunteer in the library on a Friday so I wear them then because I need to hear what people are saying”. (P109)

OU: “I always wear [them] when I am in a meeting” (P1, P44)

RU: “Meetings were the real thing that drove it home to me. Having to ask ‘what did you say again?’ that got a bit testy”. (P20)

Other situations that came up, but less often were when talking on the phone, for entertainment purposes such as watching television or movies and when driving.

RU: “When I am on the phone” (P5, P38, P53)

RU: “The best thing I need them for is to watch TV” (P17, P32, P53, P84)

1.5.6 Question 3b: Can you tell me about some occasions where you don't use your hearing aids?

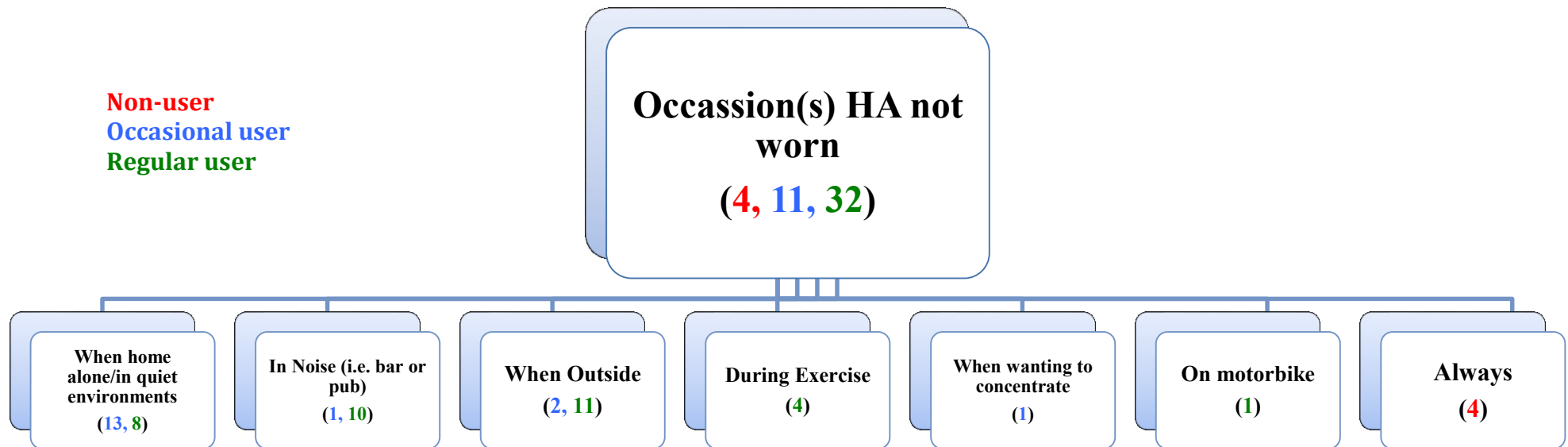


Figure 12. Diagram showing distribution of participants for 3b

1.5.6.1 Theme 6: Situations where HAs are not worn

This question does the opposite of above and looks at specific situations where people choose not to wear their HAs. This gives an indication of areas where HAs might not work as well or situations that are considered too ‘risky’ by HA owners to wear their HAs in.

Many individuals (100% OUs; 22.2% RUs) stated they do not need or wear their HAs when they are home alone or in a quiet environment, such as when they are one on one with a spouse at home or reading the paper at home.

RU/OU: “When I am home alone” (P8, P62, P64, P81, P84, P109, P130, P151, P144, P141, P120, P148, P150)

OU: “If I am just in a one on one conversation at work I don’t need them” (P1)

External noise, such as farm machinery or in a pub was another situation people chose not to wear their HAs (7.7% OUs; 27.7% RUs). People found when there was too much noise the HAs do not tend to cope as well and do not make a marked difference.

RU: “When I am on the farm on the bike or in the shearing shed I don’t wear them” (P17)

RU: “I take them out if I am in a [big] crowd or if I am at a rugby game because people clapping and screaming just reverberates around in the stadium” (P20)

OU: “There is too much background noise [in a bar or pub]...so I just take ‘em out. [The hearing aids] pick up everything so I find that [they do not] make a difference [in those noisy environments]”. (P1)

RU: “The only time I do not wear them is when I am doing heavy machinery work or making lots of noise and have earmuffs on” (P22)

Another situation in which RUs did not wear their HAs was when they were outside or doing exercise (11.11% RUs). The common reasons for this were because the HAs could get wet and damaged and because there was no real need to hear in these situations.

RU: “I don’t wear them when I am out in the garden on my own, partly because it wastes the battery and partly because I am scared of losing them” (P25)

RU: “The only times they are not useful is if you are in a situation where they might get wet or if you are outside in the wind” (P29)

RU: “I don’t like wearing my hearing aids outside because if there is a breeze blowing or something it makes a horrible noise in my ears and I can’t hear anything. I don’t wear it when I am working outdoors, because I am likely to lose the hearing aids”. (P32)

RU: “If I go for a bike ride or swim or if I am just doing some work outside on my own I don’t [wear them]” (P29)

Unsurprisingly, 80% of NUs stated that they often or always do not wear their HAs.

NU: “Lots of occasions [laughs]. Like I said sometimes I don’t wear them for 2 or 3 months so that would be everywhere” (P153)

1.5.7 Question 4: Do you find that wearing your hearing aids helps reduce the difficulties associated with your hearing loss?

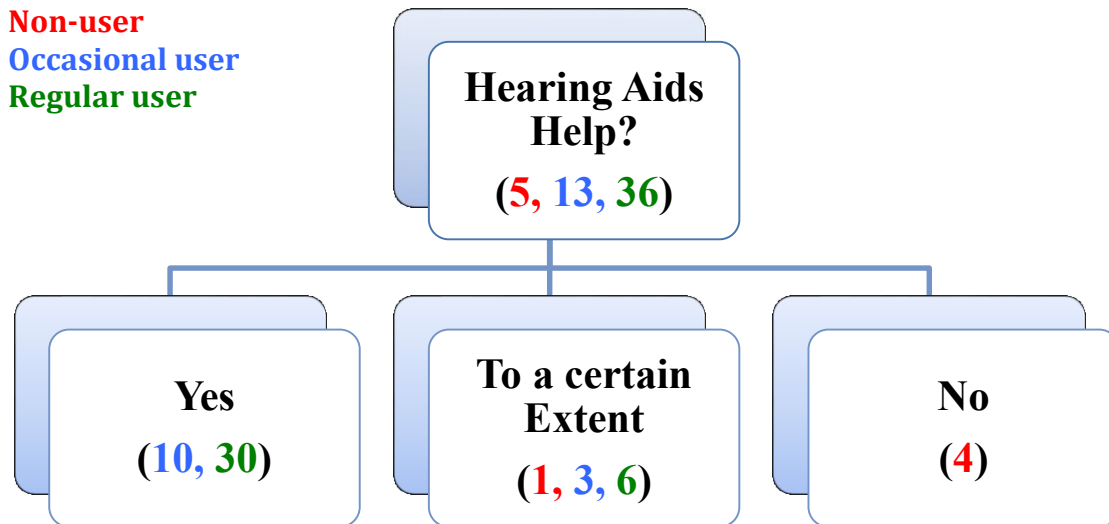


Figure 13. Diagram showing distribution of participants for question 4

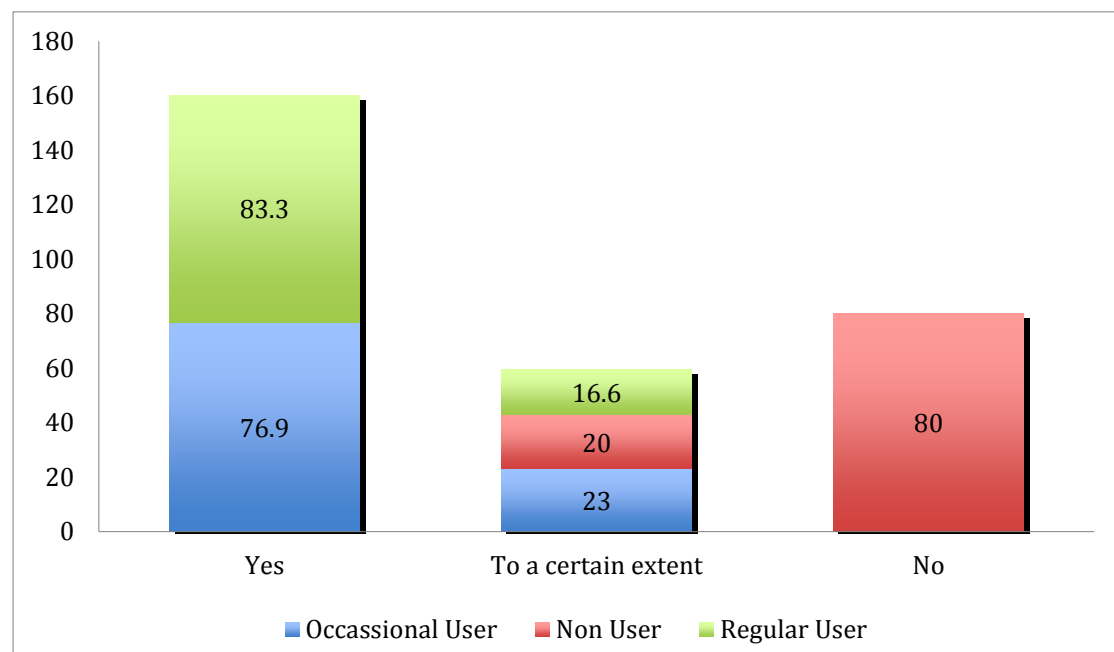


Figure 14. Column graph displaying relative percentages for the 3 HA user groups for question 4.

1.5.7.1 Theme 7: Do HAs reduce difficulties? (Perceived benefit)

This question was asked to determine whether people felt their HAs were benefitting them. As the HBM suggests, the more an individual determines a health action is benefitting them, the more likely they are to continue with it. This implies, the more a person feels their HAs are benefitting them the more likely they will be to wear them.

In line with the HBM it was found that 83.3% of the RUs and 76.9% of the OUs found that their HAs were providing benefit to them in terms of less listening effort and being able to participate in life. The quotes below show the positive impact HAs have helped to make in some of the participants lives.

RU/OU: “Yeah, definitely”(P2, P17, P20, P30, P40, P42, P62, P79, P80, P81, P83, P104, P109, P119, P144)

RU: “Very significantly. It simply means I am able to join in conversations and hear what people are saying. Without them some sounds are very indistinct and I am often left trying to guess what somebody has said....it is a sense of relief to put them on because suddenly I can hear everything very clearly”. (P8)

RU: “There is a significant different, I notice that. The birds I can hear much better and music and all sorts of things like that and my wife’s voice”. (P14)

RU: “I have only got one hearing aid because the other ear is deaf but if I didn’t wear it I wouldn’t hear. I am hopeless without it”. (P21)

RU: “Substantially. They give me meaning. It means you get the whole message and understand what is going on around you. You have to be willing

to persist in using them for a sufficiently long time to adjust to using them”

(P29)

RU: “You think everyone else mutters and talks quietly but they don’t, it’s you! [laughs]”. (P51)

RU: “Without them I do not know what life would be like...you know all your grand children, all your family, special occasions and birthdays. They are a saviour, put it that way!” (P79)

There were 10 participants (18.5%) who felt the HAs were providing benefit to a “certain extent”. These participants found moderate benefit from their HAs, however 9/10 were OUs or RUs and felt the HAs were providing enough benefit to keep using them.

RU: “To a certain extent. Hearing aids do not differentiate between noise, so if there is a background noise it tends to drown out any conversation I am having or taking part in”. (P22)

RU: “Yes, sometimes. I am not overly satisfied though. In noise they do not seem to work as well”. (P131)

NU: “They do in situations where I go out but at home I don’t worry at all, I can hear the TV”. (P153)

On the other end of the spectrum and again in line with the HBM, if an individual determines a health action is not benefitting them they will be less likely to continue with it. The participants who said that HAs were not benefitting them were 4/5 of the NUs (80%). The NUs found that the HAs made no difference, were making

a worse difference and/or were too much hassle for the small amount of benefit they provided.

NU: “I didn’t notice a difference [with HA on]” (P4)

NU: “No they did not. The hearing aid was set up to accentuate [my hearing but it] was in fact destroying my hearing ability” (P7)

NU: “They are too much hassle for the benefit they provide” (P156)

1.5.8 Question 5: Are there any obstacles that stop you using your hearing aids as much as you would like to? (Perceived barriers)

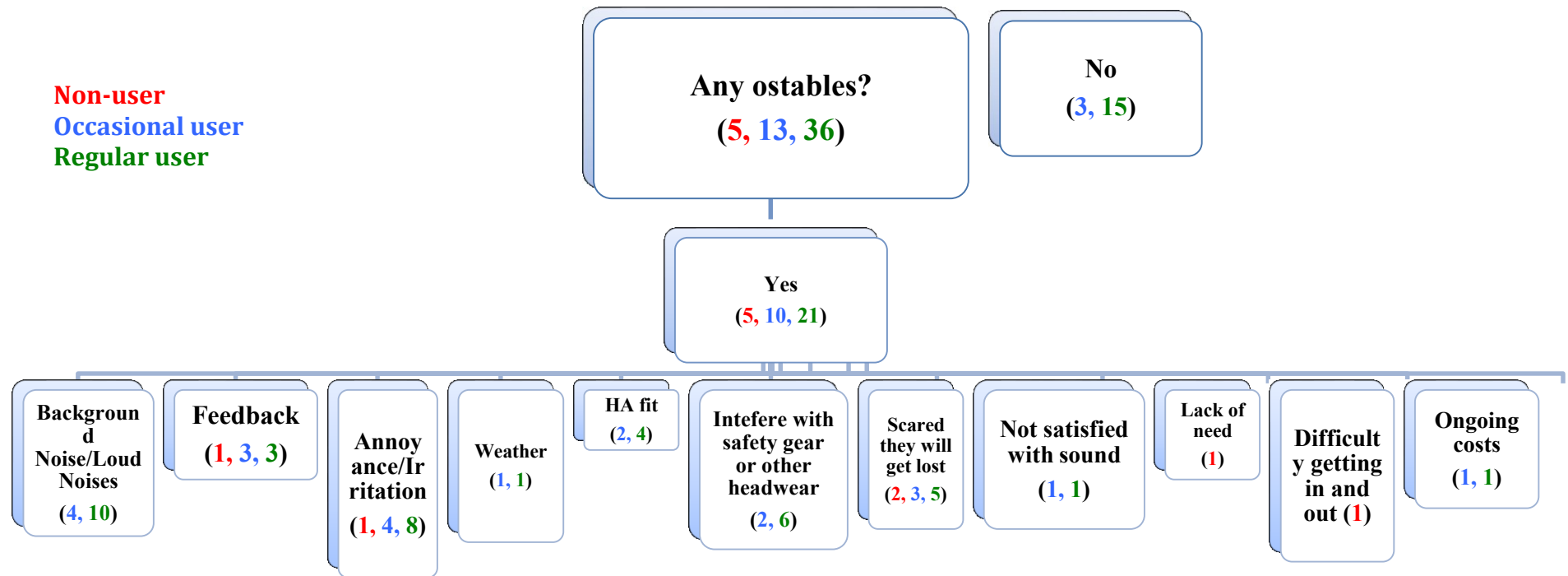


Figure 15. Diagram showing distribution of participants for question 5

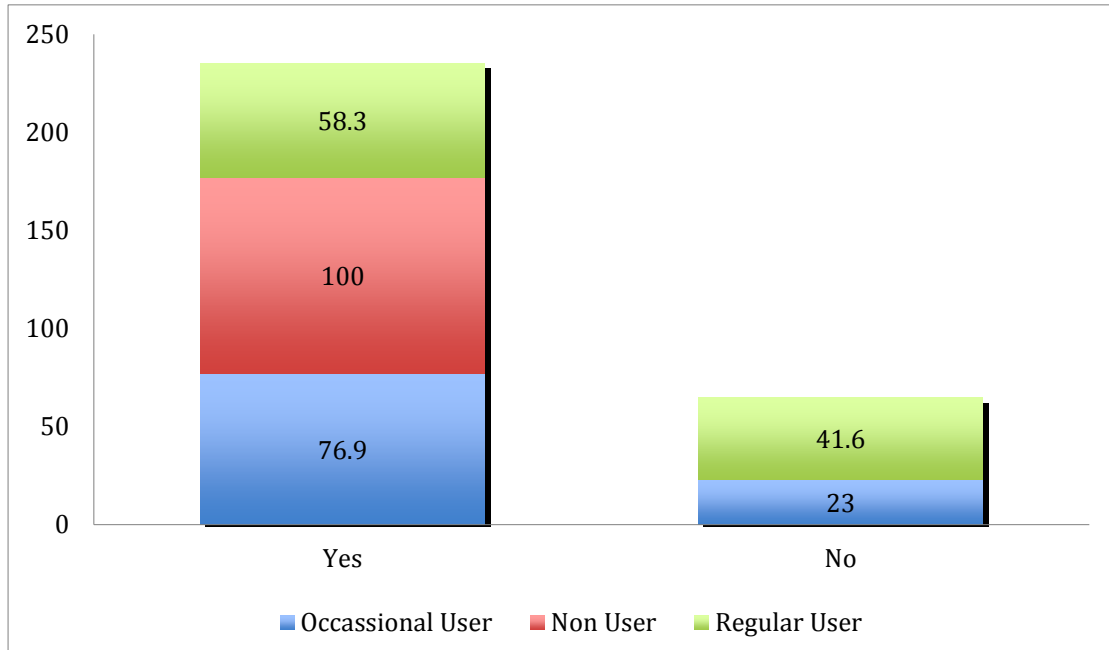


Figure 16. Column graph displaying relative percentages for the 3 HA user groups for question 5.

1.5.8.1 Theme 8: Obstacles to HA use

This question was used to determine the obstacles to HA use in New Zealand and to determine how many HA users feel there was at least one obstacle for them in terms of HA use. Obstacles are related to the perceived barriers construct of the HBM, which states that a barrier may prevent engagement in the health promoting behaviour, in this case HA use.

It was found that two thirds of participants (66.6%) had some sort of obstacle or negative side effect associated with their HAs and one third of participants (33.3%) could think of no obstacle that affected their HA use. The participants who had no obstacles were 41.6% of the RUs and 23% of the OUs.

RU/OU: “No, not really” (P2, P10, P119, P144, P148)

For the participants who noted obstacles, there were 11 different broad obstacles found. The most common obstacle for both RUs and OUs was background noise or external noise. Many HA users found that the HAs do not work well in background noise (30.7% OUs; 27.7% RUs).

RU: “External noise. If I am in a noisy situation it is not so good” (P3, P14, P44, P50, P53)

OU: “If I am in a crowd of people they really don’t work. which is probably one of the reasons why I do not socialise anymore. I haven’t been to a party, which I used to go to a fair bit before for many, many, many years” (P81)

Irritation or discomfort of the HA fit was another obstacle stated (20% NUs; 30.7% OUs; 22.22% RUs). Irritation included aspects such as itchy ears, poor HA fit, wax issues causing discomfort and HAs pressing too hard in the ear canal.

OU: “I find them a bit uncomfortable actually. Just when I put them in” (P62)

RU: “I get sick of them. They irritate my ears after a few hours. I would say on average I can go 3 or 4 hours and then I find they cause pain and I take them out” (P44)

RU: “Sometimes my ears get a wee bit itchy with [the hearing aids] sitting in there” (P20, P53, P54)

A fairly common complaint was the feedback from the HAs, causing both embarrassment and annoyance (20% NUs; 23% OUs; 8.3% RUs).

NU: “I would wind up with feedback and problems” (P7)

OU: “The problem with a tube coming from the ear to the hearing aid is you get feedback very easily, which creates problems. What is interesting is I sometimes get feedback in my bad ear, which I can’t hear but people next to me can. That is embarrassing [laughs]”. (P50)

Another obstacle to HA use was the weather. HAs are not waterproof or wind proof, so if HAs are wet they can become damaged or if there is a lot of wind participants have found that this can create feedback (7.7% OUs; 2.7% RUs).

OU: “If it is a real sour day outside...it is about 6 or 7 thousand dollars worth of hearing aids so if it is pouring down with rain I won’t wear them” (P1)

Fear of HAs getting lost in certain situations was a fairly common obstacle to HA use (40% NUs; 23% OUs; 13.8% RUs). A lot of participants stated they were scared of losing their HAs in situations such as fishing, as they were so expensive to replace.

RU: “If we are on the farm or a boat, like if we go fishing I won’t wear them, simply because I think I might lose them” (P17)

OU: “I am always scared I will lose one of them. I did lose one set at one stage, it just dropped out of my ear! And you know it gets expensive to replace them”. (P62)

A few people also noted interference with safety gear or headwear, such as glasses as being an issue for them (15.4% OUs; 16.6% RUs). Participants with behind-the-ear style HAs especially found that when removing their glasses they

might accidentally tug their HAs out or that when the glasses frames sat on the HAs they created a raspy noise.

NU: “But when I put the glasses on and off I always keep pulling, there was a little thing over the back of my ears. A little bit of plastic thin string or whatever it is and I was always catching them [hearing aids] off”. (P4)

RU: “I wear glasses at the same time and if the glasses are sort of pressing on it I take them off” (P42)

The hassle of putting them in and taking them out was the reason one NU (20%) had stopped using their HAs.

NU: “You have to put them in every morning and take them out in the evening and put them in the little compartment when you go to sleep and I can’t be bothered”. (P153)

Other less common obstacles were people not being satisfied with the sound (7.7% OUs; 2.7% RUs), lack of need for HA(s) (20% NUs) and on-going costs (7.7% OUs; 2.7% RUs).

OU: “On-going costs was quite a factor in me deciding I did not need them and deciding not to wear them”. (P144)

1.5.9 Question 6: Do you think that these obstacles affect how often you wear your hearing aids?

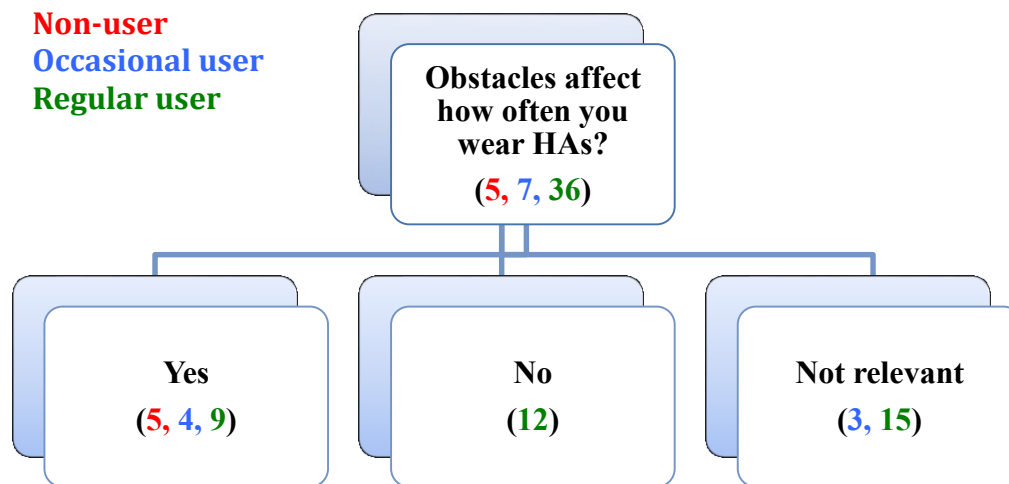


Figure 17. Diagram showing distribution of participants for question 6

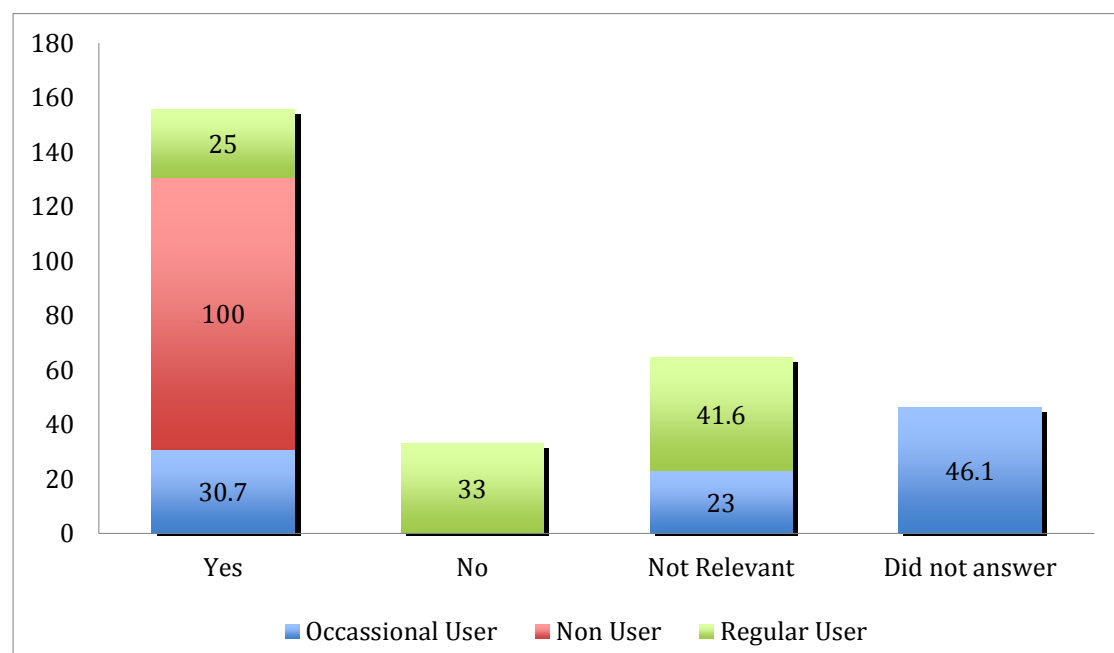


Figure 18. Column graph displaying relative percentages for the 3 HA user groups for question 6.

1.5.9.1 Theme 9: Do obstacles decrease HA use?

This question was used to determine if the obstacles stated above were severe or annoying enough to stop individuals using their HAs.

It was found that for one third of people (33.3%) the obstacles did have a negative effect on HA use and caused individuals to wear their HAs less or not at all. As the HBM states, for these individuals the perceived barriers will be greater than the perceived benefits and so they have chosen not to pursue the health promoting behaviour of HA use. In terms of the three different HA groups, all the NUs (100%) perceived the obstacles were great enough to stop HA use altogether, 30.7% of the OUs perceived the obstacles were great enough to stop using their HA as much as they would like to and 25% of the RUs stated the obstacles led to a decrease in HA use for them, despite them still wearing their HAs on a daily basis.

RU: “Yes, I do not wear them in ambient noise” (P11)

RU: “Yes I don’t wear them because I am afraid of losing them” (P53)

All NUs: “I don’t wear them at all anymore” (P4, P7, P117, P153, P156)

RU: “No” (P3, P8, P13, P40, P119, P64)

For other users (33% RUs), the obstacles were not enough to deter HA use. For these individuals the benefits of wearing their HAs outweigh the drawbacks and so they still view HA use as a positive and worthwhile health behaviour and are willing to persevere with it.

RU: “The price they are, I would want to get some use out of them” (P14)

RU: “Occasionally it gets a little bit sore in my ear, but nothing major and not enough to take them out”. (P54)

This question was not relevant to individuals who had no obstacles to start with; hence 18 participants did not answer the question.

1.5.10 Question 7: Is there anything that makes it easier for you to wear your hearing aids? (Cues to action)

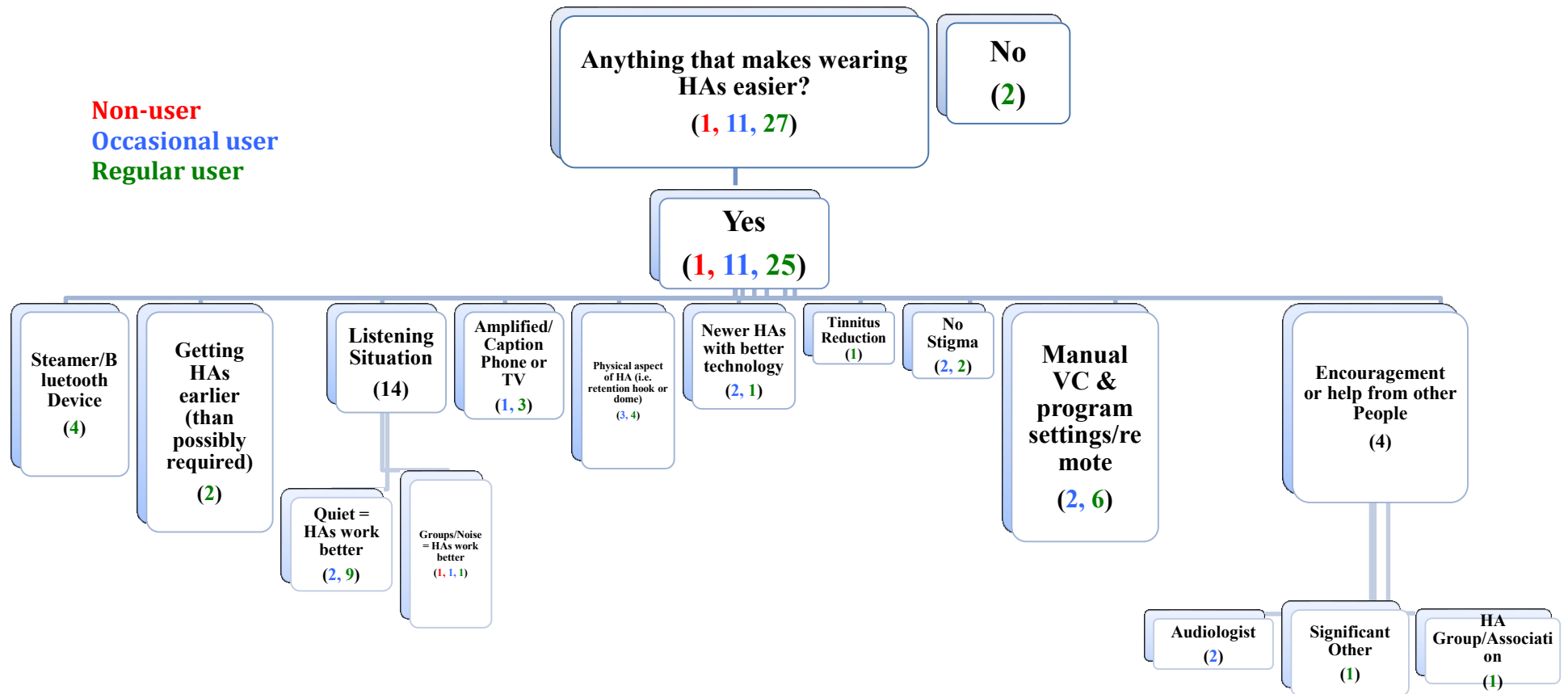


Figure 19. Diagram showing distribution of participants for question 7

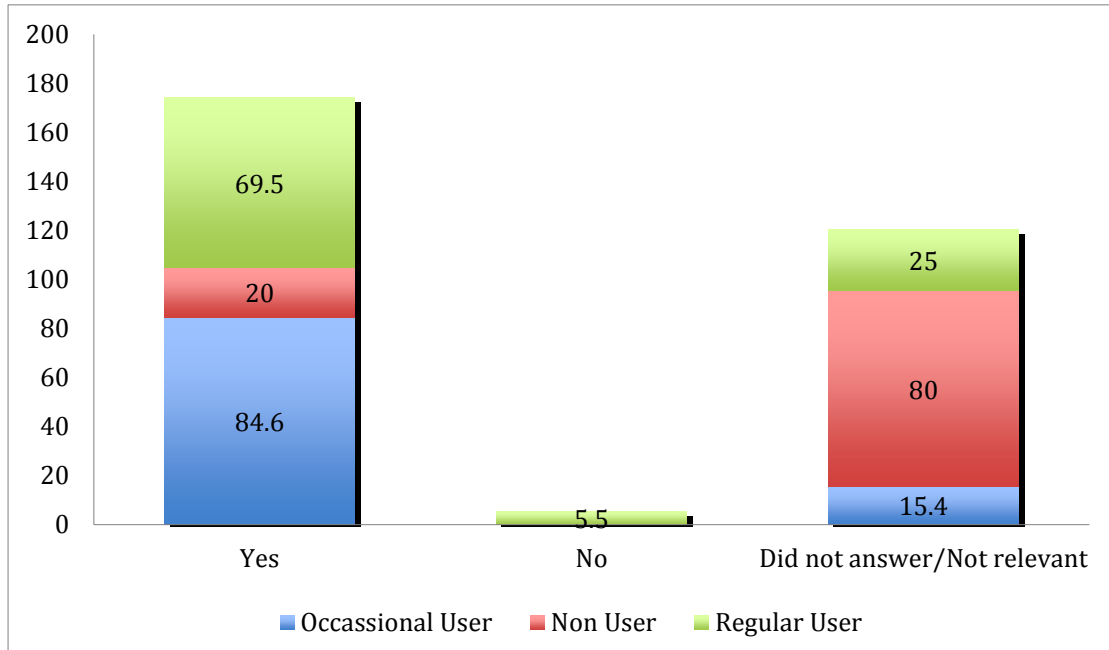


Figure 20. Column graph displaying relative percentages for the 3 HA user groups for question 7.

1.5.10.1 Theme 10: Facilitators to HA use

This question was asked to see if there was anything that facilitated or encouraged HA use in New Zealand. Facilitators can be thought of as cues to action from the HBM, an external or internal cue that encourages a course of action, such as HA use. Just over two thirds of participants (68.5%) stated that there were facilitators towards HA use for them. One of the facilitators found was having encouragement from other people including audiologist, significant other and HA association. One participant found that having rapport with the audiologist and being able to go into their clinic to sort out their HAs if there were any issues was helpful. He noted also that their service was helpful and efficient (15.4% OUs).

OU: “You know [previously] I wasn’t getting out of them what I should have been getting out of them. If things are not going right you have to go in and

ask and they have been very satisfactory with their help with these things”.

(P109)

A couple of participants found that having support from either a spouse (2.7% RU) or a HA organisation (2.7% RU), could help with any HA difficulties they were having as well as provide encouragement.

RU: “Fortunately my husband had hearing aids before me so if I do have any difficulties with the actual aids he can help me out and try fix the problem”

(P108)

RU: “The hearing aid association is absolutely brilliant. It is like a social club”. (P64)

Bluetooth or streaming devices (HATs), such as Bluetooth mobile phones were found to help some RUs (11.11%).

RU: “my phone is Bluetooth. It is amazing. It puts the person inside your head and it is quite amazing really. It cuts out everything else around and you can really hear the conversation” (P31)

Other HATs that were found to be facilitators were amplified or caption telephone or television (7.7% OU; 8.3% RUs).

Manual control buttons on the HAs themselves or a remote control, which can be used to change HA programs and/or increase and decrease volume, were also found to be useful (15.4% OUs; 16.6% RUs). Remote controls are especially useful for those individuals who have dexterity problems, as a remote control has much bigger control buttons than HAs do.

RU: “I have a remote where I can increase the volume and decrease it and a program to block out the background noise. That works to a certain extent I find” (P32)

RU: “The ones I have a couple of buttons that do adjustments such as improve your focus on hearing with music...so that helps a bit” (P25)

Listening situation was a common facilitator for HA use. Interestingly some individuals found noisier environments to be a facilitator (20% NU; 7.7% OU; 2.7% RU), while the majority found quieter environments to be a facilitator (15.4% OU; 25% RU).

RU: “If there is not background noise [it is easier for me to wear my hearing aids]” (P22)

OU: “I find them quite useful if we go out with people where it is a bit noisy but if it is not noisy I don’t really need them”. (P151)

RU: “As I said places where there are a lot of other noises they deteriorate. Around the house or somewhere where it is relatively quiet they do work better, like watching television. I am able to watch the TV lower than when I do not have hearing aids in” (P44)

One RU (2.7%) found his HAs helped reduce his tinnitus and this was a positive effect for him that encouraged him to wear his HAs.

RU: “I put them in because I get the ringing in the ear a bit and it pounds that down so when I get that I try and put them in. It calms it down so it is not as intense. It gives the little hairs something to listen to”. (P31)

Physical aspects of HAs, such as dome size and whether or not there is a retention hook can also be a facilitator (23% OU; 11.11% RU). If a HA is fitting well and feeling comfortable, as well as less likely to fall out an individual was more likely to wear it.

OU: “Well actually you know the thing that goes into your ear, there is a little dome shape thing on the end of it. Well what I have found is a bigger dome is better than a little one” (P18)

RU: “[the retention hook] has been a lot of help and stops the little wee plastic bit [dome] from coming out of my ear”. (P53)

Four participants (15.4% OU; 5.5% RU) found that there was no stigma attached to wearing their HA and this helped them continue wearing their HAs.

RU/OU: “There is no stigma attached” (P20, P42, P151, P148)

RU: “I am only 65 and I don’t want to be one of these people who can’t hear when they are 80 because they haven’t gotten used to wearing their hearing aid. That is really the reason I got myself into it. I thought I want to get familiar with it before I get too old and it become a part of my life, rather than having to adjust to it when I get older”. (P54)

Two RUs (5.5%) who could not think of a facilitator said they were happy with their HAs and would wear them all the time regardless of physical or technological factors.

RU: “[The hearing aids] are either in or they are out there is nothing I do to them to make it easier”. (P5)

Two RUs (5.5%) also stated that getting HAs earlier than required was a facilitator for them.

RU: I am only 65 and I don't want to be one of these people who can't hear when they are 80 because they haven't gotten used to wearing their hearing aid. That is really the reason I got myself into it. I thought I want to get familiar with it before I get too old and it become a part of my life, rather than having to adjust to it when I get older (P54).

Finally, a few participants (15.4% OU; 2.7% RU) stated that they had purchased new HAs in the last couple of years and that the new HAs had better technology which helped them hear better.

It should be noted that 8 individuals had trouble understanding this question and could not answer it because of this. This could be because it is a more abstract question and they have not thought about it before, it could be due to the wording of the question or it could be due to how the question was asked.

1.5.11 Question 8: Do you think that this (whatever facilitator(s) was/were mentioned) affects how often you wear your hearing aids

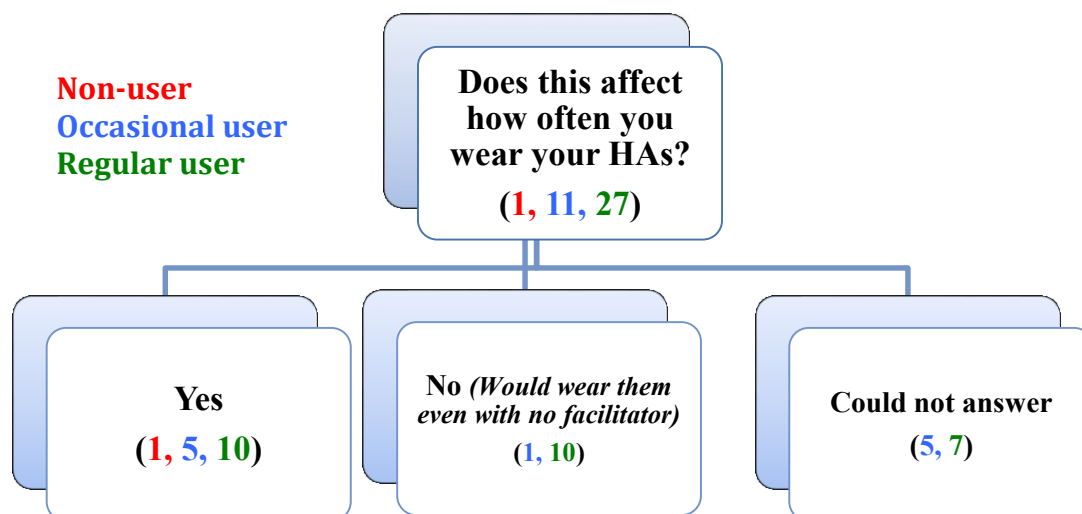


Figure 21. Diagram showing distribution of participants for question 8

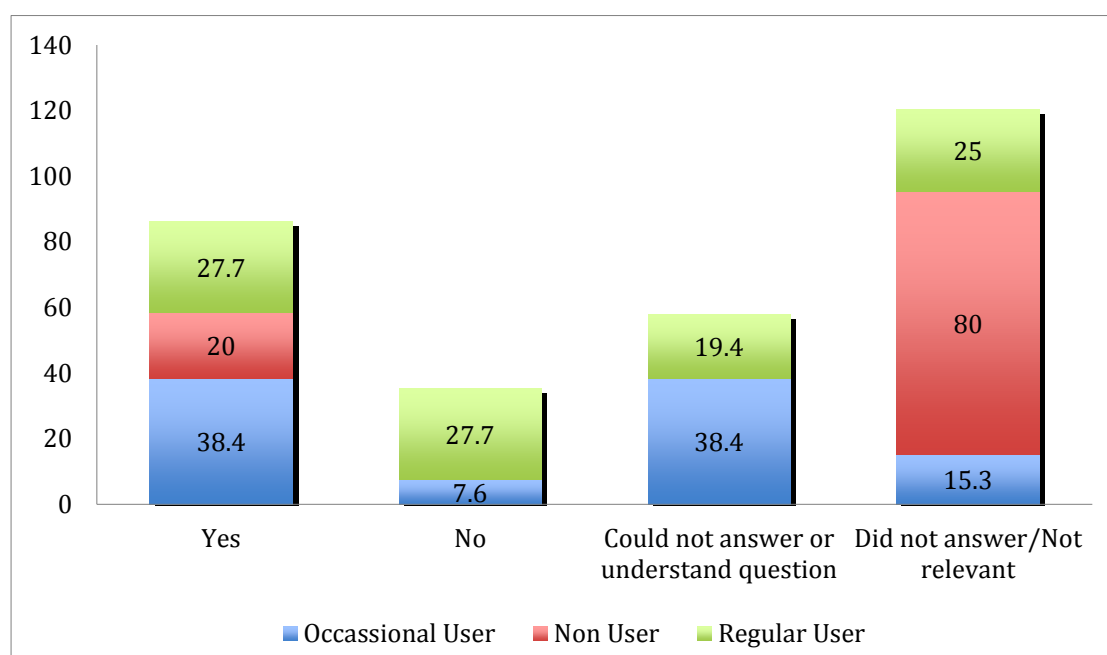


Figure 22. Column graph displaying relative percentages for the 3 HA user groups for question 8.

1.5.11.1 Theme 11: Do facilitators increase HA use?

This question was asked to determine if the facilitators encourage more use of HAs, or whether individuals would wear their HAs anyway despite the facilitator. Many participants felt that the facilitator they mentioned did increase HA use (20% NU; 38.4% OU; 27.7% RU), compared to the fewer participants who felt that the facilitator did not increase HA use for them (7.6% OU; 27.7% RU). Over a quarter of the RUs felt the facilitators did not increase HA use.

OU/RU: “Yes” (P18, P8, P25, P2, P40, P50, P51, P55, P64, P80, P104, P151)

RU: “Would wear them anyway” (P31, P17, P32, P119,)

1.5.12 Question 9a: How confident do you feel in your ability to manage your hearing aids?

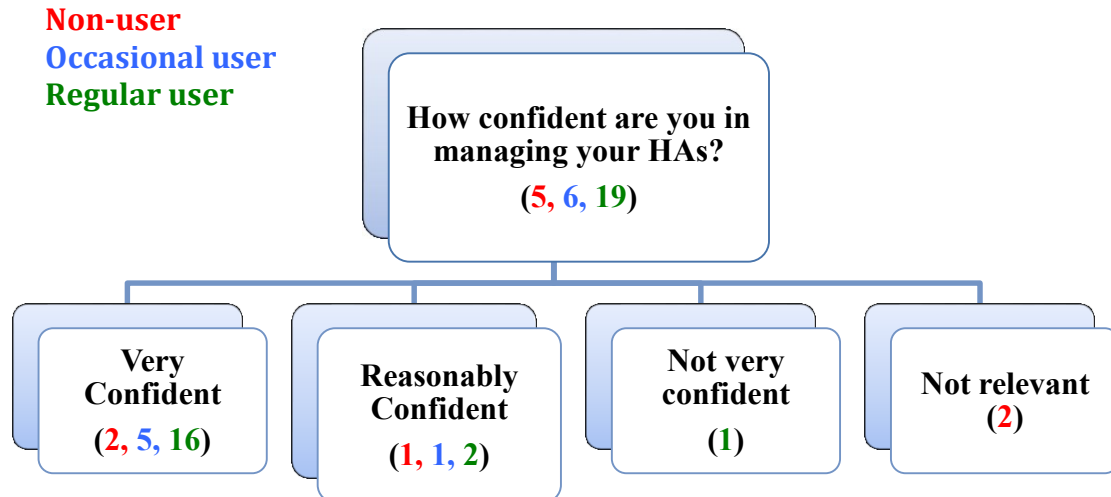


Figure 23. Diagram showing distribution of participants for question 9a

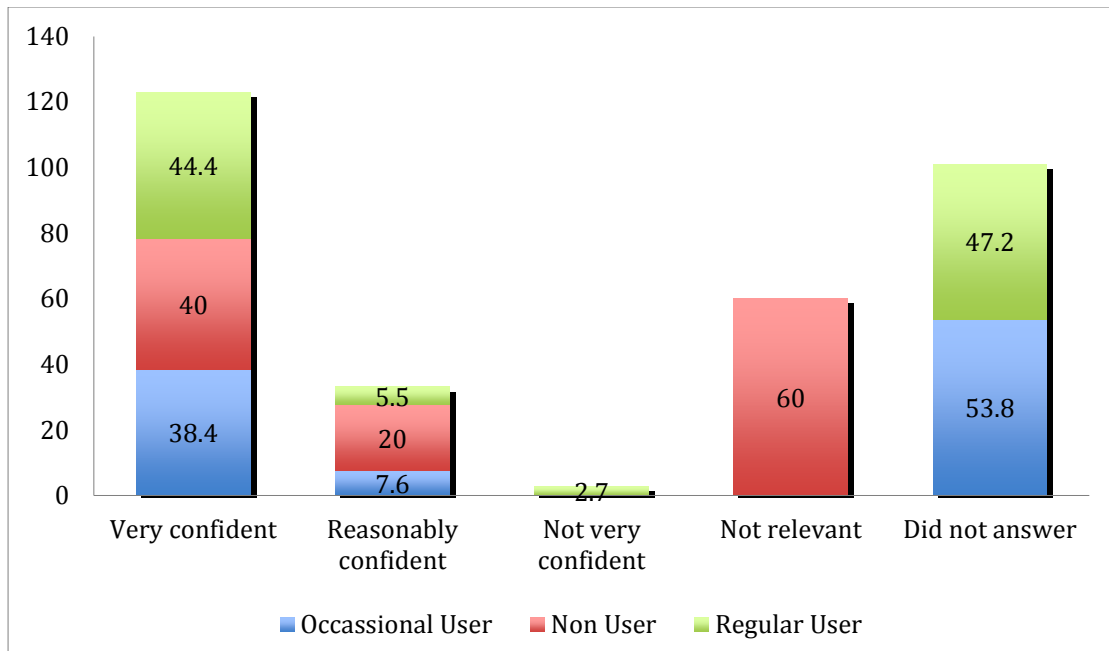


Figure 24. Column graph displaying relative percentages for the 3 HA user groups for question 9a.

1.5.12.1 Theme 12: Self-efficacy of HA management

This question was asked to determine how confident a person is in their ability to manage their HAs. Management includes cleaning, removing, inserting the HAs and using the controls. This question is related to the self-efficacy construct of the HBM and looks at an individuals perception of their ability to successfully complete or manage HAs.

The majority of participants who answered this question directly considered themselves “very” confident (40% NU; 38.4% OU; 44.4% RU) or “reasonably” confident (20% NU; 7.6% OU; 5.5% RU).

NU/RU/OU: “Very Confident”. (P7, P10, P13, P48, P83, P130, P141, P120, P148, P150)

RU: “Reasonably [confident]. I take them in periodically for a check up but I would say 75% confident in keeping them clean” (P22)

One RU (2.7%) did not feel over confident in their ability to manage their HAs

RU: “Probably not very confident” (P104)

For 3/5 of the NUs (60%) they had not worn their HAs for over a year and so felt that this question was not relevant to them.

Many participants did not answer this question directly (53.8% OU; 47.2% RU). This could be due to the fact that this question was asked as, “How confident do you feel in your ability to manage your hearing aids? Do you have difficulties handling your hearing aids?” and some participants would just answer the second half of the question or the part they heard most recently.

1.5.13 Question 9b: Do you have difficulties handling your hearing aids?

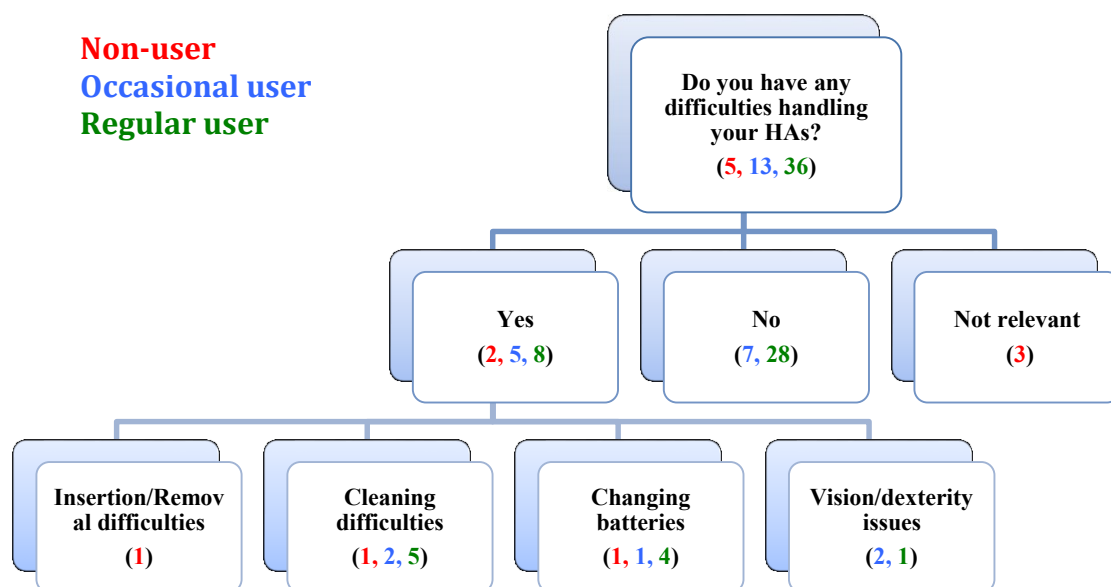


Figure 25. Diagram showing distribution of participants for question 9b

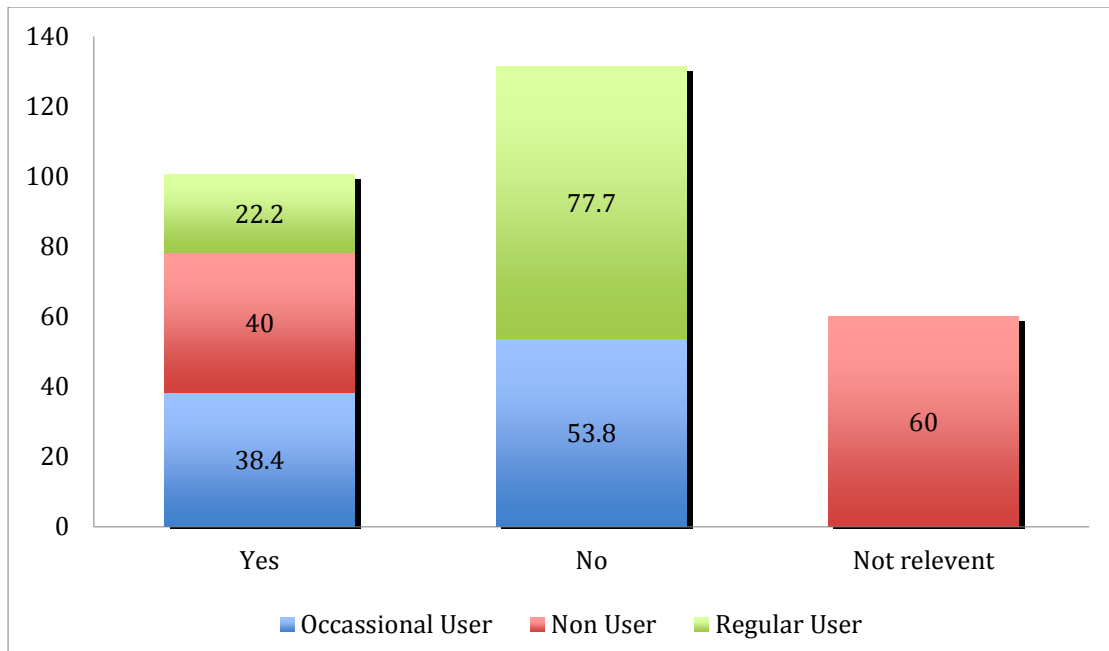


Figure 26. Column graph displaying relative percentages for the 3 HA user groups for question 9b.

1.5.13.1 Theme 13: Difficulties in HA use

This question looked at specific difficulties the participants had with HA management. Management includes cleaning, insertion and removal, changing batteries and all the other aspects involved in taking care of HAs.

Many of the OUs and RUs (53.8% and 77.7% respectively) found no difficulties with the handling of their HAs and felt they were able to look after their HAs well.

RU/OU: “No” (P3, P13, P14, P1, P20, P21, P32, P40, P42, P44, P48, P50, P53, P54, P62, P64, P76, P79, P80, P83, P84, P108, P109, P119, P130, P131, P144, P141, P120, P150)

RU: “They are easy. When I first got them I thought I would never get used to them, but over time you do get used to them...they just fit into your ear like they are part of you” (P17)

Difficulties that did arise were insertion and removal of the HA itself (20% NU); cleaning difficulties such as changing the wax filter and domes (20% NUs; 15.4% OU; 13.8% RU); changing the batteries including removing the sticker on the back of the batteries (20% NU; 7.7% OU; 11.11% RU) and vision and dexterity issues that lead to difficulties with most aspects of HA handling (15.4% OU; 2.7% RU).

OU: “I had completely forgotten that I have to change the little ring for wax” (P55)

OU: “I find that it is very fiddly changing the battery. ... Not because I do not know what to do, it is a question of manual dexterity”. (P18)

RU: “Sometimes I find a new battery a little bit difficult to fit ...you know they have the little tab on them that you have to rip off and sometimes they tend to be stuck on very hard [laughs]”. (P30)

1.5.14 Question 10: What would help you to wear your hearing aids as often as you would like?

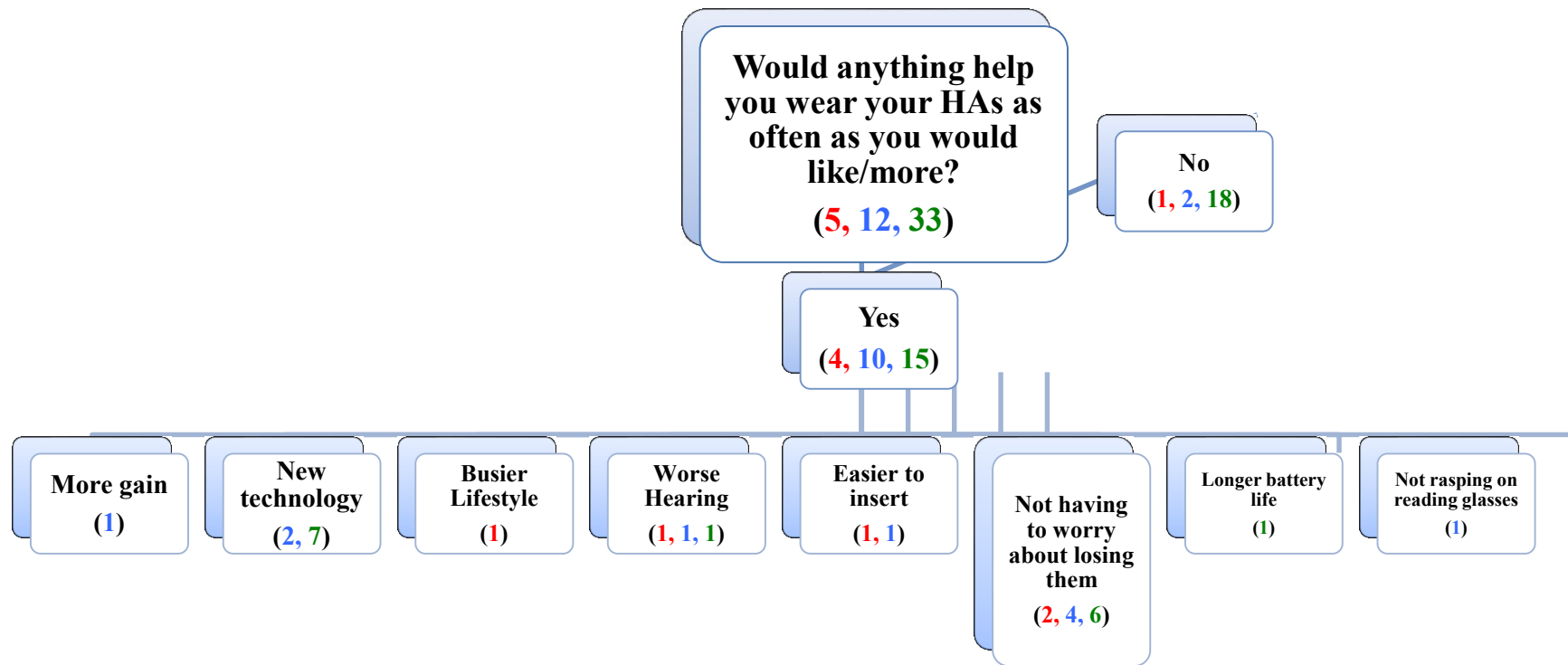


Figure 27. Diagram showing distribution of participants for question 27

1.5.14.1 Theme 14: Factors that would help increase HA use

The final question in the interview was to determine if there was anything a participant could think of that would help them wear their HAs as often as they would like.

RU: “No, I don’t think there is really” (P2)

One NU thought there was nothing that could be done because his HI was so great.

NU: “I think you will have to put me in the hopeless case basket” (P7)

One NU (20%) thought if they had a busier lifestyle that it would help them wear their HAs more. Currently they could not justify the hassle the HAs were for them for the limited benefit they give due to their quiet lifestyle.

NU: “Well only if I had a busier lifestyle and was in meetings lots. As I said I no longer have this lifestyle and therefore the need. I can hear very well in most situations without my hearing aids”. (P156)

One of the other suggestions from some RUs and OUs was better technology in HAs to help with noise (15.4% OU; 19.4% RU).

RU: “Better hearing aids” (P104)

RU: “I would love to be able to hear more clearly in a crowded room or a party situation with a big group of people. I just think there is more to hearing aids than just plain frequency. You ask a musician and they talk about the timbre and all

sorts of things and I don't think that is considered very much with hearing aids but I don't know. I just feel there is something missing...but anyway". (P50)

OU: "I don't think that they are robustly built for the price you pay". (P81)

Three participants (20% NU; 7.7% OU; 2.7% RU) said that the only thing that would make them wear their HAs more was if they thought their hearing was deteriorating.

NU: "If I thought I was getting deafer. If I definitely thought I was not hearing". (P4)

A common factor that would help many of the participants wear their HAs more was if they were not so worried about losing his HAs (40% NU; 30.7% OU; 16,6% RU).

OU: "I think if it was you know a question of not having to worry so much about losing one of them, I think that would help me quite a lot. I would probably wear them a lot more often". (P62)

Other suggestions were longer battery life (2.7% RU), more gain (7.7% OU), not rasping on reading glasses (7.7% OU) and if they were easier to insert (20% NU; 7.7% OU).

RU: "Longer battery life would be pretty good [laughs]. That can become a bit of a pain!" (P144)

1.6 Summary of Results

The facilitators to HA use that were found were: Bluetooth/Streaming devices; getting HAs earlier than needed; listening situations (with the majority people finding that HAs worked better in quiet environments); amplified phones; physical fit; tinnitus reduction programs; no stigma attached; remote controls and encouragement/support from others.

The obstacles or barriers to HA use that were found were: Background noise; feedback; annoyance/irritation; bad weather (i.e. rain and strong winds); HA fit; interference with safety gear/head gear; scared they will get lost; not satisfied with sound; lack of need and ongoing costs. It was found that the benefits of HA use must outweigh the barriers for a person to want to wear their HAs on a regular basis.

Discussion

1.7 Overview

This chapter discusses the findings of the study. The aim was to identify the main facilitators and barriers to HA use in adults throughout New Zealand. Phone interviews with questions relating to HA use were asked to delve into reasons why and when people chose to use their HAs and why and when people choose not to wear their HAs. Questions also related to self-efficacy, HA benefit and difficulties associated with HI. The questions were framed around the guiding principles of the HBM with all five concepts of the HBM explored in the interviews. Participants from around New Zealand were recruited for the study and thus involved in the phone interviews, and therefore this study may be considered largely representative for New Zealand HA users. However, a potential selection bias cannot be excluded, due to the fact that all participants were clients of a single audiology company. The phone interviews were with myself, not the audiology company, which could favour more honest responses. The results are discussed below, followed by an outline of the clinical implications, limitations of the study and suggested areas for future research.

1.8 Findings from the interviews relating to the Health Belief Model

1.8.1 Perceived difficulty

The majority of participants in this study perceived at least some hearing difficulty associated with their HI. The difficulties ranged from not being able to hear

speech clearly when in noisy situations to not being able to hear at all in quiet situations without HAs on.

Previous studies have found a correlation between perceived severity and HA uptake. Those who perceive themselves as handicapped as a result of their HI may be more likely to seek aural rehabilitation services (Lichtenstein, Bess, & Logan, 1988; Mulrow, Tuley, & Aguilar, 1992; S. Stephens, Lewis, Charny, Farrow, & Francis, 1990). Humes, Wilson, and Humes (2003) compared three groups of HA owners nonadherents, adherents who subsequently rejected their HA and adherents accepting their HA. The nonadherent group differed from both of the other groups in that the nonadherents had significantly lower scores on the Hearing Handicap Inventory for the Elderly (HHIE). Meaning they had lower self perceived participation restrictions than the groups who purchased HAs. This study thus showed that a low degree of subjective HI or perceived hearing difficulty is likely to lead to a lower rate of HA uptake. Similarly, Helvik, Wennberg, Jacobsen, and Hallberg (2008) compared HA candidates who accepted and who rejected HAs 1.5 years after issue. Higher levels of activity limitation and participation restrictions were associated with lower odds of rejecting a HA. In terms of HA use, Mulrow et al. (1992) observed that baseline HHIE score was the factor most predictive of successful HA use, in that it increased HA use positively associated with a resulting improvement in handicap and satisfaction with the HA.

Some participants stated they did not perceive any hearing difficulty, or had mild hearing difficulty associated with their HI. Interpretation of the question could have played a role for this question as some participants may have answered the question

based on hearing difficulty without HAs and some may have answered it based on hearing difficulty with HAs. For example, six RUs and four OUs stated they had no perceived difficulty communicating, yet still felt the need to wear HAs.

The 4 frequency PTA based on 0.5, 1, 2 and 4 kHz for the participants who perceived no difficulty or mild difficulty was 35.2 dB HL for their better ear and was 43 dB HL for their worst ear. The average PTA for the participants who did perceive difficulty was 46.2 dB HL for their better ear and 56.8 dB HL for their worst ear. In general, the worse the participant's PTA the more likely they were to perceive difficulties associated with their HI. However, this was not true for all participants due to HI impacting each individual differently. For example participant number 108 stated they had no difficulty associated with their HI yet their PTA for their worst ear was 78.75 dB HL and for their best ear was 47.5 dB HL, whereas participant number 31 stated they had reasonable difficulty associated with their HI yet their PTA was 30dB HL in both ears. Similarly, Bhat, Shewale, Kasat, and Tawade (2015) conducted a study in India and found that degree of HI using a four frequency PTA directly compared to self-report on the Hearing Handicap Inventory for the Elderly (HHIE) in 68% of the cases. The degree to which a given HI affects an individual's life is related to their lifestyle, occupation, academic concerns, psychological factors and other personal and environmental constructs. Hence, the HI on an audiogram may not always correspond to the degree of handicap experienced by the person (Bhat et al., 2015).

Situations in this study that were reported as difficult were in noise; when interacting with others, for example in groups and meetings; for entertainment purposes such as watching TV or listening to the radio and when on the phone. A lack of directionality for those participants who had unilateral HA fittings, was found to add increased difficulty in certain situations.

These findings support previous studies, which have found that although HAs allow for better audibility of speech sounds, individuals with HI continue to have particular difficulty in background noise (Ricketts & Dhar, 1999). Background noise can negatively affect the HA wearers understanding of speech, listening comfort and overall HA benefit (Cox & Gilmore, 1990). Related to this, research has also found that HI individuals often have difficulty communicating in large enclosures such as restaurants, classrooms and houses of worship due to factors such as high noise levels, prolonged reverberation times and extended listener to speaker distances. Unfortunately HAs alone usually offer minimal perceptual benefit in such enclosures. Listeners with SNHI require the speech to noise ratio (SNR) to be improved by 4 to 12 dB (Crandell, Smaldino, & Flexer, 1995; Killion, 1997; Moore, 2012) and need an additional 3 to 6 dB in rooms with reverberation to obtain perception scores comparable to those of normal hearers (Hawkins & Yacullo, 1984).

Another finding that came up for five participants was that when their HAs were not worn it irritates their significant other because it made communication harder. This is a situation in which it is not necessarily difficult for the HI person, rather it is difficult and

impacts on other people in their life. As third party disability suggests, a health problem such as HI does not simply impact the person with the HI it can also impact those close to them. WHO refers to "third party disability" as the study of the life functioning of family members when faced with a health condition of their significant others. A qualitative study by Scarinci, Worrall, and Hickson (2009) found that spouses experienced a wide range of activity limitations and participation restrictions in their everyday lives as a result of their partners' HI. These difficulties ranged from communicative difficulties to emotional consequences, as well as effects on their relationship, social life, and everyday activities. The wide range of experiences reported by spouses in this study highlights the significant impact of HI in older people on the unaffected spouse, and strengthens the notion of third-party disability. This is an important reason why Hickson et al. (2014) believe significant others should be involved in HA fittings.

1.8.2 Perceived Benefit

In this study HA benefit was viewed as a reduction in hearing difficulties when HAs were worn. The majority of NUs found that they were not receiving any benefit from their HAs or their HAs were not reducing their hearing difficulties. No OUs or RUs found they received no benefit from their HAs, they all reported some reduction in hearing difficulties associated with their HAs. This relates to how perceived benefit can affect rates of use. As the HBM states, the more benefit one perceives the more likely they will be to wear their HAs and if no benefit is perceived by health behaviour than it is likely a person will stop the health promoting behaviour.

Ten participants were receiving benefit to 'a certain extent' meaning they were also experiencing some barriers. For the participants who answered this way, the benefits of their HAs must have outweighed the barriers, as they were still persevering and wearing their HAs.

Vuorialho, Karinen, et al. (2006) found that follow up counselling on HA use can significantly increase the benefit obtained from a HA. It has also been found that the differences between expectation and reality can cause selective non-use or complete non-use of HAs. Kochkin (2000) reported that people who had apprehensions with audiologists in that they had received poor service from their dispenser or that they had been oversold expectations of the HA did not perceive as much benefit. The best practices employed by audiologists play a significant role in the success of persons HA experience and journey (Kochkin et al., 2010). Therefore it is important to give the right support, information and counselling at the HA fitting and follow up appointments as well as provide HA owners with realistic expectations as to what their HAs can achieve.

Bhat et al. (2015) found that participants with mild HI were found to be less satisfied with their HAs as compared to those with more severe HI. This could be because of lesser degree of perceived handicap and hence the lack of sufficient perceived benefit. However, Bertoli et al. (2009) reported that degree of handicap had no influence on satisfaction results.

1.8.2.1 Perceived Difficulty compared to perceived benefit

Although satisfaction is a different measure to a reduction in difficulties there are some similarities. Cox et al. (2007) found that higher levels of self-perceived difficulties were associated with higher HA use and higher satisfaction. We can see above that this finding is also true for this study. The participants with higher levels of self-perceived difficulty also tended to have higher rates of benefit and reported that HAs reduced communication difficulties, at least to a moderate extent. For the participants with lower levels of self-perceived difficulty, the majority still found the HAs provided some benefit, however three NUs did not notice any benefit.

I wanted to look at the correlation between increased hearing difficulties on the phone and HA benefit. In general I tended to gain less in-depth information from those individuals who struggled on the phone. This may have been due to speech processing problems, not hearing well or struggling too much to have a proper conversation/interview. The lengths of these interviews ranged between 5 minutes 50 seconds to 16 minutes 9 seconds.

There were nine participants who struggled on phone. Out of these participants 8/9 said that their HAs reduced difficulties associated with their HI and only 1/9 said that their HAs did not reduce difficulties, and subsequently had stopped wearing his HAs.

Difficulty + Benefit = 31

Difficulty + no benefit = 1

Difficulty + moderate benefit = 8

No difficulty + no benefit = 3

No difficulty + benefit = 7

As seen by this comparison, even participants who were still struggling with their HAs on felt that their HAs were still greatly improving things for them. This could be because without their HAs they had a lot of difficulty and really struggled to hear, so with their HAs even though they still have difficulty it might be far less. When looking at these participants' four frequency PTA it is not surprising they struggled more. The mean better ear PTA was 56 dB HL and worse ear PTA was 68.4 dB HL. This is significantly higher than the mean PTA of all the participants.

1.8.3 Perceived Barriers

Perceived obstacles or barriers to HA use that were reported were: external noise such as machinery and loud music, feedback, annoyance or irritation (including getting in and out), weather such as rain or heavy winds, HA fit, the interference with head gear, people being scared that the HAs will get lost, people not satisfied with their HAs and on-going costs.

This finding is fairly in line with a Swiss survey by Bertoli et al. (2009), who found that the most frequently reported reasons for HA non-use were: noisy disturbing situations, no perceived need, no or poor perceived benefit, unpleasant side effects (e.g. rashes, itching, pain, earwax accumulation;), poor sound quality, difficulties with

management, and poor fit and comfort. Obstacles I found that have not been found to be significant before were being scared of losing the HAs, HA feedback, bad weather and interference with headgear. Obstacles the above article found that I did not find were difficulties with management and no perceived need. However, no perceived need could be implied by some of the NU responses. Bhat et al. (2015) also found that background noise and difficulty with a telephone were the most common reasons for HA disuse.

External noise affecting HA benefit and use has been explored numerous times using the accepted noise level (ANL) measure, which measures a listener's reaction to background noise while listening to speech. Typically ANL is measured by delivering an audio-recorded story to a transducer through one channel of the audiometer. Each individual is asked to adjust the sound level of the story to the most comfortable level (MCL). When the MCL has been reached, a noise signal is delivered through the same transducer to the other channel of the audiometer. The individual is asked to adjust this noise to an acceptable background noise level (BNL). Nabelek, Tampas, and Burchfield (2004) described the BNL as a maximum level of the background noise to which the person would be willing to put up with without becoming tense or tired while listening to and following the words of the story. The ANL is the MCL minus the BNL. A high ANL value means that the individual accepts little noise compared to speech level and a low ANL value means that the individual accepts much noise. The ANL procedure should provide a reasonable estimate of signal-to-noise ratio the listener will tolerate. This estimate will be helpful in discussion with the listener about listening environments and the signal-to-noise ratios they may encounter in the real world. Nabelek, Tucker, and

Letowski (1991) found that full-time HA users tolerated significantly higher levels of background music, speech-spectrum noise and traffic noise than part-time users or non-users. Despite, ANL being a fast, singular measure with 85% accuracy in terms of reported usage, the precision of the existing ANL method is poor, and it has not been demonstrated that ANL is an inherent property. Future research should focus on improving the ANL method in order to improve the repeatability (Nabelek, Freyaldenhoven, Tampas, Burchfield, & Muenchen, 2006; Olsen & Brännström, 2014).

It would be interesting to see if fear of HAs getting lost would be an obstacle in countries where HAs are provided free of charge. The main reason participants in this study were scared of losing their HAs was how expensive they were.

Five NUs, four OUs and nine RUs found the obstacles they were experiencing did affect their HA use. This illustrates that obstacles or barriers towards HA use affect all types of HA users and even if an individual uses their HAs frequently, they still may require assistance to further improve their HA experience and satisfaction. The obstacle(s) were annoying enough to reduce wear time.

Although 12 RUs found there were obstacle(s) associated with their HAs, they were not viewed as annoying enough to cause a reduction in how often they wore their HAs. The perceived benefits of the HAs were greater than the perceived barriers.

1.8.4 Cues to Action

Facilitators or cues to action as the HBM calls the term, to HA use that were reported were: the listening environment a person was in; remote or manual controls; Bluetooth devices; other people such as a spouse, audiologist or a HA association; a physical aspect of the HA such as dome size; newer HA with upgraded technology; tinnitus reduction feature on HA; no stigma attached to HI or HAs; caption TV or phone and getting HAs earlier than needed.

Listening situation was found to facilitate some users with 11 participants finding their HAs worked better in quiet situations and 3 participants finding that their HAs worked better in noisier situations. Dillon et al. (1999) found that the benefit of HAs was more in quiet environments than noisy environments, but positive nonetheless. This result has been reflected in the phone interviews and many participants found that quiet environments were a facilitator for HA use, compared to noisy environments that were seen by many as an obstacle to HA use.

When Hickson et al. (2014) looked at HA success in older adults they found that the factor associated most strongly with successful HA outcomes was the positive support of significant others. This was found to be a significant facilitator for three participants in this study, where involvement of a significant other in the HA fitting process was found to have a positive impact for HA use. Solheim, Kværner, Sandvik, and Falkenberg (2012) reported an association between older users' perceived follow-up support and HA use.

HATs were found to help 9 people. These included the use of amplified telephones; caption TV, HA remotes and Bluetooth devices. Harkins and Tucker (2007) surveyed a group of 423 adults with HI, all of which were either using HAs (78%) or CIs (22%). In the survey looking at use of HATs, 84% of respondents indicated they had used assistive listening technologies or HATs in the last 2 years. Though satisfaction with these assistive devices varied across different listening situations, most respondents reported some benefit to using these, especially for better speech understanding in difficult listening situations.

Chisolm, Noe, McArdle, and Abrams (2007) reported on results from a study of 36 adults trialling FM systems. In their group, the mean HI was 70 dB HL. All 36 patients chose to continue using the FM systems after the termination of the study, and 30 of 36 were found to be using the systems one year later. Chisolm, Noe, et al. (2007) also reviewed previous studies on FM system use in adults and found that while there are many studies highlighting good benefit, trials of the actual systems have been disappointing, possibly because more training and counselling around system use are needed. Kricos (2006) drew similar conclusions about FM system use in her overview of best practices in the management of older adults with HI. Another explanation for the lack of acceptance of FM systems may be that they usually require additional equipment to be connected to the HA. While this equipment has arguably become less cumbersome over the years, it still makes HI more visible and the HA itself even more cosmetically unappealing or conspicuous.

A study by Stika, Ross, and Ceuvas (2002) found that only about 30% of audiologists even discuss the option of assistive listening devices with patients, indicating that lack of awareness may be a contributor to lack of use. I am unsure how many of the participants' clinicians discussed the use of HATs with the participants, but are aware that there were many participants who had never heard of HATs and were not using any in the study.

Physical aspects of HAs such as the fit, comfort and whether or not there was a retention hook for the BTE HA styles were also were facilitators for some participants. These are aspects which are easy to get right in HA fitting sessions and easy to change if not going to plan. There are very few reasons why physical aspects of a persons HAs should be a problem or an obstacle for them.

Better HAs, such as newer aids with improved technology also helped some longer term HA users who were on at least their second pair. This is real life evidence of how HA manufacturers are constantly working to improve HAs and make them more beneficial and appealing to HA users or potential HA users. It would be interesting to do an in-depth study and look at whether HA technology level or upgraded HAs improve HA use in New Zealand as Bertoli et al. (2009) found that the age of a HA and therefore the technical features of a HA was unrelated to rate of HA use.

Four participants citing no stigma as a facilitator and none citing stigma as an obstacle is an interesting finding of this study as it has been previously found to be a

major reason why people do not wear their HAs (Franks & Beckmann, 1985). It may be that appearance of HAs is more of a barrier to acquisition of a HAs because people who are concerned about what a HA will look like will be less likely to get a hearing test and subsequently to be fitted with a HA (Meister, Walger, Brehmer, von Wedel, & von Wedel, 2008). It could be that due to HA design overtime changing and HAs becoming significantly smaller, therefore more discrete and unnoticeable could have lead to stigma of the HAs being less than it used to be.

Sixteen participants found that the facilitator they mentioned improved HA use. This indicates there are options available that can facilitate HA use for those people who are struggling with their HAs and not using them as often as they would like to.

Eleven participants stated that the facilitators had no positive impact on HA use for them. This suggests that these participants were already wearing their HAs a fair amount and would wear them even without the facilitator mentioned.

Twelve participants found this question very hard to answer. It could have been due to the wording of the question (it did not include the word facilitator), or could be due to the fact they had never thought about this before and therefore had never been aware when and if they experienced a facilitator.

1.8.5 Perceived Self Efficacy

Perceived self-efficacy (PSE) refers to “beliefs in one’s capabilities to organise and execute the courses of action required managing situations. Efficacy beliefs influence how people “think, feel, motivate themselves and act” (Bandura, 1995, p. 2). PSE may explain the discrepancy between a person’s skills and actual performance outside the clinical environment (Bandura & Adams, 1977; Bandura & Cervone, 1986). Individuals with high PSE believe they have the skills necessary to effectively problem-solve, set goals and plan and carry out actions, be adaptive in their coping and undertake rather than avoid challenging activities.

Self-efficacy differs from self-esteem in that it reflects a person’s beliefs about their capacity to perform a specific task, not their self-worth (Bandura & Adams, 1977). As such, HA self-efficacy refers to an individual’s level of confidence in their ability to use a HA (S. L. Smith & West, 2006). Recently, HA self-efficacy was found to be one factor that influenced older adults’ decisions to consult a health professional about HI, obtain HAs, and achieve successful outcomes with HAs (Meyer, Hickson, & Fletcher, 2014)

For this study, self-efficacy of HA management ranged from “very confident” to “reasonably confident” to “not very confident”. For a couple of the NUs who no longer needed to manage their HAs this question was not relevant.

This finding, with the majority of HA owners having high self efficacy, is different to the small amount of research done of HA self efficacy which shows fairly low self-efficacy rates for HA wearers. Meyer et al. (2014) found that on average, adjustment self-efficacy levels (how well a person feels they can adjust their HAs) were low for non HA owners who had consulted a professional about hearing difficulties, as well as unsuccessful HA owners; in contrast, the mean for successful HA owners was slightly higher, meaning successful HA owners had better self-efficacy for adjusting their HAs. Whereas, advanced handling self-efficacy levels were low for both unsuccessful and successful HA owners. Factors that can influence self-efficacy are client demographics (age, gender, funding status), vision impairment, degree of HI, duration of HI, duration of HA ownership, HA style and presence of HA controls. They found that factors that influenced basic and advanced handling of HAs were age, vision impairment, duration of HI and female gender (Meyer et al., 2014).

HA handling and management difficulties reported in this study included insertion and removal, cleaning, changing batteries and vision problems. These highlight areas that may need more explanation in HA fitting and follow up sessions as well as easy explanations in HA manuals. HAs are small and fiddly devices and for those individuals who have dexterity issues they may be very hard to use. Dexterity relates to insertion and removal, cleaning and changing batteries. These dexterity problems lead to difficulties in handling. This finding has been found in a previous study looking at HA use with older adults which found that the majority of individuals with a HA are older adults and

consequently may have problems handling the device due to limitations in manual dexterity (Erber, 2003).

Some researchers have begun to address the need for extra support in how to handle HAs including Ferguson, Leighton, Brandreth, and Wharrad (2011) who are using videos on practical topics such as HA insertion and removal, HA functions and maintenance as key to aid HA users, especially new HA users.

It has also been suggested that one year follow up appointments after the fitting of a HA are appropriate to cover rehabilitation issues and improve usage rates (Goggins & Day, 2009). The reason for the low rate of handling difficulties could be because Bay Audiology provides regular follow up appointments as part of their fitting procedure to ensure the HA user is gaining as much as they can from their HA and to address any concerns they may have.

In many cases, older adults need the support of other people in helping to cope with their HAs. Gopinath et al. (2011) found that participants who self-reported a history of a diagnosed stroke were 88% less likely to own a HA at the follow up. This is most likely because adults who have experienced a stroke may have motor deficits, communication deficits and reduced dexterity (Carod-Artal, Viana-Brandi, & de Melo, 2000).

1.8.6 Other important findings

1.8.6.1 Where and when HAs are used

Knowing situations in which people find HAs useful or do not find them useful can help clinicians tailor HA fittings to suit the situations where HAs are worn. The situations in which HAs were worn were: when there is a need to communicate with others; on the phone, for entertainment purposes such as watching TV or movies, when driving, only when needed and always. The situations where HAs were not worn were: when home alone/in quiet environments; in noise (i.e. bar or pub); when outside; during exercise; when wanting to concentrate; when driving a motorbike and always.

Situations that participants stated were difficult and wore their HAs were when interacting with others, when watching TV or listening to the radio and when on the phone. A situation that participants stated was difficult but did not wear their HAs was in noise.

It is an encouraging finding that participants report wearing their HAs in three of the four broad situations they found difficult, however concerning that many did not wear their HAs in noise, a situation which was found to be difficult for just over 1/5 of participants. Reasons for this that came up in the interviews were because the HAs did not improve listening in noise, rather they made it harder by amplifying low frequency ambient noise.

The reason many HA users do not use or wear their HAs in quiet environments, such as when they are home alone could be due to the fact that when they are home alone they do not perceive a strong need to hear anything and when they are in a one on one situation they can hear adequately as there are less distraction(s) and they are able to focus on the person talking. HA use relates to the role of hearing in participation. Meaningful participation can be achieved with or without HAs; it depends on the nature of the activity in which the person participates (Lockey et al., 2010). In certain situations Lockey et al. (2010) found that participants judged their participation to be more meaningful without HAs. The ability to actively participate without HAs is often not considered by health care professionals. Non use of HAs may be because the ability to hear may not be required to participate in certain activities, such as reading alone at home. Kerr and Stephens (1997) found that the most frequently reported positive experience related to HI is that of being less disturbed by unwanted sounds. Other benefits were related to the development of sensory and mental skills, such as increased concentration and creativity. Therefore, it is not always a negative outcome if the individuals do not wear their HAs at all times.

Some HA users choose only to wear their HAs when they perceive they are going to need them, such as when they are interacting with others or listening to the television or radio and choose not to wear them when they are in a quiet situation with no other people around such as when they are home alone, because they do not have the hearing need.

The main reason that came up for not wearing HAs when exercising was there was no need, as well as the potential to damage or lose HAs. Exercise reported included swimming and boogie boarding, and as is recommended participants should not wear their HAs in water. Similarly, the reason why some participants chose not to wear their HAs when outside was because of weather which has the potential to damage or lose HAs such as heavy rain and strong winds. Again, this is not a negative finding, rather participants are being cautious as HAs can be a costly investment.

For the NUs who never wore their HAs various themes came up such as feeling as though their HI was too mild and HAs were not making a difference; being able to cope well without HAs; having negative attitudes towards HAs in the sense that one participant felt HAs were negatively impacting his HI and difficulty with insertion and removal of HAs. These findings are very similar to what Knudsen et al. (2010) found when they looked at the predictors of HA non-use by reviewing 31 papers on HA non use. They found that significant non-use predictors included few self-reported hearing problems, low acceptance of the HI, a negative attitude towards HAs, and manual dexterity problems (Knudsen et al., 2010). This finding suggests that reasons for non-use in New Zealand are similar to reasons found in other countries.

1.8.7 HA use

This question was used as a foundation for analysis as well as to work out the percentage of HA non-use rates for New Zealand/Aotearoa. It was found that only 9.3% of the participants interviewed did not wear their HAs at all. This result is higher than the

low non use rate of 3.1% Bertoli et al. (2009) found in Switzerland but still at the lower end of studies looking at HA non-use. Studies that were done in Denmark, Finland, United Kingdom and Australia reported rates of regular use ranging between 91% to 56.6% and the rate of HAs that were never used varied between 1% and 29.3% (Dillon et al., 1999; Lupsakko, Kautiainen, & Sulkava, 2005; Parving, 2003; Smeeth et al., 2002; J. L. Smith, Mitchell, Wang, & Leeder, 2005; Stark & Hickson, 2004; Dafydd Stephens, Lewis, Davis, Gianopoulos, & Vetter, 2001; Stock, Fichtl, Knoblach, Boretzki, & Heller, 1995; Uriarte et al., 2005; Vuorialho, Sorri, Nuojua, & Muhli, 2006). I did not randomly sample the participants to be interviewed; I purposefully sampled them, and so am unable to directly compare my disuse rates to other studies.

However when comparing this data, methodological differences of the studies must be taken into account such as whether it was a countrywide study or regional study. For example Lupsakko et al. (2005) used participants from a limited geographical area; the age group of participants. For example Smeeth et al. (2002) looked at participants \geq 75 years; sample size; and HA experience of participants. Dillon et al. (1999), Parving (2003) and Stark and Hickson (2004) performed their hearing surveys three to six months after the HA fitting as part of a clinical assurance program. At that stage, long-term acceptance of the HA is most likely not established. It has been found that subjective benefit, HA satisfaction and HA use significantly decline at the 6-month and 1-year post fit evaluation compared to the one-month evaluation (Humes, 2001; Humes, Wilson, Barlow, & Garner, 2002; Humes, Wilson, Barlow, Garner, & Amos, 2002). All participants in the current study had been fitted with HAs in the last three years. This

included some participants who had purchased their first pair in the last three years and many who had purchased their second, third or fourth pair in the last three years. One participant had been wearing HAs for the last 40 years and was on their fifth pair. This meant that the present study had participants with varying degrees of HA experience ranging from 2 years to 40 years. Thus the results reflect most likely the long-term acceptance of the HAs.

Also the definition of HA non-use differed between these studies, so direct comparison is unachievable. In this study non-use was considered complete non-use of HAs or that participants had worn them less than once in the last month. I used broad HA groups, for more contrast in study results.

Laplante-Lévesque, Nielsen, Jensen, and Naylor (2014) compared data logging to self report for HA use and found that data logging software on a HA showed on average 10.5 hours of HA use a day versus self report which showed an average of 11.8 hours of HA use daily. The average over report of daily HA use was 1.2 hours, with participants knowing that their data logging was being tracked. Humes, Halling, and Coughlin (1996) reported self-report to over estimate by an average of 4 hours, however their participants were not aware that their HAs had data logging capabilities. Interestingly Laplante-Lévesque et al. (2014) also found that participants for whom data logging showed an on-off pattern or who reported their HA use to be different day to day (occasional users in this study) had significantly fewer data-logged and self-reported hours of HA use. It should be noted that objective measures of HA use, such as data logging are not flawless:

they record the number of hours the HA is turned on, which is not necessarily the equal to the number of hours a HA is worn. For example, failing to turn the HAs off when you are not wearing them will inflate objective HA use, meaning if anything over report could be even more than seen in this study. This over report of HA use would have not overly affected our study results as I was not looking at hours used per day rather if they wore them everyday versus if they did not.

A principal component analysis of 26 HA outcome measures highlighted that amount of HA use is a separate concept from subjective benefit and HA satisfaction (Humes, Garner, Wilson, & Barlow, 2001). Gopinath et al. (2011) found that the three key predictors of HA use and ownership were having a HI, self-reporting a HI and positive responses to questions defining a hearing handicap. Older age was also a significant predictor.

Vuorialho, Sorri, et al. (2006) looked at changes in HA use over the past 20 years in Finland and found that the number of first time HA users who did not use their HAs had decreased from 33.3% in 1983 to 5.3% in 2006. Conversely, the number of regular users rose from 40.9% in 1983 to 56.6% in 2006. In 2006 the users were better able to use their HAs and were more satisfied with them. The number of participants who considered the counselling provided sufficient support had also increased. The authors stated that the reasons for increased use might be partially attributed to the changes in the process of HA fitting. Since 1983, the amount of counselling has increased in Finland and the fitting process in 2006 included a one-month trial of using the HAs. This is similar to

Bay Audiology, who provides a three-month money back trial of HAs which include numerous follow up appointments.

Bhat et al. (2015) found that there was a tendency to under use the HA, even when they were satisfied with the HA. Surr, Schuchman, and Montgomery (1978) have similarly reported that a majority of the population used their HAs selectively rather than on a full-time basis. Excessive background noise and lack of need constituted 63% of the reasons given for limited use or non-use.

Saunders and Jutai (2004) found a significant relationship between daily HA use and total lifetime use (>10 years). They found that over time individuals wear their HAs for longer each day. Bertoli et al. (2009) also found that adults with HI who have had their HAs for more than 5 years are more likely to use their HAs at least 1 day per week than their peers who have had their HAs for 5 years or less. This supports the common belief that HA use is likely to increase over time, perhaps as a result of acclimatization.

Table 3 shows the mean number of years a participant has owned HAs for each of the three groups for this study. The regular HA users were the group that had owned their HAs for the longest amount of time (11.9 years). Interestingly, the OU group had owned their HAs for on average two years less than the NU group (8.7 years compared to 10.8 years).

Degree of HI also impacts HA use. Hosford-Dunn (2001) measured the relation between HI and the amount of HA use per day as well as satisfaction. Despite HA use and HA satisfaction being separate concepts, they found that those with greater hearing thresholds also reported a greater amount of HA use per day and greater satisfaction levels. Bhat et al. (2015) found that subjects with severe SNHI were found to use their HAs more often than others, possibly due to greater degree of handicap. Bertoli et al. (2009) also found that the strongest determinant to regular use was severity of HI.

The average four frequency PTAs for each HA group in this study are seen in table 4. The results for the worst ear PTA are the same to what Hosford-Dunn, Bhat et al and Bertoli et al found, with the greater the hearing thresholds the more a person will use their HAs. However, the results for the better ear PTA show the occasional user HA group to have on average an 8dB HL better PTA than the non user group. This could be because one of the non-users had a PTA of 91.25 dB HL for his better ear and 92.5 dB HL for his worst ear. This is a profound HI and could have skewed the non-user group mean results.

I did not obtain information on the HA brands or HA technology levels participants had, including whether HAs worn were analogue or digital which can influence how HAs work in noise. Speech in noise has been measured in laboratory settings and findings indicate that the higher the HA technology level, the better it works in noise (Arlinger, Billermark, Oberg, Lunner, & Hellgren, 1998; Newman & Sandridge, 1998). Less conclusive results are shown for real world settings (Bentler & Duve, 2000;

Newman & Sandridge, 1998). However, Bertoli et al. (2009) found that the age of a HA and therefore the technical features of a HA was unrelated to rate of HA use so this information would not have added too much to the current study. Older studies find a difference based on technology level whereas the newer study did not, which may be related to the changes in technology in 1996, when digital signal processing (DSP) was introduced, allowing advanced signal processing algorithms to be implemented (Edwards, 2007; Strom, 2006). In 2005, 93% of the HAs sold in the United States contained DSP technology (Strom, 2006). This supports my assertion that I did not need to collect level of technology information as I can assume all HA in this study were digital.

Bhat et al. (2015) found that HAs are used predominately by males, an observation Kochkin also found, that 6 out of 10 HA users were male, though the percentage of female users has increased 3% as compared to earlier studies (Kochkin, 2011). In this study there were more males than females, which reflects both higher prevalence rates of HI in men, but also higher HA user rates in males.

I asked participants if they wore their HAs as often as they would like to as I wanted to assess whether people who did not wear their HAs very much felt fine about this or whether they would prefer to be able to wear their HAs more. The individuals in this study who wore their HAs as often as they would like to were participants from all three HA use groups. These participants were happy with the amount they wore their HAs and felt they did not need to wear them more or were already wearing them the

maximum amount possible already. This indicates that amount of HA use cannot predict HA use preference.

When Laplante-Lévesque et al. (2013) looked at optimal HA use through focus groups with HA users and audiologists they found that both clients and audiologists described optimal HA use as being frequent and regular, but even more importantly as being driven by the individual needs of the client. Both clients and audiologists highlighted how circumstances specific to each client overruled the principle that frequent HA use is optimal. The participants' views were in line with a holistic view of disability and health, in which individual influences are paramount (Gagné, Jennings, & Southall, 2009). This is similar to other studies who have found that people who use their HAs a relatively short time per day, may be just as satisfied with them as those who wear them all the time (Dillon et al., 1999; Wong et al., 2003).

Ten participants felt they did not wear their HAs as often as they would like. The majority of participants who said they did not wear their HAs as often as they would like were OUs. This is an indication that in this study, the OU group is the main HA user group that wants to wear their HAs more and so it might be beneficial to focus on OU in terms of increasing use by suggesting HATs, more counseling or more sharing more information in different ways. It may be an indication that there is a need and a want but potentially too many barriers, not enough benefit or poor self efficacy that is stopping them from wearing their HAs as often as they would like to.

When asked if there was anything that would help these participants wear their HAs as often as they would like, participants stated many factors including: more gain, a busier lifestyle, better HA technology, worse hearing, easier to insert HAs, not having to worry about losing HAs, longer battery life and HAs not rasping on reading glasses.

1.9 Possible Intervention

For individuals with HI who find listening in background noise particularly difficult, other communication strategies/devices are needed to limit their difficulty in these environments. Examples of communication devices include an FM system, or a telecoil system. An FM system is an amplification system where a speaker's voice is picked up via a FM wireless microphone located near the speaker's mouth where the detrimental effects of reverberation and noise are minimal and the acoustic signal is then converted into an electrical waveform and transmitted via FM signals to a receiver tuned to the same frequency. The electrical signal is then amplified, converted back to an acoustic waveform, and conveyed to the listener. FM systems have been shown to help HI individuals as well as normal hearing individuals with processing disorders and have been shown to provide an SNR to the listener of 15 to 25 dB (Crandell et al., 1995; Johnston, John, Kreisman, Hall, & Crandell, 2009). Examples of communication strategies that can help include decreasing distance between speaker and themselves (the listener), remaining face to face so they can see lip movements, clear speech used by the speaker and captioned media.

Boymans and Dreschler (2000); Magnusson, Claesson, Persson, and Tengstrand (2013); Prosser, Pulga, Mancuso, and Picinali (2009) all found that using noise reduction

technology in HAs, in conjunction with directional microphones significantly improves speech recognition scores. Because of this evidence, it could be beneficial to suggest to individuals who struggle in noise to use a HA with both noise reduction technology and directional microphones. Noise reduction by itself has found to lead to no difference in speech recognition scores, but does improve listening comfort (Boymans & Dreschler, 2000; Brons, Houben, & Dreschler, 2013; Magnusson et al., 2013; Mueller, Weber, & Hornsby, 2006; Prosser et al., 2009). Directional microphones reduce background noise or sounds coming from certain directions while focusing on sounds a person wants to hear, usually in speech sounds in front of them. Although other technologies such as FM systems, or assistive listening devices can improve the SNR, directional microphones are the only "HA option" proven to improve speech understanding in noise (Killion, 2004). Gnewikow, Ricketts, Bratt, and Mutchler (2009) found that when using a directional microphone system rather than an omni-directional system objective measures of speech understanding in noise strongly favoured the directional setting for mild, moderate and severe HI. Subjective measures however did not strongly support a significant real-world advantage to directional settings. The authors concluded that this could be because the measures they used did not directly address situations where directional microphones are advantageous, or they failed to effectively instruct patients in the proper use of directional HAs. The objective and subjective results taken together however indicate the potential for significant improvements in speech understanding in noise with directional microphone HAs, however counselling around correct use and best practice is strongly recommended for best results.

For those participants who have difficulty on the phone and with entertainment, HATs are a good suggestion to try and decrease difficulty. For the television there are systems, such as infrared systems that use Bluetooth, or an FM system, which stream the sounds from the television directly to a person's HAs, limiting the interference background noise can have. When on the telephone there are amplified telephones, captioned telephones and HA streamers, which use Bluetooth to directly transfer the person's voice on the telephone to a person's HA (Yanz & Preves, 2007). Often when talking to participants about facilitators for HA use they had not heard of some of the HATs available and the majority of participants were not using any HATs.

Some of the key reasons provided for non-use of HAs included that HAs do not help them hear or reduce hearing difficulties, they were uncomfortable and they were hard to put in. These issues could be overcome if the HA fitting process is adequately accompanied by counselling and continuous support from the HA manufacturer or audiologist in case of problems (Bertoli et al., 2009).

1.10 Clinical Implications

According to WHO, by 2025 there will be approximately 1.2 billion people in the world over the age of 60, which marks a shift in world population to a greater proportion of older people. Age-related HI is a leading cause of years lived with a disability in adult years (Sprinzi & Riechelmann, 2010). Audiologists need to be aware of factors that can affect HA use both negatively and positively to improve the HA benefits.

Knowing obstacles and facilitators to HA use is clinically relevant as an audiologist as well as useful for manufacturers to know. Our job is to provide the best service we can for a client, based on their wants and needs, ensuring we use evidence-based practises. Knowing the main reasons why individuals choose not to wear their HAs as well as knowing the main things that make it easier for individuals to wear their HAs can influence how we approach a HA fitting. For example, being more aware of clients who may need extra follow up appointments.

This study provided a possible profile of a typical non-user and may help clinicians better identify those clients more likely to become non-users. Often these users have mild HIs, have been forced to see an audiologist by someone else (as they do not want HAs) or are those users who continue to come back for follow up appointments and never seem happy with their HAs. Clinicians also need to be aware of and understand help-seeking behaviours for HA owners. When a client seems dissatisfied with their HAs, we need to be able to identify and/or refer these clients or provide additional support to encourage HA use. Some HA owners are not aware of the services available. Clinicians also need to give realistic expectations in regards to HA sound and make clients aware that HAs will not work as well in background noise as they will in quiet listening situations. This may reduce disappointment in HA performance. Realistic expectations also mean less hassle in the long run by having clients returning HAs they are not happy with or not wearing their HAs.

Another clinical implication is for clinicians to have more of a target on additional HA support. It was found that not many of the participants in the study were part of a HA group or society or used a HATs. Use of these additional services has been found to be a facilitator for HA use and therefore increase a persons amount of HA use. They can also improve HA performance in background noise, which was found to be an area many HA users are not satisfied with.

For clinicians we need to ensure that our clients have the best HA service possible, not just so the client is happy and wears their HAs but also so they give positive word of mouth recommendations to their friends and family and encourage them to attend their clinic. Better experience may lead to more recommendations to others.

It is also important that clinicians and HA companies try and reduce the average 10 year wait time that people have from when they notice a HI to when they purchase HAs. Seeking treatment earlier will potentially make the HA adaption process easier and improve self-efficacy. The longer a person waits, the older they get and older adults are more likely to have vision and dexterity issues than younger adults. Interestingly two participants stated that getting HAs earlier than they needed them was a facilitator for HA use for them as they were able to learn all that was involved in HA management and handling before they got too old.

Lastly, HAs have found to be cost effective and this study has shown they are a good option for individuals with HI who are having difficulties. The HA disuse rate was found to be low, which may be because the New Zealand HA fitting and follow up process focuses on clients' needs, wants and expectations. It is also important to note that there are generally two or more follow up appointments at Bay Audiology, which helps to ensure best fit to clients HI and needs.

1.11 Limitations

Firstly, a lot of HI people find it difficult to talk on the phone. This could have deterred people from participating in the study in the first place. As it was, six participants wrote that they would be unable to undergo the phone interview portion of the study due to difficulty talking on the phone and two more participants were rung up for an interview but were unable to hear me on the phone. An option to help with this difficulty was to email questions, but lots of older people do not have emails or a face-to-face interview, but as this was a New Zealand wide study this was not logistically possible. Email and face-to-face interviews have a different methodology to phone interviews and interview approach and answers would change the nature of the content received.

Telephone interviews have practical and administrative advantages over face-to-face interviews, particularly when the respondents are scattered over a wide area, like in the study I undertook. There are also limitations to the telephone interview as compared with the personal interview. Respondents who do not own telephones or cannot be

reached by telephone are excluded. Moreover, some authors have argued that lengthy interviews in which the respondent is asked about his attitudes on complex topics are not feasible by telephone (Bennett, 1961).

Hochstim (1963) makes extensive comparisons of data collected by mail questionnaire, telephone interview, and personal interview from randomly selected subsamples in the population. Generally, the three strategies produced similar results, however a few differences were found. On a question about drinking behaviour, women were a little more likely to say that they never drank wine, beer, or whiskey in the personal interview than in the telephone interview or in the mail questionnaire. The telephone interview and the mail questionnaire gave almost identical results for this question. Hochstim attributes the difference in results between the personal interview and the questionnaire to an impulsive type of face saving that is more likely to operate when confronting an interviewer who may possibly be critical than when filling in a mail questionnaire, where the situation is both more impersonal and more conducive to considered response (Hochstim, 1963). For screening a population for self reported visual impairment, Josephson found that telephone and personal interviews yielded equivalent results (Josephson, 1965).

Secondly, the first lot of 200 invitations sent out did not include return envelopes. It was observed with the 600 invitations sent out after these that the return rate increased when return envelopes were included. There could have been more participants enrolled in the study had all the study invitations included return envelopes.

Another limitation is that the four frequency PTA measure I used does not take into account high frequency HI above 4 kHz. For example many of the participants' PTA using 500, 1000, 2000 and 4000 Hz was considered mild, however above 4000 Hz their HI sloped steeply down to a more severe degree of HI. The PTA is not an overall view of a person's HI. This means the PTA measure used to look at hearing difficulty only takes into account some of a person's HI. Presbycusis is characterised by decrease in hearing for the high frequencies, which many of the participants in the study had.

I did not look into the cognitive function of participants. Lunner (2003) found that cognitive function is correlated with performance in demanding listening situations, both with and without HAs, even when age and HI is accounted for. This result differs from Humes et al. (1994) and van Rooij and Plomp (1992), who concluded that measures of HI alone explained most of the results, and that cognitive function accounted for little or no additional variance. However, these differences found could have been due to different methodologies used.

Using Bay exclusively for recruitment is a study limitation as it reduces generalizability. This may have to do with the service delivery model Bay Audiology offers, which is different from company to company (and is different again in a medical centre and a university clinic).

The interview question # 7 (*'Is there anything that makes it easier for you to wear your hearing aids?'*) was a hard question to ask and numerous participants found it difficult to answer. I had to rephrase this question often over the phone, as many participants did not understand what I was asking. This was an important question in terms of the study aim so if this question was worded in an easier to understand way I could have received more in depth information and more participants would have been able to answer it.

Because this study was the second part of a two-part study, many participants would say in the phone interviews that they have answered all the information in the questionnaires (part one of the study), so did not want to add anything, repeat themselves or gave very short responses. Many participants were confused at the nature of the study having both quantitative and qualitative aspects, which were analysed separately. Some people became frustrated at having to say on the phone what they put down in their questionnaire. The reasons for this were to get a thorough idea of reasons for HA non-use and also to compare if there were any differences between the quantitative and qualitative results.

Another limitation was the uneven group sizes. There were far more RUs in the study than OUs or Nus. I managed to reflect representative information by using relative percentages for each group. It could in fact represent the HA disuse rate in New Zealand and could therefore be accurate for the New Zealand setting. More research in this area will need to be carried out before we can be sure however.

1.12 Future Directions

In the future it could be worthwhile to do a similar study of HA non-use in New Zealand using only interviews, so participants do not feel like they are repeating themselves and using more than one HA company. It could also be good to compare publicly funded and fitted HA clients to privately fitted HA clients and compare differences.

In the future it would be interesting to do a third-party disability study interviewing the significant others of the participants in this study and looking at family member involvement in hearing rehabilitation and whether it changed outcomes. It would also be interesting to look at the patient-audiologist interaction and its relationship to uptake and outcomes.

As manufacturers are always working to improve HAs for people, a future direction for them is to improve HA capability in background noise. Difficulty hearing in background noise, even with HAs inserted is a finding that has come up many times in recent research, as well as in this study. They know this and have designed noise reduction technology as well as directional microphones, but there is still work to be done to ensure HAs provide benefit and comfort in background noise.

Another future direction would be to assess if there was any way to make HAs more secure on peoples ears, so they were no so worried about losing their HAs. It would

also be interesting to assess if certain HA styles were more prone to falling out than other styles. This would ensure many people in New Zealand wore their HAs more.

1.13 Conclusions

This study identified the rate and reasons for HA use in New Zealand. It also looked at the five constructs of the HBM and how they relate to HA use in New Zealand. These results can be used to inform clinicians on areas that need more emphasis in the fitting process and help identify those clients who are at risk for HA non-use or do not wear their HAs as much as they would like to and provide additional support to these clients. It is useful to have specific New Zealand evidence on reasons for HA non-use as due to differing HA fitting processes and environments, reasons will differ vastly between countries.

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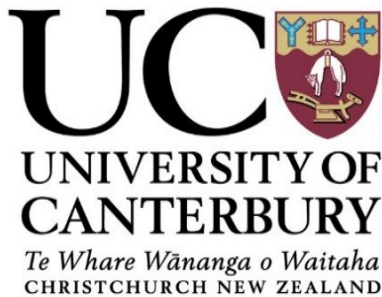
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Appendix A: Research Information Sheet



Research Information Sheet

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

Researchers:

Hannah Blood

Master of Audiology Student
Dept. of Communication Disorders
University of Canterbury
Email: hlb44@uclive.ac.nz

Dr. Rebecca Kelly-Campbell

Research Supervisor
Dept. of Communication Disorders
Email: Rebecca.kelly@canterbury.co.nz
Phone: (03) 364 2987 ext 8327

Rebekah Durrans

Master of Audiology Student
Dept. of Communication Disorders
University of Canterbury
Email: rcd53@uclive.ac.nz

Anna McMillan

Associate research supervisor
Bay Audiology
Email:
Anna.mcmillan@bayaudiology.co.nz

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 amongst 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:

- 1) Adults who have recently gotten hearing aids
 - who use hearing aids on a regular basis.
- 2) 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?

Bay Audiology: 0800 600 545

New Zealand Audiological Society: 0800 625 166

Ministry of Health Healthline: 0800 611 116

Ministry of Health Disability Support: 0800 373 664

Appendix B: Letter of Interest



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

Appendix C: Consent Form



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 the chance to ask questions.

I know what I need to do to 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 or 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

Anna McMillan: anna.mcmillan@bayaudiology.co.nz

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 Audiologist to contact me for additional support.

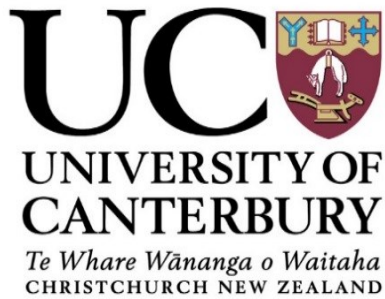
Yes ☐ No ☐

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

Name (please print): _____

Signature: _____ Date: _____

Appendix D: Participation Information



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?

- | | |
|--|----------------------------------|
| <input type="checkbox"/> New Zealand European | <input type="checkbox"/> Tongan |
| <input type="checkbox"/> Maori | <input type="checkbox"/> Niuean |
| <input type="checkbox"/> Samoan | <input type="checkbox"/> Chinese |
| <input type="checkbox"/> Cook Island Maori | <input type="checkbox"/> Indian |
| <input type="checkbox"/> Other, such as Dutch, Japanese, Tokelauan. Please state:
_____ | |

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

- | | |
|------------------------------------|--|
| <input type="checkbox"/> Single | <input type="checkbox"/> Never married |
| <input type="checkbox"/> Married | <input type="checkbox"/> In a committed relationship |
| <input type="checkbox"/> Widowed | <input type="checkbox"/> Divorced |
| <input type="checkbox"/> Separated | |

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

- | | |
|--|---|
| <input type="checkbox"/> \$0 – \$25,000 | <input type="checkbox"/> \$25,000 - \$50,000 |
| <input type="checkbox"/> \$50,000 - \$75,000 | <input type="checkbox"/> \$75,000 - \$100,000 |
| <input type="checkbox"/> 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 E: Ethics Approval Letter



HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

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.

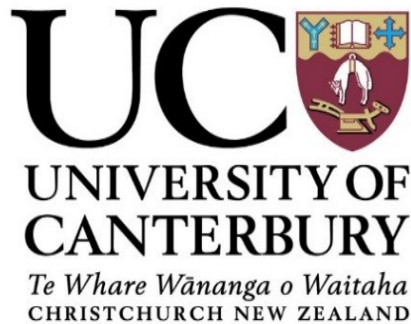
Best wishes for your project.

Yours sincerely

A handwritten signature in black ink, appearing to read 'L. MacDonald'.

Lindsey MacDonald
Chair
University of Canterbury Human Ethics Committee

Appendix F: Invitation Flyer



Participants Wanted

Hearing aid use in New Zealand

You are invited to be in a study by researchers at the University of Canterbury about reasons why adults living in New Zealand choose to use or not use hearing aids. We would like to get your opinions.

Many people who get hearing aids use them a lot and many people use them a little or not at all. We'd like to find out more about why, where and how often people like you – who have recently gotten hearing aids – choose to use them.

You will be asked to:

1. Fill in surveys about your hearing and hearing aid use
2. Be interviewed about your hearing needs and hearing aid use
3. Give Bay Audiology permission to share your hearing test results with researchers at University of Canterbury

This study should take about 1.5 hours of your time and can be done from your home.

To take part in the study, or for more information, please return the enclosed letter or contact:

Hannah Blood

University of Canterbury
(03) 364-2987 ext. 8327

hlb44@uclive.ac.nz