The relationship between practical hearing aid skills and patient satisfaction in the public health care setting

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Declaration

I, Tracy Wentzel, hereby declare that this research report is my own work except as indicated in the references and acknowledgements. I am responsible for the content of this study and the conclusions presented. No part of this research report has been previously submitted for a degree at any other University/Institution.

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Abstract

The ability to handle a hearing aid may impact on satisfaction with and acceptance of hearing aids by individuals with hearing loss. Previous research has noted the correlation between hearing aid handling skills and effective hearing aid use. Although many studies have focused on the individuals' satisfaction with their hearing aids there is a lack of information regarding the relationship between satisfaction with hearing aids and hearing aid handling skills. This is especially true for the South African context, where no studies have been conducted to explore this relationship. The main aim of the study was thus to determine the relationship between the ability to manipulate hearing aids and self-perceived satisfaction with hearing aids in individuals fitted with hearing aids in a public health care hospital.

A non-experimental, cross-sectional, correlational research design was employed for the purpose of this study. The sample included 85 adults fitted with hearing aids in a public health care hospital. There was an equal distribution of gender and the mean age of participants was 66.27 years. Participants completed the Practical Hearing Aid Skills Test – Revised (PHAST-R) version and the Satisfaction with Amplification in Daily Life (SADL) questionnaire.

The findings of the study indicate that the majority of participants were able to successfully manipulate their hearing aids (Mean score: 75.43%; Range: 10.71 - 100; *SD*: 21.58). The mean global score for satisfaction with amplification was 5.2 (Range: 3.1 - 6.8; *SD:* 0.84) indicating high levels of satisfaction with their hearing aids. Overall there was a significant correlation between hearing aid handling skills and satisfaction with amplification (r_s*= 0.22871; n = 85*) indicating that participants with good hearing aid handling skills also displayed higher levels of satisfaction with their hearing aids.

The findings suggest that the majority of participants were satisfied with the hearing aids provided in a public health care hospital and that they were able to successfully handle their hearing aids. The use of the PHAST-R as part of the hearing aid orientation session is encouraged especially in light of the poor return rate for follow-up hearing aid orientation sessions at this public health care settings. The development of standard operating procedures for hearing aid fitting and orientation in the public health care sector is recommended to ensure that the best possible outcomes are ensured for all patients.

Keywords*: hearing aids, hearing aid handling skills, satisfaction. PHAST-R, SADL, hearing aid use, public health care audiology*

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List of Abbreviations

APHAB	Abbreviated Profile of Hearing Aid Benefit
AR	Aural rehabilitation
BC	Bone conduction
BTE	Behind-the-ear
ENT	Ear, Nose and Throat specialist
HA	Hearing aid
HAO	Hearing aid orientation
HAUQ	Hearing Aid Users Questionnaire
HHI	Hearing Handicap Inventory
HHIE	Hearing Handicap Inventory for the Elderly
HJH	Helen Joseph Hospital
HL	Hearing loss
ICF	International Classification of functioning, Disability and Health
IOI-HA	International outcomes inventory – hearing aid
ITE	In-the-ear
NIHL	Noise Induced Hearing Loss
PHAST-R	Practical Hearing Aid Skills Test - Revised
PTA	Pure Tone Average
QoL	Quality of Life
SADL	Satisfaction with Amplification in Daily Life
SNHL	Sensorineural Hearing Loss
WHO	World Health Organization

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Chapter 1: Orientation

Introduction

The following chapter provides an orientation to the study. This chapter comprises of the rationale for the study by describing the background information that led to its development as well as the relevance of this area of research. Definitions of terminology used within the context of the research are provided. Finally, an outline of each of the chapters in the dissertation is provided.

Background and rationale for the study

The majority of South Africans only have access to hearing health care through public health services (Harris, Goudgea, Atagubab et al., 2011). Audiology services for these individuals who present with hearing loss and require hearing aids are available only at limited number of public health care institutions in South Africa. Once it has been confirmed that a patient would benefit from hearing amplification, hearing aids are fitted. The hearing aid fitting session typically includes hearing aid orientation (HAO) which should incorporate information on the use and care of the hearing aid, limitations of the hearing aid as well as troubleshooting tips. Patient expectations with regard to hearing amplification should also be discussed (Tye-Murray, 2014).

There is evidence that despite patients requesting to be fitted with hearing aids, a large number of these patients do not wear their hearing aids (Allan, 2015; Brian, 2007; Dugan, 2003; Hartley, Rochtcima, Newall, et al., 2010; Gianopoulos, Stephens & Davis, 2002; McCormack & Fortnum, 2013; Sooful, 2007). There are several reasons why individuals do not use their hearing aids. These include audiological factors (aspects related to the hearing loss) and/or extra audiological factors (factors that are more specific to the individual) some of which include gender, age, typical social activities, dexterity (Popelka, Cruickshanks, Wiley, et al., 1998). These aspects may negatively or positively influence the level of satisfaction individuals experience with their hearing aids and may ultimately determine their hearing aid use (Aurélio, da Silva, Rodrigues et al., 2012; Lessa, Costa, & Becker, 2010).The ability to handle a hearing aid is an important extra audiological factor that may impact on satisfaction, acceptance and hearing aid use (Desjardins & Doherty, 2009). There is evidence of the correlation between hearing aid handling skills and effective hearing aid use (Campos et al., 2014; Humes, Wilson & Humes, 2003; Hartley et al., 2010). Although many studies have focused on individuals' satisfaction with their hearing aids, internationally, only a few studies have attempted to link satisfaction and hearing aid handling skills (Campos et al., 2014; Allan, 2015).

This is especially true in the South African context, where no published studies have been conducted to explore this relationship.

This study therefore aimed to determine if there is a relationship between hearing aid handling skills and satisfaction with hearing aids provided to individuals in the public health care setting.

Definition of terminology

Audiological factors

Audiological factors include aspects such as the type, degree and configuration of hearing loss as well as the laterality of the hearing loss (Popelka et al., 1998).

Aural rehabilitation (AR)

AR is the process of training individuals to have maximum communication abilities through adjusting to their hearing loss. AR includes ensuring benefit from the hearing aids as well as managing residual limitations (ASHA, Type, degree, and configuration of hearing loss, 2015). Services can be offered to individuals, in small groups, or a combination of both. AR thus aims to minimize the residual difficulty experienced by individuals (Tye-Murray, 2014).

Conductive hearing loss (CHL)

A conductive hearing loss occurs when the outer or middle ear is not functioning appropriately (ASHA, Type, degree, and configuration of hearing loss, 2015).

Extra-audiological factors

Extra-audiological factors refer to the factors and considerations which are individual specific; and unrelated to the audiological description of the hearing loss (Helvik, Wennberg, Jacobsen et al., 2008).

Finger dexterity

Finger dexterity can be defined as the ability to skilfully and rapidly perform controlled movements of small objects (Allan, 2015).

Hearing aid (HA)

A hearing aid is an assistive device which assists in amplification of auditory stimuli to a level which is more audible to the individuals (Dillon, 2012).

Hearing loss

Hearing loss can be defined as decreased auditory functioning (ASHA, Type, degree, and configuration of hearing loss, 2015) or any challenges in hearing sounds in one or both ears (Dugan, 2003; Kreisman, Smart, & John, 2014).

Mixed hearing loss

Mixed hearing loss indicates that affected structures are a combination of outer, middle and inner ear (ASHA, Type, degree, and configuration of hearing loss, 2015).

Quality of life (QoL)

Quality of life can be described as the individual's self-reported evaluation of their life experience (Boothroyd, 2007).

Satisfaction

Satisfaction is an emotional and cognitive response, which relates to a specific focus (either on an expectation, product, consumption or experience) and the response refers to the reaction at a specific time (Giese & Cote, 2000).

Sensorineural hearing loss (SNHL)

Sensorineural hearing loss refers to a hearing loss when the inner ear is affected (Roeser, Valente, & Hosford-Dunn, 2007).

Chapter Outlines

This dissertation will be presented in five chapters.

Chapter 1 provides the orientation and rationale to the study. Included are the definitions of terminology used throughout the research report, an explanation of the abbreviations used and an outline of the chapters in this dissertation.

Chapter 2 provides the conceptual framework for the study. It commences with exploring the prevalence of hearing loss internationally and in the South African context. The unequal distribution of health resources in South Africa is highlighted. This is followed by a discussion of hearing aids and the factors affecting uptake and use, as well as the challenges experienced during hearing aid fitting, orientation and aural rehabilitation. Hearing aid satisfaction and hearing aid handling skills are discussed in depth. This chapter concludes with a discussion of international research findings related to the link between satisfaction and hearing aid handling skills.

The research methodology is presented in chapter 3. The chapter commences with the research aims followed by the research design and context of the study. A description of the participants is followed by a review of the measures and equipment utilised. The chapter concludes with the data collection procedures, ethical considerations, reliability and validity and finally the statistical analysis procedures.

Chapter 4 provides a detailed overview of the results obtained during the study. The results are critically discussed in relation to the research aims.

Chapter 5 provides concluding statements related to the current study. The chapter includes a summary of the findings of the study. This is followed by a critical evaluation of the study. The chapter concludes with the implications and recommendations for future research.

Included in the appendices are the tools used in the study. This supplies important information for the understanding of the data collection and analysis procedure, and replication of the study.

Chapter 2: Literature review

Introduction

This chapter provides an overview of the literature relevant to the study. The literature review focuses on hearing loss, the impact of hearing loss on quality of life and functioning, and disability. Hearing aids and the procedure of fitting a hearing aid is discussed, highlighting the challenges faced in South Africa. Satisfaction is considered and the tools used to evaluate hearing aid satisfaction. Dexterity and hearing aid handling skills are outlined and the tools used to evaluate these skills. Finally the research linking hearing aid satisfaction and hearing aid handling skills is reviewed.

Hearing loss

Hearing loss is defined as the decreased ability or the inability to hear sounds in one or both ears (Dugan, 2003; Kreisman et al., 2014). In adults hearing loss becomes significant if the loss is greater than 40 dBHL in the better hearing ear (World Health Organization [WHO], 2014).

Hearing loss is one of the most prevalent disabilities affecting older adults. In 2000, it was reported that 250 million individuals suffered from hearing loss (Mathers, Smith & Concha, 2000). Over the past decade this number has increased significantly to 360 million people now presenting with hearing loss worldwide (WHO, 2014). Adults constitute 91% of the people with hearing loss with one-third being older than 65 years of age (WHO, 2014; Peer, 2015). The majority of people with hearing loss live in low- middle income countries in the developing world. In Sub-Saharan Africa, 30 million adults are reported to have a disabling hearing loss (Peer, 2015).

Classification of hearing loss

Hearing loss is classified in terms of the type, degree, configuration and laterality of the loss (Roeser et al., 2007). The presentation of the hearing loss plays a major role in the management of thereof, especially in the selection of an amplification device such as a hearing aid (Dillon, 2012). Individuals with a pure tone average (PTA) of 0-25 dB are considered to have hearing within normal limits. Individuals who present with all other degrees of hearing loss should receive intervention.

There are various classifications of the degree of hearing loss (WHO, 2014; Silverman & Silverman, 1993; Kreisman et al., 2014). The different degrees of hearing loss in relation to the PTA

are outlined in Table 1. This table further highlights the difficulties which would be experienced by individuals if a hearing loss has been identified.

Grades 2, 3 and 4 are classified by the WHO (2014) as a disabling hearing loss and will require intervention by an audiologist and/or ear, nose and throat (ENT) specialist. Generally hearing aids are recommended for patients presenting with disabling hearing loss.

Table 1: Classification of hearing loss

WHO, 2014	Katz, 2014	PTA	Associated difficulties
0 - No impairment	Hearing within normal limits	25 dB or better (better ear)	Individuals with grade 0 impairment will be able to hear whispers and very soft speech with no or slight difficulty (Roeser et al., 2007; Kreisman et al., 2014).
1 - Slight impairment	Mild hearing loss	26-40 dB (better ear)	Individuals with this degree of hearing loss are unable to hear pure tones below 25 dB (Kreisman et al., 2014; WHO, 2014). They will be able to hear and repeat words spoken in regular or typical voice volume at distance of approximately 1 metre. Individuals with a mild hearing loss may experience difficulties hearing soft consonants such as /f/, /v/, /sh/ and /s/ (Roeser et al., 2007).
2 - Moderate impairment*	Moderate hearing loss	41-60 dB (better ear)	The person would be able to hear and repeat words spoken in raised voice at 1 metre (Kreisman et al., 2014; WHO, 2014). No vowel or consonants would be heard at an ordinary level or whisper for individuals with this degree of hearing loss (Roeser et al., 2007).
3 - Severe impairment	Severe hearing loss	61-80 dB (better ear)	Individuals with a severe hearing loss are able to hear only selected words when shouted into better ear (WHO, 2014)
4 - Profound impairment including deafness	Profound hearing loss	81 dB or greater (better ear)	An individual with a profound hearing loss will have difficulties hearing loud sounds such as trucks, lawnmowers and dogs barking (Roeser et al., 2007). They will also be unable to hear speech even when the communication partner raises their voice (WHO, 2014). Individuals with a profound hearing loss may have different goals for hearing aids in that the aim may not be to discriminate speech sounds but rather to amplify environmental sounds for safety and security (Dillon, 2012).

*Silverman and Silverman (1993) expanded to include a moderate-severe classification where thresholds are between 56 – 70 dB, while Katz (2014) and the WHO (2014) classify the next level of hearing impairment as 61 – 80 dB. This level of impairment can be classified as a severe hearing loss or grade 3 (Kreisman et al., 2014; WHO, 2014; Roeser et al., 2007).

Hearing loss may further be classified in terms of the symmetry of the loss. The hearing loss may be symmetrical or asymmetrical, this refers to the difference between the two ears. If a minimal difference is noted then the hearing loss is described as symmetrical (ASHA, asha.org, 2015). Hearing loss may be asymmetrical or only affecting one ear. Thus description of hearing loss may be required for each ear individually. Unilateral hearing loss affects one ear which tends to be less common than a bilateral hearing loss wherein both ears are affected (ASHA, asha.org, 2015).

Impact of Hearing loss

International Classification of Functioning, Disability and Health

The International Classification of Functioning, Disability and Health (ICF) were developed to better describe the level of impairment as a result of disability (WHO, 2014). The ICF proposes that an individual's disability is not only what can be defined medically but also the lifestyle factors (WHO, 2001).

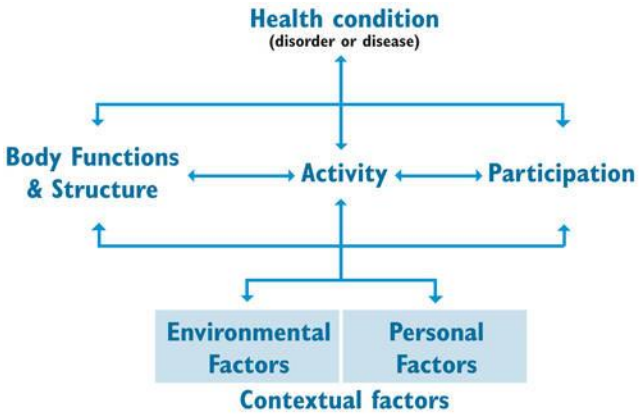

Figure 1: The ICF model (WHO, 2001).

The ICF combines the social and biomedical models of functioning (WHO, 2001). The focus is on individuals' ability to participate in social contexts, activities of daily living and how this is affected by the hearing loss.

The ICF aims to ensure a true reflection of each individual is incorporated into their medical management not only the disability. This is achieved by exploring the limitations on individuals' functioning from their disability as well as the impact of personal factors both positive and negative (WHO, 2001). The ICF views the interactions of the domains as dynamic, thus all domains have an amalgamating effect on each other. The emphasis of the ICF is on the individuals' functioning rather than the health condition (WHO, 2001).

In terms of hearing loss, individuals seek assistance when hearing loss is noted to have a negative impact on their daily lives and on the lives of their families (Hickson & Scarinci, 2007). It is frequently reported that individuals with hearing loss have difficulty understanding speech in noisy environments as well as over the telephone (Hickson & Scarinci, 2007). The ICF takes the environmental factors into account and considers the resulting feelings of the individual (WHO, 2001). The individual may begin to feel left out and socially with-draw from situations (Hickson & Scarinci, 2007). This difficulty cannot be accounted for based on the description of hearing loss in isolation.

Individuals have been noted to become isolated as a direct result of their hearing loss (Karpa, Gopinath, Beath. et al., 2010). Applying the ICF to hearing loss allows the audiologist and patient to account for all aspects of the disability. Aspects of the disability are considered at the levels of the body, activity and participation as well as the environmental and personal factors which create facilitators or barriers (Hickson & Scarinci, 2007). Generally, as the hearing loss itself cannot be reversed the use of the ICF aims to determine the day to day effects of the hearing loss on the individual and his / her family. The ICF allows for improved understanding of how disability affects quality of life (QoL).

Quality of Life

QoL can be described as an individual's self-reported evaluation of their life experience and perception of autonomy, purpose and independence (Boothroyd, 2007). There is not a universal definition of health-related QoL. However, research has shown that health-related QoL also include physical aspects but also psychological, social interaction and economic/vocational aspects (WHO, 2001; Abrams, Chisolm, & McArdle, 2012). Health related QoL is typically determined by making use of questionnaires relating to the disease or disability (Abrams et al., 2012; Knudsen, Oberg, Nielson. et al., 2010).

Several studies have investigated the impact of an untreated hearing loss on QoL (Kochkin, 2012; Dugan, 2003; Ham, Bunn & Meyer, 2014; Harris et al., 2011; Knudsen et al., 2013). Hearing loss has been associated with mood disorders including anxiety and depression as well as health related issues, such as increased mortality rates (McCormack & Fortnum, 2013; Karpa et al., 2010). The QoL of individuals with hearing loss can be improved with appropriate intervention.

Individuals seek assistance when they feel their hearing loss limits their social activities. Hearing loss often occurs gradually thus the individual may only see an audiologist once their QoL has already been significantly impacted (Tsakiropoulou, Konstantindis, Konstanantinidou et al., 2007).

Hearing aids have been noted to significantly improve the individuals' QoL when fitted and worn appropriately. Research has shown that providing an individual with a hearing aid can assist in improving individuals' communication abilities and their perception of intimacy, warmth, emotional stability, sense of control over their life mental functioning as well as physical health (Kochkin, 2012) (Dalton, Cruickshanks & Klein et al., 2003). Hearing aids can positively impact on an individual's financial situation, communication abilities, relationships with family members, ease in communicating in social situations, emotional stability, perception of mental functioning and overall

health (Dalton, et al., 2003). Thus hearing aids can assist in improving QoL (Dalton, et al., 2003; Hickson & Meyer, 2014; WHO, 2001).

Intervention for Hearing Loss

The intervention for hearing loss depends on the nature and degree of the loss. If the hearing loss is permanent and cannot be resolved though medical intervention, an audiologist will determine the patients' hearing aid candidacy (Dillon, 2012; Roeser et al., 2007). Audiological intervention for permanent hearing loss typically involves hearing aid fitting (including verification and validation of the fitting as well as hearing aid orientation) and then aural rehabilitation (AR).

Hearing aids

Hearing aids are fitted to patients who present with a hearing loss. Hearing aids do not resolve the underlying cause of the hearing loss however they allow for the sounds to be amplified to an audible level for the person with a hearing loss (ASHA, 2015; Kochkin, 2012). Hearing aids decrease auditory deprivation which results from the long term inability to hear sound (Dillon, 2012; Lena, Wong, Hickson et al., 2003). The goal of a hearing aid fitting is to attempt to maximize the patients' hearing potential (Tye-Murray, 2014).

The technological capabilities of hearing aids have advanced significantly since the introduction of digital hearing aids (Edwards, 2007). Digital hearing aids allow for flexible programming as it can be programmed according to each individual's specific hearing loss and preferred settings (Federal Drug Administration [FDA], 2014).

Many factors need to be considered in the selection of a hearing aid. Some of these factors include; degree and type of hearing loss, individual's age, and lifestyle (Knudsen et al., 2010).

Degree of hearing loss. Individuals with mild to profound degree of hearing loss are all considered candidates for hearing aids (Dillon, 2012). Digital hearing aids are able to fit a wide range of hearing loss and can be programmed to a level which is appropriate for the patient's hearing loss (Tye-Murray, 2014). The style of hearing aid will be affected by the degree of hearing loss. If an individual presents with a profound hearing loss they will more likely be fitted with a behind the ear (BTE) hearing aid. The receiver of the hearing aid determines the maximum power output of the hearing aid thus a larger receiver will be able to provide higher outputs (FDA, 2014). In the ear (ITE) style hearing aids, due to space constraints, can thus not be fitted in patients' with profound hearing loss. Patients should be counselled on the reason for selection of a particular style of hearing aid as the appearance of the hearing aid is considered as an important aspect which can affect satisfaction (Dillon, 2012; Cox & Alexander, 2001)

Type of hearing loss. The type of hearing loss does not affect candidacy as patients with all types of hearing loss can benefit from hearing amplification. The type of hearing loss will however have an impact on the style of hearing aid (WHO, 2014). Patients with conductive hearing loss due to chronic otitis media with effusion will, for example, not be appropriate candidates for a hearing aid which occludes the ear (Dillon, 2012). In these cases a bone conduction (BC) hearing aid may be most appropriate. The appearance of BC hearing aids is significantly different to BTE and ITE hearing aids as it is much more visible. It may thus not meet the patient's initial expectations of a hearing aid and may indirectly affect the satisfaction with the hearing aid (Cox & Alexander, 2001). This is an example of an area where counselling is essential for the individual prior to being fitted with a hearing aid.

Age. The age of the patient fitted with a hearing aid is an important consideration in the selection of hearing aid. There is often a deterioration of the sensory, musculoskeletal, vascular and nervous systems in humans as they age (Carmeli, Patish, & Coleman, 2003). Musculoskeletal difficulties often arise in the form of arthritis. This often results in poor manual dexterity. This coupled with possible deteriorating eyesight may impact on an individual's ability to correctly insert, manipulate and remove the hearing aid (Kumar, Hickey & Shaw, 2000; ASHA, 2015). As a result older adults may also require a more automated hearing aid which does not needs as much manual manipulation to adjust programmes and volume control of the hearing aid.

Lifestyle demands. The lifestyle demands of the individual is an important consideration in the selection of hearing aids (Dillon, 2012; Tye-Murray, 2014).

Hearing aid fitting and orientation

An integral step in the intervention process is hearing aid fitting and orientation. The hearing aid fitting is an essential phase in the audiological management of hearing loss. If not conducted appropriately the hearing aid becomes useless to the individual (Martin & Harris, 2011). The importance of following a patient-centred approach during the fitting process cannot be underestimated (Tye-Murray, 2014). The hearing aid should be set at levels which are identified through shared decision making and joint goal setting (ASHA, Type, degree, and configuration of hearing loss, 2015). The fitting should then be verified and validated using accepted protocols.

Hearing aid orientation (HAO) is the process during which the patient learns how to use and care for their hearing aid. The information typically provided during these sessions includes the use, care, troubleshooting tips, expectations and limitations of the hearing aid (Reese & Hnath Chisolm, 2005). The audiologist also includes discussions regarding hearing aid landmarks, batteries, and hearing aid cleaning (Tye-Murray, 2014; de Andrade, 2016). The audiologist trains the individual on

how to insert and remove their hearing aid, change hearing aid batteries as well as adjust programme or volume controls where necessary (Tye-Murray, 2014). Frequently overlooked goals of a HAO include review and practice use of telephone, assistive devices, visual cues and supplementary listening strategies (Tye-Murray, 2014). The audiologist typically spends 20 minutes conducting the HAO session with an individual (Reese & Hnath Chisolm, 2005). HPCSA guidelines refer to the importance of training the patient on tasks relating to hearing aid handling such as inserting and removing the hearing aid / ear mould as well as manipulation of volume controls and programme switches (de Andrade, 2016).

Aural Rehabilitation

The goal of aural rehabilitation (AR) is to attempt to minimize the residual difficulty experienced by individuals (Tye-Murray, 2014). Four facilitation strategies are usually implemented to minimize if problems are experienced with the hearing aid. These include strategies that influence: (i) interacting with a communication partner; (ii) the way the message is received; (iii) the communication environment, and (iv) altering factors within the individuals themselves, where possible (Tye-Murray, 2014).

Research has proven the efficacy of AR (Dillon, 2012; Reese & Hnath Chisolm, 2005; Tye-Murray, 2014). Most notably AR can significantly improve the patients' satisfaction with their hearing aid. AR is most beneficial to individuals who experience difficulty adjusting to the new sound quality as well as those who have difficulty hearing in noise. AR assists in addressing unrealistic expectations as well as counseling for individuals who present with poor speech discrimination abilities (Tye-Murray, 2014).

Challenges associated with hearing fitting, orientation and aural rehabilitation

Various challenges have been identified with regard to hearing aid fitting and orientation, including access to hearing aids, poor attendance of hearing aid follow-up appointments, and understanding and retention of information provided during the fitting and orientation process.

Hearing aids are expensive devices. Access to hearing aids in low and middle income countries such as South Africa is often limited. This is mostly due to the fact that private health care in these countries is unaffordable (Harris, Goudgea, Atagubab, et al., 2011). This is also true for South Africa as 86% of the population only access public health care facilities for health care (Peer, 2015).

In South Africa funds for the provisioning of assistive devices (including hearing aids) in the South African public health care sector remains a problem (Sooful, 2007). The demand for assistive devices outweighs the budget allocation to the government institutions in South Africa. In 2002, the hearing aid waiting lists at Gauteng provincial hospitals were approximately 48 individuals per hospital (Wansbury, 2002). These waiting lists resulted in extending the period between identification of the hearing loss and hearing aid fitting with often up to 12 months (Sooful, 2007). In addition to limited funds for the provisioning of hearing aids and long waiting lists the attendance of hearing aid follow-up appointments impact on the success of the amplification.

Although some degree of hearing aid fine turning is conducted immediately after the hearing aid fitting, patients are encouraged to wear the hearing aid for a few weeks to determine if further hearing aid adjustment is necessary (Tye-Murray, 2014). During the follow-up sessions, the patient describes the difficulties experienced in the various environments to the audiologist (Dillon, et al., 2006). It has been reported that patients fitted with hearing aids in public health hospitals in South Africa frequently do not return for these appointments unless they experience problems with the hearing aid (Sooful, 2007; Wansbury, 2002). Some of the reasons for the poor follow-up included travelling distance and transport costs.

In South Africa, audiology services are mostly offered at secondary- and tertiary level public hospitals. For the majority of patients accessing public health care these facilities are often not conveniently located. Although the cost of hearing aids are subsidised for these patients, travelling costs and associated expenses are not covered. Vast travelling distances and high costs of transport often impacts on the regularity and ability to attend appointments at hospitals (Sooful, 2007). Patients also report that they frequently have to miss an entire day of work to attend services (Harris, et al., 2011; Wansbury, 2002). Not attending follow-up appointments may negatively impact of the patients' hearing aid experience.

Research suggests that information provided by health care practitioners is frequently not as effectively retained by individuals as expected (Margolis, 2004). This is also true in regards to hearing aid information (Desjardins & Doherty, 2009). A South African study found a mismatch between the information provided by the audiologist following an audiological examination and what the patient retained (Watermeyer, Kanji, & Mlambo, 2015). It is suggested that approximately half of the information provided by healthcare providers is not retained (Margolis, 2004). Research has found that elderly individuals only recall 25% of information given via verbal means only (Jansen, Van Weert, Van der Meulen et al., 2008).

International studies reported that patients are able to recall 80% of information provided during the hearing aid orientation session if the information is provided in their first language (Knudsen et al., 2010; Turner, Humes, Bentler et al., 1996; Margolis, 2004).

South Africa is unique in that there are 11 official languages (Sooful, 2007). The majority of audiologists working in the public health care sector are however mainly English and Afrikaans speaking, while their clients are mainly first language speakers of indigenous Black African Languages (Louw & Avenant, 2002; Sooful, 2007). In 2002, less than 1% of qualified audiologists were able to fluently speak an indigenous Black African Language (Sooful, 2007). Since 2002, there has been an increase in the number of audiologists whose first language is one of the indigenous Black African languages. Despite this increase in African language speaking audiologists, the majority of patients accessing audiology services at public health centres still do not receive information on hearing aid use, handling and maintenance in their first language. In an attempt to facilitate understanding of information provided, audiologists are forced to use untrained interpreters such as family members, other hospital staff (cleaners or nurses) or other individuals (Sooful, 2007). Untrained interpreters convey incorrect information due to their limited experience with hearing aids (Evans, 2011; Sooful, 2007).

Watermeyer et al, 2015 noted that language barriers are a factor in information retention however this is a complex process which is also impacted by the patient centred approach of the health care practitioner (Watermeyer et al., 2015). This study also noted that poor retention of information may result in decreased patient acceptance and adherence to treatment (Watermeyer et al., 2015).

Standard practise in audiology includes giving patients written information (e.g. pamphlet, booklet or manual) that outlines the information provided during the HAO session (Dillon, 2012; ASHA, 2015). In South Africa, written health information is generally provided in English, at times Afrikaans (Sooful, 2007). Literacy levels in the South Africa are reported to be low (White, 2004) as one in every six (40%) South Africans are functionally illiterate (Rule, 2002). This was confirmed by the Census (2011) that reported that 25.5% of the South African population have no schooling or primary schooling as their highest level of education. Low levels of functional health literacy, or the capability to read, comprehend and implement medical information (Andrus & Roth, 2002) result in individuals not benefitting from the written information provided. Illiterate patients must rely solely on the information provided verbally during the hearing aid orientation. Limited retention of information may significantly impact on the benefit received from the hearing aid, as well as satisfaction with amplification.

Hearing aid use

Despite technological advances in hearing aids, usage continues to be low (McCormack & Fortnum, 2013). A large scale study amongst adults with hearing loss (*N* = 1629) reported that only 15% of adults with hearing impairment use hearing aids (Popelka, et al., 1998). A systematic review of the literature confirms these findings. It was found that between 4.7% and 40% of individuals who have a hearing aid do not wear it regularly (Knudsen et al.,2010; Natalizia, Casale, Guglielmelli, et al., 2010; McCormack & Fortnum, 2013).

Non-use of hearing aids is a great concern for audiologists and may be linked to satisfaction with their hearing aids. Research has explored the reasons for non-use of hearing aids (Hickson & Meyer, 2014; Kochkin, 1993; Popelka, et al., 1998).

Systematic review of the literature conducted by McCormack and Fortnum (2013) reported some reasons for non-use of hearing aids. Reasons included that patients (i) presented with dexterity difficulties; (ii) needed help to insert their hearing aid; and (iii) the hearing aids did not work appropriately. Hearing aids are frequently rejected due to reasons which could be resolved with further training in the use of the hearing aid (Gianopoulos et al., 2002). These findings are supported by studies conducted in developing countries (Freeborough, 2014; Campos et al., 2014). A recent study conducted in rural South Africa noted that only 48% of participants were able to fit their hearing aids independently and 41% of ear moulds were not being cleaned appropriately (Freeborough, 2014). A South American study focusing on individuals in public health care setting noted that only 70% of individuals were able to insert their hearing aid into their ear correctly, while only 20% were able to display correct telephone usage with their hearing aid (Campos et al., 2014).

Individuals who experience difficulty manipulating their hearing aids perceive less benefit and are less satisfied with their hearing aids (Desjardins & Doherty, 2009). In addition, research found that Individuals who experience difficulty manipulating their hearing aids also report decreased use of their hearing aid (Doherty & Desjardins, 2012).

Reported reasons for non-use can be summarized to include audiological and extra audiological factors. Audiological factors include type, degree, configuration and laterality of hearing loss (ASHA, Type, degree, and configuration of hearing loss, 2015). Extra audiological factors have been noted to include; age, gender, stigma of hearing aids, hearing aid value, individual not feeling their hearing loss is significant enough to warrant hearing aids, perceptions that hearing aids are uncomfortable or do not work well, fit and comfort of the hearing aid, feelings that hearing aids are not effective in improving hearing difficulties, cost factors and health care professionals attitudes (Kochkin, 1993; McCormack & Fortnum, 2013).

More recent studies have not indicated changes in the reasons for non-use (Hickson & Meyer, 2014) identified additional key factors such as; attitude towards hearing aids, degree of hearing loss, self-perceived hearing difficulties, problems with user guides, therapeutic relationship with the audiologist, visual difficulties and the individuals' familiarity with advanced technology such as mobile phones (Hickson & Meyer, 2014; Ham et al., 2014).

Satisfaction with Hearing Amplification

Satisfaction is a challenging concept to define (Giese & Cote, 2000). Three main components have been identified in the definition of satisfaction, namely that satisfaction is an emotional and cognitive response, which relates to a specific focus (either on an expectation, product, consumption or experience) and the response refers to the reaction at a specific time (Giese & Cote, 2000).

Due to the complex nature of the definition of satisfaction it becomes difficult to quantify satisfaction with hearing aids (Cox & Alexander, 2001). The common features of tools to quantify satisfaction with hearing aids include hearing aid use and benefit, overall improvement in terms of quality of life related to the hearing aid, impact on caregivers and communication partners, activity limitations, audiological services and the feelings related to the cost of the hearing aid as well as negative and positive features of the hearing aid (McCormack & Fortnum, 2013; Hickson & Meyer, 2014; Cox & Alexander, 2001).

Many studies have been conducted to determine hearing aid satisfaction and hearing aid benefit (Desjardins & Doherty, 2009; Ham et al., 2014; Lupsakko, 2005; Popelka, et al., 1998; Cox & Alexander, 2001; Desjardins & Doherty, 2009; Hosford-Dunn & Halpern, 2001). Satisfaction is an essential factor in the hearing aid fitting process. Patients who are satisfied are often more frequent hearing aid users. Satisfied patients frequently encourage other individuals with hearing loss to seek assistance and improve their own QoL (Wong et al., 2003). Satisfaction is thus frequently investigated as an outcomes measure of audiology (Cox & Alexander, 2001; Dillon, 2012; Wong et al., 2003)

Self-report questionnaires are used in conjunction with objective measures to quantify perceived hearing aid benefit and satisfaction (Turner et al., 1996; Newman, 1993).

There are a large number of self-report measures available to measure satisfaction (Knudsen et al., 2010). Some of these measures are the: (i) The International Outcomes Inventory (IOI) (Cox & Alexander, 2003); (ii) Hearing handicap Inventory (HHI) (Ventry & Weinstein, 1982); (iii) Hearing Handicap Inventory for the Elderly (HHIE) (Ventry & Weinstein, 1982); (iv) Abbreviated Profile of Hearing Aid Benefit (APHAB) (Cox & Alexander, 1995); (v) Hearing Aid Users' Questionnaire (HAUQ)

(Brian, 2007), and the (vi) Satisfaction with Amplification in Daily Life (SADL) (Cox & Alexander, 2001).

The applicability of self-report questionnaires in the South African Context has not been sufficiently investigated. Pienaar, Steam and Swanepoel (2010) investigated the international outcomes inventory – hearing aids (IOI-HA) and validated this measure for the South African Context. The IOI-HA was developed by Cox and Alexander (2003), who were also responsible for the development of the SADL (Cox & Alexander, 2001). The SADL has been indicated as the gold standard when aiming to measure the individuals' satisfaction with their hearing aid (Uriarte, Denzin, & Dunstan, 2005). The SADL displays good internal validity as well as construct validity (Cox & Alexander, 2001). The SADL has fifteen questions in total, each with seven possible answers. The SADL divides satisfaction into four sub-variables including; (i) positive effect, (ii) services and cost, (iii) negative features, and (iv) personal image. A global score is calculated based on these four areas (Cox & Alexander, 2001).

Positive effect questions, in the SADL, are related to the perceived improvement in quality of life of the individual fitted with the hearing aid (e.g. Do you think your hearing aids are worth the trouble?). Services and cost related to the assistance received from the audiologist and institution, as well as the cost of the hearing aid (e.g. How competent was the person who provided you with your hearing aid; Does the cost of your hearing aid seems reasonable to you?). Questions related to the negative features deals with the residual difficulties experienced by individuals in spite of wearing a hearing aid (e.g. Are you frustrated when your hearing aids pick up sounds that keep you from hearing what you want to hear?). Finally, personal image questions are posed to determine the role and impact of the hearing aid on personal image (e.g. Do you think people notice your hearing loss more when you wear your hearing aid?) (Cox & Alexander, 2001).

The SADL has been found to be a reliable and valid tool for use the South African population, as the difference between scores obtained in South Africa and other studies conducted internationally was not statistically significant (Vlok, 2014). The SADL was used in rural South Africa to determine satisfaction with amplification fitted during a hearing aid mission (Vlok, 2014). In this study, a mean global score of 4.99 (*SD* = 0.73, range = 3.21 - 6.15) was reported which is indicative of considerable satisfaction levels, similar to those found in other international studies (Vlok, 2014).

Hearing Aid Handling Skills

Research using the hearing aid to evaluate dexterity for hearing aid handling indicates that individuals who experience difficulty manipulating and managing their hearing aids perceive less benefit and are less satisfied with their hearing aids (Doherty & Desjardins, 2012). Individuals who

experience difficulty manipulating their hearing aids also report less use of their hearing aid (Doherty & Desjardins, 2012). Adequate finger dexterity is required for the effective of manipulation of hearing aids. Finger dexterity is defined as the ability to skilfully and rapidly perform controlled movements of small objects (Allan, 2015). Rotatory movements are required to manipulate a hearing aid, open the battery door and clean the hearing aid (Dillon, 2012). It is well-known that the natural aging process results in the deterioration of the sensory, musculoskeletal, vascular and nervous systems in humans (Carmeli et al., 2003). In addition to the increased prevalence of hearing loss (Agrawal et al., 2008; WHO, 2014), there is a decrease in functional movements of the hands (Carmeli et al., 2003; Martin, Ramsey, Hughes et al., 2015). Finger dexterity may thus decrease with age, particularly in individuals over the age of 65 years (Carmeli et al., 2003).

There is some disagreement with regard to the effect of finger dexterity on the handling of hearing aids. There are a number of studies that reported a correlation between dexterity and effective hearing aid use (Allan, 2015; Campos et al., 2014). Individuals with manual dexterity problems reported decreased use of the hearing aid (Campos et al., 2014). A correlation was noted by Allan (2015) between manual dexterity and satisfaction and between hearing aid performance and satisfaction. There was also significant correlation between manual dexterity and success with the hearing aid. It was noted that fine finger dexterity was a factor to be considered when selecting the style of hearing aid to be prescribed.

Hickson and Meyer (2014) however did not find a correlation between dexterity and effective hearing aid handling skills. Only a small percentage of participants were noted to report dexterity as a factor for non-use of hearing aids. This study reported that 11% of the participants noted difficulty handling their hearing aids as a factor and 7% reported they were unable to adjust their hearing aid.

Contrasting results such as these may be explained by the different tools used in the assessment of hearing aid handling skills. There are a number of tools that have been used to assess dexterity for handling hearing aids such as the Purdue Pegboard Test (Allan, 2015; Kumar, Hickey, & Shaw, 2000) and the Practical Hearing Aid Skills Test – Revised (PHAST-R) (Campos et al., 2014; Desjardins & Doherty, 2009).

The Purdue Pegboard test, a timed measure, is used to assess finger dexterity for individuals entering industrial work (Amirjani, Ashworth, Olsen et al., 2011). The dexterity is measured for each hand individually as well as both hands together (Allan, 2015). The test requires the individual to move and place small pegs in exact openings for their size (Kumar et al., 2000). Although a measure of dexterity, the pegboard test does not measure the correct movements required for hearing aid

manipulation. The finger and hand movement required for placing pegs into a board is different to those which are required to manipulate a hearing aid.

The Practical Hearing Aid Skills Test – Revised (PHAST-R) version is an objective test which assesses the individuals' ability to perform everyday tasks with their own hearing aid. The individual is required to complete every day handling skills such as opening the battery door, cleaning the hearing aid, and inserting and removing the hearing aid (Doherty & Desjardins, 2012). The PHAST-R is a clinically relevant tool in that it allows for an accurate, valid and quick assessment of the patients' ability to handle their hearing aid.

Client feedback regarding their ability to use and manipulate their hearing aid is often not reliable (Campos et al., 2014). Research has found that a large percentage of individuals who report that they can appropriately operate their hearing aids are not able to manipulate their hearing aids appropriately (Desjardins & Doherty, 2009; Campos et al., 2014). In a recent study, 96% of the participants reported that they had no difficulties in the use of their hearing aid. However when asked to manipulate their hearing aids only 48% were able to do so (Campos et al., 2014). This indicates that self-report questionnaires alone are not effective in the assessment of individuals' hearing aid handling skills. The PHAST-R can be used by audiologists as a tool to verify that the individual has grasped and understood all the important information from the HAO. Areas of weakness are identified immediately and the audiologist can re-counsel the individual where necessary (Desjardins & Doherty, 2009).

Campos et al. (2014) used the PHAST-R tool to identify the differences in individual handling skills between new and experienced hearing aid users. It was found that 43% of new hearing aid users presented with poor handling skills. Skills improved over time as only 32% of experienced users presented with poor handling skills. Qualitative analysis revealed that individuals had greatest difficulty with adjusting volume control and telephone usage. They further found no significant difference between groups in terms of age, schooling, socioeconomic status, hearing threshold and type of hearing aid.

Relationship between hearing aid handling skills and satisfaction

Many studies have focused on assessing individuals' hearing aid handling skills (Desjardins & Doherty, 2009; Doherty & Desjardins, 2012; Knudsen et al., 2010; Campos et al., 2014). Some of these studies have included individuals' satisfaction with amplification (Campos et al., 2014).

In a recent study, Campos et al. (2014) investigated the relationship between hearing aid handling skills and individual satisfaction using the PHAST-R, IOI-HA, hearing handicap inventory – adults (HHIA) and hearing handicap inventory – elderly (HHIE). The sample comprised 74 Brazilian

adults divided into two groups, new hearing aid users and experienced hearing aid users, with similar mean age and hearing loss. Individuals who presented with visual, dexterity and cognitive difficulties were not included in the study. Results from the IOI-HA indicated that the use of hearing aids had a positive impact on the alleviating the social and emotional disadvantages experienced prior to being fitted with hearing aids (Campos et al., 2014). There was a significant positive correlation between benefit and hearing aid usage (Campos et al., 2014). No significant correlation was found between HHIA, HHIE and the PHAST-R. Contrary to the Campos et al. (2014) study, Desjardins and Doherty (2009) found no correlation between PHAST results and measures of self-reported benefit.

There is limited information regarding the relationship between handling skills and satisfaction using the PHAST-R and the SADL especially in the South African context.

In order to identify the predictors for effective use and satisfaction with a hearing aids provided for individuals in the public health care setting, this study posed the following research questions: (i) How skilled are individuals fitted with hearing aids in manipulating their hearing aids?; (ii) How satisfied are individuals with their hearing aids; and (iii) What is the relationship between individuals' ability to manipulate their hearing aids and their self-perceived satisfaction with the hearing aids?

Chapter 3: Methodology

Introduction

This chapter provides a detailed discussion of the methodology employed for this study. The chapter commences with the research aims followed by the research design and context of the study. A description of the participants is followed by a review of the measuring instruments utilised. The chapter concludes with the data collection procedures, ethical considerations, reliability and validity, and finally the statistical analysis procedures.

Research aims

Main aim

The main aim of the study was to determine the relationship between the ability to manipulate hearing aids and self-perceived satisfaction with hearing aids in individuals fitted with hearing aids in a public health care sector hospital.

Sub-aims

The main aim was achieved with the following sub aims:

- To determine the ability of individuals to manipulate their hearing aids.
- To compare PHAST-R scores obtained in the current study to the norms provided by Desjardins and Doherty (2009) as well as more recent studies.
- To determine the self-perceived satisfaction with hearing aids in terms of the positive effects, negative features, personal image as well as the costs and services.
- To compare the SADL scores obtained in the current study to the norms provided by Cox and Alexander (1999) as well as more recent studies.
- To identify audiological and extra audiological factors which affect participants' hearing aid handling skills and their satisfaction with hearing aids.

Research Design

A quantitative, non-experimental, cross-sectional correlational research design was employed for the purpose of the study.

Quantitative research allows for an objective approach to data collection (Kumar, 2011). A systematic process was used for the analysis of data in numerical form to assist in identifying cause

and effect relationships (Gravetter & Forzano, 2003). Closed-set response options available to participants assisted in reducing researcher bias (Cresswell, 2003).

In non-experimental research, the main purpose is observation. There is thus no control over variables and the researcher aims to comment on the phenomena studied without altering the variables (Miles, Huberman, & Saldana, 2014). Cross sectional research allows for the collection of data at a specific point in time (Gravetter & Forzano, 2003). It is observational in nature and the particular research environment is not manipulated (Kumar, 2011). Participants in this study were assessed at a specific point in time in terms of their hearing aid handling skills in addition to determining their perceived benefit from amplification.

A correlational design allows the researcher the ability to find correlation between the variables studied (Gravetter & Forzano, 2003). In the current study, the relationship between the ability to manipulate hearing aid (using the PHAST-R) and the perceived satisfaction (using the SADL) were studied. Using a correlational design restricts information to that which was included in the tools of the research and thus by its nature excludes additional input.

The advantages of using a non-experimental, cross-sectional research design in this study are that variables were studied and identified as they exist within the public health care setting. This allowed for the researcher to identify current strengths and weaknesses of practises and thus suggest necessary changes to the hearing aid orientation in future.

Context

The research was conducted at the Helen Joseph Hospital (HJH) Complex in central Johannesburg, Gauteng. This tertiary level public hospital has a well-established audiology department. On average the HJH Audiology department conducts ten hearing aid fittings per month. Only digital hearing aids available on tender[1] are fitted to patients.

The audiologists at HJH report spending an average of 30 to 40 minutes with a patient during the hearing aid fitting and orientation session. The objective of the session is to assist the patient with maximum retention of information through the practical orientation to their hearing aids as well as the use of handouts outlining all aspects covered during the session. Two English handouts are provided to patients during the session, namely a hospital-developed document titled "Hearing

[1] A tender is a document whereby service providers have put forward their hearing aids to be procured by public health care service providers. The RT274-2012 tender relates to supply and delivery of hearing aids to the state (The National Treasury, 2015)

Aid Information" (Appendix A) as well as a brand-specific hearing aid booklet with extensive information on hearing aid use and care.

The audiology department also offers the patient follow-up sessions where the information provided during the hearing aid fitting session is recapped and more information (if required) is provided. Typically, the follow-up session includes information on telephone use, problem solving and troubleshooting as well as aural rehabilitation. The uptake however is poor, as only 30 - 40% of patients fitted with hearing aids return for these appointments.

Participant Selection and Description

Sampling strategy

A non-probability sampling strategy, purposive sampling, was used for this study. With non-probability sampling, the probability of selecting a participant from a population is unknown (Leedy & Ormrod, 2013). Participants were purposively selected so as to recruit as many participants meeting the participant criteria as possible (Cresswell, 2003). This sampling method had the benefit of convenience, but as the researcher only investigated the hearing aid handling skills and satisfaction with amplification at the one site, generalisability of the results to other contexts may suffer.

Inclusion and exclusion criteria

Participants had to meet specific selection criteria to be included in the study (See Tables 2 and 3).

Table 2: Participant inclusion criteria

Criteria	Rationale	Method
Proficient in English	To ensure that reliability results were not negatively affected by a limited understanding of the English language, only participants who were proficient in English were included in this study.	This was determined subjectively. The researcher confirmed language proficiency at the initial visit through conversational interaction. Participants were asked if they were comfortable communicating in English however English did not need to be the participants first language.
Adults older than 18 years of age	Patients had to provide informed consent to participate in the study.	Patients over the age of 18 were contacted and provided with the opportunity to participate in this study. The patient age was determined using the patients' date of birth as recorded in the audiological records and confirmed with the patient verbally.
Any level of education	Level of education relates to literacy levels of the participants. South Africa presents with low literacy levels. The 2011 Census reported that 25.5% of the South African population have no schooling, or primary schooling as their highest level of education (White, 2004).Standard practise in audiology specifies that the audiologist should provide a pamphlet or manual outlining the information on hearing aid orientation (ASHA, 2015; Dillon, 2012). The impact of literacy on hearing aid use and care has not yet been determined in the South African context.	Participants' educational history was obtained during the informed consent process. Illiterate participants were assisted by the researcher or research assistants to complete the demographic information and measures.
Patients who are tested and fitted with any type of hearing aid at the HJH.	The majority (86%) of the South African population receive health care from the public health care setting (Peer, 2015).	The researcher only had access to the hospital and audiological files of patients fitted at the HJH.
Fitted with hearing aid September 2012 and December 2014.	Experienced hearing aid users are regarded as more likely to be satisfied with their hearing aid than new users (McCormack & Fortnum, 2013).	The records of patients fitted between September 2012 and December 2014 were reviewed and potential participants were contacted and provided with the opportunity to participate in this study.

Table 3: Participant exclusion criteria

Criteria	Rationale	Method
Fitted with a hearing aid prior to September 2012 or after December 2014.	In order to ensure level of hearing aid technology is not affecting patients' satisfaction with the hearing aid, older technology will be excluded from this study.	Patient records were reviewed in order to ensure only patients fitted with a hearing aid from September 2012 until December 2014 were included in this study.
Fitted with body worn hearing aids	In order to ensure level of hearing aid technology is not affecting patients' satisfaction with the hearing aid, older technology will be excluded from this study	Patient records were reviewed in order to determine the style of hearing aid fitted. Only patients fitted with BTE, ITE, ITC, CIC, RIC or BCHAs were contacted and provided with the opportunity to participate in this study.
Individuals with visual difficulties which cannot be corrected through the use of visual aids	The PHAST-R contains various tasks which require good visual acuity	Information regarding visual acuity was obtained from participants as well as their medical and audiological records. Significant visual difficulties were generally noted in the audiological records as standard practice, as this is known to affect hearing aid fitting.
Patients with severe dexterity issues which result in the inability to manipulate their hearing aid	The PHAST-R contains various tasks which require manual dexterity.	Information regarding manual dexterity problems was obtained from the medical and audiological records. Significant dexterity issues are noted as standard practice as this is known to affect hearing aid fittings. This was confirmed with the participant prior to inclusion of the study.

Participant Description

A total of 285 audiological records were reviewed to identify potential participants. Of these 200 patients were not included in the study. The reasons for excluding participants are presented in Table 4. Some patients attended the clinic but were eliminated during the research process based on the inclusion and exclusion criteria mentioned above.

Table 4: Reasons for exclusion of potential participants

Reasons	***n***
No contact telephone numbers were recorded in the audiology files	15
Contact details changed	125
Passed away	10
Significant difficulties communicating over the telephone	5
Limited access to hospital (no transport, travelling distance or relocated to another province)	16
No interest in participating in the research	5
Health	2
Lost, broken or stolen hearing aids	7
Did not meet inclusion criteria	15
Total	200

A total of 85 participants (*n* = 85) were included in the study. A description of the participants' age, gender and educational level are provided in Table 5. This table also includes information on their hearing loss (type, degree, configuration and laterality), style of hearing aid and the amount the hearing aid is worn.

The average age of participants was 66.25 years (Range: 20 - 95; standard deviation [*SD*]: 15.16). The gender distribution of participants was relatively equal. The majority of participants presented with a bilateral hearing loss (82.5%; *n* = 70). Despite this only 7% (*n* = 5) wore two hearing aids. Unilateral fitting regardless of laterality of hearing loss was standard operating procedure in the public health care sector. The majority of participants (88%; *n* = 75) were fitted with BTE hearing aids with and ear moulds.

Table 5: Participant description (*N* = 85)

Gender and age					
				Age (in years)	
	n	**%**	**Mean**	**Range**	***SD***
Male	42	49.4	64.45	20-85	16.095
Female	43	50.6	68.04	23-95	14.221
Total	85	100	66.27	20-95	15.158
Level of education					
				n	**%**
No schooling				3	3.5
Primary schooling				20	23.5
Standard 8 (Grade 10)				27	32
Matric (Grade 12)				20	23.5
Post Matric				15	17.5
			Total	85	100
Type of hearing loss					
SNHL				63	74
Conductive				5	6
Mixed				17	20
			Total	85	100
Degree of hearing loss (Katz, 2014)					
Mild				14	17
Moderate				47	55
Severe				17	20
Profound				7	8
			Total	85	100
Configuration of hearing loss					
Sloping				62	73
Rising				3	4
Flat				18	21
Irregular				2	2
			Total	85	100
Laterality of hearing loss					
Unilateral HL				15	17.5
Bilateral HL				70	82.5
			Total	85	100
Bilateral HL with one HA				65	93
Bilateral HL with two HAs				5	7
			Total	70	100
Style of hearing aid					
BTE with mould				75	88
BTE with slim tube				4	5
ITE				1	1
ITC				1	1
CIC				1	1
BCHA				3	4
			Total	85	100
Amount hearing aid is worn					
Never				6	8
Once a week				2	2
A few times a week				12	14
An hour a day				4	5
2 – 5 hours a day				14	16
> 5 hours a day				8	9
Whole Day				39	46
			Total	85	100

Measures and Equipment

Two measures were used in the study namely the PHAST-R developed by Doherty and Desjardins (2012) (Appendix B) and the SADL developed by Cox and Alexander (1999) (Appendix C).

Practical Hearing Aid Skills Test (PHAST-R)

The PHAST-R is a quick and objective measure of the patients' ability to manipulate their hearing aid (Doherty & Desjardins, 2012). Individuals are required to complete eight tasks which are typically taught during the HAO session, namely: (i) inserting the HA; (ii) removing the HA; (iii) opening the battery door; (iv) changing the HA battery; (v) cleaning the HA; (iv) manipulating the volume control; (vii) Using the telephone; and (viii) Using the hearing aids directional microphone/noise programme. Patients' ability to perform each of the tasks is scored using a 3-point rating scale: 2 - Able to perform the task; 1 - Able to perform the task with deviation; and 0 - Cannot perform the task (Desjardins & Doherty, 2012).

A paper-based version of the PHAST-R was used in the current study as it was more relevant to the public health care context of South Africa that are often under-resourced in terms of access to computers. The equipment used to administer this skills test included hearing aid batteries (various sizes), hearing aid cleaning tools, battery tester, tissues, cloths, mirror, and a telephone (either cell phone or standard telephone).

This clinically relevant tool is used by audiologists to verify that the patient has grasped and understood all the important information from the HAO. Areas of weakness can be immediately identified and thus allows the audiologist to re-counsel the patient as necessary.

The PHAST-R has been used extensively in research (Campos et al., 2014; Desjardins & Doherty, 2012; Ferrari et al., 2015). The PHAST-R has good content validity, inter-rater reliability and test-retest reliability (Desjardins & Doherty, 2012).

Satisfaction with Amplification in Daily Life (SADL)

The aim of the SADL is to measure hearing aid users' level of satisfaction with their hearing aid. The SADL comprises 15 questions across four categories, namely positive effects, service and costs, negative features and personal image (Cox & Alexander, 2001). Hearing aid users are required to rate their degree of satisfaction using a 7-point rating scale. The degrees of agreement or disagreement range from 1- "Not at all satisfied" to 7 - "Tremendously satisfied". A global score is calculated to indicate the hearing aid users' overall satisfaction with their hearing aid (Uriarte et al., 2005), the higher the global score, the greater the level of satisfaction (Cox & Alexander, 2001).

The *positive effects* and *negative features* categories include sound quality, improvement on telephone, ability to facilitate conversation and understanding, feedback and amplification of background noise (Cox & Alexander, 2001). The *service and cost* subcategory addresses the hearing aid users' subjective perception of the costs related to the procurement and maintenance of the hearing aid, as well as the general dependability of the hearing aid. The last subcategory, *personal image*, refers to the hearing aid users' perception of feelings about any changes in their own appearance as a result of the hearing aid as well as the appearance of the hearing aid itself (Cox & Alexander, 2001; Uriarte et al., 2005).

Research has confirmed the reliability and validity of the SADL (Cox & Alexander, 1999; Cox & Alexander, 2001; Uriarte et al., 2005). The SADL was normed using 351 adults (Cox & Alexander, 2001). The SADL has shown good test validity and reliability across different contexts; languages and countries including the United States of America (Cox & Alexander, 2001; Oberg, Lunner, & Anderson, 2007), Australia (Uriarte et al., 2005) and South Africa (Vlok, 2014).

Equipment

The following equipment was used in this study:

- Heine mini 3000 otoscope with various sized speculae
- Cerumen management equipment including a curette, a Jobson Horne, a syringe and a steel kidney dish

Research Assistants

Two research assistants assisted with data collection. The research assistants were qualified audiologists completing their community service. The research assistants underwent training in the administration of the PHAST-R and the SADL. They were required to sign confidentiality agreements in order to ensure patient confidentiality.

Data collection procedures

Ethical permission to conduct the study was obtained from the Human Research Ethics committee (HREC) of the University of the Witwatersrand (Appendix D) (Protocol number M150493). Permission was also obtained from the Chief Executive Officer of the HJH to conduct the study (Appendix E).

Patient records from the audiology department at the HJH for the identified time frame (September 2012 to December 2014) were reviewed to identify potential participants. Individuals without working contact numbers were immediately excluded from the study.

The remaining individuals were contacted telephonically and informed about the nature of the study. Participants who gave verbal informed consent were requested to attend the audiology department on a date and time which was convenient for them. Where possible the researcher made the appointment on a date the individual was already attending the hospital for other services.

On arrival these individuals were provided with an information sheet detailing the research. They are then asked to complete an informed consent document. Individuals who did not meet the inclusion criteria were offered relevant services but not included as participants. Only individuals who provided written consent were included in the study.

Participants were then requested to complete the SADL. If needed, the research assistant or interpreter assisted the participant to complete the questionnaire. Participants were then required to perform each of seven tasks with their hearing aid as per the PHAST-R. The scores for both these measures were calculated and recorded on the data collection form.

During data collection strict infection control protocols were adhered to. Speculae and cerumen management equipment were disinfected using Ultracide as per the HJH policy on infection control.

Data was captured on an EXCEL spreadsheet, encoded according to the data definitions and analysed using various statistical procedures.

Ethical considerations

This study endeavoured to adhere to the World Medical Association (WMA) Declaration of Helsinki's Principles for Medical Research Involving Human Participants (WMA, 2013). These ethical considerations include: ethical clearance; permission from research sites; participant consent; benefits, risk and vulnerability; confidentiality; ensuring follow up services and treatment; and safe keeping of data.

Ethical clearance to conduct the study was obtained the University of the Witwatersrand's HREC prior to the research study (Protocol number: M150493) (Appendix D).

Permission from research site was obtained from the Head of Department of Speech Therapy and Audiology, as well as the Chief Executive Officer of the HJH (Appendix E).

Potential participants were informed of the nature of the study, the risks and benefits of participating in the study. As patients attending public health care services are frequently viewed as being part of a vulnerable population, participants were informed of their rights to withdraw from the study at any point with no negative consequences. Written informed consent was requested from all participants (Appendix F).

The benefits of participating in the study were explained to participants and included that: (i) All hearing aids were cleaned and checked following the completion of the PHAST-R; (ii) Hearing aids under warrantee were offered to be sent to the manufacturer for a full service if deemed necessary by the researcher/research assistant or participant themselves; (iii) All participants received additional counselling and care instructions related to their hearing aid at the discretion of the researcher/research assistant following the PHAST-R; and (iv) If indicated, cerumen management was performed.

Anonymity could not be guaranteed as participants were required to complete tasks for the research however there was adherence to participant confidentiality. All personal information supplied by the participants was kept confidential. Participant numbers were allocated and data collection took place in a separate office where no other participants or professionals could overhear information obtained.

In order to ensure safe keeping of raw data, all original forms will be stored in a locked cabinet in the researcher's private office and electronic data being stored on a password protected computer. Data will be destroyed after a period of five years.

Reliability and Validity

Reliability

Reliability is defined as the ability of an instrument to display the same results irrespective of the setting (Eldridge, 2014). Types of reliability pertinent to this research include inter-rater reliability and test-retest reliability.

Inter-rater reliability aims to assess the degree to which different researchers give consistent descriptions of the same occurrence (Trochim, 2008). The researcher aimed to ensure good reliability by observing 25% of the data collection sessions conducted by research assistants in order to ensure the tools are being scored and interpreted correctly and consistently by different research assistants. Pearson's correlation was used for interrater reliability and good reliability was noted (r = 0.39; r = 0.49 for each respective research assistant).

Test-retest reliability aims to ensure that the same test administered in the same conditions would provide the same results for the participant (Trochim, 2008). The researcher selected tools which have shown in previous research to have good test-retest reliability.

The PHAST-R displays good inter-rater reliability as well as test-retest reliability (Doherty & Desjardins, 2012). The inter-rater reliability of the PHAST-R is very high for both the total score and the individual PHAST-R tasks (intraclass correlation coefficient=1.0) (Ferrari et al., 2015).

Similarly the test-retest reliability of the SADL has been proven (Cox & Alexander, 1999; Vlok, 2014).

Validity

Validity is defined as the ability of a tool to measure the appropriate data for which it is aimed to (Gravetter & Forzano, 2003). Types of validity pertinent to this study include internal validity, content validity and construct validity.

Internal validity refers to the ability of the research to establish a cause and effect relationship. Elimination of alternative cause for results is essential in order to ensure acceptable internal validity (Leedy & Ormrod, 2013). This was achieved in the current research though stringent inclusion and exclusion criteria. The SADL has been compared to other measures of satisfaction in order to assess the internal validity of the tool. Strong internal validity has been noted for the SADL (Cox & Alexander, 2001; Cox & Alexander, 1995).

Content validity describes the extent to which the content area is being measured by the tool. The content validity is high in instances where the items in the tool consist of the parts of the area which it is assessing (Leedy & Ormrod, 2013). The content validity is of the PHAST-R is good as it assesses all aspects involved in the handing of hearing aids (Doherty & Desjardins, 2012). The SADL has been referred to as the gold standard when assessing satisfaction with hearing aids indicating high content validity in this tool (Cox & Alexander, 2001).

Construct validity refers to the extent to which the tool measures a characteristic which cannot be observed. Construct validity deals with aspects of individual's behaviour patterns (Leedy & Ormrod, 2013). Satisfaction may be included in construct validity as it cannot be directly observed and is a subjective measure of behaviour patterns. Thus good construct validity is essential for the SADL. Construct validity has been determined for the SADL in that a logical relationship was noted between the single-item satisfaction data and the SADL Global scores (Cox & Alexander, 2001).

Research indicates that the SADL appropriately measures satisfaction although the word satisfaction is not mentioned in individual items (Cox & Alexander, 2001).

Data Analysis

Descriptive statistics were used for the initial analysis of results (Kumar, 2011) and included measures of central tendency (e.g. mean) and measures of variability (e.g. range and *SD*). Descriptive analysis allowed the researcher to identify patterns and assist in the organisation and summarising of information.

A single sample *t*-test was conducted in order to compare the results from the current study (PHAST-R and SADL) to the norms, as well as previous research findings (Kumar, 2011). In addition, independent group testing was conducted to allow the researcher to identify significant variables (Kumar, 2011). In the current study a number of audiological and extra audiological variables were identified as significant (e.g. age).

Spearman's correlational coefficient allowed the researcher to determine whether there was a relationship between the independent variable (PHAST-R) and the dependent variable (SADL).

Partial correlation is a statistical analysis used to describe the relationship between two variables whilst removing the effects of another variable, or several other variables, on this relationship (Kumar, 2011). Time was identified as an underlying confounding variable a partial correlational coefficient was utilized in order to fully determine the impact of time on the data. Thus further analysis was completed taking into account the number of months since the individual had received their hearing aid.

The standard significance level of 0.05 was used for all statistical tests, unless specified otherwise (Cresswell, 2003).

Conclusion

This chapter provided a detailed description of the methodology used in this research study. The main and sub aims were discussed followed by a description of the research design. Participant selection criteria and participant description were additionally described in this chapter, followed by a description of the equipment and measuring instrumentation. This chapter concluded with a review of the data collection procedures, ethical considerations, reliability and validity and finally the data analysis applied in the current study.

Chapter 4: Results and Discussion

Introduction

A detailed overview of the results obtained during the study is presented in this chapter. The results are critically discussed in relation to the research aims. Possible causative factors are highlighted.

Hearing aid handling skills

PHAST-R

The first sub-aim of the study was to determine the ability of participants to manipulate their hearing aids. Participants were required to complete eight tasks which are typically taught during the HAO session. Their ability to perform each of the tasks was scored using a 3-point rating scale: 2 - Able to perform the task; 1 - Able to perform the task with deviation; and 0 - Cannot perform the task (Desjardins & Doherty, 2012).

The PHAST-R results indicated a mean score of 75.43% (Range: 10.71 – 100; *SD:* 21.58). Participants' skills in the different tasks will be presented in more detail.

Removal and insertion of hearing aid: It is evident that the majority of participants were able to remove and insert their hearing aids correctly (Table 6). Seventy four participants (87%) correctly grasped the hearing aid and 89% (*n* = 76) were able to correctly remove the hearing aid. Slightly less participants were able to correctly grasp the hearing aid (*78%; n= 66)* for the placement of the hearing aid. It is evident that participants displayed difficulty inserting the ear mould as only 55% (*n* = 47) were able to correctly insert the ear mould.

Table 6: Removal and insertion of hearing aid (*n* = 85)

	Removal of HA				**Insertion of HA**			
	Grasp		**Remove**		**Grasp**		**Placement**	
	n	**%**	***n***	**%**	***n***	**%**	***N***	**%**
Able to perform	74	87	76	89	66	78	47	55
Able to perform with deviant means	9	11	7	9	16	19	21	25
Not able to perform	2	2	2	2	3	3	17	20
Total	85	100	85	100	85	100	85	100

Hearing aid battery: The results are presented in Table 7. The majority of participants (*84%; n= 71*) were able to successfully locate the battery door, but only 69% (*n* = 59) were able to

correctly open the battery door. A further 19% (*n* = 16) were able to perform this task but with deviant means. Interestingly, some participants were not able to perform any of the tasks related to the hearing aid battery at all. This is of concern as in most hearing aids there is no on/off switch or button as the battery door functions as an on/off control.

Table 7: Manipulating the hearing aid battery (*n* = 85)

	Operating battery door				**Changing HA battery**							
	Locate		**Open**		**Remove**		**Size**		**Tab**		**Replace**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Able to perform	71	84	59	69	66	78	60	71	71	84	66	78
Able to perform with deviant means	7	8	16	19	12	14	12	14	7	8	12	14
Not able to perform	7	8	10	12	7	8	13	15	7	8	7	8
Total	85	100	85	100	85	100	85	100	85	100	85	100

Adjustment of hearing aid: Eighty two participants had hearing aids with *active volume control* (Table 8). Many of the participants with active volume controls were able to correctly use the volume controls (62%; *n* = 51) or with deviant means (22%; *n* = 18). Deviant means in terms of volume control adjustment includes removing the hearing aid and adjusting the volume control and then re-inserting the hearing aid. This is time consuming and requires more effort from the hearing aids user.

The majority of participants did not have a *programme button* activated (*n* = 80). All the participants (*n* = 5) that had active programme buttons were able to correctly manipulate it.

Table 8: Adjustment of hearing aid

	Manipulating volume control (*n* = 82)		**Manipulating Programme button (*n* = 5)**	
	n	**%**	***n***	**%**
Able to perform	51	62	5	100
Able to perform with deviant means	18	22	0	0
Not able to perform	13	16	0	0
Total	82	100	5	100

Telephone usage: For most participants the *telephone programmes* were not activated (93%, *n* = 79) (Table 9). In the instances where a telephone programme had been activated (*n* = 6) the majority of participants (*n* = 4) were able to correctly perform the task.

Table 9: Telephone usage

	Telephone programme (*n* = 6)		Telephone placement (*n* = 61)	
	N	**%**	***n***	**%**
Able to perform	4	67	12	20
Able to perform with deviant means	0	0	8	13
Not able to perform	2	33	41	67
Total	6	100	85	100

With regard to *telephone placement*, participants who indicated they do not require their hearing aid for telephone usage were scored as 'not applicable' for this task. These participants all presented with a unilateral hearing loss and used the ear with normal hearing for the telephone.

The use of a telephone with hearing aids requires specific placement of the telephone receiver close to the microphone of the hearing aid. Of the participants scored on telephone placement (*n* = 61) the majority (67%; *n*= 41) were not able to perform this task.

Cleaning of the hearing aid components: Participants were requested to show the researcher how they cleaned their hearing aid. Participants were only scored on components relevant to their individual fitting (e.g. standard tubing vs. slim tube) as indicated in Table 10. The majority of participants were able to clean their hearing aid appropriately. Only 3% (*n* = 3) were not able to clean the mould, whilst the remaining participants cleaned the mould correctly or with deviant means (97%; *n* = 79).

Cleaning the smaller components of the hearing aid such as the tubing and the vent was performed less frequently by participants. Cleaning the tubing and the vent requires finer motor control and coordination than cleaning the larger mould.

Table 10: Cleaning hearing aid components

	Cleaning hearing aid components							
	Mould (*n* = 81)		Tubing (*n* = 78)		Vent (*n* = 72)		Slim tube (*n* = 5)	
	N	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Able to perform	58	72	28	36	32	45	3	60
Able to perform with deviant means	20	25	25	32	24	33	1	20
Not able to perform	3	3	25	32	16	22	1	20
Total	81	100	78	100	72	100	5	100

Comparison of PHAST-R results with norms and international studies

The second sub-aim of the study was to compare the mean scores of the PHAST-R obtained in the current study to the norms (Desjardins & Doherty, 2009) and international research studies (Campos et al., 2014; Ferrari et al., 2015).

The studies used to compare the findings include a smaller number of participants than in the current study. The results of the current study were compared to the three international studies using a single sample *t*-test. A significant difference was noted between current study and the other studies (Table 11) as indicated by the low mean score of 75.43% (Range: 10.71 – 100; *SD:* 21.58) found in the current study.

Table 11: Comparative PHAST-R results

Current study	**Desjardins & Doherty (2009)**			**Campos, et al. (2014)**			**Ferrari, et al. (2015)**		
6-60 months post fitting	At least 12 months post fitting			Experienced users			Follow-up session		
N = 85	*N* = 15			*N* = 37			*N* = 60		
Mean	**Mean**	***t-test***	***p***	**Mean**	***t*-test**	**p**	**Mean**	***t*-test**	***p***
75.43	88.48	-5.574	*0.0001	79	-1.524	0.065	82.8	-3.147	0.001

Significance level p<0.05 *corrected value

Discussion of findings

Participants in the current study performed significantly poorer in handling their hearing aids when compared to Desjardins and Doherty (2014) and Ferrari et al. (2015). It is well known that hearing aid handling skills improve over time (Campos et al., 2014; Ferrari et al., 2015). It was thus expected that participants in the current study would perform much better since they were experienced hearing aid users (6 - 60 months hearing aid experience). Results were not statistically significantly different to those obtained in the Campos et al. (2014) study.

The poorer hearing aid handling skills displayed by participants in the current study can be attributed to average daily hearing aid use, reduced finger dexterity, hearing aid orientation, and language barriers.

Average daily hearing aid use: Research has found that between 5 and 40% of hearing aid users do not regularly use their hearing aids (Knudsen et al., 2010). A wide range of average hearing aid use by participants in the current study was noted. This is much lower than the average daily hearing aid use of 8.2 hours daily reported by Desjardins and Doherty (2009). Participants in the

current study who reported more frequent hearing aid use also obtained higher mean PHAST-R scores (mean 80.8).

Two recent studies were conducted on hearing aid users from a rural community in South Africa 12 months post fitting (Vlok, 2014; Freeborough, 2014). The same participants were included in both studies. It was found that majority of participants (75%; *n* = 27) reportedly used their hearing aids for more than 4 hours a day (Vlok, 2014). Despite this, the majority of participants (59%; *n* = 20) were not able to fit their hearing aids independently (Freeborough, 2014). The poor hearing aid handling skills reported by Freeborough (2014) were attributed to reduced finger dexterity and poor hearing aid orientation.

Reduced finger dexterity: Finger dexterity plays an important role in the ability of individuals to handle their hearing aids successfully (Kumar et al., 2000; Freeborough, 2014; Brooks, 1985; Kochkin, 2011). The primary cause of non-use of hearing aids by older adults is reduced or poor finger dexterity (Brooks, 1995; Kochkin, 2011; Campos et al., 2014). The findings of the current study confirm this as performance of activities requiring finer finger dexterity was poor. These activities included inserting the hearing aid, changing the hearing aid battery, adjusting the volume control, and cleaning the vents and tubing of the ear mould. Participants' poor performance in the cleaning of vents and tubing can also be attributed to the HAO. These items require explanations rather than demonstration.

Hearing aid orientation: The benefits of hearing aid orientation, especially in older adults, have been confirmed (Brooks, 1985; Dillon, 2012; Tye-Murray, 2014). Hearing aid orientation should ideally include sharing of comprehensive information in both verbal and written format, preferably the patients' language of choice.

Telephone usage is frequently overlooked during the hearing aid orientation (Tye-Murray, 2014). Only 33% of the participants in the current study were able to use the telephone. This is significantly higher than the 20% reported by Campos et al. (2014). Difficulties with telephone use have also been reported in other studies conducted in developed and developing countries (Campos et al., 2014; Desjardins & Doherty, 2009; Ferrari et al., 2015). It was noted that participants in the current study did not receive any information (verbal or written) on telephone use during the initial hearing aid orientation session, as per standard practise at the research site. At HJH, patients who attend follow-up appointments are provided with additional information on the use of telephones.

Poor attendance of follow-up appointments has been noted in South Africa in the public health care setting (Sooful, 2007). Patients who do not handle their hearing aids appropriately after attending the initial hearing aid orientation session often become hearing aid non users (Desjardins

& Doherty, 2009; Reese & Hnath Chisolm, 2005). In order to ensure appropriate telephone use, the initial hearing aid orientation should include a practical demonstration and consolidation of telephone use.

Language barriers: Patients become overwhelmed during the hearing aid orientation session thus do not retain essential information (Reese & Hnath Chisolm, 2005). Research has found that elderly individuals only recall 25% of information given via verbal means only (Jansen et al., 2008).

The retention of information is further hampered by language barriers, especially in the South African context. Language barriers in South Africa play a significant role in the retention of information provided during the hearing aid orientation sessions (Sooful, 2007; Peer, 2015). This may also be a contributing factor to patients' ability to successfully handle their hearing aids. The participants in the current study were all fitted by audiologists who were only fluent in English and/or Afrikaans. The majority of individuals who access public health care services in South Africa are not first language English speakers (Sooful, 2007). Participants in the current study generally performed better in hearing aid handling skills that the audiologists were able to demonstrate (e.g. removing and inserting the hearing aid, handling batteries). Activities that are usually not demonstrated but only explained (such as replacing the hearing aid battery, cleaning the vent and tubing, and using the telephone) received poorer scores.

Handouts outlining information covered during the HAO session serves as a reference for patients. A large percentage (27%) of participants in the current study only received primary school education or no education. Literacy is a vital component when accessing health information, however literacy levels in South Africa are low (StatsSA, 2011). Individuals with low functional health literacy are 1.5 to 3 times more likely to have poor health outcomes when compared to individuals with higher levels of literacy (Joubert & Githinji, 2014).

Satisfaction with hearing amplification

The third sub-aim of the study was to determine the self-perceived satisfaction with hearing aids. Participants were asked to rate their degree of satisfaction using a 7-point rating scale. The degrees of agreement or disagreement range from 1- "Not at all satisfied" to 7 - "Tremendously satisfied". A global score was then calculated based on scores obtained in the four sub-scales namely: (i) Positive Effects; (ii) Services and Costs; (iii) Negative Features; and (iv) Personal Image. The scores were compared to the standard scores (Cox & Alexander, 1999). Participants were deemed to be 'dissatisfied' when their scores were below the 20th percentile, 'very satisfied' when

their scores were above the 80th percentile, and 'satisfied' when their scores were between the 20th and 80th percentiles. The mean scores of participants are presented in Table 12.

Table 12: SADL scores (*n* = 85) and percentiles according to Cox and Alexander (1999).

	Scores				
	Mean	**Range**	***SD***	20th percentile*	80th percentile*
Global Scores	5.2	3.1- 6.7	0.846	4.3	5.6
Positive Effects	5.3	1.17 - 7	1.18	4.0	5.7
Services and Costs	6.0	1.33 - 7	1.15	3.8	6.0
Negative Features	4.1	1 - 7	1.46	3.0	5.3
Personal Image	5.3	2.3 - 7	1.9	5.0	6.7

Cox and Alexander (1999)

Positive effects: This subsection included questions 1, 3, 5, 6, 9 and 10. The mean score obtained for this sub-scale was 5.3. This indicates that participants were satisfied that the hearing aids positively impacted aspects such as self-confidence, improving understanding and reducing the need to request repetition.

Service and cost: Questions 12, 14 and 15 addressed aspects related to services received at the time of the hearing aid fitting. The mean level of satisfaction was 6 indicating that the participants were very satisfied with the services received at the HJH as well as the cost of the hearing aids.

Negative features: Questions 2, 7 and 11 addressed the negative features of the hearing aid, such as frustration with incorrect amplification, ability to get enough loudness without feedback and benefit from the telephone. The mean score was 4.1 which indicates that participants are satisfied that the hearing aid alleviated the negative features.

Personal image: Three items from the SADL addressed effects of the hearing aids on personal image (Questions 4, 8 and 13). The mean level of satisfaction on this sub-scale was 5.3. This indicates that participants were satisfied that with the effects of the hearing aid on their personal image.

Global score: The mean global score for participants was 5.2 indicating that participants were satisfied with their hearing aids.

Comparison of SADL results with norms and international studies

The fourth sub-aim was to compare the SADL scores reported in the current study to the norms and other research studies. A single sample *t*-test statistical comparison was made between the four different studies and the mean scores reported in the current study (Table 13).

Table 13: Comparative SADL scores

	Current Study *N* = 85	Cox & Alexander (1999) *N* = 257			Aurélio et al. (2012) *N* = 60			Uriate et al. (2005) *N* = 1014			Vlok (2014) *N* = 36		
	Mean	**Mean**	***t*-test**	***P***	**Mean**	***t*-test**	***p***	**Mean**	***t*-test**	***p***	**Mean**	***t*-test**	***P***
Global Scores	5.2	4.9	2.82	0.002	5.9	-8.07	*0.0001	5.27	-1.21	0.11	4.99	1.84	0.034
Positive Effects	5.3	4.9	3.34	0.0006	6.2	-6.83	*0.0001	4.98	2.72	0.004	5.61	-2.21	0.0147
Services and Costs	6.0	5.4	4.92	*0.0001	6.1	-0.69	0.25	5.7	2.52	0.006	4.89	9.00	*0.0001
Negative Features	4.1	3.6	3.45	0.0004	4.9	4.74	*0.0001	4.74	-3.74	0.0001	3.63	3.26	0.0008
Personal Image	5.3	5.6	-2.28	0.01	6.2	-6.9	*0.0001	5.86	-4.28	*0.0001	4.86	3.41	0.0005

Significance level: *p < 0.05* **corrected value*

There is a statistically significant difference between the global scores of the norms described by Cox and Alexander (1999) and the current study ($t = 2.82$; $p < 0.05$). This indicates that the participants in the current study were more satisfied with their hearing aids than participants in the Cox an Alexander (1999) study. The sub-scale mean scores were also compared. A single sample t-test statistical comparison revealed a significant statistical difference between the all the sub-scales. The current study indicated a significantly higher satisfaction regarding the positive effects, service and cost as well as negative features than the norms indicated by Cox and Alexander (1999). On the contrary, a significant negative difference was indicated between the personal image subscale scores ($t = -2.28$; $p < 0.05$). This indicates that the current participants are significantly less satisfied with personal image than the USA norms.

The current study displayed significantly lower global scores when compared to Aurélio et al. (2012) ($t= -8.07$, $p < 0.05$). Thus participants in the current study were significantly less satisfied with their hearing aids than participants in Aurélio et al.'s (2012) study. The service and cost subscale was most similar to that of the current study ($t=-0.69$, $p<0.05$) however all other subcategories the current research indicated significantly lower satisfaction levels.

No statistical significance was noted in comparing results of the current study to results of Uriate et al. (2005) ($t=-1.21$; $p <0.05$). However on further analysis each sub-scale indicated statistically significant differences in satisfaction levels. Positive effect ($t=2.72$; $p<0.05$) and service and cost ($t= 2.52$; $p<0.05$) indicated that participants in the current study were significantly more satisfied while negative features ($t= -3.74$; $p<0.05$) and personal image ($t= -4.28$; $p<0.05$) indicated participants were significantly less satisfied when compared to Uriate et al. (2005).

In comparison to rural South African participants, current participants were significantly more satisfied with their hearing aid across all but one of the sub-scales.

Discussion of findings

The mean global scores revealed that participants in the current study were satisfied with their hearing aid. The level of satisfaction of participants in the current study were significantly higher that reported by Vlok (2014) who conducted research in the rural South African context. Participants in the rural study had received hearing aids during a humanitarian aid mission with no or limited follow-up services available to them (Vlok, 2014). Participants in the current study received their hearing aids at an established audiology department in the public health sector. The highest mean global scores were reported by Aurélio et al. (2012). This study was conducted in Brazil where patients reportedly are generally very satisfied with public health care services (Campos et al., 2014).

Audiological services in South Africa are mainly located in the bigger hospitals in the more populated cities (Sooful, 2007). The majority of patients receiving treatment from public health care facilities in South Africa often have to travel vast distances to access services at great cost (Peer, 2015). These aspects may impact on their attendance of follow-up appointments. Follow-up sessions aim to reduce feedback and other negative features of the hearing aid (Dillon, 2012). As poor attendance to follow-up sessions is common in the public health care setting (Sooful, 2007) participants may not be aware that these difficulties can be resolved. Poor attendance may affect patient satisfaction in terms of sound quality and telephone usage, as was reported in the current study. Although there was poor adherence to follow-up sessions, it is postulated that despite the poor attendance of follow-up appointments participants knew where to access services, should the need arise.

Language barriers experienced by patients during the hearing aid fitting and orientation process at the HJH were postulated to have contributed to the lower mean global scores reported in the current study. Research has reported that language barriers are evident in South Africa, with the public health care setting being most significantly affected (Peer, 2015; Sooful, 2007). Language and literacy barriers influence appropriate pre-fitting counselling as well as fine tuning and sound quality adjustments (Sooful, 2007). Using a patient-centred approached the audiologist and patient work together to determine the most appropriate sound quality settings for the hearing aid (Tye-Murray, 2014). Research conducted in settings with language barriers noted lower satisfaction than in developed countries where language barriers are less significant (Vlok, 2014). While the participants in this study were proficient in English, many were not first language English speakers. Although not formally assessed it is postulated that they were able to understand basic English but may have had difficulty with understanding complex instructions for hearing aid use and care.

Hearing aids do not restore hearing abilities and frequently do not solve all hearing difficulties (Tye-Murray, 2014). Hearing aid technology however has improved drastically within the last few years (Kochkin, 2012). Digital hearing aids are more sophisticated than analogue hearing aids previously fitted. Analogue hearing aids may amplify all sounds thus at times potentially creating a distorted sound quality. The mean scores for the negative features sub-scales in the current study were higher than that presented by Cox and Alexander (1999) and Vlok (2014). Refurbished analogue hearing aids were fitted during the hearing aid mission in the study conducted by Vlok (2014). Similarly, at the time the Cox and Alexander study was conducted the level of technology of hearing aids were not as sophisticated as digital hearing aids currently available commercially. Participants in the current study were fitted with superior hearing aid technology when compared to participants included in the Cox and Alexander (1999) and Vlok (2014) studies.

Digital hearing aids are better able to amplify speech and dampen noise (Dillon, 2012). Higher satisfaction levels were noted the current study, as well as the research conducted by Aurélio et al. (2012) and Uriate et al. (2005) for participants fitted with digital hearing aids. The ongoing development in hearing aid technology assists in feedback prevention and amplification of speech in noise. Difficulties experienced with the sound quality of the hearing aid are frequently corrected at follow-up sessions. Participants in the study conducted by Aurélio et al. (2012) were also fitted with individual sound amplification devices. The highest mean global scores were reported by Aurélio et al. (2012). This indicates that advanced technology was utilized in order to improve the individual's communication abilities but also quality of life (WHO, 2001).

Hearing aids have been noted to significantly improve individuals' QoL when fitted and worn appropriately (Dalton, et al., 2003). Research has shown that providing an individual with a hearing aid can assist in improving individuals' communication, intimacy, warmth, emotional stability, sense of control over their life, perception of mental functioning as well as physical health (Dalton, et al., 2003; Kochkin, 2012).

Audiological and extra audiological factors

The last sub-aim was to identify variables which affect hearing aid handling skills and satisfaction with hearing aids. The variables examined included audiological factors (type and degree of hearing loss) and extra audiological factors (age, level of education, average daily hearing aid use and style of hearing aid). Results were analysed using Spearman's correlation in order to determine whether a statistically significant relationship existed between the variables. Statistically significance is set at $r_s > 0.218$ (McCall, 1994).

Audiological factors

Type of hearing loss

Participants with conductive and mixed hearing loss presented with better hearing aid handling skills (Table 14). There was a statistically significant correlation between hearing aid handling skills and satisfaction ($r_s = 0.97$; $p<0.05$) in participants with conductive hearing loss despite the small sample size ($n = 5$).

Table 14: Type of Hearing loss (n= 85)

Type of HL	*n*	Percentage				Correlation
		PHAST-R		SADL		
		Mean	Range	Mean	Range	
SNHL	63	72.83175	10.71 – 100	73.8081	39.79 - 96.2	0.180397
Conductive	5	85.982	53.57 – 96.43	75.08	55.1 - 82.65	0.975304*
Mixed	17	81.95647	23 – 100	76.84824	41- 92.9	0.176875

**Statistically significant r_s>0.218*

Degree of hearing loss

Participants with a profound hearing loss presented with high PHAST-R scores indicating very good hearing aid handling skills. There was a significant correlation between hearing aid handling skills and satisfaction (r_s = 0.56; p <0.05) in participants with a mild and moderate degrees of hearing loss (Table 15).

Table 15: Degree of hearing loss (n= 85)

Degree of HL	*n*	Percentage				Correlation
		PHAST-R		SADL		
		Mean	Range	Mean	Range	
Mild	14	78.05643	39.28 – 100	72.73143	39.79 – 90.47	0.563803*
Moderate	47	76.17681	23 – 100	76.67596	51.33 – 96.2	0.219327*
Severe	17	68.36941	10.71 – 96.43	70.29706	41 – 91.83	0.061457
Profound	7	82.31286	53.57 – 96.67	73.52429	43.8 – 93.9	-0.03487

**Statistically significant r_s>0.218*

Extra audiological factors

Age

The majority of participants were older than 65 years of age (63.5 %; *n* = 54) (Table 16). Hearing aid handling skills were noted to decline with age, however satisfaction was unaffected by age. A statistically significant correlation was noted between handling skills and satisfaction for adults younger than 65 years (r_s = 0.42; p <0.05).

Four more delineated age categories were also analysed (<40; 41 - 64; 65 - 80; 81+) (Table 16). A statistically significant correlation between hearing aid handling skills and satisfaction were noted for participants between the ages of 64 and 81 years (r_s = 0.58; p <0.05). As expected, participants older than 81 years of age displayed the worst hearing aid handling skills (62.5%) when compared to the other age groups.

There was a statistically significant correlation between hearing aid handling skills and satisfaction for all age ranges excluding 65 – 80 years (Table 16).

Table 16: Age of participants (n= 85)

Age (in years)	*n*	Percentage				Correlation
		PHAST-R		SADL		
		Mean	Range	Mean	Range	
< 65	31	83.24	33.33 – 100	74.68	39.79 – 93.33	0.427687*
> 65	54	70.94	10.71 – 100	74.37	43.8 – 96.2	0.116082
< 40	5	93.09	85.71 – 100	68.35	41 – 86.7	0.378347*
41 – 64	23	79.84	33.33 – 100	76.45	39.79 – 93.33	0.588683*
64 – 80	36	74.48	13 – 100	74.82	43.8 – 96.2	0.033716
81+	10	62.50	10.71 – 96.67	76.86	60 – 92.4	0.401031*

**Statistically significant r_s>0.218*

Level of education

There was a significant correlation between the level of education, hearing aid handling skills and satisfaction in various categories (Table 17). Participants with highest level of education being primary schooling, standard 8 and post matric presented with a statistically significant correlation between hearing aid handling skills and satisfaction.

It is interesting to note that as participants' level of education increased so did their hearing aid handling skills.

Patients with lower levels of education present with difficulties in communication with health care practitioners and this may affect them negatively in terms of their outcome and management. However this does not appear to have a relationship with their satisfaction with the hearing aid.

Table 17: Level of education (n= 85)

Level of education	*n*	Percentage				Correlation
		PHAST-R		SADL		
		Mean	Range	Mean	Range	
No schooling	3	66.85	34.37 – 92.85	80.31667	72.45 – 91.4	-0.04801
Primary schooling	20	64.804	10.71 – 96.67	76.049	55.1 – 96.2	0.22643*
Standard 8	27	79.46519	53.33 – 100	77.77778	51.33 – 96.2	0.402194*
Matric	20	78.217	13 – 100	69.887	43.8 – 89.52	0.21518
Post matric	15	80.336	23 – 100	71.47067	39.79 – 92.9	0.337948*

**Statistically significant r_s>0.218*

Average amount of reported daily hearing aid use

A statistically significant correlation was found between average daily hearing aid use, hearing aid handling skills and satisfaction for participants who wear their hearing aids between once a week and an hour a day (Table 18). It was noted that participants who wear their hearing aid more frequently are handling their hearing aid better than those who wear it less frequently.

Table 18: Average amount of hearing aid use (n= 85).

Average HA use	*n*	Percentage				Correlation
		PHAST-R		SADL		
		Mean	Range	Mean	Range	
Never	6	46.94	13 – 84.37	61.60	39.79 – 74.5	-0.15978
Once a week	2	61.66	50 – 73.33	71.90	57.1 – 86.7	-1
A few times a week	12	73.86	43.33 – 96.67	67.99	41 – 92.4	0.26735*
An hour a day	4	67.082	53.33 – 85	74.05	61 – 81.9	-0.82442
2 – 5 hours a day	14	74.74	39.29 – 96.43	76.87	57.14 – 93.9	0.151579
> 5 hours a day	8	81.61	23 – 100	73.71	61 – 87.75	-0.0779
Whole Day	39	80.83	10.71 – 100	77.95	43.8 – 96.2	0.217212

**Statistically significant r_s>0.218*

Style of hearing aid

The majority of participants in the study were fitted with BTE hearing aids (*n* = 79*)* (Table 19). Despite the small sample size, there was a statistically significant correlation (r_s = 0.99; p <0.05) between hearing aid handling skills and satisfaction in participants fitted with BC hearing aids (*n* =3) as well as in participants fitted with BTE hearing aids with slim tubes (*n* =4) (r_s= 0.76; p <0.05). Participants fitted with BTEs with slim tubes performed significantly higher on the PHAST-R and the SADL. The analysis did not include ITC, ITE or CIC hearing aids as the sample sizes were too limited to determine significance.

Table 19 Style of hearing aid (*n* = 82)

Style of HA	*N*	Percentage				Correlation
		PHAST-R		SADL		
		Mean	Range	Mean	Range	
BTE with mould	75	74.00	10.71 – 100	74.48	39.79 – 96.2	0.163612
BTE with slim tube	4	94.09	89.29 – 100	79.65	61.9 – 92.9	0.766721*
BCHA	3	81.81	58.33 – 95.45	66.63	44.9 – 80	0.999234*

**Statistically significant r_s>0.218*

Discussion of findings

Audiological factors

Type of hearing loss

Despite the small sample size (*n* = 5) there was a very strong correlation between hearing aid handling skills and satisfaction in participants with conductive hearing loss. The mean age of the participants with SNHL (69.57 years) was noticeably higher than participants with conductive hearing loss (45.8 years). Hearing aid handling skills in the current study declined with age across all types

of hearing loss. It is postulated that the type of hearing loss is not a significant factor in terms of hearing aid handling skills or satisfaction with hearing loss but is rather influenced by the age of the patients. This was confirmed by research that indicated that older participants indicated poorer hearing aid handling skills than younger adults (Campos et al., 2014).

Degree of hearing loss

Participants with a profound hearing loss presented with significantly higher PHAST-R scores indicating very good hearing aid handling skills. As all these participants were reliant on auditory-verbal communication methods, it is postulated that they are dependent on their hearing aid for improved QoL and access to sound.

Significant correlation between hearing aid handling skills and satisfaction where noted for participants with a mild and moderate hearing loss. These participants are less reliant on their hearing aids for optimal communication than participants with more severe hearing loss. Patients with mild hearing loss are thus more likely to become a non-wearer of the hearing aid than someone with a more significant hearing loss (Thomas, 2014).

Laterality of hearing loss

Participants with bilateral hearing aid fittings were not only handling their hearing aid better but were more also satisfied with their hearing aids. The lowest satisfaction score for a participant with bilateral hearing aids was 64.46% indicating bilateral fitting results in statistically higher satisfaction levels. It is well documented that bilateral hearing aid fittings provide a great deal of benefit. These benefits include improved speech discrimination in noise, sound localization and perception of a dynamic acoustic environment (Arlinger, Gatehouse, & Wouters, 2008; Dillon, 2012; Tye-Murray, 2014).

It has been noted in clinical practise research, that despite the benefits to bilateral hearing aid use some patients continue to wear one hearing aid (Arlinger et al., 2008). It has been previously hypothesised that this may be due to reduced fine finger dexterity (Arlinger et al., 2008). This is in contrast to the current study, which found that participants with bilateral hearing aids handled their hearing aids better than participants with unilateral hearing aid fittings.

Current finding suggest that patients with bilateral hearing loss should be fitted bilaterally in order to ensure improved satisfaction with hearing aids as well as superior hearing aid handling skills.

Extra audiological factors

Age

The natural aging process in humans results in the deterioration of the sensory, musculoskeletal, vascular and nervous systems (Carmeli et al., 2003). In addition to the increased prevalence of hearing loss (Agrawal, Platz, & Niparko, 2008; WHO, 2014), there is potentially a decrease in functional movements of the hands (Carmeli et al., 2003). As a result finger dexterity may decrease with age, particularly in individuals over the age of 65 (Carmeli et al., 2003). This was confirmed by the current study which found a decline in hearing aid handling skills from 70.94% in participants older than 65 years to 62.50% in participants older than 80 years of age. Other studies using older participants reported similar results (Desjardins & Doherty, 2009; Campos et al., 2014).

This creates several implications for clinical practise. It is recommended that older patients be counselled more extensively when fitted with a hearing aid. Family members or caregivers should be included in the hearing aid orientation process so as to facilitate better outcomes for these patients (Tye-Murray, 2014). Audiologists should be mindful that patients older than 80 years may need more intensive instructions, demonstrations and opportunities to practise manipulating the hearing aid. The audiologist should also highlight the importance of attending follow-up sessions.

Level of education

As participants' level of education increased so did their hearing aid handling skills. Participants with no schooling (although only n = 3) also reported the highest levels of satisfaction.

Patients with lower levels of education present with difficulties in communication with health care practitioners and this may affect them negatively in terms of their outcome and management. In South Africa, there is a discrepancy between languages spoken by most audiologists working in the public health care sectors and the patients receiving care at public health care institutions. Audiologists are most frequently fluent in English and Afrikaans which patients are mainly fluent in Zulu, Sotho or Xhosa (Sooful, 2007; Louw & Avenant, 2002). Less than 1% of qualified audiologists in 2002 were identified as able to fluently speak an indigenous Black African Language (Sooful, 2007). Thus patients are not receiving information on hearing aid use, handling and maintenance in their first language.

Average hearing aid use

Participants who reported more frequent hearing aid use were noted to present with higher scores on the PHAST-R. This indicates that the more often they were performing tasks related to the hearing aid the better they performed.

The SADL scores noted that with increased use of the hearing satisfaction increased. However the exception was the participants who reported using their hearing aid once a week. Participants who wore their hearing aid once a week scored similarly to participants who reported daily hearing aid use.

Participants who only wear their hearing aid once a week suggest that they are only using their hearing aids in difficult listening environments or situations. Frequently, patients report that they only struggle with hearing speech in noise or only in difficult listening environments such as church or large family gatherings (Kreisman et al., 2014; Tye-Murray, 2014). The results of the current study indicate that participants are satisfied with using the hearing aid in this manner, potentially only in these types of listening situations.

The majority of the participants (60%) were over the retirement age of 65 years. Retired adults often do not have as high demands on their hearing abilities when compared to their younger counter parts (Agrawal, 2008). It is hypothesized that retired adults often do not wear their hearing aids daily as they are in quieter situations and are able to compensate for their hearing loss more easily. However retired adults are satisfied with their hearing aids which are used when they feel they are necessary.

Style of hearing aid

For participants in this study the style of hearing aid and appearance appears to be an important factor for satisfaction with the hearing aid. Despite the small sample size it was noted that participants with BCHA, ITE and ITC were less satisfied than all other hearing aid styles. BCHAs are much larger and more visible (Dillon, 2012). Although ITE and ITC hearing aids are inside the participant's ear they too are very noticeable, more so than initially realised by patients who request them. Participants who were most satisfied were those fitted with the smallest hearing aids, CICs, however they are not available to all degrees of hearing loss and require very fine finger dexterity. It appears that participants would be more satisfied with larger BTE style hearing aids which are placed behind the ear. Hearing aids which are behind the ear are discrete and often unobtrusive.

Relationship between hearing aid handling skills and self-perceived satisfaction with hearing aids

The main aim of the study was to determine the relationship between the ability to manipulate hearing aids (PHAST-R) and self-perceived satisfaction with hearing aids (SADL) in patients fitted with hearing aids in a public health care sector hospital.

PHAST-R scores were calculated to be a total out of 28 – 32, dependant on the features of the hearing aid. SADL scores were calculated to a total out of 98 – 105. Due to the difference between the scales used in the two tests, a total percentage was calculated for the PHAST-R and the SADL scores as depicted in Table 20. Statistically significance is set at r_s >0.218 (McCall, 1994).

Table 20: SADL and PHAST-R scores (n=85)

Measure	Mean	Median	Mode	Range	*SD*
PHAST-R %	75.43	83.33	73.33	10.71 – 100	21.585
SADL %	74.49094	75.2	66.67	39.79 – 96.2	12.80149
SADL % – PHAST-R %	-0.93929	-8.13	-6.66	-49 – 61.5	22.54106

A Spearman's correlation was conducted to determine the relationship between hearing aid handling skills and patient satisfaction. A significant correlation was noted between PHAST-R and SADL scores (r_s = 0.22871, p > 0.05).

Similarly, Spearman's correlation was conducted to determine if a correlation exists between QoL and hearing aid handling skills. The mean positive effect scores of the SADL were compared to the PHAST-R. A statistically significant correlation (r_s = 0.25094, n = 85, p > 0.05) was found.

Discussion of findings

This was one of the first studies to be conducted to establish if there is a relationship between hearing aids handling skills and satisfaction with the hearing aids in the South African context. The current study found a significant relationship between hearing aid handling skills and satisfaction.

This is contrary to studies conducted in rural South Africa which noted that despite the majority of participants (59%) were not able to fit hearing aids independently (Freeborough, 2014), they were satisfied with their hearing aids (Vlok, 2014).

Current finding were also contrary to findings reported by Campos et al. (2014) who did not note a relationship between satisfaction (measured with the HHIA and HHIE) and hearing aid handling skills (PHAST-R).

A positive correlation was reported between QoL (IOI-HA) and hearing aid handling skills (PHAST-R) reported by Campos et al. (2014). QoL was not explored specifically in the current study. However a number of the questions (Questions 1, 3 and 9) on the *positive effect* sub-scale of the SADL addressed some aspects related to QoL. There was a statistically significant correlation found between these items and hearing aid handling skills.

Chapter 5: Conclusion

Introduction

The conclusion chapter firstly provides a summary of the significant of findings from this study in relation to the aims of the study. Following this the strengths and limitations of the study will be discussed. Finally the recommendations for further research and the implications of the study will be presented.

Summary of findings

The main aim of the study was to determine the relationship between the ability to manipulate hearing aids and self-perceived satisfaction with hearing aids in individuals fitted with hearing aids in the public health care sector. It was found that the mean PHAST-R and SADL scores for participants in this study were high, indicating that they presented with good handling skills and high levels of satisfaction. Spearman's correlation confirmed that there was a significant correlation between hearing aid handling skills and satisfaction with amplification ($r_s = 0.22871$, $p > 0.05$).

The current study was the first study to confirm a relationship between hearing aid handling skills and satisfaction with hearing aids. Internationally the relationship between QoL and hearing aid handling skills has been confirmed (Campos et al., 2014). This was also established through the positive effect subscale of the SADL and the PHAST-R in the current study. Research conducted in a rural area of South African did not indicate a relationship between hearing aid handling skills and satisfaction with amplification.

The majority of participants handled their hearing aids well with the exception of telephone use which was identified as an area of weakness for the majority of participants. This correlated with overall satisfaction with hearing aids with the exception of satisfaction with telephone use which was noted as a significantly low scoring item on the SADL.

Participants in the current study performed significantly poorer in handling their hearing aids when compared to the findings of international studies. The poorer hearing aid handling skills displayed by participants in the current study can be attributed to average daily hearing aid use, reduced finger dexterity, hearing aid orientation received, and language barriers.

The level of satisfaction in the current study was significantly higher than that in the rural South African context. Participants in the rural study had received hearing aids during a humanitarian aid mission with no or limited follow-up services are available to them (Vlok, 2014).

Participants in the current study received their hearing aids at an established audiology department in the public health sector. Factors affecting satisfaction with hearing aids included language barriers, attendance to follow-up sessions as well as level of technology in the hearing aid.

Significant audiological factors included, type, degree and laterality of hearing loss. Significant extra audiological factors included, age, level of education, average amount of hearing aid use as well as style of hearing aid.

Critical evaluation of the study

Strengths of the study

- This study was the first to use the PHAST-R in the South African context and thus provided evidence-based information regarding the hearing aid handling skills of patients fitted in a public health care sector hospital.
- This study was also the first study to compare hearing aid handling skills and patient satisfaction in the South African context
- Similarly, information was obtained regarding the satisfaction with hearing amplification in patients fitted in a public health care sector hospital.

Limitations of the study

- The use of only one site to conduct the research has limited the ability to generalise the findings to other health care settings (e.g. public sector hospitals, primary health care clinics, private practise) or other provinces.
- Not all eligible participants may have had the opportunity to participate in the study as potential participants who had difficulties in communicating telephonically with the researcher were excluded. The perspectives of these patients could have made a valuable contribution to the study.
- The subjective nature of the determining participants' proficiency in English allowed for limited interpretation in terms of the impact of language on hearing aid handling skills and patient satisfaction.
- While the sample size matched that of international research current sample size could have been increased. Significant difficulties in contacting participants telephonically indicate improved record keeping should be a goal for public health care settings. Email addresses may be a way forward for individuals who have access to this option. However individuals in the public health care setting may not have access to email.

- The research design employed in the current study, limited the opportunity to gain more qualitative information on the difficulties experienced by participants with regard to the handling of the hearing aid as well as reasons for perceived satisfaction with the amplification.

Recommendations for future research

The results revealed a variety of interesting trends. Preliminary answers and many more questions were raised that will need to be answered by future research.

- The replication of the study in a variety of health care contexts and geographical areas will expand the evidence-base of hearing aid handling skills and satisfaction with hearing aids specifically in the South African context.
- The replication of the study using translated versions of the SADL and the PHAST-R in order to determine the impact of language barriers on the current findings.
- Expansion of the study by means of a qualitative or mixed research design may provide qualitative information on the difficulties experienced by participants with regard to the handling of the hearing aid as well as reasons for perceived satisfaction with the amplification
- A description of the current hearing aid fitting and orientation protocols used in a variety of different health care contexts in South Africa is recommended. This will pave the way to the development of context-specific best practice guidelines.
- The quality, relevance and usefulness of hearing aid information pamphlets provided to patients in a variety of contexts should be determined with specific reference to the readability is recommended.

Implications

Clinical implications of the current study include:

- The importance of developing and implementing best practise guidelines for hearing aid fitting and orientation which are appropriate for a diverse South African context to facilitate maximum hearing aid benefit and satisfaction. Areas identified which require improved hearing aid handling skills included; correct insertion of the mould of the hearing aid, cleaning of the vents and tubing as well as correction telephone placement. Areas identified which will improve satisfaction include encouraging attendance to follow up sessions for fine tuning and sound quality adjustments as well as audibility over the telephone.

- Health care settings where language and literacy barriers play a significant role should introduce demonstration for learning purposes and not relying on explanations. Thus introduction of objective measures for the assessment of hearing aid handling is recommended.
- Health care settings where language barriers play a significant role should introduce handouts in various languages including telephone use with the hearing aid.
- Accurate record keeping practises that include alternative means of contacting patients who are hearing impaired. E-mail addresses for example may allow for improved future communication.

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Appendices

Appendix A: Demographic information form

Patient number:			Age			Male		Female
Level of education	no schooling		primary school		standard 8	matric		post matric
Type of HL	Conductive			Sensorineural		Mixed		
Degree of HL			mild		moderate	severe		Profound
Configuration of HL			sloping		Rising	flat		irregular
Unilateral HL			Bilateral HL			Number of HAs		
Fitted by:			PHAST conducted by:					
HA worn	Never	once a week	a few times a week	an hour a day	<2 hours a day	2-5 hours a day	> 5 hours a day	whole day

	Left HA					Right HA				
Company										
Model										
Style	BTE mould	BTE slimtube	ITE	ITC	CIC	BTE mould	BTE slimtube	ITE	ITC	CIC
S/N										
Experience with current HA	6 - 12 months	12 -18 months	18 -24 months	>24 months		6 - 12 months	12 -18 months	18 -24 months	> 24 months	
Lifetime experience with HA	6 - 12 months	12 -18 months	18 -24 months	24 - 60 months	> 60 months	6 - 12 months	12 -18 months	18 -24 months	24 - 60 months	> 60 months

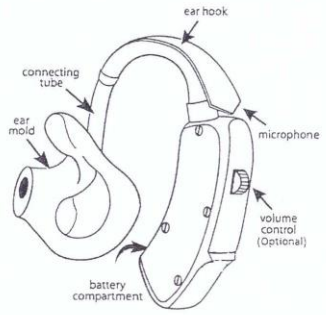
Appendix B: HJH Hearing Aid Orientation Pamphlet

Hearing Aid Information

Dear New Hearing Aid User,

Congratulations on your new hearing aid!!!

Here are some useful tips for you to follow to ensure good care and maintenance of your hearing aid.
For further instructions read the instruction manual that came in your hearing aid box.



ON/OFF

1. To switch your hearing aid **on,** place the battery into the hearing aid and close the battery door. It is now **ON!**
2. To switch **off** your hearing aid, open the battery door. The hearing aid is now **OFF!**

BATTERIES

1. Your hearing aid takes size _____ batteries.
2. They will last about 10 days.
3. Before using the new battery, remove the sticker. Once the sticker is removed, the battery starts to work.
4. When putting the battery into the hearing aid, make sure that the flat side of the battery faces upwards.
5. You can purchase batteries from the Audiology Department at Helen Joseph Hospital or at any chemist (Dis-Chem) near you. Make sure they are the right size.
6. When the battery is flat, you can throw it in the dustbin.

DRY BOX

1. Do not sleep with your hearing aid on.
2. At night, remove the hearing aid, remove the battery, and place it into the dry box.
3. The silica gel will absorb any moisture from the hearing aid. When the silica gel turns white, place it in the sun to dry out. It will turn yellow again and you can continue to use it.
4. You can replace silica gel with the packets you receive in a shoe box or medicine bottle.
5. **REMOVE THE BATTERY** from the hearing aid before you put it in the dry box.
6. If you leave the batteries inside the dry box, the silica gel will take all the energy from the battery and THEY WILL NOT WORK!!!!

CLEANING

1. **DO NOT WET THE HEARING AID**!! Do not bath, swim or shower while wearing it.
2. The mould will get full of wax and must be cleaned every day. Wipe the mould with a tissue or soft cloth. You can use an old toothbrush to clean the mould.
3. If the mould becomes very dirty, you can wash it in warm water. Separate the mould from the hearing aid by the tubing.
4. Wash the mould in warm water with sunlight soap.
5. Place the mould on some tissue paper and leave the mould in the sun to dry.
6. Reconnect the hearing aid to the mould once the mould is dry.

GENERAL CARE

1. **Do not** let other people touch or use your hearing aid.
2. The tubing on the mould eventually gets old and hard. It needs replacing. When this occurs, bring it back to the hospital for us to replace. You will be responsible for the minimal cost involved.
3. Don't store the hearing aid in the bathroom.
4. Remove the hearing aid before using hair spray or other hair products.
5. Store the hearing aid in a safe place away from children and animals.

IMPORTANT

1. **Hearing Aids are FRAGILE!**!! Be gentle with your hearing aid.
2. They are expensive to repair. If your hearing aid requires repairs, the hospital cannot pay for them, you will have to pay.

ADJUSTING TO YOUR HEARING AID

1. In the beginning you may be overwhelmed by all the new sounds. However, it is important that you wear your hearing aid as often as possible and for as long as possible. This will ensure that you get used to the hearing aid and new sounds faster. The more you wear the hearing aid, the more you will benefit from it.

`URAL REHABILITATION GROUP

We encourage you to join our rehab group. This group will allow you the opportunity to meet other people with a hearing loss and hearing aids. You will gain advice and support from people that have experienced the same challenges as you.

If you have any questions, queries or complaints regarding your hearing aid, please do not hesitate to contact the **Helen Joseph Audiology Department on 011 489 0823.**

NOTES:

_____

_____

_____

_____

Appendix C: PHAST-R

Participant Number: _____

Place the following items in front of the patient:

- A telephone
- A variety of different sized batteries
- Magnetic tool for battery removal
- Cleaning tool: brush, cloth and wax loop

Scoring
2: Able to perform task
1: Able to perform task with deviant means (e.g. takes aid out to adjust VC), needs some reinstruction
0: Cannot perform the task

Complete entire test (reinstruct on item after the test is completed).

Reinstruct on all items where the patient received a score of 0 or 1.

		Score
Please take out your hearing aid		
	Grasp	
	Removal	
Open up the battery door		
	Locate	
	Removal	
Please show me how to change your hearing aid battery		
	Remove	
	Size	
	Tab	
	Replace	
Please show me how to clean you hearing aid		
	Soundbore / wax guard	
	Mic	
	Vent	
	Open fit tube	
Please put your hearing aid back in your ear		
	Grasp	
	Placement	
Turn up the volume on your hearing aid		
	Volume control	
Show me how to use the telephone with your hearing aid		
	Programme	
	Placement	
Show me how you would adjust your hearing aid in a noisy environment		
	Programme	
Total Score		

Appendix D: SADL

Satisfaction with amplification in daily life

A	**Not at all**
B	**A little**
C	**Somewhat**
D	**Medium**
E	**Considerably**
F	**Greatly**
G	**Tremendously**

Patient number: _____

Instructions:
Listed below are questions on your opinions about your hearing aid(s). For each question, please circle the letter that is the best answer for you. The list of words on the right gives meaning for each letter.
Keep in mind that your answers should show your general opinions about the hearing aids that you are wearing now or have most recently worn.

1	Compared to using no hearing aid at all, do your hearing aids help you understand the people you speak with most frequently?	A	B	C	D	E	F	G
2	Are you frustrated when your hearing aids pick up sounds that keep you from hearing what you want to hear?	A	B	C	D	E	F	G
3	Are you convinced that obtaining your hearing aids was in your best interest?	A	B	C	D	E	F	G
4	Do you think people notice your hearing loss more when you wear your hearing aids?	A	B	C	D	E	F	G
5	Do your hearing aids reduce the number of times you have to ask people to repeat?	A	B	C	D	E	F	G
6	Do you think your hearing aids are worth the trouble?	A	B	C	D	E	F	G
7	Are you bothered by an inability to get enough loudness from your hearing aids without feedback (whistling)?	A	B	C	D	E	F	G
8	How content are you with the appearance of your hearing aids?	A	B	C	D	E	F	G
9	Does wearing your hearing aids improve your self-confidence?	A	B	C	D	E	F	G
10	How natural is the sound from your hearing aids?	A	B	C	D	E	F	G
11	How helpful are your hearing aids on MOST telephones? If you hear well on the telephone without hearing aids, check here □	A	B	C	D	E	F	G
12	How competent was the person who provided you with your hearing aids?	A	B	C	D	E	F	G
13	Do you think wearing your hearing aids makes you seem less capable?	A	B	C	D	E	F	G
14	Does the cost of your hearing aids seem reasonable to you?	A	B	C	D	E	F	G
15	How pleased are you with dependability (how often they need repairs) of your hearing aids?	A	B	C	D	E	F	G

Appendix E: Ethics Certificate

R14/49 Mrs Tracy Wentzel

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M150493

NAME: (Principal Investigator)	Mrs Tracy Wentzel
DEPARTMENT:	Speech Pathology and Audiology Helen Joseph Hospital Charlotte Maxeke Johannesburg Academic Hospital
PROJECT TITLE:	The Relationship between Practical Hearing Aid Skills and Patient Satisfaction in the Public Healthcare Setting
DATE CONSIDERED:	24/04/2015
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Karin Joubert
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	09/03/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**.

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

*note this document was reissued as the original document (dated July 2015) was not available

Appendix F: Permission from HJH

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Helen Joseph Hospita
Enquiries: Dr. M.R. Billa
Chief Executive Office
Tel: (011) 489-0306/108
Fax: (011)726-542
Email:Raymond.Billa@gauteng.gov.z

PERMISSION TO CONDUCT RESEARCH AT HELEN JOSEPH HOSPITAL

PRINCIPAL RESEARCHER

FULL NAME Tracy Wentzel

DESIGNATION Speech Therapist and Audiologist

CONTACT NUMBER 011 489 0823 / 082 776 9898

E-MAIL ADDRESS tracyredhouse@hotmail.com

DEPARTMENT Audiology

HEAD/S OF DEPARTMENT/S Kim Coutts

TITLE OF RESEARCH The Relationship between Practical Hearing Aid Skills and Patient Satisfaction in the public health care setting

OBJECTIVES OF RESEARCH

The main aim of the study is to determine the relationship between the ability to manipulate hearing aids and self-perceived satisfaction with hearing aids in individuals fitted with hearing aids in the public health care sector. • To determine the ability of individuals to manipulate their hearing aids.
• To determine the self-perceived satisfaction with hearing aids in terms of the positive effects, negative features, personal image as well as the costs and services.
• To compare the SADL scores to the norms provided by Cox and Alexander (1999) as well as more recent studies.
• To compare PHAST-R scores to the norms provided by Desjardins and Doherty (2009) as well as more recent studies.

STUDY SITE/S Helen Joseph

BRIEF OUTLINE OF METHODOLOGY Patients who agree to participate will be asked to participate in a patient satisfaction questionnaire and a practical hearing aid skills test. These two items should only require fifteen to twenty minutes of the patients' time and will be arranged for a date and time which is most convenient for the patient. Patients who provide informed consent to participate in this study will include those who have been fitted with a hearing aid within the last two years at Helen Joseph Hospital. Once data has been collected patients will remain anonymous to the researcher and no personal or confidential information will be published. Patients are in no way obligated to participate and have the right to withdraw at any point.

EXPECTED START DATE June 2015		**EXPECTED DURATION** 6 - 8 months		
ETHICS CLEARANCE	YES	NO		PENDING Approved on condition that hospital gives written consent
CONFLICTS OF INTEREST	YES	NO	X	DETAILS:
COSTS TO HOSPITAL AND/OR OTHERS	YES	NO	X	
SOURCE OF FUNDING Self-funded				
SIGNATURE OF RESEARCHER & DATE		19/06/2015		
PERMISSION GRANTED	YES	NO		
		CEO		PROVINCIAL GOVERNMENT GAUTENG HELEN JOSEPH HOSPITAL PRIVATE BAG X47 AUCKLAND PARK 2006 JOHANNESBURG
SIGNATURE (~~CLINICAL MANAGER~~ /CEO)		**NAME IN PRINT & DESIGNATION** M.R. Billa		**OFFICIAL STAMP & DATE** 19 JUN 2015 HELEN JOSEPH HOSPITAL PROVINCIAL GOVERNMENT GAUTENG

Appendix G: Participant Informed Consent

I, _____, hereby agree to participate in the research titled "*The relationship between Practical Hearing Aid Skills and Patient Satisfaction in the Public Health Care Setting*".

I understand that there will be no remuneration for participating in this research. The purpose and procedures have been explained to me. I understand that my participation is voluntary and that I may choose to withdraw from the study at any time without negative consequences. I understand that my results will be kept confidential.

Signature of participant: _____ Date: _____

Signature of researcher: _____ Date: _____

Appendix H: Participant information letter

Good day,

My name is Tracy Wentzel. I am currently completing my masters' degree at the University of the Witwatersrand.

I would like to invite you to take part in my research study. I will be inviting people who all received their hearing aids from a government hospital. This study aims to gain further information regarding "The relationship between Practical Hearing Aid Skills and Patient Satisfaction in the Public Health Care Setting". The study will take place at the hospital where you received your hearing aid.

If you agree to participate, you will be required to complete a short practical activity with your hearing aid and fill in a short questionnaire, which will take you no longer than 15 minutes.

There are no known risks associated with the research. The participation in this research study is voluntary. The refusal of the individual to participate will involve no consequence or loss of benefits to which the participant is entitled to. The participant may withdraw from the study at any stage should they wish to, without any consequences. No persons will be identifiable as participant numbers; but will be used for the research report. Every effort will be made to guarantee confidentiality; personal information will only be reviewed by the research team (researcher and academic supervisor). Personal information will be safely stored and no other parties will have access to this. This information will be destroyed after a mandatory period of five years.

All participants who choose to participate will have their ears checked for wax and the wax taken out if necessary. The participants will also receive a clean and check of their hearing aid, free of charge.

The researchers will be available should you require clarity with the questions. The results will be reviewed by Tracy Wentzel, the researcher and my supervisor, Dr Karin Joubert. The identity of you the participant will be kept confidential.

You are under no obligation to take part in the study and you have the right to withdraw at any point during the process of the study. The results of the study will be made available should you like to read them.

If you require any further information, please contact the researcher, Tracy Wentzel, on Tel: 011 489 0823 or tracyedhouse@hotmail.com or Dr. Karin Joubert, research supervisor on Tel: 011 717 4561 or Karin.Joubert@wits.ac.za.

If you want to report any complaints regarding the research study you are welcome to contact the Human Research Ethics Committee of the University of the Witwatersrand. The contact details of the secretary, Anisa Keshav, are 011-717-1234 or Fax: 011-336-5708 or Email: anisa.keshav@wits.ac.za.The chairperson of the committee is Prof. Cleaton-Jones and his contact details are 011-717-2301 or Email peter.cleaton-jones@wits.ac.za.

Yours sincerely,

Tracy Wentzel