UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Department of Speech-Language Pathology and Audiology

Understanding Hearing Aid Use and Non-Use in Adult Hearing Aid Recipients: A Qualitative Content Analysis

Jane Cumming

15191843

A dissertation in fulfilment of the requirements for the degree MA AUDIOLOGY in the Department of Speech-Language Pathology and Audiology, Faculty of Humanities

University of Pretoria

SUPERVISORS

Supervisor: Prof. De Wet Swanepoel

Co-supervisor: Prof. Faheema Mahomed Asmail

2024

RESEARCH OUTPUT AND PUBLICATION

An excerpt of this work was presented at the 16th European Federation of Audiology Societies (EFAS) 2023 congress in Sibenik, Croatia, 3rd-6th May 2023.

The research article based on this work (chapter 3) was submitted for review to the American Journal of Audiology on the 30th of August 2024.

ACKNOWLEDGEMENTS

The author wishes to extend special acknowledgement to the following individuals for their invaluable contributions to this dissertation.

To my supervisors:

- Professor Faheema Mahomed-Asmail – Thank you for your words of encouragement and continuous motivation.
- Professor De Wet Swanepoel – Thank you for sharing your knowledge and always finding a silver lining.
- Professor Vinaya Manchaiah – Thank you for your invaluable input and kindness.
- Doctor Eldre Beukes – Thank you for always making suggestions positively, and for your invaluable assistance during data analysis.

To my family:

- To my parents, I owe all that I am and have achieved to you. This would not be possible without you.
- To my brother, thank you for your endless support and for always believing in me.

PLAGIARISM DECLARATION

Full names	Jane Cumming
Student number	U15191843
Topic of work	Understanding Hearing Aid Use And Non-Use In Adult Hearing Aid Recipients: A Qualitative Content Analysis

Declaration

I understand what plagiarism is and am aware of the University's policy in this regard.
I declare that this DISSERTATION (e.g. essay, report, project, assignment, dissertation, thesis, etc.) is my own original work. Where other people's work has been used (either from a printed source, internet or any other source), this has been properly acknowledged and referenced in accordance with the requirements as stated in the University's plagiarism prevention policy.
I have not used another student's past written work to hand in as my own.
I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Signature: ***J. Cumming***

Table of Contents

ABSTRACT

The increase in hearing loss statistics continues to be a growing global health concern. Despite the critical role that hearing aids play in the clinical management of hearing loss, many recipients have reported that they do not use their devices consistently. However, over the past decade, there have been rapid advancements in the hearing aid industry with new innovations that aim to improve the functionality of the devices in general as well as user experiences. The aim of the present study was to explore the self-perceived reasons for hearing aid use and non-use among a large cohort of adult hearing aid recipients.

Utilizing a cross-sectional survey design, the study analyzed qualitative responses from 680 adult American hearing aid users, aged 19 to 93 years, collected through the Hearing Tracker and Lexie Hearing platforms. The open-ended responses were examined using content analysis, which identified key themes related to the use and non-use of hearing aids.

The findings were linked to two domains namely, hearing aid use and hearing aid non-use. Within these domains, three primary categories emerged: personal factors, situational aspects, and device-related issues. In the non-use domain, 24 sub-categories were identified, including self-consciousness, discomfort, the need for fine-tuning, and fears related to device damage or loss. Conversely, the hearing aid use domain comprised 11 sub-categories, highlighting reliance on the device for daily functioning, environmental safety and awareness, and the benefits of streaming and connectivity features.

This study highlights the importance of addressing the personal concerns of hearing aid users, particularly in enhancing the comfort and practicality of devices. By providing targeted support in challenging situations, satisfaction with hearing aids can be improved, potentially leading to more consistent use and better overall outcomes for individuals with hearing loss.

LIST OF ABBREVIATIONS

BTE – Behind-the-ear

OTC – Over-the-counter

HHP – Hearing Healthcare Provider

APP – Application

PCC – Patient-Centred Care

AI – Artificial Intelligence

KEY WORDS

Stigma

Hearing aid use

Hearing aid non-use

Patient-centred care

User perspectives

Technology

LIST OF TABLES

(Please note: for the purpose of obtaining a list of tables the numbering used in the article had to be changed for the purpose of the dissertation)

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

Hearing loss is a significant global health issue, with the World Health Organization (WHO) estimating that over 700 million individuals will have some form of disabling hearing loss by 2050. Despite this growing concern, the consistent use of hearing aids among those with hearing loss remains alarmingly low (McCormack & Fortnum, 2013; Hickson et al., 2014). In the United States, the Centers for Disease Control and Prevention (CDC) reported that 13% of adults aged 18 years and older had difficulty hearing even while using hearing aids (CDC National Center for Health Statistics, 2021; Madans, Weeks, & Elgaddal, 2021). Moreover, fewer than 11% of individuals diagnosed with disabling hearing loss are hearing aid users (Ferguson et al., 2016; Bisgaard et al., 2022). This low adoption rate is not limited to the United States; across high-income countries, hearing aid adoption for significant hearing loss remains below 20% (Chien & Lin, 2012). In contrast, in low- and middle-income countries such as Zimbabwe and Tanzania, hearing aid use is virtually non-existent (Orji et al., 2020).

The global burden of hearing loss extends beyond individual health, impacting economic productivity and societal well-being. According to the World Health Organization, untreated hearing loss costs the global economy over $750 billion annually in lost productivity, healthcare expenses, and educational support (WHO, 2017). In low- and middle-income countries, the lack of access to hearing care exacerbates these economic challenges, trapping individuals and communities in cycles of poverty (Graydon, Waterworth, Miller, Gunasekera, 2018). Hearing loss also contributes to communication barriers in the workplace, limiting career opportunities and reducing overall workforce efficiency (Stam, Kostense, Festen, & Kramer, 2013). These economic implications indicate the need for increased awareness, early detection, and intervention strategies to manage hearing loss globally.

The underutilization of hearing aids is further compounded by societal attitudes. For instance, when participants were asked to rank the importance of hearing loss compared to conditions such as diabetes, Alzheimer's, and heart disease, hearing loss was rated among the least important (Carlson et al., 2022). This reflects a broader lack of awareness about the benefits and potential of hearing rehabilitation. Consequently, the positive impact of hearing aids, such as improved communication, relationships, mental and physical health, and overall quality of life, is often underappreciated (McCormack & Fortnum, 2013). The implications of these statistics highlight a significant public health challenge, as untreated hearing loss can lead to social isolation, cognitive decline, and other adverse outcomes.

One significant barrier contributing to low adoption rates is the stigma associated with hearing aid use. Stigma, often linked to aging and disability, remains a powerful deterrent despite technological advancements that have made hearing aids more discreet (Choi et al., 2019; Wallhagen, 2009). The term "stigma" itself, originating from Greek and implying a negative mark or sign, underscores the deep-seated negative perceptions that many associate with hearing aids (Wallhagen, 2009). Ageism, a form of discrimination based on age, also plays a significant role in these perceptions(World Health Organization, 2021; Wallhagen, 2009). In many cultures, hearing loss is viewed as a sign of aging and frailty, leading individuals to avoid using hearing aids for fear of being labelled as old or incapable (World Health Organization, 2021). Media portrayals of hearing loss often reinforce these stereotypes, depicting older adults with hearing aids as out of touch or less competent (Foss, 2014). Additionally, individuals with hearing loss may internalize these societal messages, leading to feelings of shame and a reluctance to seek help (Holman, Ali, & Naylor, 2023). This internalized stigma can be particularly damaging, as it not only discourages hearing aid use but also affects the individual's self-esteem and willingness to engage in social activities (Bennett, Laplante-Lévesque, & Eikelboom, 2019).

For those who do overcome the stigma, satisfaction with hearing aids is not always guaranteed. Many users express frustration when hearing aids fail to restore normal hearing, even after adjustments have been made (Linssen et al., 2013). Physical discomfort, such as ear pain and itching, is also a common complaint (McCormack & Fortnum, 2013). These issues are often exacerbated by a poor client-provider relationship, stemming from inadequate counseling and support (Laplante-Lévesque et al., 2013; McKee et al., 2019). As a result, many hearing aid recipients struggle with managing their devices and feel that their expectations were not adequately addressed by their hearing care providers, leading to non-use of their hearing aids (Laplante-Lévesque et al., 2013).

Hearing healthcare providers (HHPs) play a crucial role in the management of hearing loss, acting as both clinicians and counsellors (McKee et al., 2022). Effective HHP-patient communication is essential to ensure that patients understand their hearing loss, the benefits and limitations of hearing aids, and the importance of consistent use (Barker, Leighton, & Ferguson (2017). However, many HHPs face challenges in addressing the diverse needs of their patients, from language barriers to varying levels of health literacy. Personalized care, where the HCP tailors their approach based on the patient's individual circumstances and preferences, is critical for improving patient outcomes (Ismail et al., 2019). This includes not only the technical aspects of fitting and adjusting hearing aids but also providing emotional support and helping patients navigate the social implications of hearing loss (Linssen et al.,

2013). Ongoing support is equally important, as patients may need time to adjust to their hearing aids and may require multiple follow-up visits to address issues such as discomfort or dissatisfaction with sound quality (McCormack & Fortnum, 2013).

Untreated hearing loss is not only a communication barrier but also a risk factor for more serious health conditions, including cognitive decline and mental health issues (Lin et al., 2013; Ferguson et al., 2016). Research has shown that individuals with untreated hearing loss are at a significantly higher risk of developing dementia and other cognitive impairments (Liu & Lee, 2019). This link is thought to be due to the brain's increased effort to process sound, which can lead to cognitive overload and reduced brain function over time (Wingfield, & Peelle, 2012). Additionally, hearing loss is strongly associated with depression and anxiety, particularly in older adults (Ciorba et al., 2012). The social isolation that often accompanies hearing loss can exacerbate these mental health issues, as individuals may withdraw from social interactions to avoid the embarrassment of not being able to hear or participate fully (Shukla et al., 2020). These findings highlight the importance of early intervention and consistent hearing aid use to mitigate the long-term consequences of hearing loss.

The technological landscape of hearing aids has seen rapid advancements in recent years, with new innovations aimed at improving user experience and functionality (Valentinuzzi, 2020). Artificial intelligence (AI) is increasingly being integrated into hearing aids, allowing for more sophisticated sound processing and automatic adjustments based on the user's environment (Fabry & Bhowmik, 2021). Connectivity features, such as Bluetooth and wireless streaming, enable hearing aids to interface seamlessly with smartphones, televisions, and other digital devices, enhancing the user's ability to engage with modern technology (Picou, 2020). These advancements not only improve the auditory experience but also address some of the convenience and usability issues that have historically been barriers to consistent hearing aid use (Coco, 2022).

Public health strategies play a crucial role in improving hearing aid adoption and addressing the barriers to use. Awareness campaigns that highlight the benefits of early intervention and hearing aid use can help to shift public perceptions and reduce the stigma associated with hearing loss (Pichora-Fuller, Mick, & Reed, 2015). Early screening programs, particularly in schools and community centres, ensure that hearing loss is detected and addressed at an early stage, preventing the long-term consequences of untreated hearing loss (World Health Organization, 2024; Ferrán et al., 2024). Community-based interventions, such as peer support groups and hearing aid workshops, provide a platform for individuals to share their experiences, learn from each other, and gain the confidence needed to use their hearing aids

consistently (World Health Organization, 2024). These strategies, when implemented effectively, can create a supportive environment that encourages hearing aid use and improves overall hearing health.

Previous research has extensively documented the barriers to hearing aid use, such as stigma, discomfort, and poor clinician-patient communication (Oosthuizen et al., 2022; Desjardins and Sotelo 2021; Dillon et al., 2020; Linssen et al., 2013; McCormack & Fortnum, 2013; Wallhagen, 2009) but there remains a gap in qualitative research that explores the nuanced experiences of hearing aid users, particularly within different cultural and socioeconomic contexts. The present study aims to fill this gap by investigating the first-hand experiences of hearing aid recipients in the American context, focusing on the reasons behind their choices to use or not use their hearing aids. The findings of this study have the potential to contribute significantly to the fields of audiology, public health, and health policy. By providing a detailed exploration of the lived experiences of hearing aid users, this research can inform clinical practices, ensuring that hearing care providers are better equipped to address the barriers to hearing aid.

CHAPTER TWO: METHODOLOGY

2.1 Research Aim

The aim of the present study is to explore the self-perceived reasons by hearing aid recipients for hearing aid use and non-use, based on a large group of hearing aid recipients.

2.2 Research Design

This study utilised a cross-sectional retrospective survey research design in order to obtain in-depth information on the nuanced experiences of hearing aid recipients. Specifically focussing on the reasons for the use and non-use of their hearing aids. The qualitative data was collected by researchers based at Lamar University through an electronically distributed survey sent to hearing aid recipients in the Hearing Tracker and Lexie Hearing databases. Qualitative content analysis was utilised in order to develop new theories rather than analysing predefined theories (Manchaiah, Beukes, & Roeser, 2020). This method of analysis allowed for a flexible yet systematic approach which identified the nuanced open-ended responses from the hearing aid recipient's voice.

2.3 Study Setting

This research study was based on adult American hearing aid users who were either part of the Hearing Tracker or Lexie Hearing database. The study was conducted during October to November 2021. The Hearing Tracker participants were fitted with hearing aids using traditional hearing healthcare provider models of care, whereas Lexie Hearing consisted of obtaining OTC hearing aids with remote support from a hearing healthcare provider. Hearing Tracker is a website consisting of the reviews and experiences of hearing aid recipients based in the US which also provides unfettered interaction with hearing healthcare professionals and fellow consumers. The HearX Group founded Lexie Hearing with the intention of providing remote assistance to consumers following a tele-audiology approach. Hearing tracker was developed by audiologists to enable hearing aid users to provide personal accounts of their hearing aid experiences and also to provide positive and negative ratings related to a certain hearing aid, providing valuable information about service delivery and device features for the healthcare provider, the manufacturing companies, and prospective hearing aid users (Hearing Tracker, 2022). Lexie hearing provides individuals with self-programmable hearing aids and provides remote support to the device users thereof (www.lexiehearing.com/us/). Lexie hearing entails purchasing an over-the-counter behind-the-ear (OTC BTE) hearing aid

which is fitted by the hearing aid user themselves, and comes with an accompanying application (app) providing the user with instructions on how to fit the hearing aid.

2.4 Data Collection Material

Two psychologists assisted in formulating the survey questions (Appendix A) sent to the participants, namely Prof James Pennebaker (University of Texas, Austin) and Prof Ryan Boyd (University of Lancaster). The survey used to collect the data was created on an online platform, Qualtrics and was sent to the relevant databases. A total of 33 closed-ended questions (Appendix A) were included, which related to demographics (age, gender, work, income, race, educational level, and ethnicity), hearing-related variables, general health, well-being, and social network. The participants then had to answer four open-ended questions relating to a) reasons for hearing aid purchase, b) meaningful life changes as a result of hearing aids, c) hearing aid use and non-use and d) improvements to the hearing aid. These are the questions upon which the larger study is based. This study focused specifically on the question related to use and non-use of hearing aids which read as follows '*we are trying to understand when people do and do not wear their hearing aids. Other than when you are alone, when do you avoid hearing aids? Why? Why do you think people often avoid wearing hearing aids in situations that they really should?*' The Hearing Tracker participants were required to write a response (minimum 20 words) describing their hearing device experience, as well as frequency and situational use, and Lexie Hearing participants had no word limit which may have resulted in shorter responses. The COREQ (Consolidated Criteria for Reporting Qualitative Research)(Appendix B) and CHERRIES (Checklist for Reporting Results of Internet E-Surveys)(Appendix C) frameworks were utilised to report the methods and results of this study. These frameworks assist in improving the transparency and quality of qualitative research reporting. The COREQ is a 32-item checklist which assists researchers conducting qualitative studies, more specifically research based on interviews or focus groups by ensuring comprehensive reporting about the study context, methods, and analysis (Tong et al., 2007). The CHERRIES is a 14-item checklist which aims to improve qualitative reporting of online survey research, by providing structure for comprehensive reporting (Eysenbach, 2004). These frameworks enhance credibility and reproducibility as well as rigor.

2.5 Research Participants

A purposive sampling technique was used in this study, as it involves specifically selecting participants based on their characteristics, knowledge or experiences (Brink, van Rensburg, & van der Walt, 2018). Participants were recruited from the two American online platforms

(Hearing Tracker and Lexie hearing). A survey was sent to the participants affiliated with the abovementioned platforms and their participation was optional. In order to participate in this study, participants had to meet the following criteria: be 18 years or older, be based in America, have no diagnosed neurological condition, be unilateral or bilateral hearing aid users, current or past hearing aid users, and provide electronic informed consent (Appendix D). Table 1 provides a rationale for each of the inclusion criteria set out.

A total of 1094 responses were obtained in the raw data set, of which 827 were from Hearing Tracker and 278 from Lexie hearing. A data set of 680 responses was analysed for the purpose of this study post exclusions. This large data set allowed for diversity and generalisability. Responses were excluded (n=414) for the following reasons: participants who did not provide informed consent (n=26; n=12 Hearing Tracker; n=14 Lexie Hearing); participants who had only an implantable device(s) (e.g., cochlear implants, bone anchored hearing aids) (n=3); participants who had other type of hearing aids such as Personal Sound Amplification Products (PSAPs) (n=14). In addition, 338 participants did not answer any open-ended question (n=338) and were thus excluded. Furthermore, duplicate (n=3), blank responses (n=6), and irrelevant responses (n=24) were excluded. Irrelevant responses were excluded based on relevance to the topic of the study as well as the relevance of the participant's specific written response. Participants were unable to change their responses once they were submitted. No personally identifiable data was collected.

Table 1. Inclusion and exclusion criteria

Criteria	Rationale
American Hearing aid user	Hearing Tracker and Lexie are both American hearing aid platforms, therefore hearing aid users based in America were recruited.
Unilateral or bilateral hearing aid users	Input from both unilateral and bilateral hearing aid users were of value and included.
Current and past hearing aid users	Participants could be current or past users. Past users were included as they provided an account of their past experience with hearing aids, and current device users provided an account of their lived experiences with hearing aids.
Adults 18 years and older	Participants were required to be 18 years and older in order to understand the objectives of the study, and to provide

	informed consent, as well as a personal account of their experience with hearing aids.
Electronic informed consent (Appendix D)	In order to ensure that the participants were aware of what the study entails and that they understood that their responses may be used for research purposes.

2.6 Ethical Considerations

Ethical clearance was obtained from Lamar University providing access to the survey response data (Appendix E) (IRB-FY21-248). Data analysis commenced after ethical clearance was obtained from the Research and Ethics committee, Faculty of Humanities at the University of Pretoria (Appendix F) (HUM014/0922). The research methodology and data analysis process of this study was consistently monitored by the research supervisors in order to avoid researcher bias. This ensured that the information obtained from the researcher's data remained applicable to the study at hand. In addition to this, plagiarism was avoided by constant monitoring of written material and accurately referencing any academic material that was consulted.

2.6.1 Informed Consent and Confidentiality

The participants were informed about the purpose of the survey, and clarity was provided indicating that participants could withdraw from the study at any point without any consequences. All participants in this study had an opportunity to review the study information and provided their consent electronically by ticking the correct answer on the electronic consent form (Appendix D), and answering the questions once they had given consent. No personal details were shared with the researchers involved in this study and each potential participant's identifying information was de-identified and had a numerical number assigned to them.

2.6.2 Data Storage

The data related to this study will be stored digitally for 10 years. The data will be stored by the University of Pretoria in the Department of Speech Language Pathology and Audiology, in accordance with the policies of the institution.

2.6.3 Protection from Harm

Participants were protected from harm as there were no factors that involved in this study that could inflict medical or psychological harm to the participants, as this study was based

on an online survey (Appendix A) that were specific to hearing aid user experiences. Participants were included in this study if they signed the electronic consent form (Appendix D), and could withdraw from the study at any point.

2.7 Trustworthiness

Trustworthiness is a term that refers to uniformity that exists between the study and the researchers (Brink, van der Walt, & van Rensburg, 2018). Trustworthiness was achieved by applying a known qualitative analysis method, namely content analysis when data analysis was conducted (Brink, van der Walt, & van Rensburg, 2018; Polit & Beck, 2014). Dependability refers to obtaining the same findings should the study be repeated with the same or similar participants (Polit & Beck, 2014). In this study dependability was achieved by extensively documenting the content analysis at each stage to ensure clear and replicable analysis. The research supervisors and collaborators cross-checked the analysis to ensure consistency of the approach (VM, EB, FA, DS). Confirmability was achieved by ensuring that any uncertainties or discrepancies were resolved through discussions with supervisors and collaborators of the project.

2.8 Data Analysis

The de-identified raw data set was exported to Microsoft Excel with demographic responses descriptively analysed using Statistical Package for the Social Sciences (SPSS) version 28, and each participant response was categorised using a unique numerical identity to be used as reference. An inductive qualitative analysis approach, specifically, content analysis as described by Brink, van Rensburg and van der Walt (2018) was utilised. A meaning unit was created for each response and a code was generated that corresponded with the specific meaning unit. The codes that were generated were structured into two domains namely, domain 1: hearing aid use and domain 2: hearing aid non-use. The data was further grouped into categories and sub-categories (11 sub-categories for hearing aid use (domain 1) and 24 sub-categories for hearing aid non-use (domain 2). This allowed for further meaningful interpretation to be made. Data saturation was achieved at 95% (n=647) of the responses. This was indicative of no new themes or information emerging from the data that was obtained. The analysis process involved consistent comparisons and continuous refinement of the codes and categories involved, in order to highlight the credibility of the research findings. Therefore, a total of 680 responses were analysed. To ensure trustworthiness, initial coding was conducted by (JC) and cross-checked by experienced qualitative researchers (EB & VM) in order to ensure that the results obtained remained consistent.

CHAPTER THREE: RESEARCH ARTICLE

Understanding Hearing Aid Use and Non-Use in Adult Hearing Aid Recipients: A Qualitative Content Analysis

Authors: Jane Cumming, Prof De Wet Swanepoel, Prof Faheema Mahomed-Asmail, Prof Vinaya Manchaiah, Eldré Beukes.

Journal: American Journal of Audiology (AJA)

Submitted: 30th August 2024

Status: (see Appendix G)

Understanding Hearing Aid Use and Non-Use in Adult Hearing Aid Recipients: A Qualitative Content Analysis

Jane Cumming,[1] Vinaya Manchaiah,[1,2,3,4,5] Faheema Mahomed-Asmail,[1,2] Eldré W. Beukes,[2,4,6] & De Wet Swanepoel[1, 2, 3]

[1]Department of Speech-language Pathology and Audiology, University of Pretoria, South Africa
[2]Virtual Hearing Lab, Collaborative initiative between University of Colorado School of Medicine, Aurora, Colorado, USA, and University of Pretoria, Pretoria, South Africa
[3]Department of Otolaryngology-Head and Neck Surgery, University of Colorado School of Medicine, Aurora, Colorado, USA
[4]UCHealth Hearing and Balance, University of Colorado Hospital, Aurora, Colorado, USA
[5]Department of Speech and Hearing, School of Allied Health Sciences, Manipal Academy of Higher Education, Manipal, India
[6]Vision and Hearing Sciences Research Group, Anglia Ruskin University, Cambridge, Cambridgeshire, UK

Word count: 4657 (Excluding references)

Conflict of interest: The data for this study was obtained through Lexie's hearing, which was founded by the hearX Group. De Wet Swanepoel is a scientific advisor and founder of the hearX Group and Vinaya Manchaiah is a scientific advisor for the hearX Group. Eldré W. Beukes, Faheema Mahomed-Asmail and Jane Cumming declare no conflicts of interest at the time of publication.

Funding: No funding was obtained for this study.

All correspondence should be addressed to: De Wet Swanepoel, Faculty of Humanities, Department of Speech - Language Pathology and Audiology, Communication Pathology Building, University of Pretoria. Address: Lynnwood Road & Roper Street, Hatfield, Pretoria, 0002, South Africa. Email: dewet.swanepoel@up.ac.za. Phone: 012 420 2816.

3.1 ABSTRACT

Purpose: Hearing loss results in various challenges, which can be mitigated by the use of hearing aids. Despite the benefits, hearing aids are often not worn consistently. Improved use of hearing aids can be supported by understanding the challenges and motivations users experience. This study explored hearing aid recipients' reasons for hearing aid use and non-use.

Method: A cross-sectional survey design was employed, with qualitative content analysis applied to responses from an open-ended question in an online survey distributed to American hearing aid users from the Hearing Tracker and Lexie Hearing databases.

Results: The study included 680 hearing aid recipients aged 18 to 93 years. The findings were structured around two domains namely, reasons for hearing aid use and hearing aid non-use. Within these two domains, three categories were identified: (a) personal factors, (b) situational aspects, and (c) hearing device-related factors. The 3 categories consisted of 11 sub-categories within the use domain, and 24 sub-categories within the non-use domain. Personal motivations for use included a reliance on hearing aids for essential daily functioning and communication, while non-use was often driven by self-consciousness and discomfort. Device-related aspects highlighted the positive impact of streaming and connectivity features, whereas non-use was frequently attributed to the users perceived need for fine-tuning. Situational factors were also important, with users valuing their hearing aids for environmental awareness and safety, while concerns about fear of damage (e.g., moisture damage) led to decreased hearing aid use.

Conclusions: Addressing personal apprehensions, improving device comfort and functionality, and acknowledging situational preferences are essential for supporting adherence and satisfaction among hearing aid users.

Keywords: Hearing aid use, hearing aid non-use, barriers, facilitators, qualitative research.

3.2 INTRODUCTION

Hearing loss profoundly affects an individuals' well-being and quality of life, often leading to social isolation, depression, reduced overall quality of life, and cognitive decline (Lin et al., 2013; Ferguson et al., 2016). Regular use of amplification devices is crucial to prevent auditory deprivation, as decreased use can result in alterations to auditory pathways and affect how individuals engage with their environment and communicate with others (Kozlowski et al., 2017; Tremblay & Sullivan, 2013; Seroto et al., 2023). Despite the benefits that hearing aids can provide as a primary treatment for hearing loss, less than 11% of individuals who are diagnosed with disabling hearing loss are hearing aid users (Ferguson et al., 2016; Bisgaard et al., 2022).

Although hearing aids have undergone significant advancements in recent decades—offering a wide range of options in size, color, type, and customization to suit individuals' lifestyles and hearing needs (Valentinuzzi, 2020)—their consistent use, especially among older individuals, remains low. This is largely due to psychosocial factors associated with these devices (McCormack & Fortnum, 2013). This is concerning given the well-established benefits of hearing aids, as well as bridging the gap between reduced quality of life and meaningful social interactions by significantly enhancing communication abilities (McCormack & Fortnum, 2013; Mantello et al., 2016; Mothamela et al., 2022).

Successful hearing aid use has been linked to several factors. For instance, Hickson et al (2014) found that adults who had the support of a significant other, displayed confidence in using their hearing aids, maintained a positive attitude towards their hearing disability and tended to experience greater success with these devices. A recent systematic review detailed additional factors facilitating consistent hearing aid use which included satisfaction with the aesthetic appearance of the device and the provision of adequate support and counselling by audiologists (Oosthuizen, et al. 2022). These early experiences can significantly influence recipients' perception and utilisation of their hearing aids. Holman, Ali, and Taylor (2023) further explored this topic, reporting that hearing aid recipients identified several benefits of hearing aid use. The reported benefits included reduced stress, anxiety, frustration and feelings of relaxation when using their hearing aids and interacting with communication partners or when they are in environments which previously caused feelings of stress.

Although many hearing aid recipients have positive experiences, significant challenges remain for others. A recent study by Holman, Yasmin, and Naylor (2023) highlighted the challenges faced by hearing aid recipients in specific contexts, such as work environments and telephonic

conversations. Many reported that the use of their hearing aids led to improved communication, which in turn led to feelings of positive emotions and, therefore, perceptions of increased hearing aid benefit. However, others experienced embarrassment due to the visibility of their hearing aids and reported that specific environments caused more stress than benefit, especially in office settings. Additional barriers to hearing aid use include discomfort, lack of perceived benefit, and difficulty managing the devices (Franks & Timmer, 2023).

Addressing the challenges contributing to poor hearing aid use requires acknowledging the pervasive influence of the 'hearing aid effect' (HAE) on individuals who view hearing aids negatively. This phenomenon encompasses negative stereotypes, such as perceptions of diminished intelligence, attractiveness, and friendliness among hearing aid recipients (Rauterkus & Palmer, 2013). Compounding these stereotypes, societal expectations place undue pressure on hearing aid recipients, assuming that the amplification device promptly resolves their hearing loss, which may not align with the reality of their experiences (Rawool, 2018). Hearing aid recipients have reported feeling compelled to meet normative standards of hearing, contributing to the perception of a lack of necessity for regular hearing aid use (Ritter, Barker, & Scharp, 2020). However, these challenges go beyond social and financial concerns, including physical discomfort and difficulties in device management. Issues related to physical discomfort and device handling contribute to non-use, emphasising the need for user-friendly and more comfortable designs (McCormack & Fortnum, 2013). Moreover, feelings of inadequacy in managing hearing loss illustrates how important it is for adult hearing aid recipients to feel empowered. How satisfied recipients feel and how well their clinicians understand their experiences are key factors in deciding whether to use their hearing aids or not (Manchaiah, Stephens, & Meredith, 2011; Kozlowski et al., 2017).

Despite the significant body of research on hearing aid use, a gap remains in understanding the first-hand experiences of hearing aid recipients regarding use and non-use, particularly from a qualitative perspective. Past studies have focused on quantitative measures of hearing aid efficacy and user satisfaction by outcome measures, but few have delved into the subjective reasons behind hearing aid use and non-use. Those that have, utilised a small sample size in comparison to the present study (Laplante-Lévesque et al., 2012; Linssen et al., 2013; Bennett et al., 2018; Franks & Timmer, 2023). Furthermore, these studies also focused on the use and satisfaction of hearing aids and not reasons for non-use, further emphasising that qualitative research can provide rich, detailed insights into the lived experiences of hearing aid users, revealing the complex interplay of personal, social, and technological factors that influences hearing aid use.

The aim of the present study is to explore the self-perceived reasons by hearing aid recipients for hearing aid use and non-use, based on a large group of hearing aid recipients.

3.3 METHOD

3.3.1 Study Design and Ethical Considerations

A cross-sectional survey design was utilized to explore the self-perceived reasons by hearing aid recipients for hearing aid use and non-use, based on a large group of hearing aid recipients. Qualitative content analysis was employed to analyze responses to an open-ended question from an online survey sent to American hearing aid users on the Hearing Tracker and Lexie Hearing aid database. The selection of this methodological framework was driven by the need to capture the complexity of individual experiences and the nuanced factors influencing hearing aid behavior (Meyer, Hickson, & Fletcher, 2014). Qualitative content analysis allows for a systematic but flexible approach to analyzing textual data, making it particularly suited to uncovering the underlying categories in the open-ended responses of hearing aid users.

Relevant institutional clearances were obtained from Lamar University (IRB-FY21-248) and the University of Pretoria (HUM014/0922) prior to data collection and analysis. The Consolidated Criteria for Reporting Qualitative Research (COREQ; Tong et al., 2007) and the Checklist for Reporting Results of Internet e-Surveys (CHERRIES; Eysenbach, 2004) was used to report the analysis of the study (see Supplementary Material 1 and 2).

3.3.2 Participants

To ensure a large-scale study participants were recruited through two American online platforms, namely Hearing Tracker (www.hearingtracker.com) mailing list and the Lexie hearing (www.lexiehearing.com) database during October and November 2021. Hearing Tracker is an online platform where the public can share their experiences with their hearing aids. The individuals using the Hearing Tracker platform had to make use of an in-person method of service delivery. Lexie hearing entails purchasing an over-the-counter behind-the-ear (OTC BTE) hearing aid which is self-fitting and comes with an accompanying application (app) providing the user with instructions to fit the hearing aid. A total of 1094 responses (827 from Hearing Tracker and 267 from Lexie Hearing) were obtained for analysis. The following responses were excluded: participants who did not provide consent (n=26); participants who

had only an implantable device(s) (e.g., cochlear implants, bone anchored hearing aids; n=3); participants who had other types of hearing aids such as Personal Sound Amplification Products (PSAPs) (n=14). In addition, 338 participants did not answer any open-ended question and were thus excluded. Furthermore, irrelevant (n=24), duplicate (n=3) and blank responses (n=6) were excluded based on relevance to the topic of the study as well as the relevance of the participant's specific written response. Therefore, 680 responses were analysed for the purpose of this study. Participants were required to be 18 years or older and should not have been diagnosed with a neurological condition.

3.3.3 Survey and Data Collection

The survey questions were developed in consultation with two prominent social-psychologists (Prof James Pennebaker, University of Texas, Austin and Prof Ryan Boyd, University of Lancaster) and was made available to participants using the online platform Qualtrics™ (https://www.qualtrics.com). The survey was distributed to the Hearing Tracker and Lexie hearing aid users via an e-mail that redirected participants to a page containing a consent form requiring participants' signatures as well as the e-online survey which had to be completed. The link could only be opened by individuals who belonged to the abovementioned platforms and were hearing-aid recipients. The e-survey included a total of 33 closed-ended questions across two sections and took approximately 15 minutes to complete. The first section related to participant demographics (e.g., age, gender, work, income, race, educational level, and ethnicity), hearing-related variables, general health, well-being, and social network. The second section included four open-ended questions which related to, a) reasons for hearing aid purchase, b) meaningful life changes as a result of hearing aids, c) hearing aid use and non-use and d) improvements to the hearing aid. This study focused on the responses to question c and was worded as follows '*we are trying to understand when people do and do not wear their hearing aids. Other than when you are alone, when do you avoid hearing aids? Why? Why do you think people often avoid wearing hearing aids in situations that they really should?*' The Hearing Tracker participants were required to write a response using a minimum of 20 words, and the Lexie hearing participants did not have a response word limit, and thus, responses may have been shorter. Participants were unable to change their responses once they were submitted. No personally identifiable data was collected. Participation was voluntary and no incentives were offered to participate in this study.

3.3.4 Data Analysis

Descriptive statistics were obtained by using the Statistical Package for the Social Sciences (SPSS) version 28 to analyse the demographic survey data. The data set was de-identified and each participant response categorised using a unique numerical identity in an excel spreadsheet. Qualitative data were analyzed using an inductive content analysis, as described by Brink, van Rensburg and van der Walt (2018). This method was chosen for its capacity to handle large volumes of textual data and to flexibly identify both manifest and latent content. The analysis began with familiarization, where the primary researcher (JC) thoroughly read through all participant responses multiple times to deeply understand the content. During the open coding phase, responses were divided into meaning units—distinct segments of text relevant to the study's aims—and these were assigned descriptive codes. These codes were then systematically organized into a coding tree, grouping similar codes together to form subcategories, which helped clarify relationships and facilitated the broader categorization of the data.

Subcategories were further grouped into larger categories that represented major themes within the data. This process of categorization and abstraction allowed for the identification of overarching themes, ensuring that the analysis captured both the breadth and depth of participant experiences. To ensure the reliability of the analysis, 50% of the codes were cross-checked by an experienced qualitative researcher (EB), with discrepancies resolved through consensus and, when necessary, input from a third researcher (VM). Data saturation was achieved at 95% (n=647) of the responses, indicating that no new themes or insights were emerging, thus confirming the thoroughness of the analysis. The entire process involved constant comparison and iterative refinement of codes and categories, ensuring the consistency, depth, and credibility of the findings.

3.4 RESULTS

A total of 680 responses (60% male; 40% female) aged 18 to 93 with a mean age of 65 (13.92 *SD*) were analysed for the purpose of this study. Of these 476 were from the Hearing Tracker database representing prescription hearing aid recipients and 204 were from the Lexie Hearing user database representing OTC hearing aid recipients. The study was structured around two overarching domains, which consisted of hearing aid use (Table 2), and hearing aid non-use (Table 3). Within both of these domains, three categories related to hearing aid usage emerged: (a) personal factors, (b) situational aspects, and (c) hearing device-related factors. These categories consisted of 11 sub-categories for hearing aid use (domain 1) and 24 sub-categories for hearing aid non-use (domain 2)

Table 2. Domain 1: Categories and sub-categories of reasons for hearing aid use (n=680 participants).

Category	Sub-category	Meaning unit examples (participant age and gender)
Personal Factors (Facilitators) (277)	Reliance for daily functioning (171)	*I wear my hearing aid all the time. There is not a situation that I don't wear it, I need it" (Male, 63).*
	Embracing HAs (57)	*"Now I show acquaintances my hearing aids! I'm not embarrassed at all anymore" (Male, 60).*
	Improved communication (43)	*"The times I do wear them is when understanding conversation is important" (Male, 84).*
	Ensure cost-benefit (6)	*If I am going to spend more than $1000 on an item I am going to make sure that I use it" (Male, 70).*
Situational Aspects (90)	Environmental awareness (28)	*I wear them even when I am alone because I want to be aware of my environment and enjoy the sounds around me." (Male, 62*
	Group settings (22)	*"I now wear my hearing aids all the time when I go out or meet people or have outside meetings." (Male, 69)*

	Recreational listening (21)	*When I am alone I still need hearing amplification for TV or listening to music." (Male, 75)*
	Telephone use (9)	*"I wear my hearing aids most days because it's easier to hear on the phone." (Female, 70)*
	Safety (8)	*"I don't avoid them. I live alone and must hear any sounds so I know what it is. I sleep with mine because I have to know what is going on around me" (Female, 68).*
	Challenging environments (2)	*"I wear my hearing aids whenever I go out. Noise can be a problem in crowded areas , as well as understanding speech" (Male, 23).*
Hearing Device-Related Factors (6)	Streaming and connectivity (6)	*"I use them a lot to listen to podcasts and read books" (Male, 78).*

Note: HAs – Hearing aids

Numbers in brackets are representative of meaning units

Table 3. Domain 2: Categories and sub-categories of reasons for hearing aid non-use (n=680 participants).

Category	Sub-category	Meaning unit examples (participant age and gender)
Situational Aspects (571)	Risk of moisture exposure (205)	*"When I am sweating heavily because hearing aids get wet, and batteries go dead very fast." (Male, 62)*
	Sleeping/in bed (129)	*"The only times I avoid wearing my hearing aids are when in the shower or in bed." (Male, 40)*
	Outdoor activity (93)	*"I avoid wearing them when I ride my bike outdoors." (Female, 62)*
	Challenging environments (68)	*"Wearing them in a group is very confusing with all the voices coming in at once… I dislike them in doctors' offices because the acoustics are generally not good." (Male, 52)*
	Staying at home (60)	*"I seldom wear them when working or alone in my office or at home." (Male, 78)*
	Damage/loss (47)	*"I don't wear them at work because I might lose them." (Female, 70)*
	Recreational (22)	*"Crowds are awful, noisy environments (restaurants, movies, loud music, sporting events) are untenable, causing immediate headaches. No hearing aids can cope." (Female, 72)*

	Background noise (17)	*"I have turned them off when in a noisy situation as they only make the noise louder not more understandable." (Male, 82)*
	Procedural necessities (5)	*"The only time I do not is when I get a haircut, or medical procedures." (Male, 78)*
	Television viewing (2)	*"I also generally don't leave my hearing aids in during TV time." (Male, 40)*
Personal Factors (Barriers) (350)	Self-conscious (165)	*"I think people avoid wearing their HAs sometimes out of self-consciousness." (Male, 66)*
	Listening fatigue (71)	*"I didn't wear my hearing aids as much and looked for opportunities to give my ears a rest." (Male, 69)*
	Lack of motivation (62)	*"The other reason is laziness on the hearing aid wearer. Just doesn't want to put them in." (Female, 68)*
	Acclimatisation (29)	*"In short, I need to gradually adapt to wearing them or not wearing them." (Female, 30)*
	Dependence (19)	*"Sometimes I don't wear a hearing aid when I go out, because I don't want my whole life to be dependent on a hearing aid, and I have to learn to be brave on my own and continue to use a hearing aid occasionally." (Female, 35)*

	Dexterity difficulty (5)	*"In some instances, older persons with poor finger dexterity may have issues with actually inserting them." (Male, 77)*
	Support required (4)	*"They do not always have someone in their life to help them figure out what works best for them as my husband has done for me." (Female, 75)*
Hearing Device-Related Factors (237)	Fine-tuning required (83)	*"…they are not tuned correctly. If you can't hear with them there is little reason to wear them." (Male, 73)*
	Discomfort of fitting (79)	*"They're not comfortable after a while. It's a matter of getting used to wearing them. I feel more comfortable when I take mine out every night." (Female, 57)*
	Compatibility with wearables (39)	*"I do take a daily walk and many times I will remove my HAs so I can use Apple AirPods. I prefer these for music over the Bluetooth of my Oticon OpnS HAs." (Male, 64)*
	Support and training gaps (16)	*"So maybe people need more training on them." (Male, 46)*
	Outer ear health (13)	*"You can't wear a hearing aid when your ear is inflamed, and you can't wear a hearing aid when your ear is running pus." (Female, 39).*

Battery life concerns (10)	*"One senior doesn't occasionally wear them because the battery life is too short." (Male, 79)*
Ongoing cost (5)	*"Cost of damage/replacement is the reason I remove them most often." (Male, 66)*

Note:

Numbers in brackets are representative of meaning units

3.4.1 Domain 1: Reasons for Hearing Aid Use

Category 1: Personal Factors

Four key sub-categories within the personal factors category were identified: reliance for daily functioning, embracing hearing aids for life-changing benefits, improved communication, and the importance of ensuring cost-benefit (Table 2 and Figure 1). Users who relied on hearing aids for daily functioning reported meaningful positive. They highlighted the inability to engage in daily activities without their hearing aids, emphasising the invaluable impact hearing aids have on their ability to interact with their surroundings. Additionally, embracing hearing aids revealed the critical importance of hearing aid user role models in influencing sceptical users. These findings, along with improved communication and a favourable cost-benefit balance, highlights the complex interaction of personal, social, and economic factors in hearing aid use (Table 2).

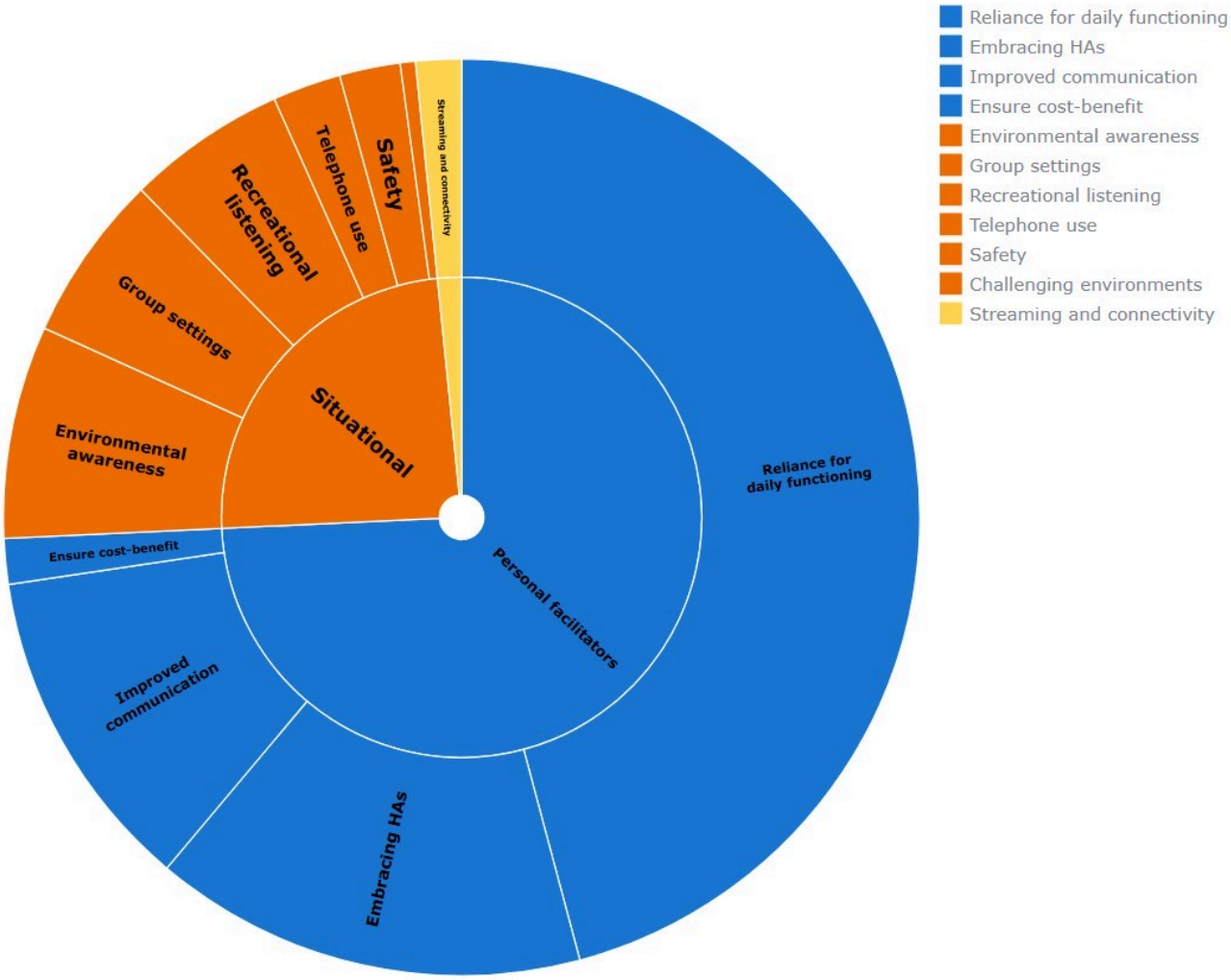


Figure 1: Categories and sub-categories of reasons for hearing aid use

Category 2: Situational Aspects

The situational category revealed six sub-categories influencing hearing aid use: environmental awareness, group settings, recreational listening, telephone use, safety, and navigating challenging environments. Participants frequently used their hearing aids at home to engage with media or converse with significant others. Others reserved their hearing aid use for specific situations such as social gatherings, office meetings, or for situational awareness while navigating streets.

Category 3: Hearing Device Related Aspects

Streaming and connectivity emerged as the only sub-category, with users emphasising the critical importance of Bluetooth connectivity for everyday communication and music streaming through systems like FM. This functionality integrates hearing aids seamlessly into users' digital lives and daily activities, *"I always wear mine even though I live alone. They connect with my phone for calls and streaming audio books" (male, 71).*

3.4.2 Domain 2: Reasons for Hearing Aid Non-use

Category 1: Personal Factors

Seven distinct sub-categories of personal barriers were identified that underlie hearing aid non-use (Table 3 and Figure 2). Most commonly participants expressed self-consciousness and fear of judgment for appearing old or incapable, leading some to choose 'Invisible' Completely-In-Canal (CIC) hearing aids over more suitable options that may have been recommended. Additionally, hearing fatigue emerged as a notable concern, with users reporting overstimulation and discomfort, leading to deliberate periods of non-use to 'rest' their ears, underscoring the sensory challenges associated with acclimating to hearing aids. The role of support—or the lack thereof—was highlighted by participants who felt neglected by their audiologists in understanding and maintaining their hearing aids.

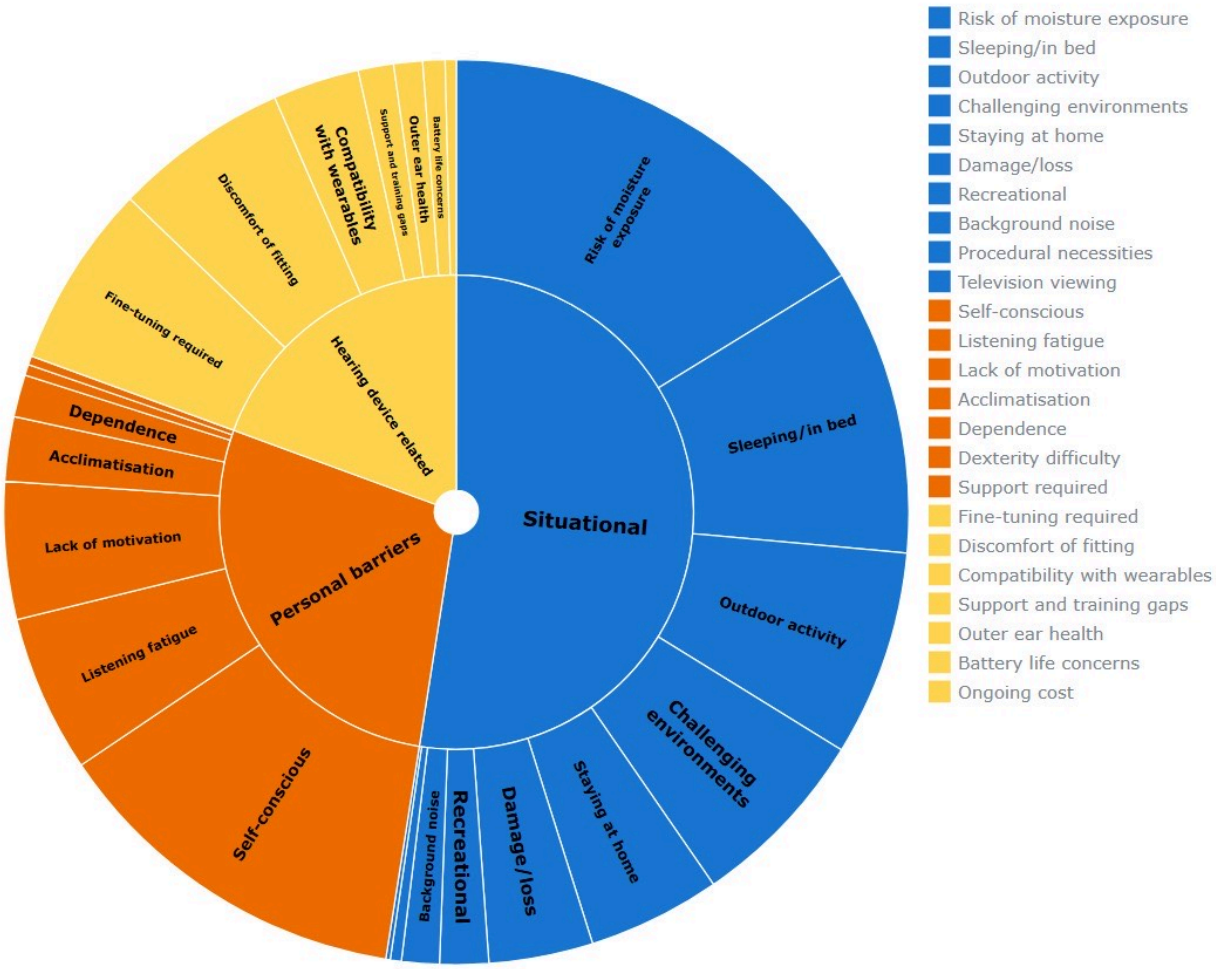


Figure 2: Categories and sub-categories of reasons for hearing aid non-use

Category 2: Situational Aspects

The analysis of non-use situations revealed ten sub-categories (Table 3). The most common factor for hearing aid non-use reported by participants was moisture exposure, many participants reported that these circumstances led to damage of their hearing aids. A common theme emerged around bedtime, with users reporting the removal of their hearing aids to avoid discomfort from noises such as whistling sounds. Similarly, a desire for silence and relief from over-stimulation led to removing hearing aids when alone at home. The fear of losing or damaging hearing aids during physical activities, including exercise and motorsports, also emerged as a significant concern influencing non-use.

Category 3: Hearing Device-Related Aspects

Seven sub-categories related to the device itself were also identified: the need for fine-tuning, discomfort of fitting, compatibility issues with other wearable devices, gaps in support and training, concerns about battery life, outer ear health, and the ongoing costs associated with hearing aid maintenance. A notable concern among users fitted with hearing aids through traditional in-person services was the frequent need for adjustments, suggesting a mismatch between initial fittings and users' evolving needs. This often resulted in suboptimal use or outright non-use due to dissatisfaction with the hearing aids' performance. Discomfort was another major issue, with users reporting problems such as ear moulds causing pain or falling out, leading to relief upon removal of the devices. Additionally, the lack of adequate support and training was evident, particularly in counselling about hearing loss types and managing expectations for first time hearing aid users.

3.5 DISCUSSION

This study qualitatively explored the factors influencing hearing aid use and non-use among recipients. The personal, device-related, and situational categories highlighted in the findings underscore the complex barriers to consistent hearing aid use, such as self-consciousness, discomfort, and the need for support. Conversely, positive personal attitudes and favourable technological features were identified as key facilitators. This underscores the importance of personalized care and tailored communication strategies to effectively address user concerns and preferences. By focusing on the subjective experiences of a large sample of hearing aid recipients, this study provides a comprehensive examination of the factors that typically hinder or promote hearing aid use.

3.5.1 Personal Factors Related to Hearing Aid Use or Non-Use

Self-consciousness emerged as a primary reason for non-use, with many participants citing stigma associated with the appearance of hearing aids and the perception of having a disability. This finding aligns with previous research highlighting the reluctance to use hearing aids due to societal stigma, contrasting sharply with the positive dependence reported by some users who embrace these devices (Oosthuizen et al., 2022; Desjardins and Sotelo 2021; Dillon et al., 2020; McCormack & Fortnum, 2013; Wallhagen, 2009). McCormack and Fortnum (2013) found that stigma was not the most reported concern in their study, and that it was reported to be an inconsistent predictor of the frequency of hearing aid use, thus calling for more research to be conducted in this regard. The introduction of over-the-counter (OTC) hearing aids, particularly those developed by well-known consumer brands, has the potential to further reduce stigma (Champlin et al. 2024; David and Werner, 2016). These brands can help normalise hearing aid use by integrating it into mainstream consumer electronics, thereby making hearing aids more socially acceptable and desirable (Coco, 2022). Implementing these strategies can help shift perceptions, encouraging more individuals to use their hearing aid technology.

The analysis revealed that positive personal attitudes were significant facilitators of hearing aid use. Participants reported that hearing aids played an essential role in their daily lives, enabling better communication and overall quality of life. For instance, one participant stated, "I can't imagine going through my day without my hearing aids. They allow me to participate fully in conversations and activities." This is further supported by Choi et al (2020) who found that participants experienced improved hearing aid benefit especially in social contexts. The presence of role models successfully using hearing aids encouraged sceptical users to

embrace these devices, which is supported by Laplante-Lévesque et al. (2012), who reported that interaction between two hearing aid users fostered a sense of inclusion and motivation to use hearing aids.

Moreover, several participants (n=20) expressed concerns about a communication gap between clinicians and hearing aid recipients. Specifically, participants noted a lack of support from audiologists and inadequate communication regarding the care and maintenance of hearing aids, which led to feelings of inadequacy and failure. Audiologists play a key role by providing personalised counselling, fostering open communication, and promoting public awareness to reduce the stigma associated with hearing aid use. Barker, Leighton, and Ferguson (2017) suggested a patient specific tailored approach and utilising motivational tools, such as IDA tools, in order to facilitate open communication about the effects of hearing aid use on the hearing aid recipients self-perception. Previous studies have also identified factors affecting hearing aid utilization, such as acclimatization difficulties and the absence of adequate support and training from audiologists (Dillon et al., 2020; Oosthuizen et al., 2022; Meyer et al., 2014; Linssen et al., 2013). Meyer, Hickson, and Fletcher (2014) also reported a need for improved clinician and hearing aid user interactions. Furthermore, a systematic review by Ismail et al., (2019) emphasised that the inability to address hearing aid recipients holistically could adversely affect the recipient's attitude and thoughts about hearing aid benefit and use. In contrast, Franks and Timmer (2023) recently reported that clinicians may feel that they have provided the necessary support and that hearing aid users are not receptive to their counselling. Such communication breakdowns negatively impact users' experiences and perceptions, often leaving them feeling unprepared to use their hearing aids effectively.

3.5.2 Situational Factors Related to Hearing Aid Use or Non-use

Difficulties in challenging environments highlight the importance of hearing aid functionality for user satisfaction and continued use. Enhancing the performance of hearing aids in such environments could significantly increase their value and use to recipients, reinforcing the need for continuous technological advancements to meet the diverse and evolving needs of those with hearing loss.

Participants reported frequent use of their hearing aids at home to engage with media or converse with significant others, while others reserved their hearing aids for specific situations, such as social gatherings or navigating streets. For instance, one participant noted, "I always wear my hearing aids during family dinners because I don't want to miss any part of the conversation." This context-dependent nature of hearing aid use highlights the need for

situational-specific solutions. The situational nature of hearing aid use was identified by Laplante-Lévesque et al (2013) to be a result of clinicians encouraging hearing aid users to only use their hearing aids when necessary. This suggests that the relationship between clinician and hearing aid recipient may significantly impact various aspects of the hearing aid recipients' experience, extending beyond personal factors.

Conversely, many participants reported removing their hearing aids when environmental noise became too bothersome as previously also highlighted (Humes et al. 2018). Additionally, Linssen et al (2013) found that participants reported non-use due to hearing aids not providing sufficient benefit in different contexts as initially expected. Participants felt strongly about rather not wearing their hearing aids and sacrificing the ability to hear in a specific context, this was also reported by 54.3% of participants in another study (Manchaiah, Picou, Bailey, & Rodrigo, 2021). This demonstrates the need for advancements in hearing aid technology, particularly features that adapt to different environments, which was a frustration commonly reported by participants of the current study, as well as Picou (2022). In addition, Dawes et al., (2014) found that the continued use of hearing aids in contexts with background noise improved when hearing aids were consistently worn, but worsened when they were removed for periods of time.

3.5.3 Hearing Device Related Factors in Hearing Aid Use or Non-use

Despite advancements like directional microphones and compression systems, the present study found that many hearing aid recipients still do not consistently use their hearing aids due to device-related challenges, which was also identified by Vercammen et al (2023) emphasising that hearing aid recipients experience sound quality and handling issues. Addressing these challenges requires improved device technology that better aligns with user needs, coupled with rehabilitation efforts to educate users on utilizing advanced features for a more personalized hearing experience. This approach could help bridge the gap between hearing aid user experiences and ensure that devices are both technically capable and user-friendly.

Moreover, hearing aid non-use was also linked to physical discomfort, such as ear pain and itching, which has previously been reported (Ribas et al. 2015; McCormack and Fortnum, 2013). This may be related to the negative side effects of hearing aids (Manchaiah et al., 2019), which are rarely measured, reported and addressed in relation to hearing aid use. While the negative side effects can be mild, it is experienced by a large number of hearing aid users (Manchaiah et al., 2019). Addressing the issues of comfortable fitting could help improve

hearing aid use (McCormack and Fortnum, 2013). This gap extends to the need for better education on maintenance and care, highlighting a crucial area for improvement in patient care.

Additionally, the technology of hearing aids, especially concerning streaming, connectivity, and compatibility with wearables, posed both challenges and opportunities to enhance user experiences. While only a few participants mentioned these issues, their feedback highlights an important area for innovation. Picou (2022) found that streaming was an important aspect of a hearing aid recipient's daily life in order to communicate adequately, it was also found that streaming ability lead to user satisfaction and was also found to have a positive impact on listening. There is a clear need for technology that seamlessly integrates with users' daily lives and other digital devices they use. Vercammen et al (2023) also found 20.8% of participants reported frustration with connectivity and streaming technology. This requires focused efforts to refine hearing aid designs, ensuring they are functional and fully integrated into users' technological ecosystem (Desai et al., 2024). Better designs could also reduce stigma and discomfort by making devices more discreet and comfortable, addressing social barriers to using hearing aids. A recent study found that providing the hearing aid recipient with more control during their hearing aid fitting may lead to improved self-reported satisfaction (Knoetze et al., 2024).

3.6 Study Limitations

This study had a rich data set as the participant responses were collected from diverse platforms, providing insights into hearing aid users' lived experiences from varying perspectives. However, several limitations should be noted. Firstly, there was potential for sampling bias since participants were recruited from two online platforms, as well as the self-selection aspect of those who participated in the answering of the questionnaire. Secondly, participants were only recruited from the United States, therefore limiting generalisability to other populations. Thirdly, Hearing Tracker users' responses were required to be a minimum of 20 words, whereas Lexie Hearing users' responses were shorter due to an absence of a minimum word limit. Therefore, the context of some participants' responses was limited. Lastly, the open-ended question in the survey was intentionally complex in order for the participants to respond comprehensively. However, the question could have been challenging for participants with limited technological literacy.

3.7 CONCLUSION

The study provides important insights into the reasons hearing aid recipients do or do not use their hearing aids, exploring personal, situational, and device-related factors through the lived experiences of recipients. These insights can guide improvements in hearing healthcare delivery and hearing aid design. The findings highlight the importance of personalised care and technological advancements that address practical and social challenges users typically face. Clinicians should prioritize open, informative communication with users, offering tailored support to meet individual needs. At the same time, manufacturers need to innovate to improve device integration, comfort, and functionality, reducing barriers to hearing aid use.

Acknowledgments

The authors of this study would like to thank Ilze Oosthuizen for her invaluable guidance during data analysis. No funding was involved in this work.

Data Availability Statement

The data analysed during the current study is available from the corresponding author upon reasonable request.

REFERENCES

Barker, A. B., Leighton, P., & Ferguson, M. A. (2017). Coping together with hearing loss: a qualitative meta-synthesis of the psychosocial experiences of people with hearing loss and their communication partners. *International Journal of Audiology*, *56*(5), 297–305. https://doi.org/10.1080/14992027.2017.1286695

Bennett, R. , Laplante-Lévesque, A. , Meyer, C. & Eikelboom, R. (2018). Exploring Hearing Aid Problems: Perspectives of Hearing Aid Owners and Clinicians. *Ear and Hearing, 39* (1), 172-187. doi: 10.1097/AUD.0000000000000477.

Bisgaard, N., Zimmer, S., Laureyns, M., & Groth, J. (2022). A model for estimating hearing aid coverage world-wide using historical data on hearing aid sales. *International journal of audiology*, *61*(10), 841–849. https://doi.org/10.1080/14992027.2021.1962551

Brink, H., van Rensburg, G., & van der Walt, C. (2018). *Fundamentals of Research Methodology for Healthcare Professionals* (4.). Cape Town: Juta and Company (Pty) Ltd.

Champlin, S., Miller, S., Griffith, A., Hatley, A., Reed, C., & Schafer, E. (2024). Opening Access but Concealing Contact: A First Study of Over-The-Counter Hearing Aid Consumer-Facing Communications. Health Communication, 1–8. https://doi.org/10.1080/10410236.2024.2375146

Choi, J. S., Shim, K. S., Shin, N. E., Nieman, C. L., Mamo, S. K., Han, H. R., & Lin, F. R. (2019). Cultural Adaptation of a Community-Based Hearing Health Intervention for Korean American Older Adults with Hearing Loss. *Journal of cross-cultural gerontology*, *34*(3), 223–243. https://doi.org/10.1007/s10823-019-09376-6

Coco, L. (2022). Over-the-Counter Hearing Aids: What the Practicing Audiologist Needs to Know. *Perspectives of the ASHA Special Interest Groups*, *7*(6), 1806–1811. https://doi.org/10.1044/2022_PERSP-22-00117

Conceiçao de Oliveira da Silva, D., & Coelho Scharlach, R. (2015). Hearing aids users' satisfaction attending a private service. *CEFAC,* 17(6).

David, D., & Werner, P. (2016). Stigma regarding hearing loss and hearing aids: A scoping review. *Stigma and Health*, *1*(2), 59–71. https://doi.org/10.1037/sah0000022

Dawes, P., Maslin, M., & Munro, K. J. (2014). 'Getting used to' hearing aids from the perspective of adult hearing-aid users. *International journal of audiology*, *53*(12), 861–870. https://doi.org/10.3109/14992027.2014.938782

Desai, N., Beukes, E. W., Manchaiah, V., Mahomed-Asmail, F., & Swanepoel, W. (2024). Consumer Perspectives on Improving Hearing Aids: A Qualitative Study. *American journal of audiology*, 1–12. Advance online publication. https://doi.org/10.1044/2024_AJA-23-00245

Desjardins, J.L. & Sotelo, L.R. (2021). Self-Reported Reasons for The Non-Use Hearing Aids Among Hispanic Adults With Hearing Loss. *American Journal of Audiology.*

Dillon, H., Day, J., Bant, S. & Muro, K.J. (2020). Adoption use and non-use of hearing aids: a robust estimate based on Welsh national survey statistics.

Ekberg, K., Grenness, C., & Hickson, L. (2014). Addressing Patients' Psychosocial Concerns Regarding Hearing Aids Within Audiology Appointments for Older Adults. *American Journal of Audiology,* 23, 337-350.

Eysenbach, G. (2004). Improving the Quality of Web Surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *Journal of Medical Internet Research*, 61(31).

Ferguson, M., Maidment, D., Russell, N., Gregory, M., & Nicholson, R. (2016). Motivational engagement in first-time hearing aid users: A feasibility study. *International Journal of Audiology.*

Franks, I., & Timmer, B. H. B. (2023). Reasons for the non-use of hearing aids: perspectives of non-users, past users, and family members. *International Journal of Audiology*, 1–8. https://doi.org/10.1080/14992027.2023.2270703

Gallagher, N.E., & Woodside, J.V. (2018). Factors Affecting Hearing Aid Adoption and Use: A Qualitative Study. *Journal of the American Academy of Audiology,* 29: 4, 300-312.

Gelling, L. (2015). Qualitative Research. *Nursing Standard,* 29(30), 43-47.

Govender, S. M., & de Jongh, M. (2021). Identifying hearing impairment and the associated impact on the quality of life among the elderly residing in retirement homes in Pretoria, South Africa. *South African Journal of Communication Disorders, 68*(1), a788. https://doi. org/10.4102/sajcd.v68i1.788

Grenness, C., Hickson, L., Laplante-Lévesque, A., & Davidson, B. (2014). Patient-centred audiological rehabilitation: Perspectives of older adults who own hearing aids. *International Journal of Audiology.*

Heselton, T., Bennett, R.J., Manchaiah, V., & Swanepoel, D. (2021). Online Reviews of Hearing Aid Acquisition and Use: A Qualitative Thematic Analysis. *American Journal of Audiology*, 1-15.

Hearing Tracker. (2022, April 26). *About Hearing Tracker.* Hearing Tracker. https://www.hearingtracker.com/about

Hickson, L., Meyer., C., Lovelock, K., Lampert., & Khan, A. (2014). Factors associated with success with hearing aids in older adults. *International Journal of Audiology,* 53: S18-S27. DOI: 10.3109/14992027.2013.860488

Holman, J. A., Ali, Y. H. K., & Naylor, G. (2023). A qualitative investigation of the hearing and hearing-aid related emotional states experienced by adults with hearing loss. *International journal of audiology*, *62*(10), 973–982. https://doi.org/10.1080/14992027.2022.2111373

Humes, L. E., Rogers, S. E., Main, A. K., & Kinney, D. L. (2018). The Acoustic Environments in Which Older Adults Wear Their Hearing Aids: Insights From Datalogging Sound Environment Classification. *American journal of audiology*, *27*(4), 594–603. https://doi.org/10.1044/2018_AJA-18-0061

Ismail, A. H., Munro, K. J., Armitage, C. J., & Dawes, P. D. (2019). What do hearing healthcare professionals do to promote hearing aid use and benefit among adults? A systematic review. International Journal of Audiology, 58(2), 63–76. https://doi.org/10.1080/14992027.2018.1531154

Jilla, A.M., Johnsohn, C.E., & Huntington-Klein, N. (2020). Hearing aid affordability in the United States. *Disability and Rehabilitation: Assistive Technology.* DOI: 10.1080/17483107.2020.1822449

Kozlowski, L., Ribas., A., Almeida, G., & Luz, I. (2017). Satisfaction of Elderly Hearing Aid Users. *International Archives of Otolaryngology, 21(1).* DOI http://dx.doi.org/ 10.1055/s-0036-1579744.

Knoetze, M., Manchaiah, V., De Sousa, K., Moore, D. R., & Swanepoel, D. W. (2024). Comparing Self-Fitting Strategies for Over-the-Counter Hearing Aids A Crossover Clinical Trial. *JAMA Otolaryngology-Head & Neck Surgery*, *150*(9). https://doi.org/10.1001/jamaoto.2024.2007

Laplante-Lévesque, A., Jensen, L.D., Dawes, P., & Nielsen, C. (2013). Optimal Hearing Aid Use: Focus Groups with Hearing Aid Clients and Audiologists. *Ear and Hearing,* 34:2, 193-202.

Laplante-Lévesque, A., Knudsen, L.V., Preminger, J.E., Jones, L., Nielsen, C., Oberg, M., Lunner, T., Hickson, L., Nayloir, G., & Kramer, S.E. (2012). Hearing help-seeking and rehabilitation: Perspectives of adults with hearing impairment. *International Journal of Audiology.* 51:2, 93-102. DOI: 10.3109/14992027.2011.606284

Lin, F. R., Yaffe, K., Xia, J., Xue, Q., Harris, T.B., Purchase-Helzner, E., Satterfield, S., Ayonayon, H. N., Ferrucci, L., & Simonsick, E.M. (2013). Hearing Loss and Cognitive Decline in Older Adults. *JAMA Intern Med.* doi:10.1001/jamainternmed.2013.1868

Linssen, A.M., Joore, M.A., Minten, R.K.H., van Leeuwen, Y.D., & Anteunis, L.J.C. (2013). Qualitative interviews on the beliefs and feelings of adults towards their ownership, but non-use of hearing aids. *International Journal of Audiology,* 52:10, 670-677. DOI: 10.3109/14992027.2013.808382

Manchaiah, V., Abrams, H., Bailey, A., & Andersson, G. (2019). Negative Side Effects Associated with Hearing Aid Use in Adults with Hearing Loss. *Journal of the American Academy of Audiology*, *30*(6), 472–481. https://doi.org/10.3766/jaaa.17118

Manchaiah, V., Swanepoel, D.W., Bailey, A., Pennebaker, J.W., Bennett, R.J. (2021). Hearing Aid Consumer Reviews: A Linguistic Analysis in Relation to Benefit and Satisfaction Ratings. *American Journal of Audiology,* 30, 761-768.

Manchaiah, V.K.C., Stephens, D., & Meredith, R. (2011). The patient journey of adults with hearing impairment: the patients' views. *Clinical Otolaryngology,* 36, 227-234.

Mantello, E.B., da Silva, C.D., Massuda, E.T., Hyppolito, M.A., & dos Reis, A.C.M.B. (2016). Relationship between Speech Perception and Level of Satisfaction of Hearing Aid Users. *International Archives of Otorhinolaryngology,* 20: 315-320. DOI: 10.1055/s-0035-1570315

McCormack, A., & Fortnum, H. (2013). Why do people fitted with hearing aids not wear them? *International Journal of Audiology,* 52:5, 360-368. DOI: 10.3109/14992027.2013.769066

McManus, H., Salbod, S., & Berg, A.L. (2016). The Hearing Aid "Effect" as a Function of Race and Gender. *The Hearing Journal.*

Meyer, C., Hickson, L., & Fletcher, A. (2014). Identifying the barriers and facilitators to optimal hearing aid self-efficacy. *International Journal of Audiology*, *53*(sup1), S28–S37. https://doi.org/10.3109/14992027.2013.832420

Moorley, C., & Cathala, X. (2019). How to appraise qualitative research. *British Medical Journal, 22(1).*

Moroe, N., & Vazzana, N. (2019). The disuse of hearing aids in elderly people diagnosed with a presbycusis at an old age home, in Johannesburg. South Africa: a pilot study. *African Health Sciences,* 19(2): 2183-2188. https://dx.doi.org/10.4314/ahs.v19i2.43

Oosthuizen, I., Manchaiah, V., Launer, S., & Swanepoel, D. (2022). Hearing aid Experiences of Adult Hearing aid Owners During and After Fitting: A Systematic Review of Qualitative Studies. *Trends in Hearing, 26: 1-21. DOI:* DOI: 10.1177/23312165221130584

Phoenix, M., Nguyen, T., Gemles, S. J., VanderKaay, S., Cross, A., & Nguyen, L. (2018). Using qualitative research perspectives to inform patient engagement in research. *Research Involvement and Engagement,* 4(20).

Picou, E. M. (2022). Hearing Aid Benefit and Satisfaction Results from the MarkeTrak 2022 Survey: Importance of Features and Hearing Care Professionals. *Seminars in Hearing*, *43*(04), 301–316. https://doi.org/10.1055/s-0042-1758375

Rauterkus, E.P., & Palmer, C.V. (2013). The hearing aid effect in 2013. *South African Journal of Communication Disorders*, 25(9): 893-903. doi: 10.3766/jaaa.25.9.10.

Rawool,V. (2018). Denial by Patients of Hearing Loss and Their Rejection of Hearing Health Care: A Review. *Journal of Hearing Science,* 8:3, 9-20. DOI: 10.17430/906204

Ribas, A., Silvestre, R., Mottecy, C. M., Kozlowski, L., & Marques, J. M. (2015). Relationship between Otolaryngologic Complaints and Systemic Comorbidities Observed in a Group of Hearing Aid Users. *International archives of otorhinolaryngology*, *19*(3), 216–221. https://doi.org/10.1055/s-0034-1395997

Ritter, C. R., Barker, B. A., & Scharp, K. M. (2020). Using attribution theory to explain to explore the reasons adults with hearing loss do not use their hearing aids. *PLoS ONE,* 15(9): e0238468. https://doi.org/10.1371/journal.pone.0238468

Seroto, C., Swanepoel, W., Manchaiah, V., Graham, M. A., & Mahomed-Asmail, F. (2023). The hearing aid effect across diverse African populations and various hearing device modalities. *Folia phoniatrica et logopaedica : official organ of the International Association of Logopedics and Phoniatrics (IALP)*, 10.1159/000535654. Advance online publication. https://doi.org/10.1159/000535654

Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care,* 19(6).

Valentinuzzi, M. E. (2020). Hearing Aid History: From Ear Trumpets to Digital Technology. *IEEE Pulse.*

Vercammen, C., Oosthuizen, I., Manchaiah, V., Ratinaud, P., Launer, S., & Swanepoel, W. (2023). Real-life and real-time hearing aid experiences: Insights from self-initiated ecological momentary assessments and natural language analysis. *Frontiers in digital health*, *5*, 1104308. https://doi.org/10.3389/fdgth.2023.1104308

Wallhagen, M.I. (2009). The Stigma of Hearing Loss. *The Gerontological Society of America.*

CHAPTER FOUR: DISCUSSION, CLINICAL IMPLICATIONS, AND CONCLUSION

4.1 Overview of Research Findings

The findings from this study were organized into two overarching domains: hearing aid use and hearing aid non-use. Within these domains, three broad categories emerged: situational aspects, device-related aspects, and personal factors. These categories were further divided into 11 sub-categories for hearing aid use and 24 sub-categories for hearing aid non-use, offering a nuanced understanding of the factors influencing hearing aid use among recipients.

The most frequently reported category within the hearing aid use domain was personal facilitators (n=277), with reliance on hearing aids for daily functioning being the most common reason cited for use. Participants often emphasized the detrimental impact of not using their hearing aids, such as missing important information or being unable to fully engage in daily activities. This finding aligns with previous research, which has highlighted the importance of hearing aids in maintaining quality of life and independence among users (Holman, Ali, Naylor, 2022). Notably, many participants framed their hearing aid use in a positive light, viewing it as a tool that enhances their daily lives rather than as a symbol of aging or disability. This positive reframing was reflected in the sub-category of non-stigmatized use, which, although less frequently mentioned (n=57), points to a shift in how some users perceive their devices.

Situational factors also played a significant role in hearing aid use, with environmental awareness being the most commonly reported reason within this category (n=28). Participants valued their hearing aids for enhancing their ability to perceive and respond to environmental sounds, such as traffic signals and conversations, which are critical for safety and social interaction. This finding underscores the importance of hearing aids in facilitating not just personal communication but also broader situational awareness, which is vital for independent living.

In contrast, the device-related category had the lowest frequency of reports, with streaming and connectivity being the least mentioned sub-category (n=6). This suggests that while technological features like Bluetooth connectivity are appreciated by a niche group, they are not yet a primary driver of hearing aid use for the broader population. However, this could represent an area for future growth, as advancements in hearing aid technology continue to evolve and become more integrated into users' daily lives (Picou, 2021). The incorporation of features that allow seamless integration with modern technology, as discussed by Vercammen et al. (2023), can further enhance user satisfaction and may address some of the existing barriers to consistent use.

The reasons for hearing aid non-use were dominated by situational factors (n=571), with the risk of moisture exposure being the most frequently cited concern (n=205). Participants expressed anxiety about moisture-related damage to their hearing aids, which they associated with a range of negative outcomes, including battery depletion, device failure, and increased maintenance costs. This concern highlights a critical gap in current hearing aid design, where improvements in moisture resistance could significantly reduce non-use due to environmental factors. In addition, personal barriers were the second most reported category for non-use (n=350), with self-consciousness being the most frequently mentioned reason (n=165). Participants often described the stigma associated with hearing aid use as overwhelming, associating it with negative stereotypes related to aging, disability, and cognitive decline. This finding is consistent with existing literature on the stigma of hearing aid use (Bennett et al., 2018; Wallhagen, 2009). The concept of the "hearing aid effect," where societal perceptions negatively influence hearing aid adoption, further explains why some individuals may avoid using these devices despite recognizing their benefits (Rauterkus & Palmer, 2013; David & Werner, 2016).

Another significant personal barrier was listening fatigue (n=71), where participants reported feeling overwhelmed by the constant auditory stimulation provided by their hearing aids, leading them to remove the devices to rest their ears and minds. This phenomenon, as described by Manchaiah et al (2019), illustrates the psychological and sensory challenges that can accompany hearing aid use, particularly when the devices are not optimally adjusted to the user's needs.

Device-related issues were less commonly reported as reasons for non-use (n=237), but they were nonetheless significant. The most common complaint in this category was the need for fine-tuning (n=83), with many participants expressing frustration over improperly adjusted hearing aids. This finding suggests that ongoing support and adjustments are critical to ensuring the long-term success of hearing aid use. Discomfort from the physical fit of the device (n=79) was another frequently reported issue, highlighting the importance of ergonomic design in hearing aid manufacturing. The need for better support and training, particularly in the management and maintenance of hearing aids, also emerged as a critical factor, underscoring the importance of patient education in the overall hearing aid experience (Laplante-Lévesque et al., 2012; Meyer et al., 2014).

Overall, these findings provide a comprehensive view of the factors that influence hearing aid use and non-use. They highlight the complex interplay between personal, situational, and

device-related factors, offering valuable insights for clinicians, manufacturers, and policymakers aiming to improve hearing aid adoption and satisfaction.

4.2 Clinical Implications

The study's findings have several important clinical implications, particularly concerning stigma, patient-centered care (PCC), and manufacturer accountability.

Stigma

Stigma remains a significant barrier to hearing aid use, with many participants expressing concerns about being perceived as disabled, old, or incapable. This finding reiterates the need for continued efforts to reduce stigma through public education, clinician training, and patient support (Bennett et al., 2018; Scharp & Barker, 2021). Clinicians play a crucial role in this effort by providing tailored care that addresses the individual concerns and preferences of their patients. Involving patients in the selection process and ensuring they are fully informed about the appearance and function of their hearing aids can help reduce feelings of self-consciousness and improve adherence. Additionally, clinicians can normalize hearing aids by integrating them into discussions of overall health and wellness, thereby shifting the focus from disability to empowerment (Laplante-Lévesque et al., 2013).

Addressing the stigma associated with hearing aids also requires a broader societal shift. The introduction of over-the-counter (OTC) hearing aids, particularly those developed by well-known consumer brands, has the potential to reduce stigma by integrating hearing aids into mainstream consumer electronics. This approach can help normalize hearing aid use, making these devices more socially acceptable and desirable (Champlin et al., 2024; David & Werner, 2016). Public health campaigns that emphasize the benefits of hearing aids and portray them as empowering tools rather than signs of aging or disability could also help to mitigate the stigma that currently surrounds their use.

Patient-Centred Care

The issue of fine-tuning hearing aids was frequently reported as a reason for non-use, with participants expressing frustration over improperly adjusted devices. This finding underscores the importance of patient-centred care (PCC) in the hearing aid fitting process. PCC involves a more individualized approach that considers the unique needs, preferences, and lifestyles of each patient. Clinicians should emphasize the importance of follow-up visits for fine-tuning and educate patients on the potential need for multiple adjustments to achieve optimal performance (Grenness et al., 2014). Moreover, building trust between clinicians and patients

is essential for successful hearing aid use. Patients who feel that their concerns are heard and addressed are more likely to engage with their devices and report higher satisfaction levels (Kelly-Campbell & McMillan, 2015).

The importance of PCC extends beyond the initial fitting. Ongoing support, including regular check-ins and adjustments, can significantly enhance the patient experience. Clinicians should adopt a proactive approach, reaching out to patients to schedule follow-ups rather than waiting for patients to report problems. This proactive engagement can help identify and address issues before they lead to non-use. Additionally, clinicians should be trained to recognize the psychological barriers to hearing aid use, such as stigma and listening fatigue, and address these issues through counselling and support.

Manufacturer Improvements

Manufacturer accountability was an important element particularly regarding the design and marketing of hearing aids. Participants expressed frustration with the lack of comfort and ease of use in their devices, particularly for older adults with dexterity issues (Singh et al., 2013; Bennett et al., 2018). This suggests a need for manufacturers to prioritize ergonomic design and user-friendly interfaces in future hearing aid models. Innovations that focus on improving the comfort and usability of hearing aids could significantly enhance user satisfaction and reduce non-use due to physical discomfort.

False advertising was another concern, with participants feeling misled by marketing that emphasizes the invisibility of hearing aids without adequately addressing their functionality and limitations. This points to a need for more transparent and realistic marketing practices that set appropriate expectations for users. Manufacturers should collaborate with clinicians to ensure that marketing materials accurately reflect the capabilities and limitations of hearing aids, helping to align patient expectations with reality.

Moisture resistance emerged as a critical area for improvement in hearing aid design. Participants reported avoiding hearing aid use in situations where they feared moisture exposure, such as during exercise or in humid weather. Manufacturers should invest in research and development to create more durable, moisture-resistant devices that can withstand a variety of environmental conditions. This could involve trial experiments to test new materials and designs, ultimately leading to products that better meet the needs of active users. Such innovations would address a significant barrier to hearing aid use and could improve the overall adoption rates among those who currently avoid using their devices due to environmental concerns.

4.3 Strengths and Limitations

Study Strengths

- The open-ended nature of the research question allowed for in-depth, detailed accounts from participants about their lived experiences with hearing aids, providing rich qualitative data.
- The large sample size (n=680) enhances the generalizability of the findings, offering a broader perspective compared to similar studies with smaller cohorts.
- Manual coding of the dataset allowed for a thorough and nuanced analysis, ensuring that significant responses were not overlooked.
- Including participants who had their hearing aids fitted by both hearing health practitioners (HHPs) and over-the-counter (OTC) self-fitting users allowed for comparisons across different fitting methods, broadening the applicability of the findings.
- The qualitative approach, combined with the large sample size, provided deep insights into the reasons behind hearing aid use and non-use, setting this study apart from previous research.

Study Limitations

- Potential sampling bias existed, as participants were recruited from only two online platforms, and the self-selection aspect may have influenced the representativeness of the sample. This could have resulted in overrepresentation or underrepresentation of certain demographic groups.
- The study's focus on participants from the United States limits the generalizability of the findings to other cultural and geographical contexts. Future research should consider including participants from diverse cultural backgrounds to explore how cultural differences may influence hearing aid use.
- The word limit imposed on participants' responses may have constrained the depth and nuance of their answers. Some responses were excluded due to illegibility or brevity, which may have impacted the comprehensiveness of the analysis. Future studies could explore ways to mitigate this limitation, such as offering alternative methods of participation, like interviews or focus groups.

4.4 Future Research

The study's findings highlight several areas for future research, particularly in the context of patient-centred care (PCC) and hearing aid design.

- Further qualitative research should explore the impact of different PCC models on patient satisfaction and hearing aid use. This research could involve audiologists and hearing aid recipients from diverse demographics and socio-economic statuses to enhance the generalizability of the findings.
- Longitudinal studies would also be valuable, tracking changes in hearing aid use and satisfaction over time to better understand how these factors evolve. Such research could provide insights into how the relationship between patients and clinicians develops and how ongoing support impacts long-term hearing aid use.
- In terms of hearing aid design, future research should focus on developing more moisture-resistant devices. Trial experiments conducted by manufacturers could test new materials and designs to improve the durability of hearing aids in various environmental conditions.
- Research could also explore the integration of emerging technologies, such as artificial intelligence (AI), to create more adaptive and personalized hearing aids that respond to users' unique needs and environments. The potential for AI to enhance hearing aid functionality by learning user preferences and automatically adjusting settings to optimize the listening experience could be a significant area of future development.
- Finally, future studies should consider the global context of hearing aid use, conducting similar research in different cultural and geographical settings. Understanding how cultural attitudes and healthcare systems influence hearing aid adoption can provide valuable insights for developing targeted interventions and improving global hearing health.

4.5 Conclusion

A comprehensive exploration of the factors influencing hearing aid use and non-use was determined which offers valuable insights into the lived experiences of hearing aid recipients. While recipients may be satisfied with their hearing aids, there is room for improvement in terms of device features, which include design changes, and moisture-resistant and user-friendly controls. The clinician's role is particularly valuable in reducing the associated stigma and the need for improved patient-centred care. By addressing these critical factors, it is possible to enhance device satisfaction and ultimately improve hearing aid use. Clinicians and

manufacturers should work together to address the barriers identified in this study, ensuring that hearing aid users receive the support and technology they need to lead fulfilling lives.

REFERENCES

Bennett, R. J., Laplante-Lévesque, A., & Eikelboom, R. H. (2019). How Do Hearing Aid Owners Respond to Hearing Aid Problems? *Ear and Hearing*, *40*(1), 77–87. https://doi.org/10.1097/AUD.0000000000000595

Bennett, R. J., Laplante-Lévesque, A., Meyer, C. J., & Eikelboom, R. H. (2018). Exploring Hearing Aid Problems: Perspectives of Hearing Aid Owners and Clinicians. *Ear and Hearing*, *39*(1), 172–187. https://doi.org/10.1097/AUD.0000000000000477

Bennett, R. J., Meyer, C. J., Eikelboom, R. H., & Atlas, M. D. (2018). Evaluating Hearing Aid Management: Development of the Hearing Aid Skills and Knowledge Inventory (HASKI). *American journal of audiology*, *27*(3), 333–348. https://doi.org/10.1044/2018_AJA-18-0050

Bisgaard, N., Zimmer, S., Laureyns, M., & Groth, J. (2022). A model for estimating hearing aid coverage world-wide using historical data on hearing aid sales. *International journal of audiology*, *61*(10), 841–849. https://doi.org/10.1080/14992027.2021.1962551

Brink, H., van Rensburg, G., & van der Walt, C. (2018). *Fundamentals of Research Methodology for Healthcare Professionals* (4.). Cape Town: Juta and Company (Pty) Ltd.

Carlson, M. L., Nassiri, A. M., Marinelli, J. P., Lohse, C. M., Sydlowski, S. A., & Hearing Health Collaborative (2022). Awareness, Perceptions, and Literacy Surrounding Hearing Loss and Hearing Rehabilitation Among the Adult Population in the United States. *Otology & neurotology : official publication of the American Otological Society, American Neurotology Society [and] European Academy of Otology and Neurotology*, *43*(3), e323–e330. https://doi.org/10.1097/MAO.0000000000003473

Chien, W., & Lin, F. R. (2012). Prevalence of Hearing Aid Use Among Older Adults in the United States. *Archives of Internal Medicine*, *172*(3), 271–297292. https://doi.org/10.1001/archinternmed.2011.1408

Ciorba, A., Bianchini, C., Pelucchi, S., & Pastore, A. (2012). The impact of hearing loss on the quality of life of elderly adults. *Clinical interventions in aging*, *7*, 159–163. https://doi.org/10.2147/CIA.S26059

Coco, L. (2022). Over-the-Counter Hearing Aids: What the Practicing Audiologist Needs to Know. *Perspectives of the ASHA Special Interest Groups*, *7*(6), 1806–1811. https://doi.org/10.1044/2022_PERSP-22-00117

David, D., & Werner, P. (2016). Stigma regarding hearing loss and hearing aids: A scoping review. *Stigma and Health*, *1*(2), 59–71. https://doi.org/10.1037/sah0000022

Desjardins, J.L. & Sotelo, L.R. (2021). Self-Reported Reasons for The Non-Use Hearing Aids Among Hispanic Adults With Hearing Loss. *American Journal of Audiology.*

Dillon, H., Day, J., Bant, S. & Muro, K.J. (2020). Adoption use and non-use of hearing aids: a robust estimate based on Welsh national survey statistics.

Dysart, J. (2017). Smart Earbuds: A Looming Threat to the Hearing Aid Market?. *The Hearing Journal*. doi: 10.1097/01.HJ.0000513790.21557.fc

Fabry, D. A., & Bhowmik, A. K. (2021). Improving Speech Understanding and Monitoring Health with Hearing Aids Using Artificial Intelligence and Embedded Sensors. *Seminars in Hearing*, *42*(03), 295–308. https://doi.org/10.1055/s-0041-1735136

Ferrán, S., Manrique-Huarte, R., Lima, J. P., Rodríguez-Zanetti,C., Calavia, D., Andrade, C. J., Terrasa, D., Huarte, A & Manrique, M. (2024). Early Detection of Hearing Loss among the Elderly. *Life*, *14*(4), 471. https://doi.org/10.3390/life14040471

Ferguson, M., Maidment, D., Russell, N., Gregory, M., & Nicholson, R. (2016). Motivational engagement in first-time hearing aid users: A feasibility study. *International Journal of Audiology.*

Gopinath, B., Schneider, J., Hartley, D., Teber, E., McMahon, C.M., Leeder, S.R., & Mitchell, P. (2011). Incidence and Predictors of Hearing Aid Use and Ownership Among Older Adults With Hearing Loss. *Elsevier.*

Graydon, K., Waterworth, C., Miller, H., & Gunasekera, H. (n.d.). Global burden of hearing impairment and ear disease. *The Journal of Laryngology & Otology*, *133*(1), 18–25. https://doi.org/10.1017/S0022215118001275

Grenness, C., Hickson, L., Laplante-Lévesque, A., & Davidson, B. (2014). Patient-centred audiological rehabilitation: perspectives of older adults who own hearing aids. *International journal of audiology*, *53 Suppl 1*, S68–S75. https://doi.org/10.3109/14992027.2013.866280

Hearing Tracker. (2022, April 26). *About Hearing Tracker.* Hearing Tracker. https://www.hearingtracker.com/about

Heselton, T., Bennett, R.J., Manchaiah, V., & Swanepoel, D. (2021). Online Reviews of Hearing Aid Acquisition and Use: A Qualitative Thematic Analysis. *American Journal of Audiology*. 1-15.

Hickson, L., Meyer, C., Lovelock, K., Lampert, M., & Khan, A. (2014). Factors associated with successful hearing aids in older adults. *International Journal of Audiology.* DOI: 10.3109/14992027.2013.860488

Holman, J. A., Ali, Y. H. K., & Naylor, G. (2023). A qualitative investigation of the hearing and hearing-aid related emotional states experienced by adults with hearing loss. International Journal of Audiology, 62(10), 973–982. https://doi.org/10.1080/14992027.2022.2111373

Ismail, A. H., Munro, K. J., Armitage, C. J., & Dawes, P. D. (2019). What do hearing healthcare professionals do to promote hearing aid use and benefit among adults? A systematic review. International Journal of Audiology, 58(2), 63–76. https://doi.org/10.1080/14992027.2018.1531154

Kelly-Campbell, R. J., & McMillan, A. (2015). The Relationship Between Hearing Aid Self-Efficacy and Hearing Aid Satisfaction. *American journal of audiology*, *24*(4), 529–535. https://doi.org/10.1044/2015_AJA-15-0028

Laplante-Lévesque, A., Jensen, L.D., Dawes, P., & Nielsen, C. (2013). Optimal Hearing Aid Use: Focus Groups with Hearing Aid Clients and Audiologists. *Ear and Hearing,* 34:2, 193-202.

Laplante-Lévesque, A., Knudsen, L.V., Preminger, J.E., Jones, L., Nielsen, C., Oberg, M., Lunner, T., Hickson, L., Nayloir, G., & Kramer, S.E. (2012). Hearing help-seeking and rehabilitation: Perspectives of adults with hearing impairment. *International Journal of Audiology.* 51:2, 93-102. DOI: 10.3109/14992027.2011.606284

Lin, F. R., Yaffe, K., Xia, J., Xue, Q., Harris, T.B., Purchase-Helzner, E., Satterfield, S., Ayonayon, H. N., Ferrucci, L., & Simonsick, E.M. (2013). Hearing Loss and Cognitive Decline in Older Adults. *JAMA Intern Med.* doi:10.1001/jamainternmed.2013.1868

Linssen, A. M., Joore, M. A., Minten, R. K. H., van Leeuwen, Y. D., & Anteunis, L. J. C. (2013). Qualitative interviews on the beliefs and feelings of adults towards their ownership, but non-use of hearing aids. International Journal of Audiology, 52(10), 670–677. https://doi.org/10.3109/14992027.2013.808382

Liu, C.-M., & Lee, C. T.-C. (2019). Association of Hearing Loss With Dementia. *JAMA Network Open*, *2*(7). https://doi.org/10.1001/jamanetworkopen.2019.8112

Madans, J. H., Weeks, J. D., Elgaddal, N. (2019). Hearing difficulties among adults: United States. NCHS Data Brief, no 414. Hyattsville, MD: National Center for Health Statistics. 2021. DOI: https://dx.doi.org/10.15620/cdc:107540.

Manchaiah, V., Abrams, H., Bailey, A., & Andersson, G. (2019). Negative Side Effects Associated with Hearing Aid Use in Adults with Hearing Loss. *Journal of the American Academy of Audiology*, *30*(6), 472–481. https://doi.org/10.3766/jaaa.17118

Manchaiah, V., Beukes, E., & Roser, R.J. (2020). *Evaluating and Conducting Research in Audiology* (4th ed.). Plural Publishing, ProQuest Ebook Central, https://ebookcentral-proquest-com.uplib.idm.oclc.org/lib/pretoria-ebooks/detail.action?docID=6499979.

McCormack, A., & Fortnum, H. (2013). Why do people fitted with hearing aids not wear them? *International Journal of Audiology,* 52:5, 360-368. DOI: 10.3109/14992027.2013.769066

McKee, M., James, T. G., Helm, K. V. T., Marzolf, B., Chung, D. H., Williams, J., & Zazove, P. (2022). Reframing Our Health Care System for Patients With Hearing Loss. *Journal of speech, language, and hearing research : JSLHR*, *65*(10), 3633–3645. https://doi.org/10.1044/2022_JSLHR-22-00052

Meyer, C., Hickson, L., & Fletcher, A. (2014). Identifying the barriers and facilitators to optimal hearing aid self-efficacy. *International Journal of Audiology*, *53*(sup1), S28–S37. https://doi.org/10.3109/14992027.2013.832420

Mills, M. (2011). Hearing Aids and the History of Electronics Miniaturization. *IEEE Computer Society.*

Orji, A., Kamenov, K., Dirac, M., Davis, A., Chadha, S., & Vos, T. (2020). Global and regional needs, unmet needs and access to hearing aids. International Journal of Audiology, 59(3), 166–172. https://doi.org/10.1080/14992027.2020.1721577

Oosthuizen, I., Manchaiah, V., Launer, S., & Swanepoel, D. (2022). Hearing aid Experiences of Adult Hearing aid Owners During and After Fitting: A Systematic Review of Qualitative Studies. *Trends in Hearing, 26: 1-21. DOI:* DOI: 10.1177/23312165221130584

Pichora-Fuller, M. K., Mick, P., & Reed, M. (2015). Hearing, Cognition, and Healthy Aging: Social and Public Health Implications of the Links between Age-Related Declines in Hearing and Cognition. *Semin Hear*, *36*(3), 122–139. https://doi.org/10.1055/s-0035-1555116

Picou E. M. (2020). MarkeTrak 10 (MT10) Survey Results Demonstrate High Satisfaction with and Benefits from Hearing Aids. *Seminars in hearing*, *41*(1), 21–36. https://doi-org.uplib.idm.oclc.org/10.1055/s-0040-1701243

Polit, D. F., & Beck, C. T. (2014). *Essentials of nursing research : appraising evidence for nursing practice* (8th ed). Wolters Kluwer Health /Lippincott Williams & Wilkins. Polit, D. F., & Beck, C. T. (2014). *Essentials of nursing research : appraising evidence for nursing practice* (8th ed). Wolters Kluwer Health /Lippincott Williams & Wilkins.

Rauterkus, E.P., & Palmer, C.V. (2013). The hearing aid effect in 2013. *South African Journal of Communication Disorders*. 25(9):893-903. doi: 10.3766/jaaa.25.9.10.

Scharp, K. M., & Barker, B. A. (2020). "I Have to Social Norm This": Making Meaning of Hearing Loss from the Perspective of Adults Who Use Hearing Aids. Health Communication, 36(6), 774–781. https://doi.org/10.1080/10410236.2020.1712523

Shukla, A., Harper, M., Pedersen, E., Goman, A., Suen, J. J., Price, C., Applebaum, J., Hoyer, M., Lin, F. R., & Reed, N. S. (2020). Hearing Loss, Loneliness, and Social Isolation: A Systematic Review. *Otolaryngology--head and neck surgery : official journal of American Academy of Otolaryngology-Head and Neck Surgery*, *162*(5), 622–633. https://doi.org/10.1177/0194599820910377

Singh, G. , Pichora-Fuller, M. K. , Hayes, D. , von Schroeder, H. P. & Carnahan, H. (2013). The Aging Hand and the Ergonomics of Hearing Aid Controls. *Ear and Hearing, 34* (1), e1-e13. doi: 10.1097/AUD.0b013e31825f9bba.

Stam, M., Kostense, P. J., Festen, J. M., & Kramer, S. E. (2013). The relationship between hearing status and the participation in different categories of work: demographics. *Work (Reading, Mass.)*, *46*(2), 207–219.https://doi.org/10.3233/WOR-131747

Valentinuzzi, M. E. (2020). Hearing Aid History: From Ear Trumpets to Digital Technology. *IEEE Pulse.*

Wallhagen, M.I. (2009). The Stigma of Hearing Loss. *The Gerontological Society of America.*

Wingfield, A., & Peelle, J. E. (2012). How does hearing loss affect the brain?. *Aging health*, *8*(2), 107–109. https://doi.org/10.2217/AHE.12.5

World Health Organization. (2021). *GLOBAL REPORT ON: AGEISM*. Retrieved from https://www.who.int/teams/social-determinants-of-health/demographic-change-and-healthy-ageing/combatting-ageism/global-report-on-ageism

World Health Organisation. (2024). *Deafness and hearing loss.* Retrieved from https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss

World Health Organization. (2017). *Global costs of unaddressed hearing loss and cost-effectiveness of interventions: a WHO report, 2017*. World Health Organization.

Appendices

Appendix A: Qualtrics Survey

Demographic and hearing aid related information

How old are you (in years)?

[ ]

Please indicate your gender:

- ○ Female
- ○ Male
- ○ Non-binary (or gender neutral)

Do you have any difficulty with your hearing (without hearing aids)?

- ○ No, I always hear everything
- ○ Yes, sometimes I do not hear what is being said
- ○ Yes, I regularly do not hear what is being said
- ○ Yes, I almost never hear what is being said

How long have you had hearing loss? Provide your answer in years.

[ ]

Do you own a hearing aid for your:

- ○ Right ear
- ○ Left ear
- ○ Both ears

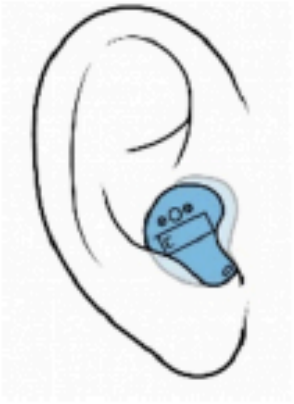
From the time you first learned you had a hearing problem how long did you wait before purchasing your first hearing aids? Please provide your answer as a numerical value (e.g., 1, 3, 15).

Year(s) ☐

Month(s) ☐

What type of hearing aid do you use?

○ In-the-ear (ITE) hearing aids (Hearing aid sits completely/entirely in the ear)



- ◯ Behind-the-ear (BTE) hearing aids (Hearing aid has 2 parts: One part, the mold, sits in the ear and the other part, the hearing aid, sits behind the ear)

Which brand hearing aid do you currently use?

- ◯ Kirkland
- ◯ Oticon
- ◯ Phonak
- ◯ ReSound
- ◯ Signia / Siemens
- ◯ Starkey
- ◯ Unitron
- ◯ Widex
- ◯ [ ] Other, please specify

How did you purchase your current hearing aids?

- ◯ From a hearing clinic (private or university)
- ◯ Discount Warehouse (Costco, Sams, etc.)
- ◯ Internet / Online
- ◯ Pharmacy Hearing Center (CVS)

- ◯ A hearing professional came to my residence
- ◯ [ ] Other, please specify:

Open-ended questions

For many people, getting and wearing a hearing aid is a major life decision. They often say that getting a hearing aid is embarrassing and makes them feel or look old. Others worry about the cost or what others will say. How did you deal with these issues when you decided to buy a hearing aid? What motivated you to get hearing aids? Was there a single reason or event that convinced you or were there many reasons? Please provide as much detail as possible about the reason or reasons why you decided to get hearing aids. What would you recommend to others who are starting to have hearing problems?

Have hearing aids changed your life in a meaningful way? Why or why not? We would really like to know your experience with your hearing aids and how you think and feel about your hearing aids.

We are trying to understand when people do and do not wear their hearing aids. Other than when you are alone, when do you avoid wearing hearing aids? Why? Why do you think people often avoid wearing hearing aids in situations that they really should?

We talk to audiologists and hearing aid companies. Tell us how you would like hearing aids to change to be more useful for you and the people around you. Please be honest. We really would like your thoughts and feelings about this. Your comments will help us when we talk to people in the industry.

Hearing aid benefit/satisfaction

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

- ○ None
- ○ Less than 1 hour a day
- ○ 1 to 4 hours a day
- ○ 4 to 8 hours a day
- ○ More than 8 hours a day

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

- ○ Helped not at all
- ○ Helped slightly
- ○ Helped moderately
- ○ Helped quite a lot
- ○ Helped very much

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

- ○ Very much difficulty
- ○ Quite a lot of difficulty
- ○ Moderate difficulty
- ○ Slight difficulty

- ○ No difficulty

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

- ○ Not at all worth it
- ○ Slightly worth it
- ○ Moderately worth it
- ○ Quite a lot worth it
- ○ Very much worth it

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

- ○ Affected very much
- ○ Affected quite a lot
- ○ Affected moderately
- ○ Affected slightly
- ○ Affected not at all

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

- ○ Bothered very much
- ○ Bothered quite a lot
- ○ Bothered moderately
- ○ Bothered slightly

- ○ Bothered not at all

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

- ○ Worse
- ○ No change
- ○ Slightly better
- ○ Quite a lot better
- ○ Very much better

General health and well-being & social network

In general, would you say your health is:

- ○ Excellent
- ○ Very good
- ○ Good
- ○ Fair
- ○ Poor

In general, would you say your mental health is:

- ○ Excellent
- ○ Very good
- ○ Good
- ○ Fair
- ○ Poor

How would you rate your quality of life?

- ○ Very poor
- ○ Poor
- ○ Neither poor nor good
- ○ Good
- ○ Very good

In a typical week, how much time do you spend in total on moderate and vigorous physical activities where your heartbeat increases and you breathe faster (e.g., brisk walking, cycling, heavy gardening, running, recreational sport):

- ○ Less than ½ an hour (30 minutes)
- ○ ½ an hour to 1½ hour (30-90 minutes)
- ○ 1½ - 2½ hours (90-150 minutes)
- ○ 2½ - 5 hours (150-300 minutes)
- ○ More than 5 hours (more than 300 minutes)

For the following questions (questions 5 to 10), please provide your answer as a numerical value (e.g., 1, 3, 15).

How many people live in your household?

How many children do you have?

How many grandchildren do you have?

How many people do you know that you would call a close friend?

How many people do you know that have hearing loss but who do not have hearing aids?

How many people do you know that have hearing loss and have/wear hearing aids?

Additional demographic information

Which of the following options best describe your work situation?

- ○ Employed or homemaker
- ○ Out of work or looking for work
- ○ Student

- ○ Unable to work
- ○ Retired

What is the highest level of schooling (education) you have completed?

- ○ Less than high school
- ○ High school
- ○ Some college but not degree
- ○ A university degree

Please select one of the following options that describes your living arrangement/ situation:

- ○ I live with my family
- ○ I live with my spouse/partner
- ○ I live with a friend
- ○ I live on my own

What is your ethnicity?

- ○ Hispanic or Latino
- ○ Non-Hispanic or Latino

What is your race?

- ○ American Indian

- ○ Alaska Native, Asian
- ○ Black or African American
- ○ Native Hawaiian
- ○ Other Pacific Islander
- ○ White
- ○ More than One Race

What is your pretax household income, approximately?

- ○ Under $25,000
- ○ $25,000 to $49,999
- ○ $50,000 to $99,999
- ○ $100,000 to $149,000
- ○ $150,000 or more

Block 5

We are inviting a few people who completed the questionnaire to participate in a virtual interview (Zoom). Are you interested in participating in this interview study?

- ○ Yes. If yes, please share your email address.
  [ ]
- ○ No

Powered by Qualtrics

Appendix B: Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist (Tong et al., 2007)

No. Item	Guide questions/description	Page Number
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	6;7
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	1
3. Occupation	What was their occupation at the time of the study?	1;7
4. Gender	Was the researcher male or female?	6
5. Experience and training	What experience or training did the researcher have?	1;7
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	N/A
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	N/A

Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	5
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	5
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	5
12. Sample size	How many participants were in the study?	5;7
13. Non-participation	How many people refused to participate or dropped out? Reasons?	5
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	6
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	8 and Table 1
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	N/A (survey was used for data collection)
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	N/A
20. Field notes	Were field notes made during and/or after the inter view or focus group?	N/A
21. Duration	What was the duration of the inter views or focus group?	6

22. Data saturation	Was data saturation discussed?	7
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	7
25. Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26. Derivation of themes	Were themes identified in advance or derived from the data?	7
27. Software	What software, if applicable, was used to manage the data?	6
28. Participant checking	Did participants provide feedback on the findings?	7
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	8 see Tables 1 and 2
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Yes. 18-21
31. Clarity of major themes	Were major themes clearly presented in the findings?	Yes. Tables 1-2 7-14
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Discussion of categories and subcategories on pages 7-14; also see Tables 1 and 2

Appendix C: Checklist for Reporting Results of Internet E-Surveys (CHERRIES; Eysenbach, 2004)

Checklist Item	***Explanation***	***Page Number***
Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	5-6
IRB approval	Mention whether the study has been approved by an IRB.	5
Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	5-6
Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	6-7
Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	6
Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Open
Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	5
Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	5
Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	5
Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the	5

	results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	
Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	6
Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	6
Time/Date	In what timeframe were the data collected?	5
Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	Not done
Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions.	N/A
Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	6
Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	6
Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if “yes”, how (usually JAVAScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as “not applicable” or “rather not say”, and selection of one response option should be enforced.	6
Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	6
Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	N/A
View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary.	N/A

Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	7
Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	7
Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	N/A
Registration	In "closed" (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A

Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	5
Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined.	N/A
Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	N/A

Appendix D: Electronic Consent Letter

LAMAR UNIVERSITY
MEMBER THE TEXAS STATE UNIVERSITY SYSTEM™

Intro

Hearing Aid Experiences

Dear Sir/Madam,

Hearing aid benefit and satisfaction as reported by its users are generally measured using standardized questionnaires. However, not all the items within these questionnaires are applicable and/or considered important by all hearing aid users. For this reason, using open-ended questions may have some value in gathering deeper insights into real-world and everyday life of hearing aid users. In this study, we aim to examine perspectives of hearing aid users from their own words. We hope that the knowledge generated from this study will help facilitate hearing aid journey as well as in designing the future generation hearing aids.

The study has been approved by the Lamar University's Institutional Review Board (IRB-FY21-248). All the information recorded will be kept confidential and stored in an encrypted manner. Participation in this study is voluntary. Estimated time of survey is 15 minutes. The attached document has some additional information. However, we are happy to answer any questions you may have before the start of this study.

To view additional study information and procedures, please click on the file below.

Additional Study Information

By clicking below, I consent electronically to participate in this study.

○ Yes, I consent

○ No, I do not consent

Appendix E: Lamar University's Institutional Review Board

[EXTERNAL] IRB-FY21-248 - Initial: Initial - Exempt - Approved

do-not-reply@cayuse.com <do-not-reply@cayuse.com>
Fri 7/23/2021 3:40 PM
To: Vinaya Manchaiah <vmanchaiah@lamar.edu>

RESEARCH & SPONSORED PROGRAMS ADMINISTRATION
LAMAR UNIVERSITY

Jul 23, 2021 3:40:40 PM CDT

Vinaya Channapatna Manchaiah

Re: Exempt - Initial - IRB-FY21-248 Hearing aid experiances

Dear Dr. Vinaya Channapatna Manchaiah

Lamar University's Institutional Review Board (IRB) for Human Research Participants Protection has completed its review of your submission and has deemed your study to be exempt from further IRB review.

Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

As a research investigator, please be aware of the following:

- You will immediately report to the IRB via LU Cayuse any injuries or other unanticipated problems involving risks.
- You acknowledge and accept your responsibility for protecting the rights and welfare of human research participants and for complying with all parts of 45 CFR Part 46, the LU IRB Policy and Procedures.
- You will ensure that legally effective informed consent is obtained and documented if necessary. If written consent is required, the consent form must be signed by the participant or the participant's legally authorized representative. A copy is to be given to the person signing the form and a copy is to be kept for your file.
- Any proposed changes, including changes to your survey, hard copy or in Qualtrics, from previously approved IRB applications must be submitted to the Office of Research and Sponsored Programs via LU Cayuse. The proposed changes cannot be initiated without IRB review and approval.

Once your study is complete, please login to Cayuse and close your study.

Good luck with your research endeavors.

Sincerely,
Lamar University Human Subjects Review Board

Appendix F: Ethical Clearance obtained at the University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

05 December 2022

Dear Ms J Cumming

Project Title:	Understanding hearing aid non-use in adults: A qualitative content analysis
Researcher:	Ms J Cumming
Supervisor(s):	Prof DCDW Swanepoel
Department:	Speech Language Pathology and Audiology
Reference number:	15191843 (HUM014/0922)
Degree:	Masters

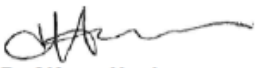
Thank you for the application that was submitted for ethical consideration.

The Research Ethics Committee notes that this is a literature-based study and no human subjects are involved. The application has been **approved** on 5 December 2022 with the assumption that the document(s) are in the public domain. Data collection may therefore commence, along these guidelines.

Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. However, should the actual research depart significantly from the proposed research, a new research proposal and application for ethical clearance will have to be submitted for approval.

We wish you success with the project.

Sincerely,



Prof Karen Harris
Chair: Research Ethics Committee
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: tracey.andrew@up.ac.za

Room 7-27, Humanities Building, University of Pretoria, Private Bag X20, Hatfield 0028, South Africa
Tel +27 (0)12 420 4853 | Fax +27 (0)12 420 4501 | Email pghumanities@up.ac.za | www.up.ac.za/faculty-of-humanities

Appendix G: Memorandum of Understanding between Lamar University and University of Pretoria

LAMAR UNIVERSITY
MEMBER THE TEXAS STATE UNIVERSITY SYSTEM™

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Memorandum of Understanding

This Memorandum of Understanding ("MOU") is made and entered into on August 01, 2021 (the "Effective Date"), between Lamar University, an institution of higher education in the State of Texas and a component of The Texas State University System, ("University'), which is located at 4400 MLK Parkway, Beaumont, Texas 77710, United States of America (USA) and University of Pretoria, Faculty of Humanities, an institution of higher education in the Gauteng Province, which is located at corner Roper Street and Lynwood Road, Hatfield, 0028, Pretoria, Republic of South Africa (SA)("Partner "), University and Partner shall be known collectively as "the Parties" and singularly as "a Party" or "the Party."

Recitals

Whereas, cordial relations exist between Lamar University and University of Pretoria, Faculty of Humanities,

Whereas, Lamar University and University of Pretoria, Faculty of Humanities have discussed mutual goals regarding academic opportunities for students and faculty; and

Whereas, Lamar University and University of Pretoria, Faculty of Humanities desire to establish a program to be formalized at a later date (the "Program") for the benefit of students and faculty of their respective educational institutions;

Now, therefore, the Parties enter into this MOU, in order to memorialize fundamental concepts regarding the Program, which includes supporting collaborative research projects, international experience for faculty/staff and students and academic teaching.

Understanding of the Parties

In contemplation of the establishment of the Program, the Parties agree as follows:

Article 1 (Objectives)

A. To contribute further to the original understanding between both countries (the United States of America and the Republic of South Africa), both cities (Beaumont and Pretoria), and both institutions (Lamar University and University of Pretoria, through mutual cooperation programs.

B. To further collaborations between Lamar University and University of Pretoria through academic programs in instruction, research and faculty/staff development among the faculty/staff and students of both institutions.

C. To enhance the international experience of faculty/staff and students in the area of:
    1. Research
    2. Joint Programs and Collaboration
    3. Exchange of Faculty/Staff and Students

Article 2 (Responsibilities of Parties)

A. Both institutions commit themselves to identify concrete areas of academic collaboration and to explore the means to achieve a successful collaboration.
B. The officials who will have the responsibility in coordinating the Program for the Parties are: Dr. Vinaya Manchaiah, Department of Speech and Hearing Sciences, Lamar University, USA; and Prof De Wet Swanepoel, Department of Speech-Language Pathology and Audiology, Faculty of Humanities, University of Pretoria, SA.

Article 3 (Understanding of Parties)

A. The Parties understand and acknowledge that they are making a significant commitment to this collaborative effort. Accordingly, the Parties agree to expend their best efforts on the design, implementation, and successful continuation of the Program.

B. This MOU shall remain effective from the effective date listed above until the end of the term of three (3) years.

C. The Parties understand and acknowledge that this MOU will provide the foundation for a more comprehensive agreement concerning the details of the Program; and that this MOU does not commit the Parties regarding the Program. This MOU is gratuitous for the parties and no payment or remuneration may be required by virtue of its execution as the Parties will absorb inherent costs to comply with this MOU at this time.

D. The Parties understand that this Program must support through its activities the mission of Lamar University and the University of Pretoria, Faculty of Humanities; that the Programs may not use the name and official seal of the other Party or any of its components without the written consent of the senior management of the other Party or her/his designee; that the Program is subject to all policies and procedures of the Board of Regents and Administration of the Texas State University System and those of the University of Pretoria, and must submit to reporting and auditing requirements as established by both Parties,.

E. Any intellectual property matters that arise from the Program shall be addressed pursuant to applicable policy, law and mutual written agreements among the Parties.

F. This MOU contains the entire understanding of Parties at this time. If either Party is unwilling or unable to continue with plans for the Program, that Party may do so by sending thirty (30) days written notice to the other Party.

G. This MOU may not be amended or otherwise modified except by the written agreement of both Parties. Neither Party may assign this MOU without the other Party's prior written consent. The invalidity or unenforceability of any provision(s) of this MOU will not impair the validity and enforceability of the remaining provisions.

H. In their execution of this agreement, all contractors, subcontractors, their respective employees, and other acting by or through them shall comply with all federal and state policies and laws that prohibit discrimination, harassment, and sexual misconduct. Any breach of this covenant may result in termination of this agreement.

In witness whereof, the Parties have caused their fully authorized representatives to execute this MOU effective as of the date written above.

Printed Name: Prof. William Harn
Signature: _____
Title: Chair, Speech and Hearing Sciences

Printed Name: Prof. De Wet Swanepoel
Signature: _____
Title: Professor, Dept of Speech-Language Pathology and Audiology

Printed Name: Prof. Nerina Holtzhausen
Signature: _____
Title: Dean, Fine Arts and Communication

Printed Name: Prof. Vasu Reddy
Signature: _____
Title: Dean of the Faculty of Humanities, University of Pretoria

Printed Name: Prof. Jerry Lin
Signature: _____
Title: Associate Provost for Research and Sponsored Program, Lamar University

Note: Modification of this form requires approval of OGC

Standard Form Approved by the Lamar University Office of General Counsel

Appendix H: Memorandum of Understanding between University of Pretoria and University of Colorado

NON-MONETARY COLLABORATION AGREEMENT

This Agreement is made by and between The Regents of the University of Colorado, a body corporate, for and on behalf of the University of Colorado Denver ("University"), and University of Pretoria, Faculty of Humanities, an institution of higher education in the Gauteng Province, Pretoria, Republic of South Africa ("Collaborator").

WHEREAS, it is in the mutual interest of University and Collaborator to participate in a study entitled: Supporting collaborative research projects, international experience for faculty/staff and students, and academic teaching. ("Project");

WHEREAS, Dr. Vinaya Manchaiah at the University, and Professor De Wet Swanepoel at the Collaborator ("Principal Investigators") are designated to coordinate the Project for University and Collaborator respectively;
Whereas, cordial relations exist between University of Colorado and University of Pretoria, Faculty of Humanities,

WHEREAS, Principal Investigators have discussed mutual goals regarding academic opportunities for students and faculty; and

WHEREAS, Principal Investigators desire to establish a program to be formalized at a later date (the "Program") for the benefit of students and faculty of their respective educational institutions;

WHEREAS, Collaborator and University shall conduct the Project in accordance with the Scope of Work ("SOW") attached as **Exhibit A**;

NOW, THEREFORE, the parties agree as follows:
1. SCOPE OF WORK. The Project shall be conducted in accord with the SOW attached

hereto as Exhibit A and incorporated into this Agreement by this reference solely for the purpose WT_Coll_09.14.10

V R

of describing the work to be performed under this Agreement. The research shall be carried out during the project period ("Project Period"), which shall be the date of this fully executed agreement and shall remain effective until the end of the term of three years. The Project may be extended by mutual written agreement; however, the Project may also be terminated early as provided in Article 15 below.

2. PRINCIPAL INVESTIGATORS. The research is to be conducted under the direction of the Principal Investigators. It will be the responsibility of each Principal Investigator to

transmit to and receive information from the other party, to coordinate visits and arrange all other matters pertinent to the Project.

3. PROTECTION OF HUMAN SUBJECTS. If applicable, Collaborator and University shall comply with Department of Health and Human Services ("DHHS") policies and regulations on the Protection of Human Subjects (45 CFR 46 as amended). Collaborator shall provide to University evidence of approval by Collaborator's Institutional Review Board. No work involving human subjects shall commence without prior approval by the Office for Human Research Protections ("OHRP") of an assurance to comply with the requirements of 45 CFR 46 to protect human research subjects.

Collaborator shall submit to the University an approved assurance, reviewed and approved by the appropriate Collaborator Institutional Review Board, that the rights and welfare of any human subjects involved in this project are adequately protected in accordance with DHHS policies and regulations on the Protection of Human Subjects.

4. RIGHTS IN DATA AND SPECIMENS. Both parties shall keep complete and accurate records of the work performed under this Agreement. Collaborator shall provide University with specimens, if applicable, along with the related reports and forms, as provided for in the Protocol. ("Study Reports"). The Parties shall own copyright relating to all Study Reports in proportion to each Party's intellectual contribution to such copyright , provided that the Party that generated such intellectual contribution to such copyright shall retain full ownership with

respect to applicable Study Reports. The Parties shall have right to use such Reports for

academic and research purposes. The Parties will not use any Protected Health Information ("PHI") or Personal Information or Confidential Information as defined by Health Insurance Portability and Accountability Act of 1996 ("HIPAA") and the Protection of Personal Information Act 4 of 2013 unless the Study subject has consented thereto in writing. Specimens will be utilized in accordance with the Exhibit A. Future use of data and specimens will be done in accordance with the study Protocol.

5. CONFIDENTIALITY. The parties may wish, from time to time, in connection with work contemplated under this Agreement, to disclose confidential information to each other related to the Project ("Confidential Information"). For purposes of this Agreement, the term "Confidential Information" shall mean any and all information, know-how, data, technical and non-technical materials, designs, concepts, processes, innovations, product samples and specifications, financial or business information, and other expertise, whether or not patentable, furnished by a disclosing party to recipient. Confidential Information shall be clearly marked by the disclosing party with the legend, "CONFIDENTIAL INFORMATION" or another appropriate proprietary legend. If disclosed orally or visually,

the employee(s) making the disclosure shall be responsible for clearly informing the recipient's employee(s), in writing within thirty (30) days, of the confidentiality of the information disclosed. Each party will use reasonable efforts to prevent the disclosure of the other party's Confidential Information to third parties for a period of five (5) years after termination or expiration of the Agreement, provided that the recipient party's obligation hereunder shall not apply to information that:

a) is not disclosed in writing or reduced to writing and so marked with an appropriate confidentiality legend within thirty (30) days of disclosure;
b) is already in recipient party's possession at the time of disclosure thereof;
c) is or later becomes part of the public domain through no fault of recipient party;
d) is received from a third party having no obligations of confidentiality to disclosing party;
e) is independently developed by the recipient party; or
f) is required by law, regulation, or court order to be disclosed.

3

VR

In the event that information is required to be disclosed pursuant to subsection 6.1(f), the party required to make disclosure shall notify the other to allow that party to assert whatever exclusions or exemptions may be available to it under such law or regulation.

6. COLORADO OPEN RECORDS ACT. Collaborator acknowledges that University is subject to the Colorado Public Records Act (C.R.S. §§ 24-72-201 et seq.). All Confidential Information of Collaborator shall be treated by University as confidential, as set forth in this Article 6, to the extent permitted under §§ 24-72-204. If University is required by Colorado Public Records Act to disclose any of Collaborator's Confidential Information, University shall: (i) use reasonable efforts to notify Collaborator in advance of such disclosure, and Collaborator shall be given the opportunity to oppose such disclosure by University by seeking a protective order or other appropriate remedy; (ii) disclose only that portion of Confidential Information which is legally required to be disclosed; and (iii) exercise all reasonable efforts to have confidential treatment accorded to the disclosed Confidential Information.

7. PUBLICATION. It is anticipated that the results of the work will be published jointly. Both parties will acknowledge the other party in any publication or presentation in accordance with academic standards.

8. USE OF NAME. Each party agrees not to include the name or any logotypes or symbols of the other party or the names of any researchers at such institutions in any advertising, sales promotion or other publicity matter without the prior written approval of the other party. However, nothing in this Article or elsewhere in this Agreement is intended to restrict either party from disclosing the existence, nature, Project, name of Collaborator or University, and

any additional matters required by law to be disclosed, or from including those items of information in the routine reporting of its activities.

9. INVENTIONS.
9.1 SOLE INVENTIONS. All Inventions conceived and first actually reduced to

practice solely by University shall be owned solely by University and shall be disposed of in

V R

accordance with University Policy, and all Inventions conceived and first actually reduced to practice solely by Collaborator shall be owned solely by Collaborator and shall be disposed of by Collaborator ("Sole Inventions"). The party who is the sole owner of such Invention shall, at its option, prepare, file, prosecute, and maintain applications throughout the world in countries of its choice.

9.2 JOINT INVENTIONS. All Inventions conceived and first actually reduced to practice by University and Collaborator as recognized under the U.S. law of inventorship shall be the mutual property of both to the extent of coinventorship, which shall, to the extent permitted by law, jointly hold all rights, title, and interest in proportion to each party's contribution to such inventions provided that the Party that generated such contributions to such inventions shall retain full ownership with respect to such inventions. The parties agree, to the extent they are legally able to do so, to negotiate in good faith the disposition of Joint Inventions.

9.3 DISCLOSURE (AND PREVIOUSLY EXISTING INVENTIONS). Each party shall promptly disclose to the other party in writing and on a confidential basis any Sole Invention or Joint Invention ("Invention Disclosure"). Notwithstanding the foregoing, it is recognized and understood that this Agreement does not affect any rights to any inventions of either party in existence prior to the Effective Date of this Agreement or those developed outside the course of the Project ("Prior Inventions"). Prior Inventions are and will remain the separate property of University or Collaborator, as applicable, and are not affected by this Agreement, and neither party shall have any claims to or rights in such separate Prior Inventions of the other.

10. LIABILITY. Each party shall be responsible for its own negligent acts or omissions or those of its officers or employees while performing their professional duties as set forth in this Agreement and the SOW, to the full extent allowed by law. Notwithstanding the foregoing, nothing in this Agreement is a limitation or waiver of the application of the Colorado Governmental Immunity Act set forth in C.R.S. §24-10-101 to §24-10-120 to any claims resulting from the performance of the University or its employees under this Agreement.

VR

11. INSURANCE. University and Collaborator certify that they maintain adequate levels of insurance or self-insurance to meet their obligations under this Agreement.

12. NOTICE. Whenever any notice is to be given hereunder, it shall be in writing and sent to the following address:

University:

University of Colorado Denver
Office of Grants and Contracts, Mail Stop F428 Anschutz Medical Campus, Bldg. 500,
W1124 13001 E. 17th Place
Aurora, CO 80045
Phone: (303) 724-0090
Fax: (303) 724-0814 OGC.Contracts@ucdenver.edu

Collaborator: University of Pretoria, Humanities Cnr Lynwood Road and Roper Street

Hatfield, 0028 Pretoria Republic of South Africa

13. TERMINATION. This Agreement may be terminated by either party at any time upon thirty (30) days prior written notice to the other party. Written notice of termination shall be directed to the appropriate individual named in this Agreement.

14. GOVERNING LAW. The parties will remain silent to governing law. Regardless of venue or jurisdiction of any dispute between the parties resulting from the performance of this agreement, the parties agree that the terms of the Colorado Governmental Immunity Act, CRS §§ 24-10-101 et seq. shall apply to such dispute.

15. EXPORT CONTROL. Notwithstanding any other provision of this Agreement, the parties understand and agree that they are subject to, and agree to abide by, any and all

VR

applicable United States laws and regulations controlling the export of technical data, computer software, laboratory prototypes and other commodities. It is the expectation of the parties that the work done pursuant to this Agreement will constitute fundamental research and be exempt from export control licensing requirements under the applicable export control laws and regulations. The parties do not wish to take receipt of Export-Controlled

Information except as may be knowingly and expressly agreed to in writing signed by an authorized representative of the parties and for which the parties have made specific arrangements. "Export Controlled Information" includes without limitation information subject to U.S. export control laws and regulations the requirements of the Arms Export Control Act, 22 U.S.C. 2751-2794, the International Traffic in Arms Regulation, 22 C.F.R. 120 et seq., the Export Administration Act, 50 U.S.C. app. 2401-2420, the Export Administration Regulations, 15 C.F.R. 730-77, Nuclear Regulatory Commission, 10 C.F.R. 110 and Department of Energy, 10 C.F.R 810. The parties agree to work together to ensure that, with regard to this Agreement, both are in compliance with any and all applicable U.S. export control laws and regulations, as well any and all embargoes and/or other restrictions imposed by the Treasury Department's Office of Foreign Asset Controls.

16. INDEPENDENT CONTRACTORS. The parties shall perform their obligations under this Agreement as independent contractors and nothing contained in this Agreement shall be construed to be inconsistent with such relationship or status.

17. ENTIRE AGREEMENT. This Agreement, together with any attachments hereto, represents the entire understanding of the Parties and supersedes any prior or contemporaneous agreements or understandings between Investigators and/or University with Collaborator with respect to the subject matter hereof. Furthermore, no modification, supplement, or new agreement may be executed, prior to the expiration of this Agreement, between Investigator and/or University with Collaborator with respect to the subject matter hereof, without formal written amendment to this Agreement, signed by all Parties. In the event of any inconsistency between this Agreement and any other attachments or documents, this Agreement shall control.

COLLABORATOR

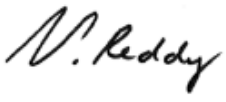
UNIVERSITY

7

By:

Name:

Prof V. Reddy
Dean: Faculty of Humanities



By: Name: Title: Date:

Liz Causey
Manager of Contracts

4/13/22

Title:
Date: 6 May 2022

8

EXHIBIT A STATEMENT OF WORK

1. To contribute further to the original understanding between both countries (the United States of America and the Republic of South Africa), and both institutions (University and Collaborator, through mutual cooperation programs.
2. To further collaborations between University and Collaborator through academic programs in instruction, research and faculty/staff development among the faculty/staff and students of both institutions.

3. To enhance the international experience of faculty/staff and students in the area of:

a. Research
b. Joint Programs and Collaboration
c. Exchange of Faculty/Staff and Students

Appendix I: Letter of Submission to the Journal of the American Academy of Audiology (JAAA)

30-Sep-2024

Dear Miss Cumming:

Your manuscript titled "Understanding Hearing Aid Use and Non-Use in Adult Hearing Aid Recipients: A Qualitative Content Analysis" has been successfully submitted online and is presently being given full consideration for publication in the Journal of the American Academy of Audiology.

Your manuscript ID is JAAA-24-Sep-0105.

Please mention the above manuscript ID in all future correspondence or when calling the office for questions. If there are any changes in your street address or e-mail address, please log in to ScholarOne Manuscripts at https://mc.manuscriptcentral.com/jaaa and edit your user information as appropriate.

You can also view the status of your manuscript at any time by checking your Author Center after logging in to https://mc.manuscriptcentral.com/jaaa.

Thank you for submitting your manuscript to the Journal of the American Academy of Audiology.

Sincerely,
Journal of the American Academy of Audiology Editorial Office

Appendix J: Table 2 and 3 with additional exemplar quotes

Table 1. Domain 1: Categories and sub-categories of reasons for hearing aid use (n=680 participants).

Category	Sub-category	Meaning unit examples (participant age and gender)
Personal Factors (Facilitators) (277)	Reliance for daily functioning (171)	*I wear my hearing aid all the time. There is not a situation that I don't wear it, I need it" (Male, 63).* *"I wear my hearing aids 100% of the time, unless I'm in a swimming type situation where the risk of water damage is too great. I cannot function without them" (Male, 75).* *"I wear my hearing aids 14-15 hours a day. I put them in after my shower in the morning and take them out before bed time" (Male, 67).*
	Embracing HAs (57)	*"Now I show acquaintances my hearing aids! I'm not embarrassed at all anymore" (Male, 60).* *"When I put it back on I always notice the big difference. I don't know why others avoid wearing their hearing aids" (Male, 67).* *"I don't know about others, but I put my hearing aids in, when I get up in the morning, and take them out when I go to bed at night. Without my hearing aids, I would miss so much of life" (Male, 39).*
	Improved communication (43)	*"The times I do wear them is when understanding conversation is important" (Male, 84).* *"The times I do wear them is when understanding conversation is important"(Male, 71).* *"I like hearing and understanding….why take them out?" (Male, 72).*
	Ensure cost-benefit (6)	

		"If I am going to spend more than $1000 on an item I am going to make sure that I use it" (Male, 70). *"After spending the kind of money for a quality pair of aids, I can't imagine letting them set in a drawer somewhere" (male, 83).* *"Cost, I always wear mine" (Male, 51).*
Situational Aspects (90)	Environmental awareness (28)	*"I wear them even when I am alone because I want to be aware of my environment and enjoy the sounds around me." (Male, 62).* *"I wear my hearing aid at all times for situational awareness" (Male, 62).* *"I go somewhere and find that I've forgotten them at home. I'm getting better at that since being bitten by a rattlesnake. Now I always wear them outside!" (Male, 87).*
	Group settings (22)	*"I now wear my hearing aids all the time when I go out or meet people or have outside meetings." (Male, 69)* *"I wear then when going out with other people" (Male, 74).* *"I definitely wear them to my office, and if I socialize" (Female, 67).*
	Recreational listening (21)	*When I am alone I still need hearing amplification for TV or listening to music." (Male, 75)* *"When I am alone I still need hearing amplification for TV or listening to music. I only remove them for shower and sleeping" (Male, 60).*

		"I put mine in upon getting up and take them out just before I go to sleep. I work alone, a solo architect, but the phone rings a good bit, face time calls happen, I listen to Mozart and Bach while I work, a pleasure" (Male, 64).
	Telephone use (9)	*"I wear my hearing aids most days because it's easier to hear on the phone." (Female, 70)* *"My hearing aids use blue tooth to connect to my phone. Phone calls are easy with my hearing aid" (Male, 67).*
	Safety (8)	*"I don't avoid them. I live alone and must hear any sounds so I know what it is. I sleep with mine because I have to know what is going on around me" (Female, 68).* *"I wear my hearing aid at all times for situational awareness." (Male, 62).*
	Challenging environments (2)	*"I wear my hearing aids whenever I go out. Noise can be a problem in crowded areas , as well as understanding speech" (Male, 23).* *"I wear it more in situations where I know I will have difficulty" (Male, 70).*
Hearing Device-Related Factors (6)	Streaming and connectivity (6)	*"I use them a lot to listen to podcasts and read books" (Male, 78).* *"Even when alone I wear my hearing aids. If I get a phone call the Bluetooth technology allows me to hear clearly." (Male, 71).* *"I always wear mine…. They connect with my phone for calls and streaming audio books" (Male, 74).*

Note: HAs – Hearing aids

Numbers in brackets are representative of meaning units

Table 2. Domain 2: Categories and sub-categories of reasons for hearing aid non-use (n=680 participants).

Category	Sub-category	Meaning unit examples (participant age and gender)
Situational Aspects (571)	Risk of moisture exposure (205)	*"When I am sweating heavily because hearing aids get wet, and batteries go dead very fast." (Male, 62)* *"I don't wear them because I perspire a great deal." (Female, 64).* *"When I work in the heat I can get them wet, so I don't wear them."(Male, 58).*
	Sleeping/in bed (129)	*"The only times I avoid wearing my hearing aids are when in the shower or in bed." (Male, 40)* *"I always wear them except for sleeping." (Female, 54).* *"When I sleep…in the shower…pool…beach. It is a bother to put them on." (Female, 54).*
	Outdoor activity (93)	*"I avoid wearing them when I ride my bike outdoors." (Female, 62)* *"Using equipment such as lawn mower or tractor chance of loss and no benefit hearing motor noise, sports with impact which could dislodge them and cause loss." (Male, 58).* *"I don't wear them hiking as they would be hard to find if they fell off while hiking." (Male, 74).*
	Challenging environments (68)	*"Wearing them in a group is very confusing with all the voices coming in at once… I dislike them in doctors' offices because the acoustics are generally not good." (Male, 52)* *"I do not wear them if I'm going out to dinner just with my husband, because the ambient noise and sounds become way too loud, and deafening." (Female, 67).*
	Staying at home (60)	*"I seldom wear them when working or alone in my office or at home." (Male, 78)*

	"In my case, I'm able to hear well enough that I'm able to get by without them when at home." (Female, 62). *"Don't always wear them when alone at home." (Female, 65).*
Damage/loss (47)	*"I don't wear them at work because I might lose them." (Female, 70)* *"I do not wear them when I am in environments where they might get wet or lost." (Male, 66)*
Recreational (22)	*"Crowds are awful, noisy environments (restaurants, movies, loud music, sporting events) are untenable, causing immediate headaches. No hearing aids can cope." (Female, 72)* *"I do not wear them while driving because the hearing aids just increase the road noise, often to a point that physically hurts my ears."(Male, 74).* *"I do NOT wear them when outside exercising. I also do not wear them when hunting." (Male, 64).*
Background noise (17)	*"I have turned them off when in a noisy situation as they only make the noise louder not more understandable." (Male, 82)* *"I usually wear my hearing aids but sometimes in situations with crowds, I opt to take them off because they amplify the noise."(Male, 80).* *"Background noise is too loud."(Male, 78).*
Procedural necessities (5)	*"The only time I do not is when I get a haircut, or medical procedures." (Male, 78)* *"I sometimes forget to put them in, but unless I'm going to get my hair cut or any other time when they might get wet." (Female, 74).*

		"I only take off my HAs for a haircut." (Female, 40).
	Television viewing (2)	*"I also generally don't leave my hearing aids in during TV time." (Male, 40)* *"I live alone so if I am not going out or watching TV I don't always put them in." (Male, 62).*
Personal Factors (Barriers) (350)"	Self-conscious (165)	*"I think people avoid wearing their HAs sometimes out of self-consciousness." (Male, 66)* *"My spouse needs hearing aids from years as soldier in Vietnam but he is too embarrassed to go for test even though doctor recommended he do so." (Female, 57).* *"Using my sister as an example, she needs hearing aids but thinks she'll "look old" with them." (Male, 61).*
	Listening fatigue (71)	*"I didn't wear my hearing aids as much and looked for opportunities to give my ears a rest." (Male, 69)* *"I didn't wear my hearing aids as much and looked for opportunities to give my ears a rest." (Female, 74).* *"Occasionally I leave them stored on my night table to give my ears a break." (Male, 78).*
	Lack of motivation (62)	*"The other reason is laziness on the hearing aid wearer. Just doesn't want to put them in." (Female, 68)* *"I sometimes forget to put them in."(Male, 68).* *"Sometimes I just FORGET because I'm usually not wearing them." (Female, 69).*

Acclimatisation (29)	*"In short, I need to gradually adapt to wearing them or not wearing them." (Female, 30)* *"I think older people don't have the patience to get used to them, not realizing that their brain needs time to adapt so they get frustrated with noise." (Male, 40).* *" Some never get use to hearing aids. They may have started to use them too late - after their brains got use to silence." (Female, 65)*
Dependence (19)	*"Sometimes I don't wear a hearing aid when I go out, because I don't want my whole life to be dependent on a hearing aid, and I have to learn to be brave on my own and continue to use a hearing aid occasionally." (Female, 35)* *"People avoid wearing hearing aids because they feel they don't need it." (Male, 66).* *" It is apparent that many of my age group try to hide their aids and even resist getting them" (Male, 59).*
Dexterity difficulty (5)	*"In some instances, older persons with poor finger dexterity may have issues with actually inserting them." (Male, 77)* *"Trouble putting them in." (Male, 62).* *"Older people can have trouble managing them."(Female, 72).*
Support required (4)	*"They do not always have someone in their life to help them figure out what works best for them as my husband has done for me." (Female, 75)* *"People are in a hurry no time to put them in. Nursing homes don't care." (Male, 79).*

		"I find that people who are new to using hearing aids do not usually know the questions to ask about how to make the most of their hearing aids. They do not always have someone in their life to help them figure out what works best for them as my husband has done for me. It can be very overwhelming to figure this all out." (Female, 69).
Hearing Device-Related Factors (237)	Fine-tuning required (83)	*"...they are not tuned correctly. If you can't hear with them there is little reason to wear them." (Male, 73)* *"The reason why people avoid wearing hearing aids is because it's not programmed properly." (Female, 65).* *"Don't have hearing aid that work properly." (Male, 87).*
	Discomfort of fitting (79)	*"They're not comfortable after a while. It's a matter of getting used to wearing them. I feel more comfortable when I take mine out every night." (Female, 57)* *"The only reason I can think of is they don't fit well." (Male, 67).* *"Also, aids left in for long periods make my ears itchy and sometimes even a little tender." (Male, 79).*
	Compatibility with wearables (39)	*"I do take a daily walk and many times I will remove my HAs so I can use Apple AirPods. I prefer these for music over the Bluetooth of my Oticon OpnS HAs." (Male, 64)* *"I usually have my hearing aids out when I'm doing anything involving a headset. The last thing I need is some video game bomb that's already loud getting amplified by my hearing aids." (Female, 52).*

	"I don't wear them on stage (I wear in-ear monitors on stage)." (Male, 63).
Support and training gaps (16)	*"So maybe people need more training on them." (Male, 46)* *"People avoid using their aids because they did not give them a fair trial after purchasing." (Female, 78).* *"I also know from what my hearing professional says, people with BTE HAs don't change their tubes often enough, allowing them to close up and get brittle, causing a loss of hearing aid performance." (Male, 61).*
Outer ear health (13)	*"You can't wear a hearing aid when your ear is inflamed, and you can't wear a hearing aid when your ear is running pus." (Female, 39).* *"The only time I don't wear them is if I have a sore." (Male, 73).* *"Whenever I have another case of otitis externa (aka Swimmer's Ear)." (Male, 64).*
Battery life concerns (10)	*"One senior doesn't occasionally wear them because the battery life is too short." (Male, 79)* *"Some might also do so in an attempt to save battery power because of the perceived financial savings." (Female, 56).* *"I get really tired of dead batteries and new batteries that are dead to start with." (Female, 72).*
Ongoing cost (5)	*"Cost of damage/replacement is the reason I remove them most often." (Male, 66)*

"Plus, the costs of ongoing audiology care and batteries for battery-operated ones. I may not have gotten the aids if I was unable to afford them (they were still expensive, even for a doctor!)" (Male, 54).

"I used to avoid them whenever I could "get away with it" or not notice it because of the trouble putting them in and maintaining them." (Male, 62).

Note: Numbers in brackets are representative of meaning units