



**Faculty of Humanities**

Department of Speech-Language Pathology and Audiology

**MEANINGFUL LIFE CHANGES FOLLOWING HEARING AID USE: A  
QUALITATIVE USER PERSPECTIVE**

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**In fulfilment of the requirements for the degree  
MA AUDIOLOGY**

**In the Department of Speech Language Pathology and Audiology,  
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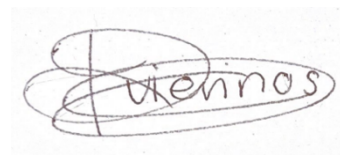
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**Date submitted:** 29-08-2024

**Topic of work:** Meaningful Life Changes Following Hearing Aid Use: A Qualitative User Perspective

A handwritten signature in black ink, appearing to read 'Avierinos', is enclosed within a hand-drawn oval. The signature is written in a cursive style.

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**Signature**

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## Abstract

This study explored the meaningful life changes experienced by adult hearing aid users, examining both the positive impacts and persistent challenges associated with hearing aid use. It critically examined the impact of hearing aid use on the quality of life in adults, specifically focusing on understanding both the meaningful life changes and persistent challenges experienced by these users.

Utilizing a cross-sectional survey design, the study employed inductive qualitative content analysis to evaluate responses to a specifically designed open-ended question in a questionnaire. Participants included 653 adult hearing aid users recruited from the Hearing Tracker website community and the Lexie Hearing database, with an average age of 65.4 years (SD = 13.6) and a gender distribution of 61.2% male, 38.3% female, and 0.5% other.

Analysis of the responses yielded two primary domains: "meaningful benefits" (80.5%, n = 1,709) and "remaining difficulties" (19.5%, n = 413) related to hearing aid use. The "meaningful benefits" encompassed five categories with 27 sub-categories, highlighting psychosocial benefits, improvements in hearing, personal benefits, connectivity features of hearing aids, and situational benefits. Key benefits included enhanced relationships, improved occupational functioning, and enriched enjoyment of auditory media. Conversely, the "remaining difficulties" domain revealed four categories with 25 sub-categories, featuring challenges such as hearing aid limitations, hearing and communication issues, situational difficulties, and personal issues. Key difficulties included listening in noisy environments, understanding speech in noisy settings, and experiencing physical discomfort with hearing aids.

The findings of this study reveal a complex array of both positive impacts and ongoing challenges associated with hearing aid use. These insights are important for developing more empathetic and effective rehabilitation strategies. Furthermore, they underscore the need for user-centric hearing aid technologies tailored to the specific needs and

preferences of end-users. This study's contributions lie in its comprehensive analysis of user experiences, offering a nuanced understanding that could inform future research and practice in audiology.

### **Keywords**

Hearing loss, Hearing aid outcome, Hearing aid use, Meaningful life changes, Hearing aid difficulties, Adult hearing aid user

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## List of Abbreviations

APHAB	Abbreviated Profile of Hearing Aid Benefit
CHERRIES	Checklist for Reporting Results of Internet E-Surveys
COREQ	Criteria for Reporting Qualitative Research
COSI	Client Oriented Scale of Improvement
CP	Communication partners
HCPs	Hear Care Professionals
IOI-HA	International Outcome Inventory for Hearing Aids
OTC	Over - the - counter
PCC	Person-centred care
SADL	Satisfaction with Amplification in Daily Life
SPSS	Statistic Package Social Sciences
WHO	World Health Organization

## Chapter 1: Introduction

As of 2018, the World Health Organization (WHO) reported that approximately 466 million people, or 6.1% of the global population, experience disabling hearing loss. Projections suggest that this number could rise to nearly 630 million by 2030 and over 900 million by 2050 (Davis & Hoffman, 2019). This increasing prevalence is driven by factors such as population growth, aging demographics, exposure to loud noises, infections like mumps and measles, and the use of ototoxic medications. Disabling hearing loss poses significant challenges, including social isolation, depression, occupational stress, and stigmatization (Olusanya et al., 2014), which carry profound implications for health systems, societal productivity, and associated costs (Davis & Hoffman, 2019).

Hearing aids are the most common intervention for managing hearing loss (Müller & Barr-Gillespie, 2015), with documented benefits such as improved communication, enhanced quality of life, reduced social isolation, and better psychological outlooks (Lockey et al., 2010; Meister et al., 2015b; Nuesse et al., 2021; Pronk et al., 2011). Moreover, recent evidence suggests that hearing aid use may reduce the risk of dementia (Livingston et al., 2020).

Typically, the effectiveness of hearing aids is assessed through standardized outcome measures focusing on user satisfaction and benefit. Satisfaction is defined as the emotional or cognitive response to the overall experience with the device (Giese & Cote, 2000), while benefit refers to the improvement in hearing ability compared to the unaided condition (Meister et al., 2015a). Common measures include the *Satisfaction with Amplification in Daily Life* (SADL) survey (Cox & Alexander, 1999), the *International Outcome Inventory for Hearing Aids* (IOI-HA) (Cox & Alexander, 2002), and the *Abbreviated Profile of Hearing Aid Benefit* (APHAB) (Cox & Alexander, 1995). However, these standardized tools may not fully capture the nuanced, real-life experiences of hearing aid users, as they often lack the flexibility to represent independent outcomes (Granberg et al., 2014).

An alternative approach involves open-ended questions that capture user perspectives on their experiences with hearing aids (Manchaiah et al., 2022). For instance, the *Client Oriented Scale of Improvement* (COSI) (Dillon et al., 1997) allows users to compare their ease of communication before and after hearing aid fitting based on situations important to them. This approach helps avoid misjudging the benefits experienced by users, offering a more personalized assessment.

Recent studies by Bennett et al. (2021) and Manchaiah et al. (2021) have analysed consumer reviews of hearing aid users through open-ended questions, revealing unique insights into perceived benefits and satisfaction. Bennett et al. (2021) identified various domains encompassing clinical processes, device functionality, and personal adjustments, providing a comprehensive view of the hearing aid experience. However, these findings may not be generalizable to the broader population due to the lack of detailed demographic and audiological data.

Qualitative research provides valuable insights into the psychosocial and interpersonal factors influencing hearing aid use, rehabilitation, and help-seeking behavior (Knudsen et al., 2012; Lockey et al., 2010). Recent qualitative and mixed-method studies have explored hearing aid use, associated difficulties, and the residual psychosocial impacts of hearing loss (Dawes et al., 2014; Laplante-Lévesque et al., 2013). A systematic review by Oosthuizen et al. (2022) found that improved psychosocial functioning is a common benefit of hearing aid use, although issues related to device-specific factors (such as discomfort and maintenance) and non-device-related factors (such as motivation and support systems) can lead to suboptimal use (Bennett et al., 2018; Bennett et al., 2021; Gallagher & Woodside, 2018; Lockey et al., 2010).

Despite the growth of qualitative research in audiology, further studies are needed to better understand the needs, beliefs, and experiences of hearing aid users, including non-users and those with various types of devices (Oosthuizen et al., 2022). Qualitative methods, with their open-ended questions, enable researchers to capture detailed and nuanced information that standardized measures may miss (Meis et al., 2018; Pronk et al., 2014; Sung et al., 2016; Vercammen et al., 2020). These insights can inform more personalized and effective interventions tailored to users' unique needs.

While hearing aids offer various benefits, research has predominantly focused on user satisfaction and specific outcomes measured through standardized tools. There is a critical gap in understanding the profound, meaningful changes that hearing aids can bring to users' lives beyond basic functionality. The rationale for this study is grounded in the need to explore these deeper impacts, which are often overlooked in traditional research. By employing a qualitative methodology to capture the unique narratives of adult hearing aid users, this research focuses on the tangible effects on their quality of life. Utilizing a robust sample size and addressing previous methodological limitations, the study seeks to uncover not only satisfaction levels but also the significant life changes and persistent challenges faced by users. These insights will contribute significantly to our understanding of the real-world implications of hearing aid adoption and underscore the importance of prioritizing user-centred approaches in audiology research. The aim of this study was to explore the meaningful life changes experienced by adult hearing aid users, examining both the positive impacts and ongoing challenges associated with hearing aid use.

## Chapter 2: Methodology

### 2.1 Research aim

This study aimed to explore meaningful life changes due to hearing aid use in adult hearing aid users.

### 2.2 Research design

This study employed a qualitative research design to explore adult hearing aid users' perceptions of their hearing aids, specifically identifying meaningful life changes resulting from their use. A qualitative approach was selected for its ability to deeply and comprehensively explore complex phenomena, allowing for the capture of rich narratives, emotions, and experiences that quantitative methods might overlook (Manchaiah et al., 2022).

To analyse the open-ended survey responses, qualitative content analysis was utilized. This method is particularly effective for understanding responses in participants' own words, providing insights that predefined options might miss (Manchaiah et al., 2022). Through the interpretation and coding of textual material, qualitative content analysis yields reliable and repeatable conclusions that reflect participants' opinions, perspectives, and attitudes. Although time-consuming, this process offers a broad and accurate description of the data.

The study was guided by the phenomenological research tradition, which focuses on understanding participants' subjective perspectives and lived experiences (Gurwitsch, 1966; Moustakas, 1994). Phenomenology is especially suitable for exploring how individuals perceive and make sense of their experiences with hearing aids, providing a valuable framework for interpreting the data collected.

## 2.3 Participants

### 2.3.1 Sampling

Participants for this study were recruited from two primary sources: the Hearing Tracker US database and the Lexie Hearing user database. Hearing Tracker is an online platform where users share reviews and ratings of hearing aids and hearing care professionals based on their personal experiences, while Lexie Hearing offers affordable, over-the-counter hearing aids with remote support, including troubleshooting and fine-tuning by experts via video or audio calls. These platforms were chosen due to their active engagement with hearing aid users, making them ideal for accessing a large and diverse sample.

A convenience sampling method was employed, which is a widely used strategy in qualitative research, especially when aiming to gather insights from specific populations that are easily accessible and highly relevant to the research question (Etikan, Musa, & Alkassim, 2016). This approach was particularly appropriate for this study, as the primary aim was to explore the lived experiences of adult hearing aid users rather than to achieve statistical generalizability. Convenience sampling allowed for the efficient recruitment of participants who were already engaged with hearing-related services and communities, thereby ensuring that the sample was both relevant and reflective of the study's objectives.

The data collection took place between October and November 2021, facilitated by Lamar University (USA) through an electronically distributed survey focused on hearing aid satisfaction and benefit (see Appendix A). The use of an electronic survey was strategic, providing a practical and efficient means of reaching many potential participants, all of whom were already active in online communities related to hearing healthcare.

A total of 653 US-based adult hearing aid users were ultimately included in the study. This robust sample size was instrumental in providing a thorough exploration of the research questions and ensured that the findings were grounded in a diverse array of perspectives. The use of participants from two well-established platforms enabled the

study to draw from a broad spectrum of experiences and interests in hearing healthcare, which was essential for capturing the complexity and depth of users' experiences.

The substantial sample size not only allowed for a more nuanced understanding of various hearing aid-related experiences but also enhanced the study's credibility and applicability. By encompassing a wide range of user experiences, the study was better positioned to identify patterns and trends that may not be visible in smaller studies. This approach contributed to the external validity of the findings, making it more likely that the results can be generalized to a broader population of hearing aid users. The diverse participant pool was pivotal in ensuring that the qualitative insights gained were representative of the varied realities faced by hearing aid users, thereby enriching the study's overall findings and their implications for future research and clinical practice.

Moreover, the recruitment strategy effectively aligned with the research objectives by targeting individuals who were likely to provide pertinent and insightful contributions. The use of convenience sampling in this context is justified, as it enabled the researchers to efficiently gather detailed, qualitative data from a relevant and engaged population, thus contributing to the depth and validity of the study's findings.

### **2.3.2 Participant selection criteria**

Participants were eligible for inclusion if they were adults aged 18 or older and used either unilateral (a hearing aid in one ear) or bilateral (hearing aids in both ears) devices. The survey (Appendix A) was distributed only to individuals whose profiles indicated they met these criteria.

### **2.3.3 Study population**

The study population comprised 653 US-based adult hearing aid users, drawn from two primary sources: the Hearing Tracker website community and the Lexie Hearing database. These participants were selected based on their active engagement with hearing-related services and platforms, ensuring that they had relevant experience and insights to contribute to the research.

The analysed responses came from adults aged between 22 and 93 years, providing a broad age range that encompassed both younger adults and older individuals. This diversity in age allowed the study to capture a wide spectrum of experiences and perspectives on hearing aid use, reflecting the varied challenges and benefits encountered across different stages of life. The mean age of the participants was 65.4 years, with a standard deviation of 13.6 years, indicating a typical age distribution for hearing aid users, who often experience age-related hearing loss.

By including participants from such a diverse age group, the study was able to explore how hearing aid use impacts adults at different life stages, from younger adults who may still be in the workforce to older adults who may face additional challenges related to aging. This broad demographic spread was essential for understanding the full scope of the meaningful life changes associated with hearing aid use, as the experiences and needs of hearing aid users can vary significantly depending on their age and life circumstances.

Furthermore, the decision to focus on US-based participants ensured that the findings were relevant to the context of hearing healthcare in the United States, where access to hearing aids, healthcare services, and support systems can differ from those in other countries. This geographic focus also allowed the study to consider cultural and systemic factors specific to the US that might influence the experiences of hearing aid users.

Overall, the study population was well-suited to the research objectives, providing a robust and diverse sample that facilitated a comprehensive exploration of the significant life changes experienced by adult hearing aid users.

## **2.4 Ethical considerations**

The study received clearance from the Faculty of Humanities Research Ethics Committee, University of Pretoria (Ref: HUM052/1022) (Appendix B) and ethical approval from Lamar University's Institutional Review Board (IRB-FY21-248) (Appendix C).

### *Informed consent*

Participants received an email containing a link to the survey. This link included a participant informed consent letter (Appendix A), which needed to be signed electronically before they could proceed with the survey. The informed consent letter (Appendix A) provided a comprehensive overview of the study, including its rationale and background. It also detailed the significance of the survey, explaining its importance and outlining what participation would involve. This thorough explanation ensured that participants were fully informed about the purpose and scope of the research before agreeing to take part.

### *Risks and safety*

This study aimed to understand and explain the meaningful life changes due to hearing aid use from the perspective of adult hearing aid users, by analysing their text responses in a large-scale survey. The data was de-identified and analysed retrospectively, posing no more than minimal risk to the participants. These ethical principles ensured the protection of the research participants within the study setting (HPCSA, 2016).

### *Confidentiality*

Confidentiality in respecting the participants' right to privacy and showing consideration for the participants' expectations of remaining anonymous, through the research process was of utmost importance (Artal & Rubenfeld, 2017). This included that the data remained anonymous and was protected (Artal & Rubenfeld, 2017). Caution was taken to ensure that the confidentiality of participant data was maintained. This was important during qualitative research outcomes due to the regular practice of utilising excerpts (i.e., verbatim quotes) of the participant reports. Each participant received a participant code, and only de-identified data was used for data analysis and handling of verbatim quotes.

### *Data storage*

All the information recorded during the survey was kept confidential and stored in an encrypted manner. For the duration of the study, firewalls, encrypted files, and complex passwords were used on all computers to ensure that the identity of the participants was kept secure (Manchaiah et al., 2022). Upon completion of the study, the data will be stored electronically at the Department of Speech-Language Pathology and Audiology for a

minimum of 10 years. In addition, data will also be uploaded unto the University of Pretoria Research Data Repository (Figshare).

### *Release of findings*

Dissemination of the findings was conducted with the objective of adding to the knowledge base on the topic covered, to improve patient outcomes and standard of care (Manchaiah et al., 2022). A research article was submitted and accepted for publication (Appendix D), and the online research dissertation will be accessible on the University of Pretoria's' library database. Research results may also be presented at conferences.

### **2.5 Data collection material**

This study was embedded within a larger online survey (Appendix A) on hearing aid experiences and outcomes (Swanepoel et al., 2023). The online survey was sent out using the Qualtrics platform during October and November 2021. The survey included demographic and hearing aid-related questions and four open-ended questions (Appendix A). For this study, responses gathered from one of the open-ended questions (Appendix A; Section 2 question 2), namely meaningful life changes resulting from hearing aid use, were analysed retrospectively, using inductive, qualitative content analysis (Manchaiah et al., 2022).

Open-ended questions were used in this study to allow participants to express their thoughts in their own words, an approach particularly useful when exploring unfamiliar subject areas (Manchaiah et al., 2022). Content analysis was employed to interpret and code the textual material, ensuring reliable and repeatable deductions that captured participants' opinions, perspectives, and attitudes. An inductive approach was used to generate new theories from the data (Manchaiah et al., 2022).

The survey items were developed through an iterative process grounded in contemporary research on factors influencing hearing aid experiences. Input from four audiologists, who piloted the survey, was integrated to refine the items further. The finalized survey was then uploaded to Qualtrics (Qualtrics, Provo, UT) and subsequently reviewed by a multidisciplinary panel, consisting of audiologists (Prof. Vinaya Manchaiah and Prof. De Wet Swanepoel) and social psychologists (Ryan Boyd and Jamie Pennebaker), to

evaluate its functionality. The open-ended questions were meticulously formulated by this team to elicit comprehensive responses from participants, drawing on their collective expertise in survey methodology.

## **2.6 Data collection procedures**

The survey was conducted via the Qualtrics platform (Appendix A). Participants received an email with a link to access the survey during October and November 2021. The link contained a participant information consent letter (Appendix A), which had to be electronically signed before the survey could be completed. The estimated time to complete the survey was 15 minutes. Participation was voluntary, and no incentives were offered to participate in the study. A completeness check was included for each question of the survey. As the survey was conducted through consumer databases (Hearing Tracker & Lexie Hearing) with restricted access, participation rate and completion rate were not able to be calculated.

## **2.7 Data processing and analysis**

The open-ended responses were exported from the Qualtrics platform into Microsoft Excel for analysis. In qualitative research, two primary approaches can be used: data-driven inductive methods or theory-driven deductive methods (Graneheim & Lundman, 2004; Laplante-Lévesque et al., 2012). For this study, an inductive content analysis was employed to explore the data without preconceived frameworks (Knudsen et al., 2012). This method allows for findings that range from descriptive reports of human actions to abstract theories about behaviour and social structures (Knudsen et al., 2012).

Initially, 1,094 responses were collected, with 827 from Hearing Tracker and 267 from Lexie Hearing. During screening, responses that did not answer the open-ended questions ( $n = 338$ ), reported childhood hearing loss and hearing aid fitting ( $n = 40$ ), lacked informed consent ( $n = 26$ ), used personal sound amplification systems ( $n = 14$ ), relied on implantable devices ( $n = 3$ ), were irrelevant ( $n = 11$ ), or were duplicates ( $n = 9$ ) were excluded. This left 653 responses for analysis.

Inductive content analysis was used to systematically code the data while preserving its original meaning (Graneheim & Lundman, 2004; Manchaiah et al., 2022). De-identified demographic data were first coded in Microsoft Excel and then transferred to SPSS

version 28 for statistical analysis, where descriptive statistics, including range, mean, frequency, and standard deviation, were calculated. The qualitative data were also analysed through inductive content analysis in Microsoft Excel, following established guidelines (Graneheim & Lundman, 2004; Knudsen et al., 2012).

This content analysis enabled reliable and repeatable deductions by interpreting and coding the textual material, considering participants' opinions, perspectives, and attitudes (Manchaiah et al., 2022). The primary researcher (RJA) manually coded the responses after thoroughly reading them to gain a holistic understanding of the data. The responses were then segmented into meaning units, labelled with codes, and grouped into sub-categories, which were eventually organized into overarching categories (Graneheim & Lundman, 2004). The co-author (EB), an experienced qualitative researcher, cross-checked 30.5% of the coding, and discrepancies were resolved through discussions with a third researcher (VM).

Data saturation was assessed by analysing the responses for recurring patterns and the emergence of new codes. Saturation was reached after analysing 86.9% of the responses ( $n = 575$ ), at which point no new codes or themes emerged, confirming that further analysis would not yield additional insights (Manchaiah et al., 2022).

The findings have been comprehensively represented through tables and a diagram, providing an overview of the coded content.

## **2.8 Validity and reliability**

Reliability is determined by the consistency of the results if the same methods were repeated and produced the same findings (Nelson & Gilbert, 2020). The reliability of research standards could be measured by their dependability (Manchaiah et al., 2022). To ensure the dependability of the study, research findings need to be repeatable and consistent (Marcucci, 2011). Careful documentation of each methodology step had been conducted to ensure that future researchers could determine if the results were dependable (Manchaiah et al., 2022).

Research validity refers to the extent to which a study measures what it intends to measure (Cook et al., 2002). When a study is valid, its findings are considered truthful and credible (Manchaiah et al., 2022). In qualitative research, validity does not have a fixed definition but rather focuses on the integrity and rigor of the study's methodology (Manchaiah et al., 2022). To ensure high reporting standards in this study, adherence to the Consolidated Criteria for Reporting Qualitative Research (COREQ) (Tong et al., 2007) and the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) guidelines (Eysenbach, 2004) was maintained (see Appendices E and F, respectively). Conducting and reporting this study in accordance with COREQ and CHERRIES guidelines ensured its quality and transparency.

Validity in this study was further addressed through an evidence-based method of qualitative data categorization, utilizing categories and sub-categories (Manchaiah et al., 2022). The primary researcher (RJA) conducted the initial coding manually, which was subsequently validated through monitoring and cross-checking by a co-author (EB) to ensure the repeatability and credibility of the data analysis (Manchaiah et al., 2022). Data analysis continued until data saturation was achieved, enhancing the robustness of the findings. Additionally, data source triangulation, using the Lexie Hearing and Hearing Tracker databases, was employed to further improve the credibility of the study (Manchaiah et al., 2022).

## Chapter 3: Research article

### Meaningful life changes following hearing aid use: A qualitative user perspective

**Authors:** Ruth Avierinos, Eldre Beukes, Vinaya Manchaiah, Ilze Oosthuizen, Talita le Roux, & De Wet Swanepoel

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**Proof of acceptance and publication:** Appendix (D)

#### 3.1 Abstract

**Objective:** This study aimed to explore meaningful life changes due to hearing aid use in adult users.

**Design:** A cross-sectional survey design was used with open-ended questions analysed using inductive qualitative content analysis.

**Study sample:** US-based adult hearing aid users (n=653) from the Hearing Tracker website community and Lexie Hearing database.

**Results:** Participants had a mean age of 65.4 years (13.6 SD), including 61.2% males, 38.3% females (0.5% other). Analysis of 2122 meaning units from responses identified two broad domains: 'meaningful benefits' (n=1709; 80.5%) and 'remaining difficulties' (n=413; 19.5%). The meaningful benefits domain included five categories (27 sub-categories): (a) psychosocial benefits, (b) improvements in hearing, (c) personal benefits, (d) hearing aid features and connectivity, and (e) situational benefits. Participants reported enhanced relationships and improved occupational functioning as key benefits. The remaining difficulties domain contained four categories (25 sub-categories): (a) hearing aid limitations, (b) hearing and communication issues, (c) situational difficulties, and (d) personal issues. Notable difficulties included hearing aid design issues and challenges in noisy environments.

**Conclusion:** Hearing aid users reported diverse benefits and persistent challenges related to device use, illustrating the complexity of their lived experiences. These findings can inform empathetic, effective rehabilitation strategies and user-centric hearing aid technologies.

### **Keywords**

Hearing loss, Hearing aid outcome, Hearing aid use, Meaningful life changes, Hearing aid difficulties

### **3.2 Introduction**

Hearing aids are the most common way to manage permanent hearing loss (Müller & Barr-Gillespie, 2015) and have been proven not only to support better hearing, but also improve relationships (Kamil & Lin, 2015; Lockey et al., 2010), reduce social isolation (Lockey et al., 2010), and promote independence (Tai et al., 2021). Using hearing aids is likely to slow down cognitive deterioration (Lin et al., 2023) and reduce the excess risk of dementia (Livingston et al., 2020). Recent research has demonstrated notable advancements in self-perceived auditory capabilities, encompassing sound detection, speech intelligibility, and spatial localization (Lansbergen et al., 2023). This was observed among 1319 adult new hearing aid users and experienced individuals requiring replacement of their hearing aids (Lansbergen et al., 2023). Contrary to expectations, factors like hearing aid technical specifications, severity of hearing loss, age, gender, and hearing aid style did not significantly affect the patient-reported outcome measures (PROMs) results. This emphasizes the importance of personalized rehabilitation strategies and refined outcome assessments (Lansbergen et al., 2023).

Hearing aid effectiveness is typically assessed using standardized measures evaluating benefit and satisfaction. Benefit refers to improved hearing ability, while satisfaction reflects users' emotional or cognitive response to the product (Giese & Cote, 2000; Meister et al., 2015b). Objective measures like speech recognition in various environments are commonly used to gauge benefit (Cox, 2003; Meister et al., 2015). Subjective measures include standardized questionnaires like the *Satisfaction with Amplification in Daily Life survey* (SADL; Cox & Alexander, 1999) and the *Abbreviated Profile of Hearing Aid Benefit* (APHAB; Cox & Alexander, 1995). However, these

standardized patient-reported outcome measures (PROMs) may not fully capture individual needs and experiences. Open-ended questions, such as those in the *Client Oriented Scale of Improvement* (COSI) (Dillon et al., 1997), offer an alternative approach by allowing users to share real-life experiences and outcomes. This method helps prevent misjudgement of benefits experienced, unlike some other PROMs.

Qualitative methods can complement standardized tools with more detailed and nuanced information about users' real-life experiences and perspectives with hearing aids, as well as the psychosocial and interpersonal factors influencing their hearing-related behavior and rehabilitation. Recent qualitative studies have explored hearing aid use and satisfaction, associated difficulties, and the residual psychosocial impacts of hearing loss, providing a deeper understanding of the user experience (Dawes et al., 2014; Kozlowski et al., 2017; Laplante-Lévesque et al., 2013; Oosthuizen et al., 2022). Qualitative methodologies examining outcomes can provide valuable insights into the effects of hearing aids that may be overlooked by standardized measures (Knudsen et al., 2012; Lockey et al., 2010; Meis et al., 2018; Pronk et al., 2014; Sung et al., 2016; Vercammen et al., 2020). Similarly, analysis of open-ended text responses from consumer reviews can illuminate various domains related to clinical processes, device functionality, and personal adjustments to hearing aids (Bennett et al., 2021; Manchaiah et al., 2021). Using open-ended questions that are analysed qualitatively, can help avoid misjudgement and shed light on perceived benefits, satisfaction, and unique insights beyond clinical measures (Manchaiah et al., 2022).

Heselton et al. (2022) conducted a qualitative study analysing 1378 open-text responses from online users regarding their hearing aid experiences. Thematic analysis revealed three domains: clinical processes, device aspects, and personal factors, each with multiple themes and subthemes. The study emphasized the importance of incorporating end-users' perspectives into product development and service delivery models to promote person-centred care (PCC) (McLean, 2022). However, as audiological and demographic details were unknown, the findings may not generalize to the broader population of hearing aid users. While the study assessed user satisfaction, it did not explore the meaningful life changes resulting from hearing aid use, limiting insights into factors contributing to improved quality of life.

Oosthuizen et al. (2022) conducted a systematic review of 25 qualitative studies exploring the hearing aid experiences of adult users. They found that enhanced psychosocial functioning was commonly reported but identified various device-related and non-device-related challenges leading to sub-optimal use (Gallagher & Woodside, 2018; Lockey et al., 2010). However, many studies in the review had limitations, such as small sample sizes and limited participant diversity (Choi et al., 2019; Chundu et al., 2021; Kozlowski et al., 2017). Despite the increasing qualitative audiological research, there is still a need for further studies to better understand the needs, beliefs, and experiences of hearing aid users (Oosthuizen et al., 2022).

Previous research has extensively explored the benefits and challenges of hearing aid use. However, existing studies primarily focused on user satisfaction and specific benefits, resulting in a notable gap in literature to explore how hearing aids contribute to meaningful changes in users' lives. Thus, this study aimed to explore a different perspective on hearing aid use, focusing on the meaningful life changes experienced by hearing aid users, providing a comprehensive insight beyond the typical focus on satisfaction and basic functionality.

### **3.3 Method**

#### **Study design**

This study used a prospective cross-sectional survey design. Ethical approval for the survey study was obtained from Lamar University's Institutional Review Board (IRB-FY21-248) prior to data collection. In addition, this study also received institutional review board clearance from the Faculty of Humanities Research Ethics Committee, University of Pretoria (HUM052/1022). The Consolidated Criteria for Reporting Qualitative Research (COREQ; Tong et al., 2007) and the Checklist for Reporting Results of Internet E-Survey (CHERRIES; Eysenbach, 2004) guidelines were used to report the methods and results of this study (see additional Supplementary Material 1 and 2). Interested readers can access the supplementary material at <http://tandfonline.com/doi/suppl>.

## Survey

The current study, part of a larger survey on hearing aid experiences and outcomes (Swanepoel et al., 2023), utilized an electronic questionnaire (see Supplementary Material 3) developed on the Qualtrics platform. The questionnaire items were iteratively developed based on existing research on hearing aid experiences from adult users, with feedback from four audiologists incorporated. The finalized questionnaire was imported into Qualtrics (Qualtrics, Provo, UT) and reviewed for functionality. Responses were not randomized, and participants couldn't modify their answers after submission. Personally identifiable data weren't collected; each participant received a participant code, and only de-identified data were analysed. All survey data were kept confidential and stored securely, using firewalls, encrypted files, and complex passwords (Manchaiah et al., 2022).

The survey consisted of four sections, including 1) demographic and audiological related items (11 questions); 2) open-ended questions on hearing aid experiences (four questions); 3) International Outcomes Inventory for Hearing Aids (IOI-HA; Cox & Alexander, 2002; seven questions); and 4) general health, well-being and social network items (18 questions). Questions per page ranged from two to five questions with 12 pages in total excluding the cover page. The present study was part of a broader survey investigating hearing aid experiences and outcomes (Swanepoel et al., 2023). Due to the large sample and amount of collected data, the current study only focused on responses from section 1, the second open-ended question in section 2 and section 3. The other open-ended questions focused on different experiences and outcomes with hearing aids and data obtained for these questions were analysed separately (e.g., Knoetze et al., 2023). The open-ended questions were created by a multidisciplinary team, including audiologists (VM and DS) and social psychologists (Ryan Boyd and James Pennebaker). Contextual information was used to formulate the questions to motivate the participant to write as much as possible. This study analysed the responses to the second open-ended questions that was worded as: "*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*".

## Data collection

The research participants were recruited by email using convenient sampling through the Hearing Tracker US database ([www.hearingtracker.com](http://www.hearingtracker.com)) and the Lexie Hearing US ([www.lexiehearing.com](http://www.lexiehearing.com)) database. Hearing Tracker is an online forum allowing public members to share reviews and ratings of hearing aids and healthcare professionals (HCPs) based on personal experiences. Lexie Hearing offers affordable over-the-counter (OTC) hearing aids with a companion application. Despite potential variations in participant characteristics, researchers combined the data to extract meaningful insights from both sub-populations. Participants were included if they were adults (18 years and older) and using either unilateral or bilateral hearing aid(s), including conventional and OTC hearing aids. Data on the duration of hearing loss was gathered from section one of the survey and average daily use was gathered from question 1 of the International Outcome Inventory for Hearing Aids (IOI-HA; Cox & Alexander, 2002), which constituted section 3 of the original survey. Notably, the duration of hearing aid use was not a determining factor for inclusion. However, participants who initiated hearing aid use during childhood were excluded from the study. This decision was made to mitigate concerns about the potential influence of childhood experiences on recall accuracy, aligning with the study's emphasis on investigating meaningful life changes associated with hearing aid use in adult users.

The survey was administered via the Qualtrics platform during October and November 2021. COVID may have influenced responses by changing participants' daily routines, leading to decreased social interactions and increased dependence on phone calls and online meetings compared to pre-pandemic times. While some individuals reported improved comprehension during online meetings with Bluetooth streaming, determining the exact regulations each participant encountered is challenging due to the dispersed geographic locations of participants across the US. The participants received an email with a link to open the questionnaire. The link included a participant information sheet and a consent form, which had to be signed electronically before the survey could be completed. The estimated time to complete the questionnaire was 15 minutes. Participation was voluntary, and no incentives were given to participate in the study. A completeness check was included for each question of the questionnaire. As the survey

was conducted through consumer databases (Hearing Tracker and Lexie Hearing) with restricted access, response rates and completion rates could not be calculated.

### **Data analysis**

A total of 1,094 responses (827 from Hearing Tracker and 267 from Lexie Hearing) were exported to Microsoft Excel for data screening and analysis. Participants were excluded if they did not respond to the open-ended questions ( $n = 338$ ), reported childhood hearing loss and were fitted with hearing aids during childhood ( $n = 40$ ), did not provide informed consent ( $n = 26$ ), used personal sound amplification systems ( $n = 14$ ), or had implantable devices such as cochlear implants ( $n = 3$ ). Additionally, irrelevant ( $n = 11$ ) or duplicate responses ( $n = 9$ ) were excluded. After applying these exclusion criteria, 653 responses, all from participants using Behind-The-Ear (BTE) and In-The-Ear (ITE) devices, were analysed. These criteria were established to ensure the relevance and reliability of the data, thereby maintaining the integrity of the research findings.

De-identified demographic data were coded in Microsoft Excel (2019) and transferred to Statistic Package Social Sciences (SPSS) version 28 for statistical analysis. Results were analysed using descriptive statistical measures of range, mean, frequency, and standard deviation. Furthermore, 653 responses were analysed in Microsoft Excel (2019) using qualitative, inductive content analysis (Graneheim & Lundman, 2004; Knudsen et al., 2011). Qualitative content analysis was selected as the approach for producing reliable and repeatable deductions by interpreting and coding the textual material to gain an understanding of the data (Graneheim & Lundman, 2004), including the individual's opinions, perspectives, and attitudes (Manchaiah et al., 2022). The coding was conducted manually by the primary researcher (RJA, female). The primary researcher read through the responses iteratively to gain a comprehensive understanding of the data in its entirety. Subsequently, the responses were divided into meaning units and labelled using codes, after which the codes were grouped into sub-categories and eventually into categories (Graneheim & Lundman, 2004). Data saturation, indicating no new significant data, was achieved after analysing 87% of responses ( $n=575$ ). Validation involved cross-checking 30.5% of the coding by a co-author (EB, female), with discrepancies resolved through discussions with a third researcher (VM, male). A frequency count of the codes per category and sub-category was added to provide further information regarding the

perceived benefits. No subgroup analyses were conducted for the two sub-populations with the focus on understanding them as a unified cohort.

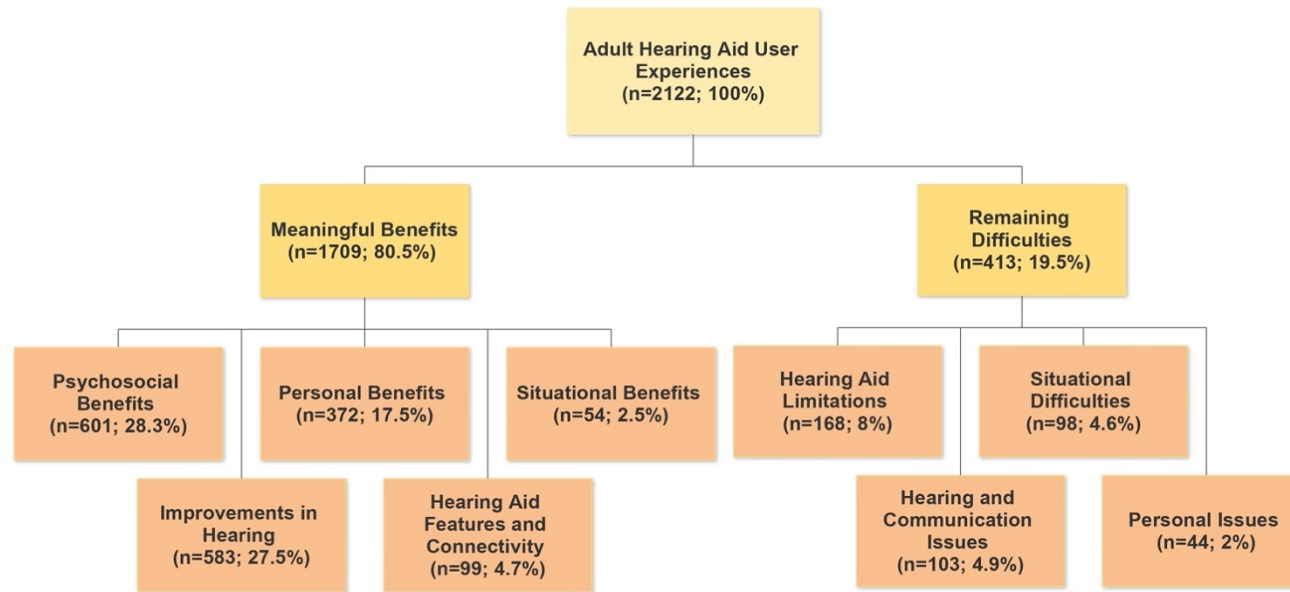
### 3.4 Results

Responses of 653 adults aged between 22 and 93 years old, with a mean age of 65.4 years (13.6 SD) were analysed in this study. The duration of hearing loss ranged from .0 to 74 years, with a mean of 18.3 years (SD = 16.2). Further demographic information as well as hearing aid use is provided in Table 1.

**Table 1: Summary of participant demographics (n = 653)**

Variable	Characteristics	n (%)
<b>Age group (years)</b>	18-30	18 (2.8%)
	30-40	25 (3.8%)
	40-50	41 (6.3%)
	50-60	76 (11.6%)
	60-70	198 (30.3%)
	71-80	231 (35.4%)
	80+	64 (9.8%)
<b>Gender</b>	Male	401 (61.4%)
	Female	249 (38.1%)
	Other (non-binary; prefer not to say)	3 (0.5%)
<b>Hearing aid fitting</b>	Bilateral	601 (92.0%)
	Unilateral	52 (8.0%)
<b>Type of hearing aid(s)</b>	Behind the Ear Hearing Aid(s)	604 (92.5%)
	In The Ear Hearing Aid(s)	49 (7.5%)
<b>Where hearing aid(s) were purchased</b>	Internet/online	278 (42.6%)
	Hearing clinic or private university	233 (35.7%)
	Discount Warehouse	75 (11.5%)
	Other	60 (9.2%)
	Pharmacy hearing centre	4 (0.6%)
	Hearing professional came to house	3 (0.5%)
<b>Duration of daily use</b>	None	13 (2.0%)
	Less than 1 hour a day	13 (2.0%)
	1-4 hours a day	46 (7.0%)
	8 hours a day	94 (14.4%)
	More than 8 hours a day	483 (74.0%)

The content analysis of responses to the open-ended question resulted in a total of 2122 meaning units grouped into two broad domains focusing on meaningful benefits (n=1709; 80.5%) and the remaining difficulties (n=413; 19.5%) experienced with hearing aids (see Figure 1). The meaningful benefits domain contained five categories, including psychosocial benefits, improvements in hearing, personal benefits, hearing aid features helping with connectivity, and situational benefits, and had 27 sub-categories (see Table 2). Approximately a fifth of the meaning units were on the remaining difficulties domain, which had four categories: hearing aid limitations, hearing and communication issues, situational difficulties, and personal issues, and 25 sub-categories (see Table 3).



**Figure 1: Domains and categories of adult hearing aid user experiences**

### Meaningful benefits of hearing aid use

This domain and categories are discussed below (see Table 2).

**Table 2. Meaningful benefits due to hearing aid use reported by 653 participants (n = 1709 meaning units).**

Category	Sub-category	Meaning unit examples (participant ID, age in years, gender)
Psychosocial benefits(n=601)	Improved participation in conversations (171)	<i>"Socially with friends and family members I can get together without fear of missing their conversations" (P252, 84 years, male)</i>
	Improved relationships (145)	<i>"I would have no friends without them." (P277,70 years, female)</i>
	Enabled inclusion into society (131)	<i>"Hearing aids allow me to function in society as a hearing person" (P53, 56 years, male)</i>
	Improved functioning in occupation and/or education (77)	<i>"Hearing aids allowed me to do my job, be a productive member of society, and kept me from becoming antisocial and depressed." (P87,67 years, male)</i>
	Improved positive attitudes (77)	<i>"Changed desire to get up in the morning" (P254,82 years, male)</i>
Improvements in hearing (n=583)	Improved hearing ability (291)	<i>"Immediately after getting them, could tell a major difference" (P170, 70 years, male)</i>
	Watching TV (70)	<i>"hear TV at levels the rest of my family can enjoy" (P513, 58 years, female)</i>
	Improved speech understanding (65)	<i>"It's nice to be able to hear and understand most people" (P332, 71 years, male)</i>
	Improvement in phone usage (55)	<i>"I can clearly hear my phone calls now" (P36, 83 years, female)</i>
	Ability to hear environmental sounds (50)	<i>"I heard birds singing. I cried. I didn't realize all that I was missing" (P35, 64 years, male)</i>
	Improved enjoyment of music/podcasts/audiobooks/radio (42)	<i>"I can enjoy music again and I've started playing my instruments enjoyably!" (P623, 68 years, male)</i>
	Helped reduce tinnitus (6)	<i>"It really helps stop my ears ringing" (P537,64 years, female)</i>
Reduced auditory fatigue (4)	<i>"I enjoy company more knowing that I can hear without straining to hear" (P166,70 years, female)</i>	
Personal benefits (n=372)	Improved quality of life (185)	<i>"They have absolutely helped enhance my life. Without them, I can't hear music, watch tv, participate in conversation. I'd feel lost without them" (P73, 54 years, male).</i>
	Essential to daily functioning (92)	<i>"I really could not function without my hearing aids" (P117, 78 years, male)</i>
	Enable independent living (51)	<i>"Hearing aids are a necessity and helped me keep my independence!" (P387, 73 years, female)</i>
	Improvement in health as a result of being able to hear (18)	<i>"I want to hear the world. As a psychologist I am acutely aware that not hearing affects me cognitively. I do not want that." (P320, 93 years, male)</i>
	Reduced stress associated with communication breakdown (15)	<i>"It was such a relief not to have to ask repeatedly what was said" (P218, 71 years, female)</i>
Improved safety due to sound awareness (11)	<i>"I feel safer knowing I can hear what is going on around me" (P45, 77 years, male)</i>	

Hearing aid features and connectivity (n=99)	Bluetooth connectivity (47)	<i>"It's easier for me to work now, especially remote with the new Bluetooth capabilities of hearing aids." (P3, 46 years, male)</i>
	Improved design (37)	<i>"My first set of aids required batteries, these do not. Work great." (P55, 78 years, male)</i>
	Assistive devices (15)	<i>"I have a TV connector so the TV comes through my two hearing aids. So nice not to have to turn the volume up." (P332, 71 years, male)</i>
Situational benefits (n=54)	Improved participation in group and social interaction (29)	<i>"wearing HAs enables me to hear and understand others, particularly in work of social settings with groups of people." (P340, 73 years, male)</i>
	Improved performance/understanding in noisy environments (18)	<i>"Crowded spaces like restaurants are not as frustrating" (P77, 67 years, male)</i>
	Improvement in religious gatherings/interactions (7)	<i>"I am now a leader in my church and several smaller groups. I would not be able to do this without the hearing aids." (P667, 83 years, male)</i>

Note: Numbers in brackets are the frequency of the meaning units reported in each category or sub-category

HA=Hearing Aid, TV=Television.

### *Psychosocial Benefits (n=601)*

The use of hearing aids resulted in significant psychosocial benefits, as reported by participants. One notable impact was the improvement of interpersonal relationships; participants either noted enhancements in existing relationships or found it easier to establish new ones. Furthermore, hearing aid use was associated with increased active conversation engagement, enabling participants to function more effectively in educational and/or occupational settings. Some participants experienced improved comprehension in online meetings facilitated by Bluetooth streaming, necessitated by COVID regulations. Additionally, participants reported improved attitudes and more positive outlooks on life as important benefits, which, in turn, contributed to enhanced mental health.

### *Improvements in Hearing (n=583)*

A primary benefit of hearing aid use reported by participants was improved hearing ability. Participants experienced an enhanced ability to understand communication partners (CP) and increased environmental awareness. They enjoyed listening to music, podcasts, audiobooks, and the radio, highlighting the clarity of sound that the hearing aids provided. Additionally, participants appreciated the ability to partake in daily activities, such as phone conversations and watching TV at a comfortable volume with family and friends. Few participants also reported reduced perceived tinnitus and auditory fatigue.

### *Personal Benefits (n=372)*

Participants frequently reported improved quality of life as a meaningful personal benefit of hearing aid use. For many, using hearing aids was described as essential or necessary for independent living, occupational or educational environments, and social engagement. A subset of participants highlighted improved safety and confidence in occupational settings, demonstrated by an enhanced ability to hear critical cues with power tools during activities such as woodworking, thereby preventing potential harm.

### *Hearing Aid Features and Connectivity (n=99)*

Bluetooth connectivity, a feature prevalent in some modern hearing aids, was regularly cited as an important benefit in occupational and social contexts. Participants

appreciated updated hearing aid design, which they described as more user-friendly. They noted improvements in acoustic feedback control, comfort, rechargeable batteries, user-friendly program controls, aesthetics, and teleaudiology features. Additionally, assistive devices such as TV connectors, speaker microphones, and telecoil systems were praised for enhancing direct access to speech and entertainment sounds in various settings, including cinemas, theatres, and concerts.

#### *Situational Benefits (n=54)*

The ability to manage in noisy environments and increased participation in social activities, group gatherings, and religious interactions were prominent situational benefits reported by participants. They expressed positive experiences with hearing aids, highlighting how these devices have enhanced their daily lives. Participants described feeling more confident and less isolated due to their ability to engage in social activities without difficulty.

#### ***Remaining Difficulties Following Hearing Aid Use***

The remaining difficulties domain included four categories, as discussed below (see Table 3).

**Table 3. Remaining difficulties with hearing aid use reported by 653 participants (n = 413 meaning units)**

Category	Sub-category	Meaning unit examples (participant ID, age in years, gender)
Hearing aid (HA) limitations (n=168)	Poor HA design (54)	<i>"I wish hearing aids were more robust and waterproof" (P127, 72 years, male)</i>
	Can't replace normal hearing (41)	<i>"They help me hear but not like the way my ears used to hear" (P74, 78 years, female)</i>
	Limitations to HA performance (34)	<i>"I just wish hearing aids would get better at removing background noise" (P65, 69 years, female)</i>
	High cost (25)	<i>"For what I consider to be an excessive price the quality falls short of what was promised!" (P191, 71 years, male)</i>
	Maintenance (12)	<i>"The only downside to having hearing aids is the maintenance of them" (P115, 65 years, female)</i>
	Limited Bluetooth connectivity (2)	<i>"some functions are intermittently not working (real intermittent)-the bluetooth on phonecalls" (P284, 70 years, male)</i>
Hearing and communication issues (n=103)	Residual speech understanding difficulties (50)	<i>"I miss most of others' conversations, I even have trouble hearing my husband in a quiet room" (P224, 79 years, female)</i>
	Certain voices/ pitches (18)	<i>"Still difficult to understand soft sounds of my granddaughters" (P156, 70 years, male)</i>
	Listening to music (10)	<i>"I am a classical music lover, and my hearing aids distort the sound of music... listening to what used to be a great pleasure has become painful enough that I don't listen to it anymore. It is a loss." (P212, 75 years, male)</i>
	Telephone conversations (9)	<i>"I often still have problems fully understanding everything over the phone and with electronic media" (P60, 71 years, female)</i>
	Television (7)	<i>"I need to purchase a streamer as TV is difficult" (P299, 69 years, male)</i>
	Poor clarity of sounds (7)	<i>"I am disappointed that the clarity is not better" (P247, 67 years, female)</i>
	Listening fatigue (2)	<i>"I get physically tired in noisy situations" (P234, 76 years, male)</i>
Situational difficulties (n=98)	Noisy situations (55)	<i>"I still have major issues in places that are noisy" (P112, 70 years, female)</i>
	Social isolation (27)	<i>"I avoid social situations because I hate having to ask people to repeat themselves over and over" (P300, 47 years, female)</i>
	Environmental challenges (12)	<i>"Indoors better than outdoors" (P286, 81 years, male)</i>
	Group conversations (4)	<i>"still have difficulty hearing in groups or certain voices" (P283, 50 years, male)</i>
Personal issues (n=44)	Dislike wearing HA (18)	<i>"I hate wearing them but have to so I can survive" (P317, 66 years, male)</i>
	Health problems (12)	<i>"I have had more wax and infection with aids" (P528, 73 years, male)</i>
	Adjustment to HA (5)	<i>"I am still adjusting to the new sounds but so far they have helped tremendously." (P689, 46 years, male)</i>
	Increased stress (4)	<i>"I worry about something happening in the middle of the night and I won't hear it if I take out both aids" (P383, 76 years, male)</i>
	Using HA in occupational settings (3)	<i>"I am a carpenter so, I can't wear them at work all the time because of the dust" (P628, 70 years, male)</i>
	Expectations of communication partners (2)	<i>"People get upset with me when I don't understand them if they see the HA, bc they think it's a 100% fix...it is so VERY far from that!! Crutches don't allow for sports, running, etc!! (P465, 65 years, female)</i>

Note: Numbers in brackets are the frequency of the meaning units reported in each category or sub-category TV=Television

### *Hearing Aid Limitations (n=168)*

Participants raised several concerns regarding hearing aid design. Common complaints included hearing aids being easily damaged or broken, discomfort, and irritation caused by the sound delivery system entering the ear canal. Participants desired more discreet hearing aids and broader colour options to suit individual preferences. While acknowledging improved hearing ability with hearing aids, participants noted that the quality of sound frequently failed to replicate the experience of normal hearing. They reported ineffective filtering of background noise, sound distortion, and ongoing challenges in hearing aid maintenance, including changing batteries, cleaning wax filters and domes, and intermittent Bluetooth connectivity issues, which mainly affected phone conversations. Due to these limitations some participants stated that hearing aids needed to be removed in certain work environments causing frustration and lack of confidence in hearing aid ability.

### *Hearing and Communication Issues (n=103)*

Participants reported persistent difficulties in hearing certain voices or pitches, including grandchildren's voices, people with accents, those speaking different languages, soft-spoken individuals, and high-frequency sounds. They indicated that residual speech understanding difficulties persisted due to missing specific speech sounds during conversations. Consequently, some participants no longer enjoyed listening to music. A subset of participants attributed challenges in daily life to hearing difficulties, primarily poor sound clarity, with difficulties watching TV and unclear sounds during phone conversations as ongoing problems. Additionally, a few participants reported no perceived reduction in listening fatigue with hearing aid use.

### *Situational Difficulties (n=98)*

Participants commonly reported challenges in noisy environments, such as crowded restaurants, parties, checkout counters, and large gatherings. Participants also indicated that they often avoided group interactions to escape the embarrassment of repeatedly asking CP to repeat themselves. They identified a considerable contrast between indoor and outdoor sound quality, citing overwhelming wind noise and inaudible environmental sounds outdoors.

### *Personal Issues (n=44)*

Several participants described negative experiences with hearing aids related to discomfort and hearing health issues, such as increased cerumen production, ear infections, itchiness of the ear canal, and general discomfort. Adjusting to the hearing aids posed a significant challenge for some participants. Stress factors included not hearing when hearing aids were removed at night, occupational settings where hearing aid use was hindered, and the mismatch between CP expectations and the actual capabilities of the hearing aids to restore hearing to level prior to hearing loss which were contributing factors to remaining personal issues.

### **3.5 Discussion**

This study explored the life changes experienced by hearing aid users, revealing two major domains: benefits and challenges. The participants' experiences with hearing aids were largely positive, with 80% of responses indicating positive changes and 20% highlighting remaining difficulties with hearing aid use. Consistent with prior research (Bennett et al., 2020; Kozlowski et al., 2017), our findings highlight that the benefits of using hearing aids generally outweigh the challenges, though some studies (e.g., Baker et al., 2017) reported contrasting results, highlighting more negative aspects than positive benefits. An additional noteworthy aspect of the responses obtained for this dataset is that the majority of participants (n= 653) provided both positive and negative perspectives on their hearing aids, highlighting the effectiveness of the survey question and the comprehensive nature of participants' feedback.

Psychosocial benefits were identified as a widely reported meaningful life change for hearing aid users. These findings align with several studies indicating hearing aids positively impact relationships, attitudes, reduce feelings of loneliness, and increase social interaction (Bennett et al., 2020; Oosthuizen et al., 2022; Sarant et al., 2020). Hearing loss is known to impair social functioning and cause participation restrictions (Knudsen et al., 2012; Pronk et al., 2011; Scarinci et al., 2008). Using hearing aids can alleviate these issues and enhance psychosocial functioning, whilst also contributing positively to occupational and academic functioning, providing new opportunities for career advancement and mainstream education (Grimby & Ringdahl, 2000; Barker et al. 2017). Many recounted narratives of missed opportunities prior to

hearing aid adoption highlighted participants' newfound sense of their potential post-adoption. These narratives align with existing research indicating that improved auditory capabilities can open avenues for career advancement and enhance academic experiences (Grimby & Ringdahl, 2000; Mener et al., 2013). Additionally, the MarkeTrak 2022 consumer survey indicated that hearing aid users reported higher levels of satisfaction with their hearing ability in both workplace and large lecture halls (38% increase) and school or classroom settings (36% increase) compared to non-users (Picou, 2022).

Situational benefits emerged as another key benefit. Participants articulated an improved ability to discern speech in varied settings, including noisy environments, which often posed insurmountable challenges before hearing aid use. These situational improvements translated into benefits, such as active participation in community events and gatherings. These benefits correspond with the findings of Ellis et al. (2021), demonstrating that hearing interventions alleviated social isolation and loneliness. However, they noted limited evidence for these interventions in the elderly due to factors like small sample sizes and study heterogeneity. Our study contributes to this evidence with a qualitative perspective across a large sample and diverse population. Furthermore, Auerbach and Gritton (2022) linked the situational benefits of using hearing aids by providing a comprehensive overview of the neural and behavioural processes that form the basis for these benefits. Their findings suggest that improving speech intelligibility in complex environments may positively affect cognitive function, social well-being, and emotional well-being – vital aspects of quality of life –aligning with the reported benefits in our study.

Hearing aid users in our study experienced personal benefits in their daily living, such as improved quality of life, increased independence, and reduced communication stress. This aligns with the findings of Carioli et al. (2014), which evaluated the influence of hearing aids on daily activities among middle-aged and elderly users. Using the improvement of Instrumental Activities of Daily Living (IADL; Lawton & Brody, 1969), their study indicated a general improvement in independence following the adoption of hearing aids. The 2022 MarkeTrak survey indicated a rise in the perceived quality of life among hearing aid users over the past seven years (Picou, 2022).

While hearing aids offer various benefits, our study's participants reported remaining challenges, including device limitations, speech perception difficulties, and personal challenges. Technological advancements were noted, but difficulties such as inadequate sound quality, limited Bluetooth connectivity, and hearing aid performance in background noise persisted. This dissatisfaction reflects findings from existent literature, highlighting issues such as residual speech perception, challenges in listening to audio media, and coping with listening fatigue (Greasley et al., 2020; Holmain et al., 2019). Situational difficulties, particularly in loud settings, have been noted to discourage social interactions and increase isolation (Bott & Saunders, 2021; Kamil & Lin, 2015; Li et al., 2021). Additionally, personal challenges are prevalent, encompassing health concerns, mental stress, and misconceptions about aids completely restoring hearing. Researchers, reflecting on the MarkTrak 2015 study and recent decade-long developments, have identified key challenges in hearing aid usage, particularly focusing on issues of sound quality, value, and clarity. These factors significantly impact satisfaction levels, especially in noisy settings and during phone call conversations (Abrams & Kihm, 2015).

Participants in this study identified certain aspects of hearing aids that have improved over the last decade that contributed to improved quality of life. These enhancements encompassed increased participation in conversations, fostering independence in society, and facilitating inclusion. Additionally, novel reported benefits included enriched auditory experiences such as listening to podcasts and audiobooks, alongside newfound enjoyment of music, attributable to improved sound clarity. Other notable improvements involved clearer phone conversations aided by hands-free capabilities, heightened environmental awareness leading to reduced stress and improved safety, enhanced speech comprehension, refined sound localization especially in noisy environments, reduced auditory fatigue, and alleviated tinnitus. Technological advancements such as Bluetooth connectivity, sound enhancement features, and assistive devices (e.g., TV and microphone streamers), along with aesthetically appealing hearing aid designs, have contributed to heightened user satisfaction, corroborating existing literature (Kozlowski et al., 2017; Thibodeau, 2020; Voss et al., 2022).

The study emphasizes the multifaceted benefits of hearing aids, spanning social interaction, improved communication, and various psychosocial advantages. Such insights can be pivotal during consultations, helping prospective hearing aid users understand the potential benefits. Nevertheless, it is evident that while hearing aids offer numerous advantages, they are not a panacea to hearing loss. Challenges stemming from device limitations, environmental factors, and personal issues suggest hearing aids are part of a holistic solution. This approach recognizes that hearing loss is often accompanied by other chronic conditions, such as cardiovascular disease, dementia, and falls, which can negatively impact an individual's quality of life (Maidment et al., 2023). By adopting a holistic approach, hearing healthcare professionals can develop more effective and empathetic rehabilitation strategies that promote positive hearing health and minimize the negative health impact of hearing loss and related co-morbidities (Maidment et al., 2023). Further, hearing aid manufacturers are advised to improve design enhancements, including durability, comfort, aesthetics, and technology improvements, particularly in Bluetooth connectivity and environment adaptability, as these can further enhance the user experience.

The current study had some limitations. Participants were recruited via online platforms and self-selected to participate, which may have resulted in potential sampling bias. Sampling bias can limit the generalizability of findings. Specifically, patients who elected to participate in surveys like this may tend to be ones who were more pleased with the overall experience, potentially skewing the results towards more positive perspectives. Certain demographic variables, such as the degree and type of hearing loss, were not captured during the survey. This impacts the ability to identify if specific remaining difficulties are linked to the type and degree of hearing loss. A further limitation of this study is the absence of certain demographic variables, such as race, socioeconomic status, and level of education, for the Lexie participant group, as this data were not available from this cohort. Additionally, the age distribution among participants was a limiting factor. As indicated in Table 1, 87.2% of individuals included in the data were over 50 years old. This demographic, whilst representative of the general population, may affect the generalizability of study findings to younger populations, as livelihood needs and lifestyles can vary significantly across different age groups. Future research should aim to include a more diverse age range to

enhance the generalizability of findings across broader populations. However, the study's broad participant demographics and relatively large sample size, in comparison to similar studies, enhance the value of this study's findings.

### **3.6 Conclusion**

The results of this study underscore the profound positive impact of hearing aids on users' lives, encompassing improvements in quality of life, emotional well-being, and daily satisfaction, along with enhancements in auditory abilities, environmental awareness, and communication across various contexts. However, it is imperative to acknowledge the persistent challenges faced by users. These findings hold significant implications for both healthcare professionals and the hearing aid industry. Healthcare professionals can leverage this knowledge to refine their counselling strategies and expectation management techniques. By highlighting the substantial benefits of hearing aids and proactively addressing potential challenges, healthcare professionals can empower individuals with hearing loss to make informed decisions about their healthcare. Additionally, these insights serve as a valuable resource for the hearing aid industry, prompting innovation and customization to better cater for the diverse needs of users. By developing hearing devices that align more closely with user preferences and lifestyles, the industry can foster greater adoption and satisfaction among users. Ultimately, these findings provide a platform for raising awareness about the benefits of hearing aids and improving the care and support offered to individuals with hearing loss, thereby enhancing their overall well-being and quality of life.

### **Disclosure statement**

No potential conflict of interest was reported by the author(s)

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### Data availability statement

The data analysed during the current study will be made available from the corresponding author upon reasonable request.

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## Chapter 4: Discussion and conclusion

Hearing aid users have been demonstrated to encounter various difficulties in adapting to their devices and report unsatisfactory outcomes regarding their hearing aid usage (Bennett et al., 2018). The aim of this study was to explore the user experience of hearing aids and meaningful self-reported life changes.

### 4.1 Overview of research findings

The findings of this study align with prior research, affirming the overall positive impact of hearing aid use on users' lives. Notably, the predominance of positive changes reported by participants reflects the conclusions drawn by Bennett et al. (2020) and Kozlowski et al. (2017), which emphasize the outweighing of benefits over challenges in hearing aid adoption. However, this study diverges from narratives like those presented by Baker et al. (2017), which emphasize more negative aspects of hearing aid use compared to the positive benefits. This discrepancy could be attributed to differences in study populations, methodologies, or contextual factors. For example, variations in the demographic characteristics of participants, such as age, duration of hearing aid use, or type of hearing aids, could influence user experiences. Additionally, the methodological approach—whether qualitative or quantitative, or the specific focus of the survey questions—might lead to differing emphases on positive or negative outcomes. Contextual factors, such as the quality of professional support received, access to modern hearing aid technologies, or cultural and societal attitudes towards hearing loss and hearing aids, may also contribute to this spectrum of experiences.

Furthermore, this investigation explored the hearing difficulties associated with hearing aid use alongside the meaningful life changes it brings, revealing its role in improving social functioning and fostering positive attitudes. While prior studies have emphasized the detrimental impact of hearing loss on social participation (Knudsen et al., 2012; Lormore & Stephens, 1994; Pronk et al., 2011; Scarinci et al., 2008), this research demonstrates the transformative potential of hearing aids in enhancing interpersonal relationships and restoring individuals' sense of belonging. These findings not only corroborate existing literature but also provide new insights into the mechanisms through which hearing aid use contributes to psychosocial well-being,

aligning with Cacioppo et al.'s (2000) framework on the importance of social relationships in enhancing resilience and coping mechanisms.

Moreover, this study extends beyond the social domain to highlight the profound implications of hearing aid use on occupational and educational functioning. While previous research has suggested the role of improved auditory capabilities in facilitating career advancement and academic success (Grimby & Ringdahl, 2000; Mener et al., 2013), this study's findings provide tangible narratives of missed opportunities addressed through hearing aid adoption. The participants' narratives not only validate prior assertions but also emphasize the instrumental role of hearing aids in unlocking their potential and broadening their horizons, consistent with the perspectives of Grimby & Ringdahl (2000) and Mener et al. (2013).

Grimby & Ringdahl (2000) highlight the critical impact of hearing aids on enhancing communication abilities, which, in turn, facilitates greater participation in professional and social settings. Their findings underscore how improved auditory function can lead to increased self-confidence and autonomy, enabling individuals to pursue opportunities that may have previously been inaccessible due to hearing impairments. Similarly, Mener et al. (2013) focus on the broader socio-economic benefits of hearing aid use, demonstrating how effective hearing rehabilitation can contribute to improved occupational outcomes and educational achievements. They argue that by mitigating the barriers imposed by hearing loss, hearing aids empower individuals to fully engage in their environments, thus enhancing their overall quality of life and societal contributions.

Together, these perspectives underscore the transformative potential of hearing aids, not merely as tools for auditory improvement but as enablers of personal and professional growth. The findings of this current study reinforce these views, revealing that participants experienced not only enhanced communication and social interaction but also significant personal development, such as increased confidence and independence, further illustrating the comprehensive impact of hearing aids on users' lives.

The study revealed the interplay between technological advancements and user satisfaction, emphasizing the pivotal role of features like Bluetooth connectivity and

sound enhancement in improving the overall user experience. While prior research acknowledged the importance of technological innovations in driving hearing aid satisfaction (Kozlowski et al., 2017; Thibodeau et al., 2020), the findings from this study highlighted the evolving nature of user preferences, particularly the emerging trend of using hearing aids for streaming audiobooks and podcasts. This dynamic interaction between technology and user behaviour not only underscored the significance of innovation in the hearing aid industry but also demonstrated the potential of hearing aids as multifunctional devices catering to diverse user needs.

Additionally, the current study offers a comprehensive examination of the persistent challenges faced by hearing aid users, emphasizing both design and situational difficulties. These findings align with previous research, which has consistently highlighted the limitations in hearing aid design and functionality. For instance, Kochkin and Rogin (2000) noted that despite advancements in hearing aid technology, users continue to report dissatisfaction with sound quality, particularly in challenging listening environments. Similarly, Bennett et al. (2020) identified issues such as the discomfort of wearing hearing aids, difficulties in sound delivery, and the ineffectiveness of noise reduction features as significant barriers to user satisfaction.

In this study, participants expressed frustration with the fragility of hearing aids and discomfort associated with the sound delivery system. These complaints are consistent with findings by Heselton et al. (2022), who reported that physical discomfort and device durability are common concerns among hearing aid users. The desire for more discreet designs and a broader range of color options also reflects the growing demand for hearing aids that not only function well but also serve as personal accessories, a trend supported by Laplante-Lévesque et al. (2013), who discussed the importance of aesthetic considerations in hearing aid adoption.

Sound quality was another significant issue raised by participants, particularly the inability of hearing aids to replicate natural hearing. This finding echoes previous studies by Meister et al. (2015) and Nuesse et al. (2021), which highlighted the limitations of current hearing aid technology in providing clear, natural sound, especially in noisy environments. The challenge of filtering background noise remains a pervasive problem, as noted by Thibodeau et al. (2020), who emphasized that even

with modern features, many users still struggle with understanding speech in complex auditory settings.

Maintenance issues, including the need for frequent battery changes, cleaning wax filters, and dealing with intermittent Bluetooth connectivity, were also prevalent in the narratives. These technical difficulties have been documented in prior research, such as by Pronk et al. (2014), who pointed out that maintenance challenges can lead to reduced hearing aid usage and lower overall satisfaction. The need for some participants to remove their hearing aids in specific work environments underscores the persistent challenge of seamlessly incorporating these devices into daily life, a challenge similarly noted by Smith and Osborn (2008).

Moreover, the study revealed persistent hearing and communication challenges, particularly with certain voices and pitches, such as those of grandchildren or accented speakers. This finding is consistent with the work of Gallagher and Woodside (2018), who reported similar difficulties among hearing aid users, particularly with high-frequency sounds. The impact on activities like music listening and television watching further illustrates the limitations of hearing aids in providing a full auditory experience, as discussed by Dawes et al. (2014).

Situational difficulties, especially in noisy environments, were another major concern. The avoidance of group interactions due to embarrassment, as reported by participants, aligns with the findings of Lockey et al. (2010), who identified social isolation as a common consequence of hearing aid limitations in noisy settings. The contrast between indoor and outdoor sound quality, with issues related to wind noise, has also been previously documented by Manchaiah et al. (2022), who noted the challenges users face in adjusting to different acoustic environments.

Finally, personal issues such as discomfort, increased cerumen production, ear infections, and the stress of not hearing without hearing aids were significant factors contributing to user dissatisfaction. These health-related concerns have been similarly noted by Smith and Osborn (2008), who emphasized the psychological and physical challenges that accompany hearing aid use. The mismatch between communication partners' expectations and the actual capabilities of hearing aids, leading to frustration, is a recurring theme in the literature, as highlighted by Grimby and Ringdahl (2000),

who discussed the unrealistic expectations that often accompany hearing aid adoption.

These results suggest that while hearing aids have the potential to significantly improve users' quality of life, there remains a critical need for more personalized and effective interventions. The integration of user feedback into the design and development process, as well as the consideration of both technical and psychosocial factors, is essential for advancing hearing aid technology and ensuring that it meets the diverse needs of users.

In conclusion, this study enriches the existing literature by offering a comprehensive exploration of the benefits and challenges associated with hearing aid use in adults while also providing novel insights into the underlying mechanisms and contextual factors shaping users' experiences. By integrating empirical findings with theoretical frameworks and practical implications, the research contributes to a deeper understanding of hearing aid utilization and informs targeted interventions aimed at optimizing user satisfaction and well-being.

## **4.2 Clinical implications**

This study highlights the positive effects of hearing aid use on various aspects of well-being, including social participation, communication, psychosocial benefits, personal benefits, situational benefits, hearing improvements, and connectivity through hearing aid features. These results can inform and motivate potential hearing aid users during consultation sessions by emphasizing the tangible benefits they can expect from using hearing aids.

### **4.2.1 Implications for hearing healthcare professionals**

The insights from this study provide valuable contributions that can significantly influence current clinical practices and guidelines in audiology, particularly for adults with hearing loss. These findings align with the rehabilitation process proposed by Stephens and Kramer (2010), which includes four key steps: evaluation, integration and decision-making, short-term remediation, and ongoing remediation. This problem-solving approach is designed to enhance the activities and participation of individuals

with hearing difficulties, improve their quality of life, and mitigate the impact on their significant others while helping them accept their residual hearing challenges (Stephens, 2009). Based on these findings, healthcare professionals (HCPs) could be encouraged to actively involve communication partners (CPs) in rehabilitation, addressing specific issues and communication challenges to enhance user satisfaction during interactions.

The study's findings offer updated and relevant insights that complement those obtained from existing standardized patient-reported outcome measures, such as the Abbreviated Profile of Hearing Aid Benefit (APHAB) (Cox & Alexander, 1995), which remains a widely utilized tool for assessing hearing aid outcomes in both research and clinical settings. HCPs can utilize the reported findings to inform more relevant questions and discussion points focused on the domains identified in the study. This could aid HCPs in the integration and decision-making process of rehabilitation, particularly in counselling potential hearing aid users facing challenges with their CPs or difficulties with telephonic conversations. The practical applications of these insights for HCPs are further detailed in Table 4.

**Table 4: Clinical implications of study findings for enhancing hearing aid counselling**

Aspect	Key discussion topics for counselling prospective hearing aid owners
Psychosocial	Emphasize the potential for hearing aids to improve engagement in conversations and strengthen relationships. Highlight the possible benefits, such as reduced feelings of isolation and increased ease in participating in social events. Discuss how hearing aids may help alleviate challenges in professional or educational settings and potentially enhance overall confidence in hearing abilities. Consider the potential impact on group conversations and social isolation.
Hearing Improvements	Discuss the potential enhancements in hearing clarity that hearing aids may offer, such as improved TV audio and reduced need for frequent repetition during conversations. Highlight the possible benefits of clearer phone conversations and renewed enjoyment in listening to music, radio, audiobooks, and podcasts. Additionally, consider the ongoing challenges in understanding speech, particularly with certain voices or pitches, and difficulties in noisy environments.
Personal Benefits	Emphasize the potential benefits of improved quality of life through enhanced hearing ability, noting how hearing aids can make daily tasks more manageable and increase independence, such as by ensuring users can hear safety alarms. Discuss the possibility of reduced stress in communication due to improved hearing, while also acknowledging the personal challenges that may arise, such as discomfort with wearing hearing aids, health concerns, and the adjustment period that can elevate stress levels.
Hearing Device Features	Highlight the potential advantages of using Bluetooth technology with hearing aids, such as the convenience of streaming audio directly from TVs, phones, or laptops, which can enhance overall user experience. Emphasize the compatibility of hearing aids with smartphones, which can further improve ease of use and functionality. However, it is important to also acknowledge the limitations of Bluetooth connectivity, including possible intermittent issues, and the necessity for regular maintenance of hearing aids to ensure optimal performance.
Situational Benefits	To convey potential benefits to hearing aid users, emphasize the possible improvements in social and group interactions, noting how hearing aids can make conversations easier to follow. Discuss the enhanced ability to hear in noisy environments and the increased enjoyment of activities, such as religious gatherings, due to improved hearing. Also, address the challenges of using hearing aids in noisy situations and the influence of environmental factors on their effectiveness, while being mindful that outcomes can vary among users.
Challenges and Limitations	Provide a comprehensive overview of the challenges users may encounter, such as high costs, the need for regular maintenance, and limited Bluetooth connectivity. Discuss the potential for poor sound clarity and listening fatigue, especially in music, telephone conversations, and television. Address the stress associated with using hearing aids in occupational settings and managing communication partners' expectations. Highlight the importance of setting realistic expectations to ensure a satisfactory hearing aid experience.

Responses to these considerations can help guide the selection of hearing aids that most effectively address the patient's specific priorities. By emphasizing the features that provide the most benefit in areas needing the greatest improvement, healthcare professionals can ensure that the selected device meets the patient's specific needs. This approach embodies person-centred care (PCC) by prioritizing individualized assessment, collaborative decision-making, and focusing on outcomes that are most meaningful to the patient.

#### **4.2.2 Implications for hearing aid manufacturers**

This study carries significant implications for hearing aid manufacturers by identifying persistent difficulties that users encounter despite advancements in current hearing aid technology. The findings reveal that certain limitations in hearing aid performance continue to impede effective communication, particularly in complex listening environments and during telephonic conversations. To address these issues, manufacturers should focus on refining both the design and functionality of hearing aids, incorporating advanced features specifically aimed at the identified problem areas. For example, enhancing noise reduction capabilities, improving speech clarity across diverse acoustic settings, and developing more intuitive user interfaces could substantially mitigate the challenges reported by users. Additionally, integrating adaptive technology that dynamically responds to varying environmental conditions and improving connectivity options for modern communication devices are essential steps for advancing hearing aid effectiveness. Key considerations for hearing aid manufacturers are outlined in Table 5, offering actionable insights to refine products and better meet the needs of users. These recommendations, grounded in our study's results, underscore persistent gaps in user satisfaction and the need for technological advancements. Crucially, incorporating ongoing user feedback into the design and development process is essential for improving user outcomes and experiences, ensuring that the products evolve in response to real-world needs and challenges.

**Table 5: Key considerations for hearing aid manufacturers**

Aspect	Key considerations
Design and aesthetics	Offer variety of hearing aid colours and styles to create devices that are visible fashion statements, empowering users and enhancing their satisfaction. Offer bright, expressive colours as requested by multiple participants. Aim to make wearers proud and happy with the design of their devices.
Durability and comfort	Based on the study's findings, hearing aid manufacturers should focus on improving the durability and water resistance of their devices, while acknowledging current technological limitations. Enhancements in resilience against moisture and easier maintenance, particularly for users with dexterity issues, could address key user concerns identified in the study, ultimately leading to greater satisfaction and reliability.
Functionality	To enhance user comfort, develop behind-the-ear tubing that prevents condensation buildup and reduces excessive movement within the ear canal, thereby minimizing itchiness. This can be achieved by using materials that offer a more secure fit or by designing tubing with improved flexibility to better adapt to the contours of the ear, such as the helical crus. Additionally, consider designing molds with smoother surfaces or hypoallergenic materials to reduce friction and irritation, further decreasing the discomfort caused by movement.
Usability	Improve the ease of putting on and removing hearing aids, especially for users with dexterity issues.
Safety	Recognizing the physical limitations of current technology, manufacturers should explore the feasibility of designing hearing aids that can be comfortably worn during sleep for users who desire this functionality. While this is a challenging task, addressing the anxiety some users feel about not being able to hear safety alarms at night is a significant concern. By prioritizing comfort and reducing pressure points, it may be possible to create hearing aids that users can safely and comfortably wear overnight, providing peace of mind without compromising on sleep quality. While fully solving this issue may not be immediately achievable, incremental improvements could make a meaningful difference for users.
Connectivity	Enhance Bluetooth connectivity and compatibility with various devices such as iPhones, Android phones, tablets, smart TVs, and laptops for direct streaming. Enable hearing aids to connect directly to TVs without the need for an adapter, like many earbud products.

### 4.3 Critical evaluation

A critical appraisal of the study's methods and findings was conducted to assess its strengths and limitations. This study aimed to explore how hearing aid use can induce significant and meaningful changes in users' lives, addressing a notable gap in the existing literature. By employing a large sample size and refining previous methodological approaches, the research sought to offer a more comprehensive understanding of key demographic factors, including gender, unilateral versus bilateral fittings, place of purchase, and duration of use. However, it is important to note that the analysis did not differentiate between various types of hearing aids or between prescription and over-the-counter devices (Dawes et al., 2014; Gallagher & Woodside, 2018; Laplante-Lévesque et al., 2013; Lockey et al., 2010).

### *Strengths of the study*

- **Large sample size:** Utilizing a large sample size significantly enhances the study's reliability and comprehensiveness. A larger sample provides a more accurate representation of the population, minimizing potential biases and increasing the robustness of the findings (Polit & Beck, 2010). This approach allows for a thorough exploration of diverse experiences and outcomes, facilitating the identification of patterns and trends that might not emerge in smaller studies (Weyant, 2022). Additionally, a substantial sample size improves the external validity of the findings, making it more feasible to generalize the results to broader populations (Faber & Fonseca, 2014). Consequently, the insights gained from this study offer valuable information for guiding future research and informing clinical practices.
- **Qualitative analysis:** The current study's strength lies in its use of qualitative analysis, which provided a thorough exploration of the experiences and perceptions of the 653 US-based adult hearing aid users. This qualitative approach was crucial in capturing the complexity and richness of participants' experiences, offering insights that might be missed by quantitative methods alone (Patton, 2015). By analysing the detailed narratives of participants from two diverse platforms, the study was able to uncover nuanced patterns and themes related to hearing aid use, such as persistent difficulties and unmet expectations. This method allowed for an in-depth understanding of how hearing aids impact users' lives, addressing both their challenges and benefits (Weyant, 2022). The qualitative data revealed intricate details about users' subjective experiences, such as issues with sound clarity, comfort, and connectivity, that are essential for developing theories and frameworks grounded in real-world experiences (Denzin & Lincoln, 2011). Thus, the insights gained from this qualitative analysis provide a more holistic view enriching the overall understanding of hearing aid use.
- **Comprehensive impact assessment:** The study conducted a thorough evaluation of the impact of hearing aid use across multiple dimensions of well-being, including emotional, social, and functional aspects. By examining these

varied facets, the research provides a holistic view of both the benefits and challenges experienced by hearing aid users. This comprehensive approach allows for a more nuanced understanding of how hearing aids influence users' overall quality of life, beyond just auditory improvements (Granberg et al., 2014). By integrating these diverse aspects, the study contributes to the existing literature on hearing aid use and well-being, offering insights that can inform both clinical practice and future research (Oosthuizen et al., 2022).

- Alignment with PCC principles: The study's focus on individual preferences and needs, and the involvement of communication partners and family members, aligns with PCC principles. This alignment underscores the practical relevance of the findings for improving patient care and service delivery in audiology (McLean, 2022).

#### *Limitations of the study*

- Sampling bias: Participants were recruited via online platforms and self-selected for participation, which may have introduced sampling bias. This method of recruitment can result in a sample that is not fully representative of the broader population, as it may overrepresent individuals who are more engaged online and willing to participate in surveys. Consequently, this could limit the generalizability of the findings to those who are more active on digital platforms, potentially skewing the results (Bethlehem, 2010).
- Response bias due to open-ended questions: The open-ended questions were part of a larger survey, which might have led to brief responses as participants may have experienced survey fatigue or prioritized earlier questions (Manchaiah et al., 2022).
- External factors: Several external factors, including the socio-economic status of participants, access to healthcare technology level of hearing aids used were beyond the control of this study and could have influenced the outcomes. For instance, socio-economic status can affect an individual's ability to afford higher-quality hearing aids or access consistent follow-up care, potentially leading to disparities in user satisfaction and overall outcomes (Smith & Jones,

2017). Access to healthcare, including the availability of audiology services and ongoing support, can also vary widely, influencing the effectiveness of hearing aid use (Bainbridge & Ramachandran, 2014). Additionally, the specific models of hearing aids used by participants could introduce variability in the results. High-end hearing aids with advanced features, such as improved noise reduction, directional microphones, and better connectivity options, may lead to more positive outcomes compared to basic models (Chung, 2004). This variability in technology level and functionality could result in differences in user experiences and perceived benefits, thereby influencing the study's findings. Acknowledging these external factors helps contextualize the study's limitations and provides a more nuanced understanding of the results, emphasizing the need for further research that controls for these variables.

#### **4.4 Future research recommendations**

This study provides valuable insights into the significant life changes experienced by hearing aid users but also reveals limitations and gaps that future research must address to enhance the findings' validity, reliability, and generalizability.

- Incorporating a mixed-methods research approach that blends qualitative and quantitative data is crucial for achieving a more nuanced understanding of hearing aid use (Plano Clark & Ivankova, 2017). For example, supplementing qualitative insights with quantitative data on user satisfaction scores, frequency of hearing aid use, and objective measures of hearing aid performance could provide a more comprehensive analysis. Surveys capturing these quantitative metrics, combined with in-depth interviews, would allow for the alignment of statistical trends with personal narratives, leading to a more robust exploration of user experiences. This approach has been demonstrated to enhance both the depth and breadth of findings in health research (Creswell & Clark, 2017).
- Incorporating control groups, such as non-hearing aid users or potential users with similar characteristics (e.g., age, socio-economic status, degree of hearing loss), is essential for comparative analysis in this study. By comparing these groups with hearing aid users, the study can more accurately determine the specific benefits and challenges associated with hearing aid use. This approach

allows for a clearer differentiation between the effects of hearing aids and other influencing variables, thereby offering more precise and robust conclusions about their impact. The inclusion of control groups is widely recognized for enhancing the rigor and validity of clinical studies, as it provides a baseline for comparison that strengthens the study's overall findings (Friedman, Furberg, & DeMets, 2015). Specifically, in the context of this research, control groups would help in understanding the unique contributions of hearing aids to users' quality of life, social integration, and functional abilities, which are central to the study's objectives.

- Exploring the perspectives of significant others, such as family members, friends, and colleagues, can provide a holistic view of the impact of hearing aids on communication and relationships. Understanding these social dynamics is vital for designing interventions that support both users and their social networks, a consideration supported by social-ecological models of health (McLeroy et al., 1988).
- The development of an app-based, open-ended survey could revolutionize patient monitoring and feedback by enabling continuous, real-time data collection on patient satisfaction and challenges. This approach aligns with current trends in personalized medicine and digital health (Topol, 2019), offering timely interventions and personalized care adjustments.

In the context of the current study, where survey questions were presented in a fixed order rather than randomized, improving survey design through techniques like randomizing question order or using a modular approach could have mitigated potential response biases. These methods are particularly effective in reducing survey fatigue, which is a common issue in survey-based research (Lavrakas, 2008). By maintaining participant engagement and ensuring that responses more accurately reflect user experiences, such improvements could enhance the validity of the findings. In future research, adopting these strategies could provide a more nuanced and reliable understanding of hearing aid users' experiences, aligning closely with the study's aim to capture the complexity of these experiences comprehensively.

- Employing representative sampling methods, like stratified random sampling, is critical for enhancing the generalizability of findings. A representative sample provides insights applicable to diverse user groups, a key factor in ensuring the external validity of research (Kukull & Ganguli, 2012).
- Addressing external factors, such as socio-economic status and access to healthcare, is necessary to clarify the true impact of hearing aid use. Controlling for these variables is essential to avoid confounding effects, leading to more accurate conclusions and a clearer understanding of the factors influencing hearing aid effectiveness (Krieger, 2012).

Future research can significantly deepen our understanding of hearing aid use by focusing on these areas, leading to more comprehensive and generalizable insights. These efforts will ultimately inform better practices for healthcare professionals and manufacturers in the audiology field.

#### **4.5 Conclusion**

This study significantly contributes to the broader field of audiology by highlighting the multifaceted impacts of hearing aid use from the perspective of users themselves. Through a comprehensive qualitative analysis, this research expands upon previous studies by not only identifying the domains and categories influencing meaningful hearing aid use but also by examining a notably larger sample size. By delving into the nuances of users' experiences, this study underscores the profound positive effects of hearing aid adoption on various aspects of users' lives, including emotional well-being, social interaction, and environmental awareness.

Furthermore, by highlighting the ongoing challenges experienced by hearing aid users, including maintenance difficulties and technological limitations, this research offers valuable insights for both healthcare professionals (HCPs) and the hearing aid industry. HCPs can apply these findings to refine their support strategies, ensuring they address common user concerns while emphasizing the potential transformative benefits of hearing aids. Concurrently, the hearing aid industry can utilize this

knowledge to drive innovation and improve their products, better aligning them with the diverse needs and preferences of users.

Ultimately, by deepening our understanding of the experiences and needs of adult hearing aid users, this study equips healthcare professionals with valuable clinical insights and empirical evidence. Armed with this knowledge, they can optimize interventions, empower current users, and inspire potential ones, fostering greater acceptance and utilization of hearing aids within the broader community. As advancements in hearing aid technology continue, user satisfaction and quality of life are expected to improve significantly over the next decade, ensuring that individuals with hearing loss can lead fuller, more connected lives.

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## Appendices

### Appendix A: Electronic survey



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

**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:

- 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)

- 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)



- 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

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: Ethical clearance from the Faculty of Humanities, University of Pretoria



**Faculty of Humanities**  
Fakulteit Geesteswetenskappe  
Lefapha la Bomotheo



6 December 2022

Dear Miss RJ Avierinos

Project Title: Exploring meaningful life changes due to hearing aid use: A qualitative user perspective  
Researcher: Miss RJ Avierinos  
Supervisor(s): Prof DCDW Swanepoel  
Department: Speech Language Pathology and Audiology  
Reference number: 17164011 (HUM052/1022)  
Degree: Masters

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

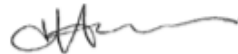
The Research Ethics Committee notes that this is a literature-based study and no human subjects are involved.

The application has been approved on 1 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

Research Ethics Committee Members: Prof KI Harris (Chair); Mr A Bizo; Dr A-M de Beer; Dr A dos Santos; Dr P Gubura; Ms KT Govinder Andrew; Dr E Johnson; Dr D Krige; Prof D Maree; Mr A Mohamed; Dr I Noomé; Dr J Okeke; Dr C Puttergill; Prof D Reyburn; Prof M Soer; Prof E Tajard; Ms D Mokalapa

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 C: Ethical Clearance LAMAR University



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.

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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

7/23/2021

Mail - Vinaya Manchaiah - Outlook

7/23/2021

Mail - Vinaya Manchaiah - Outlook

Good luck with your research endeavors.

Sincerely,  
Lamar University Human Subjects Review Board

**\*\*ALERT\*\* This email originated outside Lamar University. Do not click links, open attachments, or respond unless you validate the sender and know the content is safe.**

## Appendix D: Proof of acceptance of article



International Journal of Audiology

ISSN: (Print) (Online) Journal homepage: [www.tandfonline.com/journals/ija20](http://www.tandfonline.com/journals/ija20)

Taylor & Francis

### Meaningful life changes following hearing aid use: a qualitative user perspective

Ruth Jayné Avierinos, Eldre Beukes, Vinaya Manchaiah, Ilze Oosthuizen, Talita le Roux & De Wet Swanepoel

To cite this article: Ruth Jayné Avierinos, Eldre Beukes, Vinaya Manchaiah, Ilze Oosthuizen, Talita le Roux & De Wet Swanepoel (13 Jul 2024): Meaningful life changes following hearing aid use: a qualitative user perspective, *International Journal of Audiology*, DOI: 10.1080/14992027.2024.2376043

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03/07/2024, 22:24

Gmail - International Journal of Audiology - Decision on Manuscript ID 237203648.R2



Ruth Avierinos <r.avierinos@gmail.com>

## International Journal of Audiology - Decision on Manuscript ID 237203648.R2

8 messages

International Journal of Audiology <onbehalf@manuscriptcentral.com>

Sat, Jun 29, 2024 at 11:45 PM

Reply-To: jclark@utdallas.edu

To: r.avierinos@gmail.com, dewet.swanepoel@up.ac.za

MS: "Meaningful life changes following hearing aid use: A qualitative user perspective"  
MS#: 237203648.R2

Dear Miss Avierinos (Ruth) and Prof Swanepoel (DeWet):

Thank you for submitting your above listed revised manuscript. Based on the reviewers recommendations received, it is a pleasure to accept your manuscript for publication in the International Journal of Audiology. Congratulations!

At this time, your manuscript will be sent to the publisher for the final production processes. The journal issue in which your article will be assigned requires at least 4-5 months to reach formal electronic publication. Page proofs and copyright release websites will be sent to you via email during part of the production phases. Please be sure to check your inbox and SPAM/Junk Mail (in case the email lands in the wrong place). It is very important that you read your page proofs carefully (after receiving them) and return them promptly to production so that your manuscript can be published on schedule. After you review your page proofs your article will be finalized to make it available to those interested by navigating to the Taylor & Francis Early Online publication website with email announcements distributed globally. You and others will be able to view your article, along with the newest International Journal of Audiology online manuscripts at the website. Please keep in mind that the early online (electronic) publication of your article is considered formal publication with a unique assigned DOI.

We want to increase the impact of your article, and we work with authors to ensure your work reaches the widest possible (and most appropriate) audiences. Discover some simple yet effective ways to highlight your research at <https://authorservices.taylorandfrancis.com/ensuring-your-research-makes-an-impact/>.

Thank you for your fine contribution. On behalf of the Editors of the International Journal of Audiology, we look forward to your continued contributions to the International Journal of Audiology. Of particular importance is that you consider accepting the offer to review papers for IJA if/when asked. Finding seasoned authors to review papers is a critically important component of the peer review process and your assistance in this area would be most appreciated.

All the Best,

jackie

Jackie L Clark, PhD  
Managing Editor  
International Journal of Audiology  
[jclark@utdallas.edu](mailto:jclark@utdallas.edu)

---

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<https://mail.google.com/mail/u/0/?ik=52415bf616&view=pt&search=all&permthid=thread-f:1803237318853840825&simpl=msg-f:1803237318853840825&si...> 1/4

**Appendix E: The consolidated criteria for reporting qualitative Research  
(COREQ; Tong Et Al., 2007)**

No. Item	Guide questions/description	Page Number
<b>Domain 1: Research team and reflexivity</b>		
<i>Personal Characteristics</i>		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	31
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	27
3. Occupation	What was their occupation at the time of the study?	27; 31
4. Gender	Was the researcher male or female?	33
5. Experience and training	What experience or training did the researcher have?	27; 31; 33
<i>Relationship with participants</i>		
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 interviewer/facilitator? e.g. Bias, assumptions, reasons and	N/A

	interests in the research topic	
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	27; 33
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	32
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	32
12. Sample size	How many participants were in the study?	27; 33
13. Non-participation	How many people refused to participate or dropped out? Reasons?	33
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	31 (page nr that states that it was an electronic survey)
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	34 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 interview or focus group?	N/A
21. Duration	What was the duration of the inter views or focus group?	32
22. Data saturation	Was data saturation discussed?	33
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?	33
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?	33
27. Software	What software, if applicable, was used	33

	to manage the data?	
28. Participant checking	Did participants provide feedback on the findings?	No, inferred on page 33
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	37-38 and 41 see Tables 2 and 3
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Yes. 39-42
31. Clarity of major themes	Were major themes clearly presented in the findings?	Yes. Pages 34-43; also see Tables 1-3 and Figure 1
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Discussion of categories and subcategories on pages 43-47; also see Tables 2; 3 and Figure 1

**Appendix F: Checklist for reporting results of internet e-survey (CHERRIES; Eysenbach, 2004)**

<b>Checklist Item</b>	<b>Explanation</b>	<b>Page Number</b>
Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In “open” surveys this is most likely.)	30-31
IRB approval	Mention whether the study has been approved by an IRB.	30
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?	32
Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	31
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.	31
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.)	31

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.	31
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?	31
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 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	31
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?	32

Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	32
Time/Date	In what timeframe were the data collected?	32
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.	31
Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	31
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.	33
Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step	32

	which displays a summary of the responses and asks the respondents if they are correct).	
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.	32
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	33

	measure for this, use the word “completeness rate”.)	
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	<p>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)?</p>	N/A
Handling of incomplete questionnaires	<p>Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?</p>	33
Questionnaires submitted with an atypical timestamp	<p>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.</p>	N/A
Statistical correction	<p>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.</p>	N/A