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Faculty of Humanities
Department of Speech-Language Pathology and Audiology

THE HEARING AID EFFECT ACROSS SOCIOECONOMICALLY DIVERSE SETTINGS

by

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(16085362)

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PLAGIARISM DECLARATION

Student name: Cathrine Motlhamare

Student number:16085362

Degree/Qualification: Masters in Audiology

Title of dissertation: The hearing aid effect across socioeconomically diverse settings

I declare that thesis is my own original work. Where secondary material is used, it has been carefully acknowledged and referenced in accordance with university requirements.

I understand what plagiarism is and am aware of university policy and implications in this regard.

31 August 2023

Signature **Date**

ETHICS STATEMENT

The author, whose name appears on this dissertation's title page, has obtained, for the research described in this work, the applicable research ethics approval.

The author declares that she has observed the ethical standards required in the University of Pretoria's Code of ethics for researchers and the Policy guidelines for responsible research.

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ABBREVIATIONS

LMIC/s	Low- and middle-income country/countries
WHO	World Health Organisation
PSAP	Personal sound amplification product
DTC	Direct-to-consumer
BTE	Behind-the-ear
ITC	In-the-canal
RIC	Receiver-in-canal
CIC	Completely-in-canal
ST	Slim tube
SPSS	Statistical Package of the Social Sciences

PUBLICATIONS AND RESEARCH OUTPUTS

The dissertation is based on the following original article: Motlhamare,C., Graham., M.A., Machaiah, V.,Swanepoel, D.W., & Mahomed-Asmail, F. (with editor). The hearing aid effect in an African population.

FORMATTING

This research dissertation used the American Psychological Association (APA) 7th edition referencing style.

The formatting style of chapter three (publication above) may differ from the rest of the document as the journal's format was used to compile the submitted article.

ABSTRACT

Hearing aids serve as the prescribed intervention for addressing the majority of hearing losses, yet their adoption and usage encounter resistance among individuals. This is largely attributed to the hearing aid effect (HAE), wherein negative stereotypes are linked to hearing aid users. While existing research has explored the HAE in relation several factors little is known about how factors like rural or urban settings and level of education influence it. This study aims to address this gap by investigating the hearing aid effect across diverse rural and urban populations with varying educational backgrounds.

A quantitative cross-sectional questionnaire was completed by 322 participants (urban=161, rural=161) selected through purposive snowball sampling. Participants were required to complete the Bipolar Semantic Differential Scale based on photographs of a model wearing seven hearing devices, namely standard behind-the-ear hearing aid (BTE HA) with an earmould; mini BTE HA with a slim tube (ST), in-the-canal (ITC) HA, Airpod, receiver-in-canal (RIC); completely-in-canal (CIC) HA; and Personal sound amplification product (PSAP).

Comparisons were made between the mean scores obtained for the various devices to those of the standard BTE hearing aid. Findings show that the hearing aid effect exists and there are significant differences ($p < 0.01$) between the rural and urban populations in ratings for attributes such as age and hardworking. Significant differences ($p < 0.01$) were also noted across levels of education; those with tertiary education, compared to those with primary and secondary education, found the model

to be younger when wearing an Airpod and to be more hardworking when wearing a ST hearing aid.

This study concluded that there is a neutral to positive view of hearing devices. These findings highlight the significance of considering patients' socioeconomic circumstances when prescribing hearing aids. Nevertheless, further research is required to investigate the underlying reasons behind the differences in perception between rural and urban residents.

KEYWORDS

Hearing loss

Hearing aid effect

Hearing devices

Stigma

Attitude

Socio-demographic factors

Socioeconomic

African communities

Ear electronics

CHAPTER 1: INTRODUCTION

The World Health Organization (WHO) has estimated that by 2050, over 700 million individuals will present with disabling hearing loss (WHO, 2021). A hearing loss is considered a functional disability as it can limit one's ability to work independently and may result in difficulties with communication, emotional and social wellbeing (WHO, 2021). However, these difficulties can be alleviated by using hearing aids (McComarck & Fortnum, 2013). Hearing aids are the most used rehabilitation option for persons with a hearing loss (McComarck & Fortnum, 2013). However, numerous studies across Europe and North America have shown that only about 20 to 25% of people with a hearing loss own hearing aids (Chien & Lin, 2020; Davis et al., 2007). This rate is far lower in developing low- to middle-income countries, with only one in five hearing-impaired individuals owning a hearing aid (McComarck & Fortnum, 2013, Bisgaard et al., 2021; Sinha et al., 2020). As 85% of the world's population resides in LMICs (WHO, 2021), the world-wide hearing aid coverage is about 10 to 11% (Bisgaard et al., 2021). Moreover, studies suggest that nearly 20% of those who own hearing aids do not wear or use them (Hartley et al., 2010).

Stigma related to hearing aid use is one of the leading reasons for non-adoption of hearing aids. As a result, these individuals will often be reluctant to admit their hearing loss (Kochkin, 2007; McComarck & Fortnum, 2013). The concept "stigma" is loosely defined in relation to hearing loss and hearing aids (Manchaiah et al., 2015). A scoping review on stigma related to hearing loss and hearing aids showed that there isn't a unique definition of stigma regarding hearing loss and/or a theoretical framework resulting in studies often only addressing the stereotypical associations to hearing loss and hearing aids (David & Werner, 2016). A common phrase used in literature is

"hearing aid effect" which refers to the assignment of negative attributes to individuals using hearing aids (Rauterkus & Palmer, 2014). It has the potential to create a social and psychological barrier to seeking rehabilitation for hearing loss, which may have an impact on the effectiveness of the treatment process (Zaitzew, 2016).

The hearing aid effect was first reported in 1977 by Blood, Blood and Danhauer. Thereafter, numerous studies conducted primarily in the United States of America (USA), have investigated, and reported on the hearing aid effect (Dogett et al., 1998; Cienkowski & Pimentel, 2001; Andersson & Hagnebo, 2003; Kochkin, 2007; Wallhagen, 2009; Southall et al., 2011; Foss, 2014; Rauterkus & Palmer, 2014; Zaitzew, 2016). This phenomenon, as well as the factors that influence it, was investigated by using a rating system, the Bipolar Semantic Differential Scale, where participants had to rate a model wearing several types of hearing devices. The rating tool consists of the following factors; personality traits; appearance; and intelligence level (Blood, Blood & Danhauer, 1978; Danhauer et al., 1985; Dogette et al., 1998; Strange et al., 2008; Rauterkus & Palmer, 2014). Results of these studies have indicated that the size of the hearing aid influenced the ratings of personality traits regardless of whether the study used the general public or people with hearing loss as participants (Dangerink & Porter, 1984; Strange et al., 2008). Hearing aids that were more visible were rated more negatively for intelligence, achievement, and attractiveness compared to those where the hearing aids were not visible (Blood, Blood & Danhauer, 1978). Participants with hearing loss mentioned that since hearing aids are visible on the ear, wearing one brings attention to their disability, is a sign of weakness, cites ridicule and carries the connotation of ageing (Archana et al., 2016,

Waseem et al., 2019; Andersson & Hagnebo, 2003). Similar emotions can be seen in the workplace. Regarding jobs and career advancement, people with hearing loss experience prejudice in the workplace due to the hearing aid effect; they are perceived to be less intelligent than their colleagues (Wallhagen, 2009). The hearing aid effect has been shown to have a negative impact on these individuals' self-efficacy, self-esteem, and pride (Wallhagen, 2009).

Undeniably, previous studies have investigated the hearing aid effect through the perception of participants of different genders, age groups and have even explored the concept in workplaces and social environments (Blood, Blood & Danhauer, 1978; Dogett et al., 1998; Cienkowski & Pimentel, 2001; Andersson & Hagnebo, 2003; Kochkin, 2007; Wallhagen, 2009; Southall et al., 2011; Foss, 2014; Rauterkus & Palmer, 2014; Zaitzew, 2016). However, to our knowledge, no study has explored the impact of socioeconomic factors such as urban and rural settings as well as education level and its influence on the perception of hearing aids.

Individuals with lower socioeconomic status face restricted access to hearing aids due to limited resources (Tsimpida et al., 2019). There is reportedly a severe shortage and unequal rural/urban distribution of trained healthcare professionals, infrastructure, and resources in these settings (Frisby et al., 2023). Existing literature also suggests that those in a lower socioeconomic category are less inclined to seek assistance or access hearing healthcare services (Tsimpida et al., 2019). Hearing loss, especially when left untreated, can create barriers to education, employment, income-earning potential, and access to hearing care, all of which influence socioeconomic status (Malcolm et al., 2022).

Hearing aid designs have also changed substantially over the last decade with modern hearing aids being much smaller and potentially attracting less attention (Dysart, 2017). Smart ear electronics have created a whole range of direct-to-consumer (DTC) hearing products known as hearables which include personal sound amplification products (PSAPs) (Dysart, 2017). Smart ear electronics such as earbuds are also penetrating the hearing aid market (Dysart, 2017) as they include features such as noise cancellation, are equipped with microphones which make it easy to receive phone calls, and are smaller in size (Dysart, 2017). Some of these devices, like the Airpods, now have a feature called Live Listen which allows the user's smartphone to function like a microphone, essentially providing the basic function of hearing aids (Gilmore, 2019). This study sought to investigate the hearing aid effect across socioeconomically diverse urban and rural populations with varying levels of education, and its association with modern hearing devices.

CHAPTER 2: METHODOLOGY

2.1. Research Aims

The study aimed to determine whether the hearing aid effect exists in a socioeconomically diverse setting across a range of modern hearing aids.

2.1.1. *Sub-Aims*

Sub-aims included:

- determining if the residence of participants (rural versus urban) is associated with the hearing aid effect.
- determining whether the educational level of participants is associated with the hearing aid effect.
- exploring the impact of modern hearing aids on the hearing aid effect.

2.2. Ethical Considerations

Ethical approval was obtained prior to data collection from the Research Ethics Committee, Faculty of Humanities at the University of Pretoria, approval number HUM013/1220 (Appendix A). The ethical considerations for this research study were as follows:

2.2.1 *Protection from Harm*

Participants were not exposed to physical or psychological harm (Leedy & Ormrod, 2019). They were provided with information letters explaining the study's aim and procedure (Appendix B and D). Participants were also aware that they may withdraw from the study at any given moment without any negative implications.

2.2.2 *Voluntary and Informed Consent*

It is vital for the participants to have full knowledge about the nature of the study and what is required of them (Leedy & Ormrod, 2019).Therefore, data collection commenced after written consent was obtained from the participants (Appendix B and D). Furthermore, the dominant language in the rural area is Sepedi; thus, the letters (Appendix D) and questionnaire were translated into Sepedi by a Board-Certified translator. Additionally, the researcher, who is fluent in Sepedi, was available to clarify any uncertainties that they had.

2.2.3 *Right to Privacy*

Personal or sensitive information provided by the participants was kept confidential by the researcher and the supervisors. A unique code was allocated to each participant to ensure confidentiality (Leedy & Ormrod, 2019).

2.2.4. *Data Storage*

The data will be stored for 15 years as outlined by the University of Pretoria's regulations in the institutional repository (FigShare).

2.2.5 *Honesty with Professional Colleagues*

The data collected was not altered to fit a specific outcome (Leedy & Ormord, 2019). Research findings were presented in a manner that is honest and clear, with no misleading information (Leedy & Ormord, 2019).

2.2.6. *Plagiarism*

The work presented is that of the researchers involved. All information retrieved from other sources was fully acknowledged (Leedy & Omrod, 2019)

2.3 Research Design

The study followed a quantitative cross-section design. Participants were recruited through purposive snowball sampling from a rural and urban communities. Participants were required to complete a questionnaire where they rated photographs of a model wearing different hearing devices. Comparisons of the ratings between the different ages, gender and socioeconomic status of groups were made (Wisdom & Creswell, 2013).

2.4. Setting

A total of 322 participants took part in this study. 161 participants were from Kgautswane, which is part of the Sekhukhune district municipality in Limpopo province, South Africa. It is a rural, underdeveloped area with a high unemployment rate of 60% of the population (Ntawanga, 2013). The other 161 participants were from Pretoria and Johannesburg, which is in the northern part of Gauteng province and is the administrative capital of South Africa. It is a developed urban area with many economic activities and an employment rate of 24-25% (Stats SA, 2011). The region of Limpopo contributes 7.4% to the country's GDP (Gross Domestic Product) and Gauteng contributes 34.5% and is rated as the highest-income region in the country (Stats SA, 2019). Pretoria contributes 28.4% of provincial GDP and 10% of the national GDP (Cogta, 2020). Pretoria on its own contributes 9.4% towards the national GDP whiles

Johannesburg contributes 21.2% towards the provincial GDP and 6.85% of national GDP (Cogta, 2020).

2.5. Study Participants and Selection Criteria

A purposive and snowballing sampling method was used to identify 161 participants living in a rural area (Kgautswane) and 161 residing in an urban area (110 from Pretoria and 51 from Johannesburg).

2.5.1 *Inclusion Criteria*

Participants were included if they met the following criteria:

- Male and female adults who were 18 years and older. They resided in a rural area (Kgautswane) and had self-reported good vision.
- Male and female adults who were 18 years and older. They resided in an urban area (Pretoria and Johannesburg) and had self-reported good vision.
- Those who wore prescribed glasses were required to wear them to be able to assess photographs during the study.

2.6 Equipment, Apparatus, And Materials

The following equipment, apparatus, and material were used in the study during data collection:

2.6.1. *Model*

A 24-year-old black female residing in an urban setting (Pretoria, South Africa) who was easily accessible to the researcher and willing to participate in the study, was used as the model. Once informed consent was obtained from the model, photographs of

her wearing the devices were taken. The model was asked to pretend to be reading a book while the photographs were taken from a 90-degree angle from the side with the devices in her ear. This ensured that she was in the same position in all the photographs and that the devices were clearly visible to the participants. The model wore the same clothing items for all the photographs to eliminate clothing as a variable, and her hair braids were tied up, so they did not cover the devices (Figure 1). An earmould of her right ear was made, ensuring that the devices were customised for the standard BTE with earmould and the CIC. The Airpod was included as it is a popular device that is currently used daily for recreational purposes.

2.6.1. *Photographs*

A photographer was recruited to take the photographs using a Canon EOS 200D camera. The model was photographed wearing seven different devices: standard behind-the-ear (BTE) HA with an earmould, mini BTE hearing aid with a slim tube, in-the-canal (ITC) HA, Airpod, receiver-in-canal (RIC), completely-in-canal (CIC) HA, and personal sound amplification (PSA) product (Table 1).

2.6.2. *Questionnaire*

The questionnaire consisted of two sections, i) biographic information and the ii) 7-point Likert Bipolar Semantic Differential Scale (Rauterkus and Palmer (2014) (Appendix C & E). The demographic questions included their age, gender, residence (urban versus rural), level of educational and employment. The rating tool consisted of eight attributes that participants had to complete based on a 7-point Likert Scale, with one being the negative descriptor and seven being the positive descriptor of the attribute. The rating tool was translated into Sepedi by a Board-Certified translator. The

participants completed the questionnaire and ratings in English or Sepedi, depending on their preferred language. Due to limited access to smart devices and the internet, participants from the rural area mostly completed the paper-based questionnaire. In rural areas, the principal researcher went from one household to another, collecting data face-to-face. For the urban area, the online questionnaire was completed on Qualtrics.com and was distributed via a link on social media platforms (i.e., Instagram, LinkedIn, Facebook, Twitter, and WhatsApp).

2.7. Data Collection Procedure

The process followed for data collection was consistent with previous studies on the topic of hearing aid effect (Blood, Blood & Danhauer, 1978; Danhauer et al., 1985; Dogette et al., 1998; Rauterkus & Palmer, 2014). After the study received ethical clearance, the principal researcher went door to door in the rural community where participants completed the paper-based questionnaire once they provided informed consent. For the urban group, the questionnaire was posted on social media platforms, using Qualtrics.com. Participants had to provide their age, gender, residence (urban versus rural), level of educational and employment. This was followed by ratings, participants had to look at a photograph of the model in a particular device and give her ratings between one and seven. Each photograph had its own 7-point Linkert Bipolar Semantic Differential Scale. Participants rated all 7 photographs of the model in different device configurations (Chapter 3, Figure 1). The researcher used a Latin square design for paper-based for rural participants so that the photographs were presented in different orders for the participants. The photographs on Qualtrics.com were set to be presented randomly for all participants. Both formats of the survey took no more than 10 minutes to complete.

Table 1. Devices included in the study that were worn by the model.

Device	Image
Standard behind the ear (BTE) hearing aid with an earmould	
Mini BTE hearing aid with a slim tube	
In-the-canal (ITC) hearing aid	
Airpod	
Receiver-in-canal (RIC) hearing aid	
Completely-in-canal (CIC) hearing aid	
Personal Sound Amplifier Product	

2.8 Data Analysis

The data were analysed using the Statistical Package for the Social Sciences (SPSS, v27. Chicago, Illinois). Descriptive and inferential analyses were conducted to examine the data obtained in this study. A 1% level of significance is used as it provides "moderate to strong" strength of evidence and an 11% chance of incorrectly rejecting the null hypothesis when the null hypothesis is true (Type I error), whereas using a higher level of significance, such as 5%, only provides "moderate" strength of evidence and a 29% chance of a Type I error (Goodman, 2001; Nuzzo, 2014). To assess the normality of the continuous variable (age), the Shapiro-Wilk test was performed. The obtained p-value, which was less than 0.01, indicated a significant deviation from normality. Consequently, nonparametric tests were employed for further analysis. Similarly, as the attribute ratings were ordinal data skewed to the left; most responses were closer to 7; nonparametric tests were deemed appropriate. The chi-square ($\chi 2$) test was utilized to examine the association between demographic variables (gender, level of education, employment, self-perceived hearing problem, and family history of hearing loss) and Mann-Whitney U test (ZU) (for the continuous variable age) were performed to determine the association between demographic variables and area of residence (rural versus urban). The study examined both continuous and Likert-type ordinal data. For the continuous age variable, median (Md), interquartile range (IQR), mean (M), and standard deviation (SD) were detailed due to non-parametric methods being employed. However, only Md and IQR were provided for the Likert-type data. Friedman's test (Fr) was used to compare significant differences between attribute ratings across different devices, specifically against the BTE device. The Kruskal-

Wallis H test (H) evaluated education level differences, followed by post hoc Dunn's pairwise tests (ZD) if significant differences were found.

To capture varied perspectives, a 7-point Likert scale was utilized, emphasizing extreme viewpoints (1 and 2 for negativity, 6 and 7 for positivity) and not delving into the data composing of the midpoint (4) of neutrality (with 3 and 5 being in the vicinity of neutrality). Pairwise z-tests (Zp) were conducted to examine differences in proportions between negativity (1 and 2) and positivity (6 and 7). Additionally, in all tables except for the initial demographic characteristics table, median values of 6 and 7, indicating positivity, were highlighted in bold to emphasize this category compared to neutrality (ranging from 3 to 5).

2.9 Reliability and Validity

Several measures were taken to ensure that the study was valid. The data was collected in a real-life setting; participants completed the questionnaires in their daily environment so no controlled environment could have influenced their ratings. The 7-point Linkert Bipolar Semantic Differential Scale a validated tool that has been used in previous studies (Dogett et al., 1998; Cienkowski & Pimentel 2001; Andersson & Hagnebo, 2003; Kochkin 2007; Wallhagen, 2009; Southall et al., 2011; Foss, 2014; Rauterkus & Palmer, 2014; Zaitzew, 2016). Moreover, the study has a large sample that was also representative of individuals of different genders, ages, and socioeconomic statuses therefore, the results of the study may be generalised over a large population.

To ensure the reliability of the study, the validated scale swapped three of the eight

attributes rating descriptors (i.e., age, hardworking, friendliness), making one the positive descriptor and seven the negative descriptor. This ensured that participants read the instructions and the scale tool carefully before answering each device. Also, the feasibility and validity of the questionnaires in both languages was confirmed through pilot testing involving three participants. The presentation of the photographs was randomized for both the online and paper-based questionnaire to counteract participant fatigue, where the last few devices are rated unfairly due to fatigue and decreased focus.

CHAPTER 3: RESEARCH ARTICLE

Title: The hearing aid effect in an African population

Authors: Cathrine Motlhamare, De Wet Swanepoel, Vinaya Manchaiah, Marien Graham, Faheema Mahomed Asmail,

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3.1 ABSTRACT

Introduction: : The stigma associated with wearing hearing aids, known as the "hearing aid effect," remains a significant issue in hearing healthcare. Despite notable changes in the look and feel of hearing aids over the last decade, little is known about the influence of socioeconomic factors on the perception of different hearing devices in a socioeconomically diverse setting. Therefore the objective of the study is to determine the hearing aid effect across a range of hearing devices and its association with socioeconomic factors, namely area of residence and level of education across African communities.

** This article was edited in accordance with the editorial specifications of the International Journal of Phoniatrics Speech Therapy and Communication and may differ from the editorial style of the rest of this document.*

Method: The study used a cross-sectional design with 322 participants (161 rural, 161 urban); mean age 31.9 years (14.7 *SD*). Participants rated photographs of seven different styles of devices [standard behind-the-ear hearing aid (BTE HA) with an earmould, mini BTE HA with a slim tube (ST), in-the-canal (ITC) HA, Airpod, receiver-in-canal (RIC), completely-in-canal (CIC) HA, and Personal Sound Amplification Product (PSAP)] worn by a peer model using a validated scale of eight attributes (*attractiveness , age, success, hardworking, trustworthiness, intelligence, friendliness, education*). The ratings of the BTE HA with earmould were used as a benchmark for comparison.

Results: No hearing aid effect was observed across all participants (n = 322) with device ratings ranging between neutral and positive. Significant differences between device ratings were evident for *attractiveness* for ST and PSAP and *trustworthiness* for ITC. In terms of residence, urban participants provided more favorable ratings compared to rural participants, with significant differences across three attribute ratings: *hardworking* for ST; *attractiveness*, *hardworking* for ITC; *age* for RIC and Airpod and *hardworking* for PSAP. For level of education, significant differences were found for attributes of *attractiveness* (H = 13.5; p = 0.001) for ITC; *attractiveness* (H = 14.7, p = 0.001) for PSAP; *age* (H = 9.5; p = 0.009) for RIC; *age* (H = 14.3; p < 0.001) and *intelligence* (H = 15.1; p < 0.001) for Airpod and; *hardworking* (H = 11.9, p = 0.003) for ST.

Conclusion: Overall, participants had a neutral to positive view of hearing devices with preferences for less visible, conventionally styled devices. Socioeconomic variables such as educational attainment and geographical location influence perceptions of hearing devices emphasizing the importance of taking these aspects into account when prescribing hearing devices.

Key Words

Hearing loss, Hearing aid effect, Hearing devices, Stigma, Attitude, Socioeconomic factors, African communities

3.2 INTRODUCTION

Hearing aids are the most commonly used rehabilitation option for persons with hearing loss. The worldwide hearing aid coverage is about 10 to 11% [1], with numerous studies across Europe and North America reporting that only 20 to 25% of people with hearing loss own hearing aids [2]. Approximately 85% of the world's population resides in low- and middle-income countries [3], where hearing aid uptake numbers are even lower, ranging between 1 to 12% [1]. Studies have also shown that if purchased, nearly 20% are returned to the audiology clinic, or the users do not wear or use them [4-5].

Although there is a wide range of reasons for the low uptake of hearing aids, stigma related to hearing aid is one of the top five reasons for non-adoption of hearing aids. As a result of stigmatisation some individuals will be reluctant to admit their hearing loss [6-7]. The size and visibility of hearing aids were found to be the major features associated with reluctance to wear or use hearing aids [8], resulting in its associated "stigma". A synonymous phrase used in literature is "hearing aid effect", which refers to the assignment of negative attributes to individuals using hearing aids [9]. The hearing aid effect was first reported in Blood, Blood and Danhauer [10]. Since then, numerous studies conducted primarily in the United States of America (USA), have investigated and reported on the hearing aid effect [6,9,11-17]. These studies not only considered the existence of this phenomenon but also the factors related to it.

To determine the hearing aid effect, a rating system has been used previously [9-11,18-19]. The rating tool consists of attributes, namely personality, appearance, and achievement level, that participants have to consider when rating a model wearing several different types of hearing devices [9-11,18-19]. Results have indicated that the size of the hearing aid was negatively associated with the ratings of personality by both the general public and individuals with hearing loss [19]. The bigger the hearing aid was, the more negatively the wearer was rated by participants [19]. Moreover, people with hearing loss indicated that since hearing aids are visible on the ear, wearing one brings attention to their disability, is a sign of weakness and carries a connotation of aging [13,20-21]. A multi-country study that used a different

theoretical framework (i.e., social representations theory) and methodology (i.e., free association task) across participants from India, Iran, Portugal, and the United Kingdom also found a negative association to hearing aids in terms of appearance [22-23].

The influence of biological sex, age groups, workplaces and social environments on the hearing aid effect has also been investigated [6,9,11-16]. However, to our knowledge, no study has explored the impact of socioeconomic factors on a person's perception of hearing aids. Socioeconomic status is a part of socio-demographic factors, besides age and gender, it includes level of education, income, and occupation of an individual, and area of residence [24-25]. Understanding the hearing aid effect in contexts like Africa and the potential effect of socioeconomic factors is important to support appropriate education, intervention programs and clinical service.

Close to a decade ago, Rauterkus and Palmer [9], investigated the hearing aid effect in the 21st century using BTE with earmold, ST, CIC, an earbud, and a Bluetooth receiver. They found that the hearing aid effect has diminished compared to data reported in the 1970s and '80s [10,18,26-27]. However, Direct-to-consumer (DTC) hearing devices including Personal Sound Amplification Products (PSAPs) and hearables have since been introduced to the market [28]. This study therefore aimed to investigate the hearing aid effect across a range of hearing aids and hearables in two diverse African communities. Furthermore, associations between the hearing aid effect and socioeconomic factors, namely area of residence and level of education, were investigated.

3.3 METHOD

Study Participants

Participants were recruited through purposive snowball sampling from rural and urban communities. Half of the participants (n = 161) were from Kgautswane, an area that falls as part of the Sekhukhune district municipality in Limpopo province, South

Africa (SA). It is a rural, low-income community with a high unemployment rate of 60% [29]. The other half of the participants (*n* = 161) were from Pretoria and Johannesburg, which is in the northern part of Gauteng and is the administrative capital of South Africa. The region of Limpopo contributes 7.4% to the country's GDP (Gross Domestic Product), whereas Gauteng contributes 34.5% and is rated as the highest-income region in the country [30].

Participants had to be 18 years or older, reside in the above-mentioned areas, have self-reported good vision, and understand English and/or Sepedi (these are two of eleven official languages in SA) to be included in the study. Those who wore prescription glasses were required to wear them to assess and rate the photographs.

Procedures

A 24-year-old female residing in Pretoria, South Africa, who was easily accessible to the researcher and willing to participate in the study, was recruited as the model. Once informed consent was obtained in a written format from the model, photographs of her wearing the seven devices were taken. The model was asked to act as if she was reading a book while the photographs were taken from a 90-degree angle from the side with the devices in her ear (Figure 1). This ensured that she was in the same position in all the photographs and that the devices were visible to the participants. The model wore the same items of clothing for all the photographs to eliminate clothing as a variable, and her hair braids were tied up, so they did not cover the devices. She was photographed wearing seven different devices, which included the: standard behind-the-ear (BTE) hearing aid with an ear mould, mini BTE hearing aid with a slim tube (ST), in-the-canal (ITC) hearing aid, Airpod, receiver-in-canal (RIC), completely-in-canal (CIC) hearing aid, and Personal Sound Amplification Product (PSAP) (Figure 1). An ear mould of her right ear was made, ensuring that the devices were customised for the standard BTE with ear mould. An Airpod and a PSAP were included as they are popular devices currently used daily for recreational purposes.

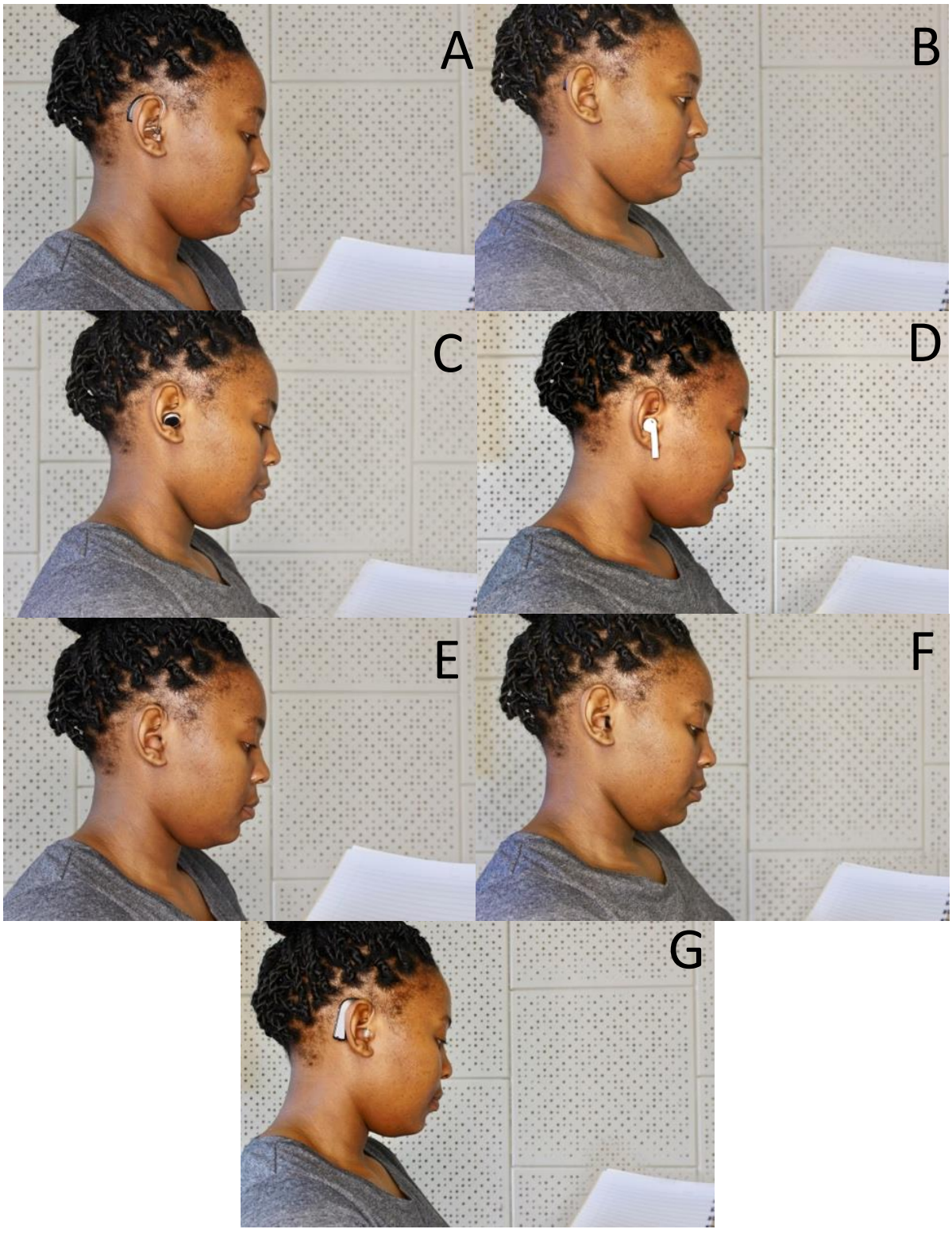

Figure 1. Photographs of the model wearing the devices. (A) standard BTE hearing aid coupled with earmould, (B) mini BTE with slim tube, (C) ITC, (D) Airpod, (E) RIC, (F) CIC, (G) PSAP.

Participants were required to complete a questionnaire with two sections. The first section included demographic questions, which included their age, gender, area of residence, level of education, and employment. This section was followed by a 7-point rating scale of the photographs (Figure 1) taken of the model with the different devices according to eight personality attributes (i.e., *attractive, young, successful, hardworking, trustworthy, intelligent, friendly,* and *educated*) (Supplementary digital content 1). The 7-point Likert scale was used in the previous studies relating to the topic of the hearing aid effect [9-11]. The questionnaire could be completed either online or in paper-based hard copy. The presentation of the photographs was randomised for both formats.

It should be noted that in the original 7-point Likert scale, the ratings were provided as follows: *Attractiveness* (1 = unattractive to 7 = attractive), *age* (1 = young to 7 = old), *success* (1 = unsuccessful to 7 = successful), *hardworking* (1 = hardworking to 7 = lazy), *trustworthiness* (1 = untrustworthy to 7 = trustworthy), *intelligence* (1 = unintelligent to 7 = intelligent), friendliness (1 = friendly to 7 = unfriendly), *educated* (1 = uneducated to 7 = educated). Thus, for some traits/attributes, higher ratings indicate more favourable perceptions (*attractiveness, success, trustworthiness, intelligence* and *educated*), whereas, for others, lower ratings indicate more favourable perceptions (*age*, *hardworking* and *friendliness*). As the current research involves identifying the most favourable traits/attributes across devices, *age*, *hardworking* and *friendliness* were reverse-scored so that higher ratings for those traits/attributes also indicate more favourable perceptions for these attributes to be similarly interpretable as the rest of the attributes.

In rural areas, due to limited access to smart devices and internet, participants from rural areas completed the paper-based questionnaire. The first author (CM) went from one household to the next, collecting data face-to-face using a paper-based questionnaire. For the urban area, the online questionnaire was completed on Qualtrics.com and was distributed via a link on social media platforms (i.e., Instagram, LinkedIn, Facebook, Twitter, and WhatsApp). The dominant language in the rural area is Sepedi; thus, questionnaires were translated by a board-certified

translator from English to Sepedi. The questionnaires in both languages were piloted by three participants confirming the feasibility. The participants completed the questionnaire and ratings in their preferred language (i.e., English or Sepedi).

3.4 Data Analysis

The data were analysed using the Statistical Package for the Social Sciences (SPSS, v27. Chicago, Illinois). A series of descriptive and inferential data analyses were completed. The Shapiro-Wilk test was conducted to determine whether the continuous variable (age) was normally distributed, and since the *p*-value was less than 0.01, the data differed significantly from normality and as such nonparametric tests were used. The nonparametric test was also used to analyse the attribute ratings as they were ordinal data skewed to the left (i.e., most responses are closer to 7 (the highest value on the Likert-scale) rather than 1 (the lowest value on the Likert-scale). For the continuous age variable, the median (*Md*) and the interquartile range (*IQR*) were reported along with the mean (*M*) and standard deviation (*SD*) since non-parametric methods were used and for the Likert-type non-parametric ordinal data, only the *Md* and *IQR* were reported. Chi-square (χ^2) analyses (for nominal categorical variables such as gender, level of education, employment, self-perceived hearing problem, and family history of hearing loss) and the Mann-Whitney U test (Z_U) (for the continuous variable age) were performed to determine the association between demographic variables and area of residence (rural versus urban). Friedman's test (F_r) was used to check for significant differences between the attribute ratings of the different devices. The differences found were compared to the results of the BTE device. The Kruskal-Wallis H test (*H*) was used to evaluate the differences across the three levels of education (primary, secondary, and tertiary) for the device ratings; if the test indicated a significant difference between the three levels, post hoc Dunn's pairwise tests (Z_D) were conducted.

A 7-point Likert-scale was used for the purposes of exploring negative views, positive views and neutral views. For negativity 1 and 2 on the Likert-scale were used, for positivity 6 and 7 on the Likert-scale were used. This grouping aligns with the objective of the current study to explore the far ends of the spectrum to explore

negativity and positivity rather than delving into the data encompassing the midpoint (4) of neutrality (with 3 and 5 being in the vicinity of neutrality). In the cases where the first round of statistical tests indicated significant differences, pairwise z-tests for differences in proportions (Z_p) tests were conducted to test whether the proportion/percentage between negativity and positivity differed significantly for the percentages for Likert-scale numbers 1 and 2 combined (negativity) and for Likert-scale numbers 6 and 7 combined (positivity). For all the tables, except for the first table that displays the demographical characteristics of the participants, all median values of 6 and 7, representing positivity, were presented in bold typeface which served to accentuate this sentiment category from the medians indicative of neutrality (ranging from 3 to 5).

3.5 RESULTS

The study sample consisted of 322 participants, with 50% residing in rural areas and the other half in urban areas (Table 2). The majority of participants (n = 245) completed the English version of the questionnaire, while the rest completed the Sepedi version. The mean age of participants was 31.9 years (14.7 *SD*; 26.5 *Md*; 15.0 *IQR*), with the ages not significantly different (Z_{MW} = -0.312, p = 0.755) between rural (34.9 *M*; 18.5 *SD*; 28.0 *Md*; 26.0 *IQR*) and urban (29.0 *M*, 8.6 *SD*; 26 *Md*; 10 *IQR*) participants. There were significant differences between the urban and rural participants (Table 1) in terms of educational background ($\chi^2(2) = 171.2$, $p < 0.001$) and employment ($\chi^2(1) = 56.5$, $p < 0.001$).

Table 2. Demographic characteristics of participants (*n* = 322)

		All % (*n*)	Rural area % (*n*)	Urban area % (*n*)	χ^2 (*p*-value)
Total		100 (322)	100 (161)	100 (161)	
Gender	Female	64.3(207)	58.4 (94)	70.2 (113)	4.9 (0.027)
	Male	35.7 (115)	41.6 (67)	29.8 (48)	
Education	Primary	39.1 (126)	72.7 (117)	5.6 (9)	171.2 (<0.001*)
	Secondary	26.1 (84)	21.1 (34)	31.0 (50)	
	Tertiary	34.8 (112)	6.2 (10)	63.4 (102)	
Employed	Yes	39.8 (128)	19.3 (31)	60.2 (97)	56.5 (<0.001*)
	No	60.2 (194)	80.7(130)	39.8 (64)	
Self-perceived hearing problem	Yes	7.8 (25)	5.6 (9)	9.9 (16)	2.1 (0.145)
	No	92.2 (297)	94.4 (152)	90.1(145)	
Family history of hearing loss	Yes	17.4 (56)	13.7 (22)	21.1 (34)	3.1 (0.078)
	No	82.6 (266)	86.3 (139)	78.9 (127)	

**Statistically significant p < 0.01*

Hearing Aid Effect

No hearing aid effect was observed across participants (*n* = 322) for the seven hearing devices included in this study. The attributed ratings across device types, with the BTE used as a benchmark, are shown in Table 3. In comparison to the BTE; devices ST, RIC and CIC were perceived favourably with a median of 6 while ITC, Airpod and PSAP were perceived neutrally, with a median rating of 5. IQR's indicate that individual participants' views varied across attributes and device types. Significant differences ($p > 0.01$) in ratings of attributes were only found for two of the eight attributes, which included *attractiveness* and *trustworthiness*` for ST, PSAP and ITC respectively.

A further investigation was conducted for *attractiveness* and *trustworthiness* to determine the differences between the negativity and positivity views. For *attractiveness*, the positivity percentages differ significantly (BTE = 50.6%, ST = 66.5%) with ST being significantly higher (Z_p = -5.025, $p < 0.001$), however, the negativity percentages do not differ significantly. When comparing BTE *attractiveness*

and PSAP *attractiveness*, Z_p = 4.264, p < 0.001, for positivity and Z_p = -4.225, p < 0.001, for negativity, both the positivity percentages (BTE = 50.6%, PSAP = 38.2%) and the negativity percentages (BTE = 9.0%, PSAP = 19.3%) differ significantly, with the PSAP being rated significantly lower in both cases. When comparing BTE and ITC for *trustworthiness*, Z_p = 3.488, p < 0.001, for positivity and Z_p = -2.117, p = 0.034, for negativity, only the positivity percentages (BTE = 54.7%, ITC = 45.0%) differ significantly with ITC being significantly lower than BTE.

Table 3. Descriptive analysis, *Md* (*IQR*), for attribute ratings across device types for all participants (*n* = 322)

	Attractiveness	Age	Success	Hardworking	Trustworthiness	Intelligence	Friendliness	Education
BTE	**6.00 (3.00)**	5.00 (2.00)	**6.00 (3.00)**	4.00 (3.00)	**6.00 (3.00)**	**6.00 (2.00)**	5.00 (3.00)	**6.00 (2.00)**
ST	**6.00 (2.00)*#**	5.00 (2.00)	**6.00 (3.00)**	5.00 (3.00)	**6.00 (3.00)**	**6.00 (2.00)**	5.00 (2.00)	**6.00 (2.00)**
ITC	5.00 (4.00)	5.00 (2.00)	5.00 (3.00)	4.00 (3.00)	5.00 (3.00)*#	**6.00 (3.00)**	5.00 (3.00)	**6.00 (3.00)**
Airpod	5.00 (3.00)	5.00 (3.00)	5.00 (3.00)	4.00 (3.00)	5.00 (2.00)	**6.00 (3.00)**	4.00 (3.00)	**6.00 (3.00)**
RIC	**6.00 (3.00)**	5.00 (2.00)	**6.00 (3.00)**	5.00 (3.00)	**6.00 (2.00)**	**6.00 (2.00)**	5.00 (2.00)	**6.00 (2.00)**
CIC	**6.00 (2.00)**	5.00 (2.00)	**6.00 (3.00)**	5.00 (3.00)	**6.00 (3.00)**	**6.00 (2.00)**	5.00 (3.00)	**6.00 (2.00)**
PSAP	5.00 (4.00)*#	4.00 (3.00)	5.00 (3.00)	5.00 (3.00)	**6.00 (3.00)**	**6.00 (2.00)**	5.00 (3.00)	**6.0 (2.00)**

** F_r statistically significantly p<0.01*

 # Z_P statistically significantly p<0.01

Effect of Demographic Factors on the Hearing Aid Effect

The effect of residence on hearing aid effect was investigated by comparing the ratings of devices between urban and rural residents using the Mann-Whitney U test (Z_U) (Supplementary digital content 2). There were statistically significant differences ($p < 0.01$) found in the rating of personality attributes by participants in rural versus urban communities (Table 4). Significant differences were obtained for ST when rated for *age* and *hardworking*; ITC device when rated for *attractiveness*, *age* and *hardworking*; Airpod and RIC rated for *age*, and lastly how PSAP was rated for *hardworking* (Table 4) by participants in the different communities (Supplementary digital content 2).

In cases where the Mann-Whitney (Z_U) statistics showed significant differences in responses between rural and urban setting, the pairwise z-tests for differences in proportions were conducted (Z_p) to determine if there were significant differences in the negativity outlook between rural and urban residents and in the positivity outlook between rural and ruban residents. Significant differences between the positivity outlook were found for *attractiveness* (ITC), *hardworking* (ST, ITC, PSAP) and *age* (Airpod, RIC) and between the negativity outook for *hardworking* (ST, ITC). Overall results show that urban participants viewed the devices more positively than rural participants.

Table 4. Descriptive analysis of Hearing aid effect ratings with significant differences between device types in rural (*n* = 161) and urban (*n* = 161) participants

Attributes	Devices	Statistics	Rural	Urban	Z_U (*p*-value)[a] Z_P (*p*-value)[b]
Attractiveness	ITC	*Md; IQR*	5.0 (3.0)	5.0 (3.0)	-3.122 (0.002*)
		Neg%; Pos%	13.0%; 49.7%*	21.7%; 35.4%*	2.592 (0.010*)
Age	ST	*Md; IQR*	4.0 (2.5)	5.0 (3.0)	-2.639 (0.008*)
		Neg%; Pos%	15.6%; 31.3%	9.9%; 44.7%	-2.486 (0.013)
	ITC	*Md; IQR*	4.0 (3.0)	5.0 (2.0)	-2.945 (0.003*)
		Neg%; Pos%	17.4%, 28.0%	8.7%, 38.5%	-2.011 (0.044)
	Airpod	*Md; IQR*	4.0 (2.0)	6.0 (3.0)	-4.585 (<0.001*)
		Neg%; Pos%	14.3%, 24.2%*	11.8%, 51.6%*	-5.055 (<0.001*)
	RIC	*Md; IQR*	4.0 (2.0)	5.0 (3.0)	-2.968 (0.003*)
		Neg%; Pos%	11.8%, 29.2%*	9.9%, 43.5%*	-2.665 (0.008*)
Hardworking	ST	*Md; IQR*	5.0 (3.0)	5.0 (3.0)	-3.926 (<0.001*)
		Neg%; Pos%	20.5%*, 30.4%*	7.5%*, 49.1%*	-3.416 (<0.001*)
	ITC	*Md; IQR*	4.0 (2.0)	5.0 (2.5)	-3.670 (<0.001*)
		Neg%; Pos%	20.5%*, 24.2%*	8.1%*, 39.1%*	-2.875 (0.004*)
	PSAP	*Md; IQR*	4.0 (2.0)	5.0 (2.5)	-2.807 (0.004*)
		Neg%; Pos%	24.2%, 24.2%*	14.9%, 39.1%*	-2.875 (0.004*)

** ZU statistically significantly p<0.01*

 # ZP statistically significantly p<0.01

a ZU test statistics and their corresponding p-values reported for Md and IQR

b ZP test statistics and their corresponding p-values reported for Neg% and Pos%

The Kruskall Wallis H test was used to examine the effect of education level on hearing aid effect (Supplementary digital content 3). Table 5 shows the statistical differences found between the groups with different educational levels. For all the device attribute ratings, the groups gave responses that were mostly neutral (medians of 3 to 5 across attributes). Statistically significant differences were found in

the ratings for attribute *attractiveness* (*H* = 13.5; *p* = 0.001) for ITC; *attractiveness* (*H* = 14.7, *p* = 0.001) for PSAP; *age* (*H* = *9.5*; *p* = 0.009) for RIC; *age* (*H* = 14.3; *p* < 0.001) and *intelligence* (*H* = 15.1*; p* < 0.001) for Airpod, *hardworking* (*H* =11.9, *p* = 0.003) for ST. From Table 5 it can be seen that positive ratings ranged across the education levels, with secondary level education participants having more positive ratings for two of the attributes (*age, attractiveness)* across two devices (PSAP, RIC), whereas those with primary education found ITC and Airpod significantly more positive for *attractiveness* and *intelligence*, and those from tertiary level found Airpod and ST statistically more positive for *age* and *hardworking.*

Table 5. Differences across education levels for device ratings of all participants (*n*=322)

			Primary education	Secondary education	Tertiary education
Attractiveness	ITC	*Md; IQR*	6.0; 3.0*	5.0; 4.0	4.0; 3.0*
		Neg%; Pos%	12.7%; 52.4%*	17.9%; 44.0%	22.3%; 30.4%*
	PSAP	*Md; IQR*	5.0; 3.0*	5.0; 4.0*	4.0; 3.0*
		Neg%; Pos%	14.3%; 43.7%*	15.5%; 48.8%#	27.7%; 24.1%*#
Age	RIC	*Md; IQR*	4.0; 1.0*	5.0; 3.0*	5.0; 3.0
		Neg%; Pos%	11.1%; 24.6%*#	8.3%; 44.0%*	12.5%; 43.8%#
	Airpod	*Md; IQR*	4.0; 1.0*	5.0; 4.0	6.0; 3.0*
		Neg%; Pos%	15.9%; 22.2%*#	11.9%; 44.0%*	10.7%; 50.9%#
Hardworking	ST	*Md; IQR*	5.0; 3.0*	5.0; 4.0	6.0; 3.0*
		Neg%; Pos%	19.0%; 28.6%*	13.1%; 39.3%	8.9%; 52.7%*
Intelligence	Airpod	*Md; IQR*	6.0; 2.0*	6.0; 2.0	5.0; 2.0*
		Neg%; Pos%	6.3%; 62.7%*	3.6%; 56.0%	4.5%; 40.2%*

** ZD statistically significantly p<0.01*

 # ZP statistically significantly p<0.01

3.6 DISCUSSION

Hearing devices are perceived positively across a diverse socioeconomic setting indicating no observed hearing aid effect. In this study; BTE, ST, RIC and CIC were found to be more favourable than ITC, Airpod and PSAP. This shows that devices that have a conventional appearance (BTE) are generally favoured. In terms of attributes, participants found the model to be generally attractive, successful, trustworthy, intelligent, and educated. They had a neutral view with regards to her age, how hardworking and friendly she is. Participants notably found the hearing devices more positive for five (*attractiveness, success, trustworthiness, intelligence and education*) of the eight attributes.

When compared to BTE for *attractiveness*, ST was perceived better whereas PSAP was perceived more negatively. This can be attributed to the fact that STs are smaller and less visible whereas PSAPs are larger [31]. The current study's findings concur with previous studies investigating the hearing aid effect where the main reason provided for reluctance to use hearing aids were the size and visibility [19-21]. Interestingly, ITCs were seen as more attractive by rural participants and those with a primary level education but were rated significantly lower for attributed *trustworthiness* which was also found in a previous study [9].

In terms of residence, urban participants generally viewed devices more positively than rural participants. However, differences were found for Airpod and RIC between the rural and urban groups for age with the latter giving more favourable ratings for both these devices. This was also noted between education levels where more educated participants (secondary and tertiary) rated RIC and Airpod more positively for *age.* This was expected as the majority of rural participants had lower levels of education. However, participants with primary level education rated Airpod higher for attribute *intelligence.* The difference in scoring by these participants may be attributed to a lower penetration rate and less exposure to Airpods in rural communities, resulting in participants not associating the Airpod with popularity among young people and associating them to individuals who are more educated [32].

Overall, these findings hold implications for public education efforts aimed at destigmatizing hearing aids and for device selection during audiological rehabilitation sessions. While hearing devices are generally viewed more positively, individuals still exhibit preferences for less visible, conventionally styled devices. In some cases clients may opt for CICs, as they attract less attention and patients do not need to be self-conscious about their appearance or others' perceptions [7]. However, it should be emphasized that CICs are suitable for specific types of hearing loss, and their small size may pose challenges for patients with dexterity issues. Furthermore, socioeconomic factors such as place of residence and education should be taken into account during hearing aid fittings. In order to meet the client's needs and address their concerns, counseling should be tailored focusing on their comfort with the device and their concerns regarding appearance and societal perceptions [33].

Limitations of this study include a potential sampling bias risk due to the snowball method used. Secondly, although the researcher took measures to be neutral when gathering the data, participants in the rural area had the opportunity to interact directly with the researcher which may have resulted in observe-expectancy bias for the rural community when compared to the urban population who mainly completed the online questionnaire.

3.7 CONCLUSIONS

The hearing aid effect was not observed across a socioeconomically diverse population. There is a neutral to positive perception across a wide range of hearing devices, including wearables. While there is a preference for hearing devices with a conventional appearance like BTE, ST, and RIC, it is essential to acknowledge the influence of socioeconomic factors such as place of residence and education during hearing device selection.

3.8 STATEMENT OF ETHICS

This study protocol was reviewed and approved by the Research Ethics Committee, Faculty of Humanities, University of Pretoria, approval number HUM013/1220. The study followed a cross-sectional design in which written informed consent was

obtained from the participants for publication of the details of their questionnaire responses and any accompanying images.

3.9 CONFLICTS OF INTEREST

The authors have no conflict of interest to declare. All the authors are not involved in a funding or grant that is relevant to this study.

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3.11 AUTHORS' CONTRIBUTIONS

Vinaya Manchaiah spearheaded the conceptualization of the research, with substantial support from De Wet Swanepoel and Faheema Mahomed-Asmail in the development of the research methodology. Cathrine Motlhamare contributed to the data curation and original draft of the article, while Marien Graham assumed responsibility for data analysis. Additionally, Faheema Mahomed-Asmail played a crucial role in securing the funding for the research. All authors actively participated in the process of writing, reviewing, and editing the manuscript.

3.12 DATA AVAILABILITY

Data is not publicly available due to institutional regulations, but access may be granted upon request and in compliance with the specific data access policies of the institution (https://www.up.ac.za/media/shared/12/ZP_Files/research-data-management-policy_august-2018.zp161094.pdf)

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CHAPTER 4: DISCUSSION, CLINICAL IMPLICATIONS AND CONCLUSION

4.1. Overview of Research Findings

Previous studies have reported that the hearing aid effect plays a significant role in the uptake or the continual use of hearing aids (Knudsen et al., 2010; Meyer & Hickson, 2012; Meyer et al., 2014; Simpson et al., 2019; van Leeuwen, 2021; Kochkin, 2007; Kochkin, 2000; McComarck & Fortnum, 2013). The current study explored the hearing aid effect across socioeconomically diverse urban and rural populations. There were 322 participants; 161 from a rural area and 161 from an urban area. Participants were required to rate photographs of a model wearing seven different devices. The participants rated the devices on eight attributes, including attractiveness, age, success, hardworking, trustworthiness, intelligence, friendliness, and education.

Results indicate that no hearing aid effect exists in socioeconomically diverse settings. The BTE with standard earmould was used as the benchmark of comparisons for all other devices as it is the most common type of hearing aid used. The ITC, Airpod and PSAP were found to be the least favourable as they were the neutrally rated devices for all the attributes. These devices are the most visible around the ear compared to all the other devices. Compared to BTE (Fr = 3.5, $p < 0.001$), the ST was rated favourably (Fr = -3.5, $p < 0.001$) while PSAP was rated neutrally for attractiveness. ITC was rated less favourably than the BTE for trustworthiness (Fr = 2.9, $p = 0.003$). One would have expected better ratings, particularly for the Airpod, since it is considered to have a fashionable appearance (Ryan, 2014) and to be a popular smart ear electronic (Gilmore, 2019). Interestingly, ratings indicate that the ST and CIC, were the more attractive devices which is contrary to finds from Reuterkus and Palmer (2014) where

earbuds were rated to be the most attractive, followed by CIC, BTE as the third and ST as the fourth most attractive device. This indicates that despite the use of new advanced hearing aids and smart ear electronic, this current study is consistent to prior studies (Strange et al., 2008, Archana et al., 2016, Waseem et. al., 2019) where the least visible devices were preferable compared to the more visible ones.

In terms of urban versus rural settings, device ratings mostly yielded neutral results (median of 3-5) (see Chapter 3, Table 4). Participants from rural and urban areas differed significantly in their ratings for ST when rated for age and hardworking; ITC device when rated for attractiveness, age and hardworking; Airpod and RIC rated for age, and lastly how PSAP was rated for hardworking. In general, the findings indicate that urban participants held a more favourable view of the devices compared to their rural counterparts. These findings indicate that the hearing aid effect can vary depending on the participants' residential context, distinguishing between rural and urban settings.

The association of educational levels to the hearing aid effect also showed significant differences between the ratings. Neutral ratings (median of 3-5) were mostly given across attribute ratings. The group of participants with primary education rated the model as most attractive when wearing an ITC (*Md* 6.0, *IQR* 3.0) whiles the group with tertiary education gave the highest rating to PSAP (*Md* 6.0; *IQR* 3.0) for age. Furthermore, participants with higher levels of education demonstrated a tendency to perceive the model as younger when wearing an Airpod. This observation could be attributed to limited exposure of rural participants to Airpods as was also noted by Gilmore (2019).

4.2 Clinical Implications

The above-mentioned findings have clinical implications for hearing healthcare professionals and researchers working with socioeconomically diverse populations. It highlights the importance of considering various factors, such as device appearance, residential context, educational background, and age, when assessing individuals' preferences, acceptance, and perceptions of hearing aids. Understanding these factors can help tailor interventions, counselling, and device selection to meet the diverse needs and preferences of different populations.

Differences between Rural and Urban Participants: Urban participants had a better perception of ST, ITC, Airpod, RIC devices than the rural participants for age and hardworking. One of the factors affecting the uptake of hearing aids is how the device looks on (attractiveness) and the perception that they make one appear older, however this study's results indicate that most of the devices were rated favourably by the urban participants for age making this group more receptive to hearing aids as a form of intervention. This shows that the hearing aid effect can vary depending on the participants' residential context which should be considered when making clinical recommendations.

Educational Background and Device Ratings: Participants with different educational backgrounds rated devices differently, with those who had primary education finding the ITC to be an attractive device compared to the two other groups (secondary and tertiary education), where the PSAP was found attractive by

participants with secondary education. Additionally, participants with higher levels of education tended to perceive the model as younger when wearing an Airpod in contrast to participants with lower levels of education. This could be attributed to the limited exposure of the latter group to Airpods. Educational backgrounds thus also influence perceptions of hearing aid attributes which could affect device preference and acceptance.

Device type: BTEs are the commonly offered hearing aids and can be fitted for most types of hearing losses. These devices (ST, RIC and BTE) were rated higher and more readily accepted by all participants in this study. This finding suggests that BTE's should still be offered within the clinical setting for both rural and urban participants. However, in terms of attractiveness, participants favoured smaller devices (ST, RIC, CIC) compared to bigger devices because smaller devices were less visible. Clinicians should thus ensure that they offer a fair range of hearing aids that patients can choose from that suit their preferences.

Relevance for audiological rehabilitation: Clinicians should ensure they conduct a holistic assessment of the patient taking into account the communication needs, environmental and social factors. This will support offering hearing aid options that are specifically tailored to suit the individual's preferences that take into consideration their background, personal concerns, and preferences. These results can also be used in audiological rehabilitation or follow-up sessions when patients may be hesitant to continue their journey with hearing aids due to being concerned or afraid of how they

will be viewed by society. This would support device usage reducing the associated stigmatisation at a personal and community level.

Even though wearing less noticeable hearing aids like the ST and CIC can alleviate the external hearing aid effect, it may not lessen thoughts of embarrassment and inferiority of the wearer. Counselling, specifically person-centred counselling may be helpful, with the emphasis that the patient must be open to disclosing their feelings about obtaining and/or wearing hearing aids (Coleman et al., 2018). Factors such as the visibility of the hearing aid, family and their communities' views must be addressed. Once patients have been fitted with devices, it is recommended that they receive assertiveness training to support them during their communication interactions (Coleman et al., 2018). Clinicians should also participate in public education to minimize the hearing aid effect and promote and encourage hearing aid uptake for those who have a hearing loss.

4.3 Critical Evaluation:

The current study presented with specific strengths and limitations that are discussed below:

4.3.1. *Strengths of the current study*

- A key strength of the present study is that it was the first to explore the hearing aid effect in a diverse socioeconomic population.
- A large sample size was collected with equal distribution of participants from rural and urban communities.
- The diverse range of device designs enabled comprehensive comparisons among them, enhancing the depth of analysis.

4.3.2. *Limitations*

- The principal researcher collected data in person in the rural area as participants in this group did not have access to online questionnaire. The engagement with participants to clarify questions due to language barrier may be susceptible to an observer-expectancy bias with rural participants.
- Participants were not selected randomly, thus creating an additional risk of potential sampling bias.
- The gender and age of participants were not controlled to ensure that there was an equal number of participants of different genders and ages within and between the rural and urban participants of which limited the type of data analysis that could be done.

4.4 Recommendations for Future Research

It is recommended that a qualitative study on the hearing aid effect also be conducted in these populations to provide subjective information regarding the hearing aid effect. Research shows that Airpods are mostly sold in high-income countries, namely, North America, Europe and China so similar research in these countries in which it is most popular will provide better information on how the Airpod is perceived (Statista, 2023). Future studies should have additional devices; new hearing aids (air/bone conduction spectacles) and additional types of smart ear electronics (wireless buds and earphones) should be included to investigate the hearing aid effect.

4.5 Conclusion

The study highlights a neutral or positive view of hearing devices and emphasizes the need to address the socioeconomic factors influencing perception and attitudes towards hearing aids. The hearing aid effect does not exist in African communities however, sociodemographic factors such as residence location (rural vs urban) and education status are associated with the hearing aid effect. The findings of this study can help hearing healthcare professionals develop strategies to improve the adoption and acceptance of hearing aids in different communities. The study results have implications for public education to minimize issues related to hearing aid image and device choice during audiological rehabilitation sessions.

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APPENDIX A: ETHICAL CLEARANCE LETTER

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Humanities 100
Since 1919

25 January 2021

Dear Miss CM Motlhamare

Project Title:	The hearing aid effect in a low-and middle-income country
Researcher:	Miss CM Motlhamare
Supervisor(s):	Prof DCDW Swanepoel
	Dr F Mahomed Asmail
Department:	Speech Language Path and Aud
Reference number:	16085362 (HUM013/1220)
Degree:	Masters

I have pleasure in informing you that the above application was **approved** by the Research Ethics Committee on 14 December 2020. Data collection may therefore commence.

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. Should the actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

We wish you success with the project.

Sincerely,

Prof Innocent Pikirayi
Deputy Dean: Postgraduate Studies and Research Ethics
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: PGHumanities@up.ac.za

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Research Ethics Committee Members: Prof I Pikirayi (Deputy Dean); Prof KL Harris; Mr A Bizos; Dr A-M de Beer; Dr A dos Santos; Ms KT Govinder Andrew; Dr P Gutura; Dr E Johnson; Prof D Maree; Mr A Mohamed; Dr I Noomè; Dr C Puttergill; Prof D Reyburn; Prof M Soer; Prof E Taljard; Prof V Thebe; Ms B Tsebe; Ms D Mokalapa

APPENDIX B: ENGLISH CONSENT LETTER FOR PARTICIPANTS

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Dear prospective participant,

I, Cathrine Motlhamare, am a master student at the Department of Speech-Language Pathology and Audiology, University of Pretoria. Thank you for considering participating in my project. My study is titled: ***The hearing aid effect in a low-and middle-income country*** and it aims to evaluate existence of the hearing aid effect, by doing so we wish to learn more about how people with different educational backgrounds and residing in different geographical areas think about hearing aid wearers.

The information in this document is provided to help you to decide if you would like to participate in this study. Before you agree to take part in this study, you should fully understand what is involved. If you have any questions, which are not fully explained in this document, do not hesitate to ask the researcher.

Inclusion criteria: Male and female adults who 18 years and older. You must currently reside in a rural area (Kgautswane) or an urban area (Pretoria) and have self-reported good vision.

Procedures: You can complete the questionnaire can be complete face to face or online using the Qualitrics link which will be sent via Whatsapp and/or email. You will be required to first complete your demographic information and then provide a description of your view towards hearing aids which can either be written text or provided verbally which will be recorded for analysis. You will then proceed to rate each of the seven photographs according to the Bipolar Semantic Differential Scale. The Bipolar Semantic Differential Scale is a tool that consists of eight attributes (e.g., attractiveness, age, intelligence) that you will have to rate on a 7-point scale, with 1 being the negative descriptor and 7 being the positive descriptor of the attribute. The negative descriptor will be on the left while the positive descriptor is on the right side of

the toolIf you wear prescribed glasses will be required to wear them for the rating. The rating will only take 10 minutes of your time.

Rights as a volunteer: Your participation in this study is completely voluntary and you have the right to withdraw from the study at any time.

Confidentiality: Personal or sensitive information will be kept confidential. This will be ensured by assigning an alpha-numeric code e.g., B012 to you. Your information will only be known to the researcher and supervisors. Therefore, no personally identifying information will be disclosed when the dissertation and article are published.

Risks: There are no risks involved in the study.

Sharing of results: Results that will be obtained from this research will be shared in the form of a scientific article and dissertation, which will be available to the professionals in the field of Audiology.

A copy can be made available, should you require one.

Data storage

The data collected will be stored in hard and soft copy at the Department of Speech-Language Pathology and Audiology at the University of Pretoria for 15 years for research purposes.

If you have any questions concerning this study, you may contact Cathrine Motlhamare on 072 9453 762 or moipone.motlhamare.mm@gmail.com

Cathrine Motlhamare

Principal investigator

Dr Faheema Mahomed Asmail

Research Supervisor

……..
Prof De Wet Swanepoel Research Supervisor

CONSENT TO PARTICIPATE IN THIS STUDY

Participant information number	

I have read and understood the information above. I,

_____

(name and surname) voluntarily consent to participate in the study: *The hearing aid effect in a low- and middle-income country.* I am aware that I may withdraw from the study at anytime.

_____ _____

Participant's signature Date

AFFIRMATION OF INFORMED CONSENT BY AN ILLITERATE PARTICIPANT
(If suitable)

I, the undersigned, _____ have read and have explained fully to the participant, named _____, the participant informed consent document, which describes the nature and purpose of the study in which I have asked the participant to participate. The explanation I have given has mentioned both the possible risks and benefits of the study. The participant indicated that he/she understands that he/she will be free to withdraw from the study at any time for any reason and without jeopardizing his/her standard care.
I hereby certify that the participant has agreed to participate in this study. I also consent to the researcher helping me to fill out the questionnaire.

_____ _____

Participant's name (Please print) Date

_____ _____

Participant's Signature or Mark Date

APPENDIX C: ENGLISH QUESTIONNAIRE

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

STUDY : The hearing aid effect in a low-and middle-income country

Age: _____ **Gender:**

Please tick place of residence in 2021: Kgautswane ☐ Pretoria☐

Highest academic qualification: _____

Employed? Yes/ No, if yes please indicate your occupation:

Do you have a hearing problem? _____

Do you have family history of hearing loss? _____

What comes to your mind when you think about hearing aids?

There is no right or wrong answer to this question. We are interested in knowing your personal opinion and views about hearing aid(s) in terms of what comes to mind regarding its function, potential benefits and limitations, as well as how it looks, etc. Please write as much as you can.

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Please rate the pictures according to the corresponding scales below:

1.

Unattractive	1	2	3	4	5	6	7	**Attractive**
Young	1	2	3	4	5	6	7	**Old**
Unsuccessful	1	2	3	4	5	6	7	**Successful**
Hard Working	1	2	3	4	5	6	7	**Lazy**
Untrustworthy	1	2	3	4	5	6	7	**Trustworthy**
Unintelligent	1	2	3	4	5	6	7	**Intelligent**
Friendly	1	2	3	4	5	6	7	**Unfriendly**
Uneducated	1	2	3	4	5	6	7	**Educated**

(From Rauterkus & Palmer, 2014)

2.

Unattractive	1	2	3	4	5	6	7	**Attractive**
Young	1	2	3	4	5	6	7	**Old**
Unsuccessful	1	2	3	4	5	6	7	**Successful**
Hard Working	1	2	3	4	5	6	7	**Lazy**
Untrustworthy	1	2	3	4	5	6	7	**Trustworthy**
Unintelligent	1	2	3	4	5	6	7	**Intelligent**
Friendly	1	2	3	4	5	6	7	**Unfriendly**
Uneducated	1	2	3	4	5	6	7	**Educated**

(From Rauterkus & Palmer, 2014)

3.

Unattractive	1	2	3	4	5	6	7	**Attractive**
Young	1	2	3	4	5	6	7	**Old**
Unsuccessful	1	2	3	4	5	6	7	**Successful**
Hard Working	1	2	3	4	5	6	7	**Lazy**
Untrustworthy	1	2	3	4	5	6	7	**Trustworthy**
Unintelligent	1	2	3	4	5	6	7	**Intelligent**
Friendly	1	2	3	4	5	6	7	**Unfriendly**
Uneducated	1	2	3	4	5	6	7	**Educated**

(From Rauterkus & Palmer, 2014)

4.

Unattractive	1	2	3	4	5	6	7	**Attractive**
Young	1	2	3	4	5	6	7	**Old**
Unsuccessful	1	2	3	4	5	6	7	**Successful**
Hard Working	1	2	3	4	5	6	7	**Lazy**
Untrustworthy	1	2	3	4	5	6	7	**Trustworthy**
Unintelligent	1	2	3	4	5	6	7	**Intelligent**
Friendly	1	2	3	4	5	6	7	**Unfriendly**
Uneducated	1	2	3	4	5	6	7	**Educated**

(From Rauterkus & Palmer, 2014)

5.

Unattractive	1	2	3	4	5	6	7	**Attractive**
Young	1	2	3	4	5	6	7	**Old**
Unsuccessful	1	2	3	4	5	6	7	**Successful**
Hard Working	1	2	3	4	5	6	7	**Lazy**
Untrustworthy	1	2	3	4	5	6	7	**Trustworthy**
Unintelligent	1	2	3	4	5	6	7	**Intelligent**
Friendly	1	2	3	4	5	6	7	**Unfriendly**
Uneducated	1	2	3	4	5	6	7	**Educated**

(From Rauterkus & Palmer, 2014)

6.

Unattractive	1	2	3	4	5	6	7	**Attractive**
Young	1	2	3	4	5	6	7	**Old**
Unsuccessful	1	2	3	4	5	6	7	**Successful**
Hard Working	1	2	3	4	5	6	7	**Lazy**
Untrustworthy	1	2	3	4	5	6	7	**Trustworthy**
Unintelligent	1	2	3	4	5	6	7	**Intelligent**
Friendly	1	2	3	4	5	6	7	**Unfriendly**
Uneducated	1	2	3	4	5	6	7	**Educated**

(From Rauterkus & Palmer, 2014)

7.

Unattractive	1	2	3	4	5	6	7	**Attractive**
Young	1	2	3	4	5	6	7	**Old**
Unsuccessful	1	2	3	4	5	6	7	**Successful**
Hard Working	1	2	3	4	5	6	7	**Lazy**
Untrustworthy	1	2	3	4	5	6	7	**Trustworthy**
Unintelligent	1	2	3	4	5	6	7	**Intelligent**
Friendly	1	2	3	4	5	6	7	**Unfriendly**
Uneducated	1	2	3	4	5	6	7	**Educated**

(From Rauterkus & Palmer, 2014)

APPENDIX D: SEPEDI CONSENT LETTER FOR PARTICIPANTS

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Mokgathatema yo a rategago,
Nna, Cathrine Motlhamare, ke moithuti wa mastase Kgorong ya Dithuto tša Mathata a Polelo le Go Kwa (*Department of Speech-Language Pathology and Audiology*), University of Pretoria. Ke leboga ge o naganišitše sephetho sa go kgatha tema projekeng ya ka. Phatišišo ya ka e bitšwa: ***The hearing aid effect in a low-and middle-income country*** (Khuetšo ya dithuši tša go kwa nageng ya letseno la fase le la gare) gomme e nepiša go lekodišiša go ba gona ga khuetšo ya dithuši tša go kwa. Re dira se gore re ithute kutšwana mabapi le ka moo batho ba magato a go fapanego a tša thuto bao ba dulago mafelong a go fapana ba naganago ka gona ka ga batho ba go apara dithuši tša go kwa.

Tshedimošo ye e lego sengwalong se e abja gore e go thuše go tšea sephetho sa ge eba o ka rata go kgatha tema phatišišong ye. Pele o dumela go kgatha tema phatišong ye, o swanetše go kwešiša ka botlalo gore e akaretša eng. Ge eba o na le dipotšišo tše e lego gore ga se di hlalošwe ka botlalo sengwalong se, o se ke wa tšhaba go botšiša monyakišiši.

Mokgwa wa kakaretšo: Banna le basadi ba mengwaga ye 18 le go feta. O swanetše go ba o dula lefelong la metsemagaeng (Kgautswane) goba metsesetoropong (Pretoria) gomme o tiišeditše ka bowena gore o bona gabotse.

Ditsepedišo: O ka tlatša lenaneopotšišo ka sebele goba inthaneteng ka go šomiša linki ya Qualitrics yeo e tlogo romelwa go wena ka Whatsapp le/goba ka emeile. O tla swanela ke go tlatša pele tshedimošo ya go amana le wena bjalo ka leloko la setšhaba gomme ka morago wa hlaloša kgopolo ya gago mabapi le dithuši tša go kwa, o ka dira seo ka mokgwa wa go ngwala goba wa bolela ka molomo gomme wa gatišwa gore go dirwe tshekatsheko. Go tloga fao o tla lekanyetša diswantšho tše šupa go ya ka Sekala sa Pharologantšho ya Tlhalošo go ya ka Maikutlo, (*Bipolar Sementic Differential Scale*). Sekala sa Pharologantšho ya Tlhalošo go ya ka Maikutlo ke setlabelo sa go

laetša dilo tše šupa tša go sepedišana le semelo sa motho (mohlala, tebelego, mengwaga, bohlale) tšeo o tla swanelago gore o di lekanyetše go ya ka sekala sa dintlha tše 7, fao ntlha 1 e fago tlhalošo ya go se dumelelane le se sengwe mola ntlha 7 e bontšhago go dumelelana ka botlalo le tlhalošo ya semelo se itšego. Tlhalošo ye o sa dumelelanego le yona e tlo ba ka letsogong la nngele mola ya go bontšha go dumelelana le semelo e tla hwetšagala ka go la go ja ga sekala. Ge eba o apara dipeketsana, o tla swanela ke gore o di apare ge o dira tekanyetšo. Tekanyetšo ye e tla tšea nako ya gago ya go lekana metsotso ye 10.

.

Ditokelo tša moithaopi: Bokgathatema bja gago phatišišong ye bo tloga e le boithaopi bjo bo feleletšego gomme o na le tokelo ya go ikgogela morago phatišišong nako efe goba efe.

Khupamarama: Tshedimošo ya gago goba ye o sa ratego go e abelana le ba bangwe e tlo swarwa bjalo ka khupamarama goba sephiri. Se se tla phethagatšwa ka go šomiša tlhakaina le nomoro ye itšego bakeng sa leina la gago bjalo ka B012. Tshedimošo ya gago e tla tsebja fela ke monyakišiši le bafahloši ba gagwe. Ka fao, ga go na tshedimošo ye e ka go šupago thwii yeo e ka tšweletšwago ge sengwalwatherwa goba sengwalwaphatišišo di phatlalatšwa.

Dikotsi: Ga go na dikotsi tše di amanywago le go kgatha tema phatišišong ye.

Kabelo ya dipoelo: Dipoelo tše di tla hwetšwago phatišišong ye di tlo abja ka mokgwa wa sengwalwaphatišišo sa saense le sengwalwatherwa, tšona di tla ba gona gore ditsebi tša lefapha la Dithuto tša go amana le go kwa di e šomiše. Khopi ye nngwe e ka hwetšagala ge o ka e kgopela.

Polokelo ya tshedimošo

Tshedimošo ye e kgobokeditšwego e tlo bolokwa tekanyo ya mengwaga ye 15 ka mokgwa wa pampiri le ka mokgwa wa elektroniki Kgorong ya Dithuto tša Mathata a Polelo le Go Kwa, University of Pretoria gore e šomišwe mererong ya diphatišišo.

Ge eba o na le dipotšišo mabapi le phatišišo ye, o ka ikgokaganya le Cathrine Motlhamare go 072 9453 762 goba moipone.motlhamare.mm@gmail.com

Cathrine Motlhamare

Monyakišišimogolo

Dr Faheema Mahomed Asmail

Mofahloši wa Phatišišo

……

Prof De Wet Swanepoel

Mofahloši wa Phatišišo

TUMELELANO YA GO KGATHA TEMA PHATIŠIŠONG YE

Tshedimošo ya nomoro ya mokgathatema	

Ke badile le go kwešiša tshedimošo ya ka godimo. Nna, _____ (leina le sefane) ke dumela ntle le go gapeletšwa go tšea karolo phatišišong ye ya: *The hearing aid effect in a low- and middle-income country.* Ke a tseba gore nka ikgogela morago phatišišong ye nako efe goba efe.

_____ _____

Mosaeno wa mokgathatema Tšatšikgwedi

TIIŠETŠO YA TUMELELANO YE E SEDIMOŠITŠWEGO YA MOKGATHATEMA WA GO SE KGONE GO BALA LE GO NGWALA

(Ge go hlokega)

Nna, _____, yo a saennego ka fase, ke baletše le go hlalošetša

mokgathatema ka botlalo, yo a bitšwago _____,

mabapi le sengwalwa sa tumelelano ye e sedimošitšwego, seo se hlalošago mokgwa le morero wa phatišišo yeo ke kgopetšego mokgathatema gore a tšee karolo go yona. Tlhalošo ye ke e filego e akaretša dikotsi le mehola ye e ka bago gona ka bobedi ya phatišišo. Mokgathatema o laeditše gore o a kwešiša gore o dumeletšwe go ikgogela morago phatišišong nako efe goba efe ka mabaka a itšego gomme se se ka se ame gampe tlhokomelo ya gagwe ya motheo.

Ke tiišetša le go hlatsela gore mokgathatema o dumetše go kgatha tema phatišišong ye.

_____ _____

Leina la mokgathatema (Mongwalo ka botlalo) Tšatšikgwedi

_____ _____

Mosaeno goba leswao ka mokgathatema Tšatšikgwed

APPENDIX E: SEPEDI QUESTIONNAIRE

Mengwaga: _____

Bong: _____

Ka kgopelo, swaya lefelo la bodulo nakong ya ngwaga 2021: Kgautswane ☐ Pretora ☐

Lengwalo la godimo la tša thuto: _____

Naa o a šoma? Ee/ Aowa, ge eba karabo ke ee, ka kgopelo laetša maemo a mošomo wa gago: _____

Naa o na le mathata a go kwa? _____ **Naa balapa la geno ba na le histori ya go itemogela mathata a go kwa?**

_____

Naa ke eng se se go tlelago ka kgopolong ge o nagana ka dithuši tša go kwa?

Ga go na karabo ya maleba goba ye e phošagetšego go potšišo ya mohuta wo. Re na le kgahlego ya go tseba kakanyo le pono ya gago mabapi le dithuši tša go kwa go ya le gore o nagana eng ka tšona mabapi le tšhomišo ya tšona, mehola ye e ka bago gona le mellwane, gammogo le gore di lebelega bjang, bjalo bjalo. Ka kgopelo, ngwala ka botlalo ka mo o ka kgonago ka gona.

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Ka kgopelo, lekanyetša seswantšho se sengwe le se sengwe go ya ka sekala se se filwego ka fase:

1.

Ga a lebellege	1	2	3	4	5	6	7	**O a lebellega**
Yo moswa	1	2	3	4	5	6	7	**Yo mogolo**
Ga se a atlega	1	2	3	4	5	6	7	**O atlegile**
O šoma ka maatla	1	2	3	4	5	6	7	**O a tšwafa**
Ga a tshepagale	1	2	3	4	5	6	7	**O a tshepagala**
Ga a bohlale	1	2	3	4	5	6	7	**O bohlale**
O na le botho	1	2	3	4	5	6	7	**Ga a na botho**
Ga se a rutege	1	2	3	4	5	6	7	**O rutegile**

(Go tšwa go Rauterkus & Palmer,2014)

2.

Ga a lebellege	1	2	3	4	5	6	7	**O a lebellega**
Yo moswa	1	2	3	4	5	6	7	**Yo mogolo**
Ga se a atlega	1	2	3	4	5	6	7	**O atlegile**
O šoma ka maatla	1	2	3	4	5	6	7	**O a tšwafa**
Ga a tshepagale	1	2	3	4	5	6	7	**O a tshepagala**
Ga a bohlale	1	2	3	4	5	6	7	**O bohlale**
O na le botho	1	2	3	4	5	6	7	**Ga a na botho**
Ga se a rutege	1	2	3	4	5	6	7	**O rutegile**

(Go tšwa go Rauterkus & Palmer, 2014)

3.

Ga a lebellege	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**O a lebellega**
Yo moswa	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Yo mogolo**
Ga se a atlega	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**O atlegile**
O šoma ka maatla	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**O a tšwafa**
Ga a tshepagale	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**O a tshepagala**
Ga a bohlale	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**O bohlale**
O na le botho	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Ga a na botho**
Ga se a rutege	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**O rutegile**

(Go tšwa go Rauterkus & Palmer, 2014)

4.

Ga a lebellege	1	2	3	4	5	6	7	**O a lebellega**
Yo moswa	1	2	3	4	5	6	7	**Yo mogolo**
Ga se a atlega	1	2	3	4	5	6	7	**O atlegile**
O šoma ka maatla	1	2	3	4	5	6	7	**O a tšwafa**
Ga a tshepagale	1	2	3	4	5	6	7	**O a tshepagala**
Ga a bohlale	1	2	3	4	5	6	7	**O bohlale**
O na le botho	1	2	3	4	5	6	7	**Ga a na botho**
Ga se a rutege	1	2	3	4	5	6	7	**O rutegile**

(Go tšwa go Rauterkus & Palmer, 2014)

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5.

Ga a lebellege	1	2	3	4	5	6	7	**O a lebellega**
Yo moswa	1	2	3	4	5	6	7	**Yo mogolo**
Ga se a atlega	1	2	3	4	5	6	7	**O atlegile**
O šoma ka maatla	1	2	3	4	5	6	7	**O a tšwafa**
Ga a tshepagale	1	2	3	4	5	6	7	**O a tshepagala**
Ga a bohlale	1	2	3	4	5	6	7	**O bohlale**
O na le botho	1	2	3	4	5	6	7	**Ga a na botho**
Ga se a rutege	1	2	3	4	5	6	7	**O rutegile**

(Go tšwa go Rauterkus & Palmer, 2014)

6.

Ga a lebellege	1	2	3	4	5	6	7	**O a lebellega**
Yo moswa	1	2	3	4	5	6	7	**Yo mogolo**
Ga se a atlega	1	2	3	4	5	6	7	**O atlegile**
O šoma ka maatla	1	2	3	4	5	6	7	**O a tšwafa**
Ga a tshepagale	1	2	3	4	5	6	7	**O a tshepagala**
Ga a bohlale	1	2	3	4	5	6	7	**O bohlale**
O na le botho	1	2	3	4	5	6	7	**Ga a na botho**
Ga se a rutege	1	2	3	4	5	6	7	**O rutegile**

(Go tšwa go Rauterkus & Palmer, 2014)

7.

Ga a lebellege	1	2	3	4	5	6	7	**O a lebellega**
Yo moswa	1	2	3	4	5	6	7	**Yo mogolo**
Ga se a atlega	1	2	3	4	5	6	7	**O atlegile**
O šoma ka maatla	1	2	3	4	5	6	7	**O a tšwafa**
Ga a tshepagale	1	2	3	4	5	6	7	**O a tshepagala**
Ga a bohlale	1	2	3	4	5	6	7	**O bohlale**
O na le botho	1	2	3	4	5	6	7	**Ga a na botho**
Ga se a rutege	1	2	3	4	5	6	7	**O rutegile**

(Go tšwa go Rauterkus & Palmer, 2014)

APPENDIX F: BOOKLET OF PHOTOGRAPHS OF MODEL

Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotho

MA AUDIOLOGY

Cathrine Motlhamare

STUDY TITLE

STUDY TITLE: The hearing aid effect in a low-and middle-income country

DATA COLLECTION TOOL

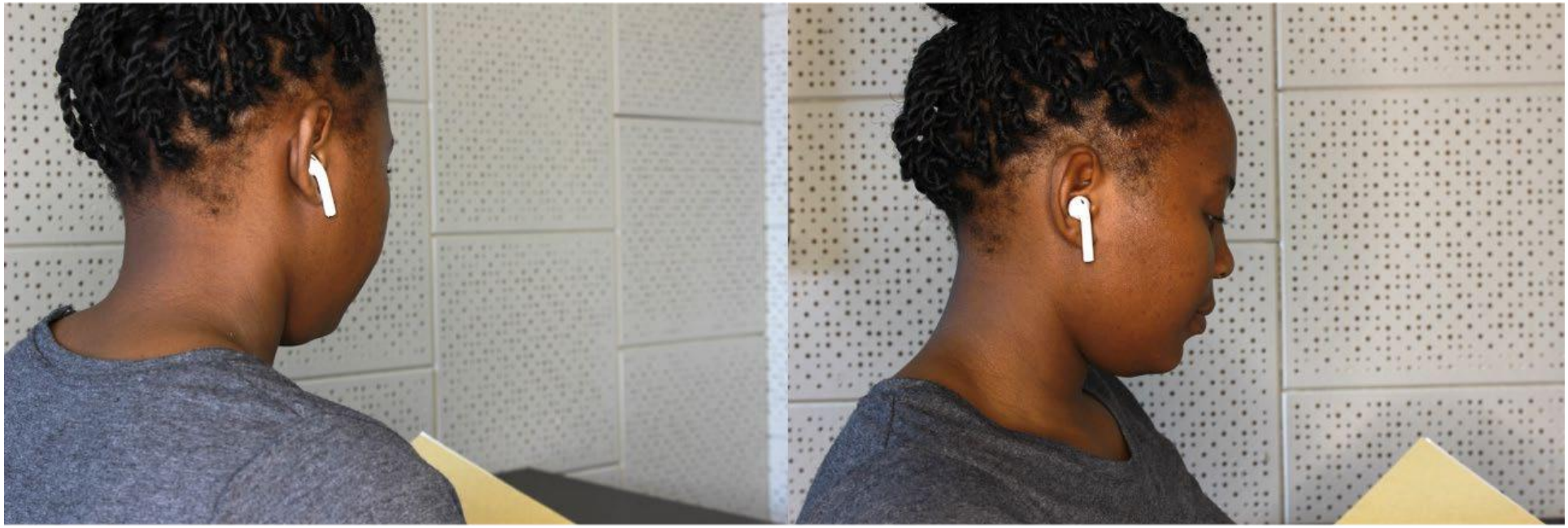
A.

B.

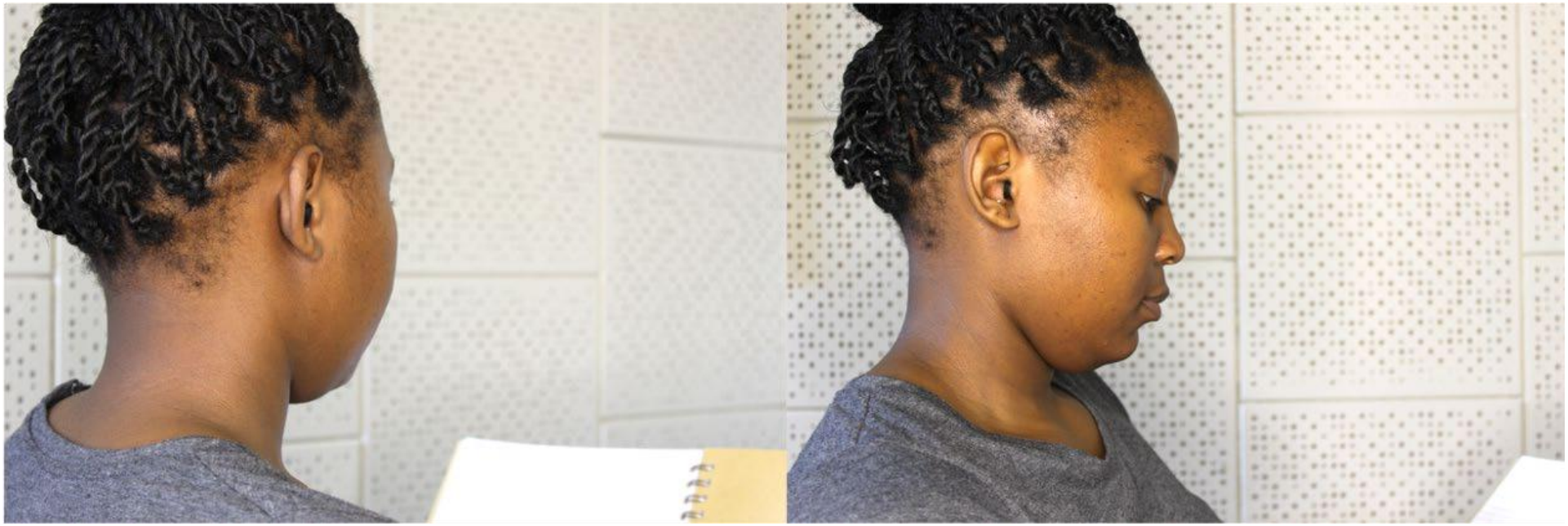
C.

D.

E.



F.



G.