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Master's Research Project

Current tele-audiology services in clinical practice and the influence of the Covid-19 pandemic on audiologists' perceptions of tele-audiology

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Abstract

Background: Increasing access to hearing healthcare (HHC) services is needed as an ever-growing number of individuals are being diagnosed with disabling hearing loss particularly in low-middle income countries (LMIC) such as South Africa. Efforts to prevent the spread of Covid-19 resulted in a rapid uptake of remote models of service delivery across the healthcare sector including audiology. Tele-audiology has presented the profession with an opportunity to address barriers to HHC in LMIC.

Study aims: The study aimed to describe tele-audiology services implemented in clinical practice in South Africa and to determine the impact of the Covid-19 pandemic on South African audiologists' perceptions of the use of tele-audiology for provision of HHC services.

Methodology: A descriptive cross-sectional survey research design was utilized. An online survey was developed as the tool for data collection and consisted of closed-ended and open-ended questions categorized into the following domains: demographic information, employment information, application of tele-audiology, tele-audiology resources and perceptions of tele-audiology. The survey was validated with an expert panel and piloted prior to data collection which occurred between May-September 2022. Participants were recruited via purposive sampling through social media platforms. Qualitative data obtained from the open-ended question underwent thematic analysis and quantitative data was analysed using descriptive and inferential statistics.

Results: A total of 50 audiologists in South Africa completed the survey of whom 38% provided various tele-audiology services on multiple platforms in clinical practice. There was no significant association found between participant's employment sector and whether they provided

tele-audiology services. No significant association was also noted between whether participants provided tele-audiology and their views on the sustainability thereof. The themes identified based on participants views of the role of tele-audiology in clinical practice were improved access to HHC, augmentative service delivery model, sustainability of tele-audiology in clinical practice, factors limiting use of tele-audiology in clinical practice and considerations for successful implementation of tele-audiology in clinical practice.

Conclusions: Research findings indicated that the use of tele-audiology in South Africa is feasible and is being implemented despite resource challenges. However, there is a need to increase the implementation of tele-audiology as an option for the provision of HHC. Engagement with various stakeholders to refine tele-audiology regulations and guidelines may increase audiologists' willingness for implementation and positively impact on the sustainability of tele-audiology into the future.

Key words: tele-audiology, hearing healthcare, service-delivery models, Covid-19, e-health, smartphone, remote care, South Africa

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List of Abbreviations

CBT:	Cognitive Behavioural Therapy
CVI:	Content Validity Index
CVR:	Content Validity Ratio
HHC:	Hearing Healthcare
HPCSA:	Health Professions Council of South Africa
I-CVI:	Item Level Content Validity Index
LMIC:	Low-Middle Income Countries
NHI:	National Health Insurance
POPIA:	Protection of Personal Information Act
SAAA:	South African Association of Audiologists
SASHLA:	South African Speech Language and Hearing Association
S-CVI/AVE:	Scale Level Content Validity Index/Average
S-CVI/UA:	Scale Level Content Validity Index/ Universal Agreement
S-CVI:	Scale Level Content Validity Index
SPSS:	Statistical Package for the Social Sciences
UCT:	University of Cape Town

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Chapter 1: Introduction

Introduction. The following chapter will introduce and define the concepts which provide context for the research rationale. The concepts explored will include disabling hearing loss, barriers to accessing HHC and defining tele-audiology as a service delivery model.

The Prevalence and Impact of Disabling hearing Loss

It is estimated that 2.5 billion people will experience some degree of hearing loss by 2050 and 700 million of these will suffer from disabling hearing loss (World Health Organisation, 2024). Disabling hearing loss is defined as a hearing loss greater than 35 decibels in the better hearing ear (World Health Organisation, 2024). On a global scale, up to 80% of individuals with disabling hearing loss reside in LMIC (World Health Organisation, 2024). Public health action aimed at increasing access to HHC, and audiological rehabilitation is urgently required to address the projected growth of disabling hearing loss, particularly in LMIC (World Health Organisation, 2021).

Untreated hearing loss has adverse effects on both an individual and societal level. In childhood, untreated hearing loss affects the development of spoken language thereby hindering communication (François et al., 2015). Untreated hearing loss has also been shown to affect a child's academic progress, literacy, behaviour and self-esteem (François et al., 2015; LeClair & Saunders, 2019; Warner-Czyz et al., 2015). Children are further affected in adulthood as employment opportunities are limited in comparison to hearing peers (World Health Organisation, 2021). In adults, hearing loss is associated with social isolation, depression, and an increased risk of developing dementia due to cognitive decline associated with auditory deprivation (Griffiths et al., 2020; Li et al., 2014; Shukla et al., 2020).

Financially, the global economic burden of disabling hearing loss has been estimated to cost 981 billion dollars annually (McDaid et al., 2021); 57% of which is incurred in LMIC (World Health Organisation, 2024). Financial implications for the individual with untreated hearing loss result from limited opportunities to actively participate in the work force of a country (Borrea et al., 2021).

Barriers to HHC Access

Despite the devastating effects of untreated hearing loss, many people particularly in LMIC have limited access to HHC because of barriers which limit the availability of services (Blackwell et al., 2021). In South Africa, barriers to HHC access include a limited workforce, finances, geographical barriers and a multilingual/multicultural population for which there is limited representation amongst audiologists (Gordon et al., 2020; Pillay et al., 2020). The implementation of tele-audiology offers audiologists an opportunity to address the above barriers to HHC (Gordon et al., 2020).

Defining Tele-audiology

Tele-audiology has been defined as the use of technologies refers to the use of electronic and telecommunication technologies to support remote HHC, professional/public education and health administration (Northern, 2012). Tele-audiology has also been defined as the provision of audiology services using various digital platforms and devices (Eikelboom & Swanepoel, 2016). Tele-audiology can be implemented using multiple methods of application which can categorised into two main types: Synchronous and Asynchronous. Synchronous, also referred to as, real-time telehealth, consists of live interactions between patient and audiologist (Coco et al., 2020). In most instances a trained assistant is on site with the patient whilst the audiologist is controlling the equipment and testing from a different location (Prigge, 2020). Asynchronous refers to store-and-

forward and remote monitoring approaches (Wolfgang, 2019). Store-and-forward allows for gathering of patient information/test results at one site and sending saved results to a different location for interpretation (Coco et al., 2020). The store-and-forward method has been known to be useful in areas with limited internet connection (Wolfgang, 2019). With remote monitoring, patients can conduct self-assessments and monitoring (Wolfgang, 2019). Remote monitoring has therefore been deemed more promising given increased access of individuals to smartphones and technological device (Wolfgang, 2019). For example, there are mobile apps such as hearScreen USA which enable patients to self-detect hearing loss by performing an at-home hearing assessment (Wolfgang, 2019). Patients are then able to connect with and set up an appointment with an audiologist in the app (Wolfgang, 2019). In addition to the above, a hybrid approach has also been documented and consists of providing both synchronous and asynchronous approaches to deliver HHC services (Coco et al., 2020). With the use of either approach, tele-audiology in practice has the potential to increase accessibility, convenience, and efficiency of HHC services in clinical practice (Saunders & Roughley, 2020).

Study Rationale

Many health professionals needed to implement alternative methods of service delivery such as tele-audiology to limit face-to-face contact during the COVID-19 pandemic (World Health Organisation, 2021). In South Africa, tele-audiology research has mainly focused on barriers to implementation and audiologists' perceptions thereof. However, little is known about current tele-audiology services available in clinical practice. Additionally, research in South Africa has not considered the impact of the Covid-19 pandemic on audiologists' perceptions of using tele-audiology beyond the pandemic.

There is a gap in the literature regarding tele-audiology services currently available in clinical practice in South Africa. Hence, the proposed study aimed to contribute to this gap in the literature by exploring current tele-audiology practices in clinical practice. Results from this study may provide insight to academic institutions planning of tele-audiology courses and implementation guidelines regarding tele-audiology practices in South Africa. Additionally, results may aid in planning of professional development activities to develop audiologists' skills and confidence in tele-audiology practices. Given the ever-changing nature of the Covid-19 pandemic, it is also important to consider the influence of Covid-19 on audiologists' perceptions of tele-audiology to provide insight into their willingness to provide these services in clinical practice. Tele-audiology services in addition to personal contact will be essential for ensuring increased access to HHC services in a post-pandemic world.

Chapter 2: Literature Review

Introduction. The following chapter provides a detailed discussion of the key considerations for implementation of tele-practice before exploring audiologists' perceptions of tele-audiology and how it may address some of the many barriers to accessing HHC beyond the Covid-19 pandemic.

Application of Tele-audiology in Clinical Practice

With technology rapidly evolving, opportunities to provide tele-audiology services are expanding (Muñoz et al., 2021). The application of tele-audiology in clinical practice has been researched in various areas of audiology including hearing screening, diagnostic testing, aural rehabilitation, tinnitus, and vestibular management.

Otoscopy

Certain remote audiology practices such as otoscopy, require the assistance of an on-site facilitator (Coco et al., 2020). Remote otoscopy can be conducted synchronously or asynchronously using either images or video (Eikelboom et al., 2021). Video-otoscopy is often used and has been found to be of equal quality to that of in-person otoscopy performed by qualified clinicians such as audiologists (Eikelboom et al., 2021). Sebothoma and Khoza-Shangase (2018) research on the reliability of remote video-otoscopy in patients living with Human Immunodeficiency Virus (HIV) in South Africa, revealed that otorhinolaryngologists were able to classify various middle ear pathologies using images. Remote video-otoscopy can greatly contribute to early and accurate identification of middle ear pathologies in this patient population particularly in the South African context where human resources are limited (Sebothoma & Khoza-Shangase, 2018; Sebothoma et al., 2021). Similarly, a scoping review by Metcalfe et al. (2021) found that 81% of video-otoscopy images gathered from facilitators were of adequate quality for

diagnosis. Shah et al. (2018) compared remote otoscopic images taken by parents and trained physicians using the CellScope iPhone Otoscope and their findings, concluded that although the application provided reliable otoscopic images, only health professionals provided images of diagnostic quality. These findings highlight that remote otoscopy can be an effective and safe procedure, however the training of facilitators in patient safety and maximising picture quality is important to ensure images and/or videos allow for accurate diagnosis (Metcalfe et al., 2021).

Hearing Screening and Diagnostic Testing

The California Tele-Audiology Program was the first to perform complete diagnostic assessments on newborns who failed their hearing screener (Dharmar et al., 2016). No infants were lost to follow-up and both audiologists and parents reported being highly satisfied with the overall experience (Dharmar et al., 2016). The findings revealed that a high-quality assessment can be successfully conducted remotely and yield comparative results to that of an in-person assessment (Dharmar et al., 2016). A similar study was conducted in South India with remote auditory brainstem response diagnostic testing of infants who required follow-up testing (Ramkumar et al., 2019). Researchers found that the follow-up rate of those assessed remotely surpassed the follow-up rate of those referred for in-person testing (Ramkumar et al., 2019). The improved follow-up rate was attributed to reduced travel time and costs associated with travelling (Ramkumar et al., 2019). Ultimately, these remote hearing screening and diagnostic services for newborns further allowed for early identification and intervention of confirmed hearing loss (Ramkumar et al., 2019). In South Africa, Swanepoel and Biagio (2011) investigated whether computer based pure tone audiometry results were as reliable as standard audiometry. Results revealed that air and bone conduction thresholds obtained via the computer-based audiometer were within test-retest limits of thresholds obtained through conventional audiometry (Swanepoel & Biagio, 2011).

Aural Rehabilitation

In aural rehabilitation, the application of remote hearing aid fittings and follow-up consultations have also been extensively investigated. Remote hearing aid fittings in the United States go back as far as 1990 where audiologists at Mayo clinic implemented a pilot program to adjust patients hearing aid devices remotely using remote controlled applications (Lima et al., 2021). Being the first study to conduct a randomized control study in this field, Tao et al. (2021) used a blended approach to the hearing aid rehabilitation process. Tele-audiology consultations were provided in addition to in-person interactions in the hearing aid fitting and follow-up process. Participants reported high satisfaction levels with both tele-services and in-person consultations (Tao et al., 2021). Despite promising and comparative outcomes, participants did not show a specific preference for tele-audiology services, leaving researchers to conclude that tele-audiology services could still not replace traditional in-person consultations for participants (Tao et al., 2021). Ratanjee-Vanmali et al. (2020) measured patient satisfaction through the process of receiving tele-HHC services. Researchers established a pilot clinic in Durban, South Africa to investigate patient experiences with a model of service delivery which combined face-to-face services and remote HHC services. Participants went through a 5-step hybrid HHC delivery model which included hearing screening, diagnostic assessment, hearing aid fitting to continued rehabilitation services (Ratanjee-Vanmali et al., 2020). Results revealed that patients had positive experiences accessing various hybrid HHC services. The study concluded that a hybrid approach may allow more flexibility in patient care and provide a means to overcoming many barriers to accessing HHC (Ratanjee-Vanmali et al., 2020). Platia (2021) however questioned the sustainability of remote hearing aid services following an investigation into the quality of consultations for hearing aid tele-audiology services. The researcher noted the importance of considering the availability of

good quality video signal transmission and access to visual cues when choosing how to communicate with the patient (Platia, 2021). The importance of visual cues from the audiologist during remote consultation was also highlighted by participants in a study conducted by (Tao et al., 2021). Participants noted the lack of visual cues as a hindrance to their satisfaction with tele-audiology services (Tao et al., 2021).

Research has also investigated remote tele-audiology services for other amplification devices such as cochlear implants. Hughes et al. (2018) investigated whether there were any differences in threshold levels of children fitted with cochlear implants by conducting visual response audiometry in-person and remotely. Findings of the study revealed no significant difference in threshold levels, test time or measurement success rate in the two testing conditions (Hughes et al., 2018). More recently, research by Buckman and Fitzharris (2020) noted that programming, maintenance, aural rehabilitation, and counselling for those fitted with cochlear implants can all be completely successfully through remote consultations. The researchers highlighted that tele-audiology may be a feasible option particularly in LMIC such as South Africa, where there are limited audiologists trained in cochlear implants and limited government facilities to access cochlear implant services (Buckman & Fitzharris, 2020).

Tinnitus Management

Approximately 10-15% of the global population suffer from tinnitus (Zhou et al., 2022). Tinnitus has been defined as the perception of sound in one or both ears and/or head in the absence of an external sound (Zhou et al., 2022). Audiologists in the United States developed a telehealth version of their Progressive Tinnitus Management (PTM) known as Tele-PTM (Henry et al., 2020). PTM is a method of providing tinnitus-related services to assist in the management of this often-chronic condition (Henry et al., 2020). PTM and Tele-PTM were compared in a large-scale

randomized control trial and both versions were deemed effective in the management of tinnitus (Henry et al., 2020). There is also evidence to support self-led tinnitus interventions (Eikelboom et al., 2021). Self-led internet-based cognitive behavioural therapy (CBT), without active monitoring or contact with a clinician, has been demonstrated to significantly improve tinnitus distress (Eikelboom et al., 2021). Jasper et al. (2014) conducted a randomized trial over 6 months to compare in-person group CBT and a guided self-help internet-based treatment for tinnitus distress. Researchers concluded that internet-based CBT may be equally effective as in-person CBT for the management of chronic tinnitus despite noting that further research should be done to determine under which circumstances it is effective (Jasper et al., 2014). Jasper et al. (2014) noted that further research should be conducted to determine under which circumstances self-led internet-based CBT is effective proposing that the intervention could be utilized for clients experiencing lower levels of tinnitus distress. However, Weise et al. (2016) found similar results with internet-based CBT in patients with severe bothersome tinnitus in a randomized control study. Ultimately, better outcomes have been demonstrated with guided internet therapy interventions (Eikelboom et al., 2021).

Vestibular Management

Pyykkő et al. (2017) developed an internet-based self-help program to manage individuals with Meniere's disease in Finland. The results of their pilot study of the program revealed that participants experienced significant improvements in their overall health-related quality of life concluding that the program had potential to be used in as a remote approach to management of patients with Meniere's disease (Pyykkő et al., 2017). However, research on tele-audiology in vestibular management remains limited (Beukes & Manchaiah, 2019).

Considerations for Implementation of Tele-audiology

Audiologists should familiarise themselves with tele-audiology legislation, reimbursement, and privacy considerations which often act as a barrier to implementation (D'Onofrio & Zeng, 2022).

Legislation and Guidelines for Tele-audiology

Varying legislation globally has restricted implementation of tele-audiology services in clinical practice (Percept, 2020). In South Africa, tele-practice is regulated by the Health Professions Council of South Africa (HPCSA; Meyer & Nel, 2021). Requirements by the HPCSA to practice tele-audiology has hindered its widespread adoption. When South Africa went into hard lockdown, the HPCSA issued revised guidelines regarding telemedicine for healthcare practitioners during Covid-19 based on the general ethical guidelines for good practice in telemedicine booklet no.10. In this amendment, the HPCSA stood firm in their position that telemedicine may only be allowed where there is an existing relationship between the health professional and patient (HPCSA Corporate Affairs, 2020). Following scrutiny by the South African Medical Association, the HPCSA made further amendments to their guidelines to allow for first-time teleconsultations for patients and health professionals without an existing relationship (Percept, 2020). The amendments further allowed for health professionals in other countries to provide telemedicine in South Africa where they only had registration with the board in their country (Meyer & Nel, 2021). With this amendment, the opportunity for implementation of telemedicine in South Africa grew during the Covid-19 lockdown (Percept, 2020). However, it has been noted that the HPCSA's guidelines will only be in effect during the Covid-19 pandemic after which a statement will be released to state when the guidance will cease to apply (HPCSA Corporate Affairs, 2020). The HPCSA last updated their guidelines on 17 August 2022 to allow

for virtual management of patients (HPCSA Corporate Affairs, 2022) and there has since been no communication from the HPCSA regarding the way forward. It is therefore necessary that as telemedicine programs increase and mature, so should laws, regulations, and policies be constantly refined to encourage the use of newly available and innovative solutions (Polity, 2019). This research study will therefore identify whether audiologists are aware of guidelines available to assist in the implementation of tele-audiology.

Re-imbursement of Tele-audiology Services

Audiologists working in private practice need to consider re-imbursement of tele-audiology services. Ravi et al. (2018) highlighted issues related to reimbursement of tele-audiology services as one of the barriers to implementation. For example, in the United States of America, Medicaid programs only cover some tele-audiology services in 48 of 50 states (Bishop, 2021) with re-imbursement of tele-audiology services largely dependent on where patients reside (Nalley, 2020). Additionally, programs in the United States such as Medicare have made reimbursement even more complex (Jilla, 2021). These complexities in reimbursement arise from the classification of audiologists primarily as diagnosticians in hearing and balance care and thereby does not recognize the audiologist as a provider in the management of these disorders (Jilla, 2021; D'Onofrio & Zeng, 2022). As a result, although Medicare released a list of codes for reimbursement of tele-audiology services, audiologists could not use these codes to be reimbursed for remote management of hearing and balance disorders (D'Onofrio & Zeng, 2022). Additionally, the codes have only been made temporarily available for the duration of Covid-19 public health emergency and have not been proposed for extension beyond this period.

In South Africa professional boards such as the South African Audiology Association (SAAA) and South African Speech Language Hearing Association (SASLHA) collaborated to

ensure recognition and reimbursement of remote services such as tele-audiology by medical aid schemes (SASLHA & SAAA, 2020). The Council for Medical Schemes' rendered payment of telehealth services to be lawful with the publication of circular 25 of 2020 which encouraged the use and appropriate reimbursement of telehealth consultations (SASLHA & SAAA, 2020). According to the practical guide to tele-audiology there have been reports of certain medical aid schemes in South Africa that proposed reimbursing at a lesser rate for telehealth services (SASLHA & SAAA, 2020). They further called on these medical schemes to honour benefits patients are entitled to despite the setting in which they received the service (SASLHA & SAAA, 2020). Similar views were expressed by Jilla (2021) noting that tele-audiology services should be of comparable quality to in-person consultations and therefore reimbursement rates should also be the same despite the location of provision (Jilla, 2021).

Various regulations relating to reimbursement globally should encourage audiologists to confirm billing and coverage of tele-audiology services prior to providing these services (D'Onofrio & Zeng, 2022). This study will further explore the impact of reimbursement on the implementation of tele-audiology in private practice.

Privacy Considerations in Tele-audiology Practice

Not only are multiple forms of data creation the product of tele-practice, however by nature, tele-practice entails the free flow of health data being shared across networks within the ultimately borderless setting of the internet (Townsend et al., 2019). When considering this, it is therefore evident that data can be easily misused (Townsend et al., 2019). Remaining compliant with legal requirements regarding protection of patient information has become increasingly difficult with rapid technological advances (Campbell & Goldstein, 2022). In a scoping review conducted by

Chifamba (2018) on the implementation of tele-practice in South Africa, data security considerations were highlighted as one of the main challenges to implementation.

Privacy acts and the consequences associated with non-compliance vary globally. In the United States, there are privacy acts such as the Health Insurance Portability and Accountability Act of 1996 ensuring protection of medical information (Bassan, 2020). Non-compliance with the act may result in criminal charges either through being sued by the patient or through criminal prosecution which could ultimately lead to time in prison (Cavitt, 2018). Before implementing tele-audiology, audiologists need to ensure that all communication systems are compliant with the act (Jilla, 2021). In South Africa, audiologists need to be aware of individuals right to privacy stipulated in the constitution, the National Health Act No. 61 of 2003, the Promotion of Access to Information Act No. 2 of 2000, the HPCSA's ethical guidelines on patient confidentiality booklet no. 10 and more recently the implementation of the Protection of Personal Information Act (POPIA) No. 4 of 2013 (HPCSA, 2021b). By ensuring compliance with the POPIA, a health professional should ensure data is collected, processed, stored and shared in a responsible manner (SASLHA & SAAA, 2020). Where a health professional is found to have caused a breach in a patient's privacy, they may face consequences which include penalties of up to R10 million, a sentence of up to 10 years imprisonment, termination of employment and penalties by the HPCSA (Buys, 2017).

With the availability of multiple applications and technological products to provide tele-audiology services, audiologists may have difficulty discerning which complies with regulations regarding patient privacy and confidentiality (Jilla, 2021). Some regulatory bodies have released guidelines for audiologists on various tools that may be used in tele-audiology services. The HPCSA has not released specific guidelines for which specific equipment may be used for

telehealth (SASLHA & SAAA, 2020). The Allied Health Professions Council of South Africa (AHPCSA), a statutory health body established to control all allied/complementary health professionals, did however provide a useful guideline on software to be used to ensure protection and guaranteed privacy and confidentiality of patients (SASLHA & SAAA, 2020). The Allied Health Professions of South Africa noted that software should be recognized and secure online platforms with the ability to record a consultation for patient records and end-to-end encryption to ensure all patient information is protected (SASLHA & SAAA, 2020).

Although unreasonable to expect audiologists to be accustomed with details relating to legislation of each tele-audiology tool, audiologists should have a basic understanding of legislation regarding patient confidentiality and how it applies to tele-audiology services (Campbell & Goldstein, 2022). Campbell and Goldstein (2022) noted the need for efforts from various platforms such as regulatory bodies, professional organizations, and information technologies to provide comprehensive support and education to health professionals on patient privacy with remote service delivery models.

The unfolding of the Covid-19 pandemic has forced a reconsideration of current legislation, re-imbursement and privacy laws governing tele-practice, as its potential to address barriers to HHC challenge traditional service delivery models (Jinsook et al., 2021). This study will therefore explore the impact of these laws and guidelines on the implementation of tele-audiology in clinical practice in South Africa.

Addressing Barriers to HHC Through Tele-audiology

Tele-audiology has the potential to address many of the barriers to accessing HHC particularly that of limited human resources, costs associated with HHC and addressing a multilingual/cultural population (World Health Organisation, 2021).

Tele-audiology in clinical practice in South Africa

The shortage of audiologists globally has been frequently noted as one of the main challenges to increasing access to HHC (Jinsook et al., 2021). In 2020, research found that South Africa only had 39 audiologists available per one million population (Pillay et al., 2020). In comparison, a developed country such as the United States has approximately one audiologist available per 25 000 individuals (D'Onofrio & Zeng, 2022). In South Africa, HHC services are mainly located in urban areas although approximately 64.7% of the population resides in rural areas (Gordon et al., 2020; Mahlathi & Dlamini, 2015). The year 2030 is of particular importance given that South Africa is one of 192 countries to adopt the 2030 Agenda for Sustainable Development with one of the goals being health for all (Statistics South Africa, 2019). In the public sector alone, the current rate at which audiologists are entering the workforce is insufficient to accommodate the number of patients needing HHC in the public sector (Pillay et al., 2020). The scarce availability of HHC services has also been reported in remote communities within developed countries such as the United States and Canada (Barr et al., 2019). Tele-practice therefore has the potential to address the shortage of audiologists particularly in LMIC such as South Africa by allowing the current workforce to extend their reach (Khoza-Shangase et al., 2021). For example, audiologists can make use of existing minimally trained human resources, such as community health workers and teachers, to conduct hearing screening particularly in areas where services are limited (Muñoz et al., 2020). The use of existing human resources led by the audiologist remotely, ensures sustainability (Muñoz et al., 2020).

The cost of HHC has also been identified as a common barrier affecting accessibility for those in need (Gordon et al., 2020). Most HHC services can only be accessed in private practices (Pillay et al., 2020). Due to the high cost of HHC services in private practice, 84% of South Africans rely on government funded facilities where only 22% of the South African audiology

workforce is employed (Pillay et al., 2020). A study conducted by Ravi et al. (2019) identified cost of HHC to also be a barrier for those residing on Pacific Island in New Zealand. These findings suggested that financial barriers associated with accessing HHC are not only unique to LMIC (Ravi et al., 2019). The cost of HHC is not only felt by patients but audiologists and facilities providing these services burdened by the high cost associated with purchasing and maintaining audiological equipment (D'Onofrio & Zeng, 2022). Yet, tele-audiology may offer a cost-effective solution to accessing HHC particularly for patients who face many socio-economic challenges (Zhang & Zaman, 2020; Khoza-Shangase et al., 2021). With the implementation of National Health Insurance (NHI) in South Africa, tele-practice has also been deemed cost-effective in obtaining universal health coverage (Khoza-Shangase et al., 2021). The goal of the implementation of NHI is to extend the coverage of healthcare services to the population, improve the quantity and quality of these services, ensure financial protection for the population, and reduce costs associated with accessing healthcare (Michel et al., 2020). Therefore, with the use of available human resources to facilitate tele-audiology services such as those previously mentioned, HHC may be more cost-effective and thereby increase access to HHC (Muñoz et al., 2020). Furthermore, the growing accessibility of broadband internet in addition to development of technology leading to rapid advancements in artificial intelligence may in turn produce improved computers/smart phones features which will assist in the provision of tele-audiology services and accelerate adoption at a more affordable cost globally (Muñoz et al, 2020; D'Onofrio & Zeng, 2022).

Tele-audiology may further be a means to provide appropriate care for the multilingual/cultural nature of populations. Providing culturally and linguistically relevant services is important to ensure patients understand their unique health situation to make an informed decision regarding available intervention (Gaeta et al., 2021). Multilingual and cultural

representation has been a concern for audiologists in both developed and developing counties (Gaeta et al., 2021). In countries such as South Africa where there are 11 official languages, linguistic and cultural representation amongst audiologists remains limited (Blackwell et al., 2021). Again, audiologists may make use of facilitators in tele-audiology programs who are familiar in the local language and culture of community to further ensure HHC services are linguistically and culturally appropriate (Coco et al., 2020).

Despite the benefits of tele-audiology to address some of the above-mentioned barriers to HHC, the onset of the global Covid-19 pandemic fast-tracked tele-health into the limelight (Chandra et al., 2022). The study will therefore describe how audiologists in the South African context have overcome the many barriers to implementation of tele-audiology by providing an overview of tele-audiology services in practice.

Tele-audiology During Covid-19 and Beyond

Infection control measures to limit the spread of the disease and ensure patient safety resulted in an increased movement towards remote models of service delivery (Muñoz et al., 2020). Some audiologists implemented tele-audiology as an alternative model of service to ensure patients continued to receive much needed services (Aggarwal et al., 2021).

COVID-19 ensured that all health professionals, audiologists included, receive support and guidance for implementation of remote services during the mandatory lockdowns (Aggarwal et al., 2021). In South Africa, tele-audiology guidelines were issued by the HPCSA, SAAA and SASLHA. The Covid-19 pandemic resulted in a shift to less traditional service delivery models in HHC, and exploration of alternative models of service delivery such as tele-audiology is necessary to ensure accessibility of services. According to Swanepoel (2023) existing models of service delivery are inadequate to address HHC and require innovative and low-cost solutions to address

the global burden of hearing loss. Telehealth providers have raised their concerns, noting that the progress of telehealth seen during the pandemic may be temporary with some providers reporting reduced uptake with easing of lockdown restrictions (Percept, 2020). A survey of 108 audiologists practicing in India revealed mixed opinions regarding the future of tele-audiology (Nihara & Seethapathy, 2022). Many participants agreed that tele-audiology would be useful beyond the Covid-19 pandemic with half of the participants indicating that in-person services would be replaced by tele-audiology in the future (Nihara & Seethapathy, 2022).

It must be noted however that there are other factors independent of the Covid-19 pandemic, contributing to the growth of tele-health. The improvement of connectivity globally as access to smartphones and internet coverage (Percept, 2020). Between 2017-2021, South Africa has had a large increase in 4G connectivity with numbers increasing from 53% in 2017 to 97.7% in 2021 (Galal, 2022). Despite increasing internet access, digital literacy of both patient and audiologist should also be considered beyond the Covid-19 pandemic with D'Onofrio and Zeng (2022) highlighting that the Covid-19 pandemic led to patients and health professionals having to rely on technology that may have been beyond their digital literacy abilities. Digital literacy in the elderly population is of particular concern and will require various techniques to assist these populations to use digital tools (Thai-Van et al., 2021). In future, audiologists should therefore formally assess a patient's digital abilities to tailor tele-audiology services according to the patient's comfort level (Thai-Van et al., 2021). Whilst the digital literacy of health professionals should also be considered, another key factor contributing to the growth of tele-health is the retirement of older health care workers who are being replaced by younger, more technologically savvy practitioners (Percept, 2020).

Although the future of tele-audiology appears promising, it is important to be aware of the risks imposed by tele-audiology such as worsening existing inequalities and the digital divide (D'Onofrio & Zeng, 2022). Populations such as those residing in rural areas, racial/ethnic minorities and low socio-economic status have mostly been negatively impacted by the digital divide (D'Onofrio & Zeng, 2022). Health professionals, including audiologists, should therefore not only consider the accessibility of digital services but whether the quality of these services are consistent (D'Onofrio & Zeng, 2022). In future, it is therefore suggested that audiologists continue to provide tele-audiology services particularly to patients with health, mobility, and transportation barriers (Coco et al., 2020). Audiologists have also been encouraged to share their experiences of implementing tele-audiology amongst each other whilst developing training programs for other staff (Coco et al., 2020). Ramkumar et al. (2023) conducted a scoping review in search of tele-audiology programs which have continued service-delivery beyond the initial research stage. The researchers found poor reporting of guidelines/frameworks used in the implementation of tele-audiology programs (Ramkumar et al., 2023). The researchers further noted that programs require appropriate research for implementation and outcome measures to identify factors which contribute to the sustainability of tele-audiology services (Ramkumar et al., 2023). Additionally, to continue tele-audiology services, support is needed from regulatory bodies such as the HPCSA, national governments, funders, technology providers, patients, and health professionals (Meyer & Nel, 2021). Ramkumar et al. (2023) noted that these support structures are vital in the sustainability of tele-audiology services deeming a lack thereof as detrimental to any program. The current study will therefore explore audiologists' perceptions of the sustainability of tele-audiology post Covid-19 and whether audiologists are aware of support available for the implementation on tele-audiology.

Audiologists' Perceptions of Tele-audiology

One barrier to the implementation of tele-audiology, covered extensively in research, is the varying perceptions amongst audiologists.

Eikelboom and Swanepoel (2016) international survey of audiologist's attitudes towards telehealth revealed that despite a more positive outlook by audiologists in the global community, the varying opinions has impacted implementation of tele-audiology. Rashid et al. (2019) also noted a divide in views of tele-audiology by audiologists in Malaysia. Parmar et al. (2021) surveyed audiologists in the public and private sector in the United Kingdom before and after the introduction of restrictions to curb the Covid-19 pandemic to determine their attitude towards tele-audiology. Their findings revealed that both private and public audiologists reported moderate levels of comfort in performing tele-audiology services (Parmar et al., 2021). The scarce utilization of tele-audiology however paints a different picture (Alexander et al., 2020). Research conducted by Singh et al. (2014) in Canada reported that audiologists positive outlook was more geared at no-touch tele-audiology services such as counselling. In the United States, Schonfeld (2016) administered a survey to 422 audiologists of whom only 31 reported using tele-audiology, further suggesting a generally scarce uptake. More recently, a study conducted on audiologists working in the public sector in South Africa, majority of participants reported not using tele-audiology but willing to use it (Bhamjee et al., 2022).

Scarcity of tele-audiology practices have been linked to audiologists' hesitancy towards changing the traditional practice procedures (Ballachandra, 2020). Whilst some audiologists believe tele-audiology will decrease the quality of relationship between patient and audiologist (Alexander et al., 2020), others have views of tele-audiology posing a threat to their business fearing that remote services will replace face-face interactions (Ballachandra, 2020).

A study conducted by Govender and Mars (2018) further attributed scarcity of uptake to a possible lack of training which affects clinical competence and confidence in administering tele-audiology service. A systematic review conducted by Ravi et al. (2018) revealed that most audiologists received tele-audiology training on the job. Audiologists today still are more likely to receive training on the job as was highlighted by participants survey responses in a more recent study (Bishop, 2021). The findings of this study revealed a need for formalized undergraduate education and professional development training for graduates regarding tele-audiology practices (Bishop, 2021). A more recent study conducted in India by Bhattarai et al. (2022) found that of their participants, only 16% received some form of training to deliver tele-audiology services. This low percentage was attributed to a lack of formal training and representation in the academic curriculum (Bhattarai et al., 2022).

Although formal training is lacking, many audiologists particularly during the Covid-19 lockdown, have implemented tele-audiology programs. This study will therefore explore the way in which audiologists are currently using tele-audiology practices to continue providing HHC despite the many challenges they are faced with.

Chapter 3: Methodology

Introduction. The following chapter details the aims and objectives of the research in addition to the research design, data collection procedures, validity and reliability measures undertaken.

Research Aims

Table 1

Aims and Objectives of the Research Study

Aims	Objectives
To describe tele-audiology services implemented by audiologists working within a clinical setting in South Africa.	• To describe various characteristics (audiology services offered via tele-audiology, populations offered these services, tools/platforms used to provide tele-audiology services, offsite assistance) of tele-audiology services implemented in clinical practice. • To identify resources accessed by audiologists to support implementation of tele-audiology services. • To describe differences/similarities of tele-audiology services between the private and public sector.
To determine the impact of the Covid-19 pandemic on South African audiologists' perceptions of the use of tele-	• To describe audiologists' perceptions of the opportunities/challenges associated with the implementation of tele-audiology services.

audiology for provision of HHC services.	• To highlight audiologists' views of tele-audiology as a sustainable means of increasing access to HHC beyond the COVID-19 pandemic.

Study Design

A descriptive cross-sectional survey research design was employed. Survey research has become an approach to research defined as the collection of information through individuals' responses to questions (Check & Schutt, 2012; Ponto, 2015). This information could include characteristics, beliefs or opinions (Anheier & Scherer, 2015). Descriptive research is most appropriate when a study aims to detail various characteristics of a phenomenon (Nassaji, 2015). Detailing a phenomenon of which little is known is an important first step to providing the necessary foundation from which more complex research may be conducted (Nassaji, 2015). Descriptive research was therefore appropriate for this study as limited research was available regarding tele-audiology practices in South Africa. A cross-sectional element to the design allowed investigation of multiple characteristics of the phenomenon from the population at a single point in time (Spector, 2019). Given the time and budget constraints for the study, conducting a cross-sectional study was suitable as it allowed the researcher to detail various aspects of tele-audiology services at once (Spector, 2019).

Participants

Sampling

The researcher sampled participants using the purposive sampling technique. Purposive sampling is a form of non-probability sampling in which participants are selected based on certain characteristics better suited to answer a research question (Etikan et al., 2016). It is inexpensive

and time-efficient (Taherdoost, 2016a) and was therefore appropriate given the time and budget constraints for this study.

Inclusion and Exclusion Criteria

The table below provides an overview of the inclusion and exclusion criteria applied to sampling of participants in this study (see Table 2).

Table 2

Inclusion and Exclusion Criteria for Recruitment of Participants

Inclusion Criteria	Exclusion Criteria
Audiologists registered with HPCSA who are: • Patient-facing and actively practicing • Providing clinical training to undergraduate students	Audiologists registered with HPCSA who: • see less than one audiology patient a week

Sample Size

According to HPCSA iregister, there were 2549 registered audiologists as of 3 January 2022. A sample size target of 242 participants was calculated using the Raosoft online sample size calculator based on this population size, 6% margin of error and 95% confidence level. An acceptable margin of error for a survey is 5-10% whilst the level of confidence is typically set at 90-95% (Suresh & Chandrashekara, 2012). This sample size was therefore considered appropriate as a similar number of responses were obtained for previous research recruiting South African audiologists for a survey (Pillay et al., 2020). A total of 59 participants completed the initial survey screener nine of whom were not eligible to participate based on the initial eligibility screener. Of

the nine ineligible participants, six were not in active clinical practice/clinical education whilst the remaining three were providing audiology services less than once a week. The remaining 50 participants who completed the entire survey were included in the data analysis. The online survey had a completion rate of 85% and response rate of 21%. The completion rate was calculated by dividing the total number of participants by the number who completed the entire survey. The response rate was calculated by dividing the target sample size by the number of participants who responded.

Recruitment

The researcher recruited participants by posting an advertisement (see Appendix 1) and survey link to online social media groups and databases for professionals in South Africa. The link directed participants to an information letter and consent form (see Appendix 2). Participants then needed to provide electronic consent before being directed to the eligibility screening (see Appendix 3). Participants proceeded to the survey questions (see Appendix 3) if they passed the screener according to pre-set parameters by the researcher. Those who did not meet the eligibility criteria were redirected to an end of survey page stating this. A low response rate was a particular challenge during the recruitment process. To mitigate this, the researcher and supervisors frequently readvertised the research survey on all platforms to encourage participation. The use of an online survey allowed for recruitment to occur beyond geographical barriers to ensure the sample was representative of audiologists in South Africa.

Validity

The initial survey was designed by the researcher and supervisors based on previous studies with similar objectives identified through the literature review. Thereafter, a panel of 5 experts were sampled to determine the content validity of the survey instrument. Content validity is the

degree to which contents measure all aspects of a construct (Zamanzadeh et al., 2015). The number of experts was considered appropriate to determine content validity according to literature (Zamanzadeh et al., 2015). The expert panel consisted of experts who were academics in audiology and patient-facing audiologists who also provided clinical training to undergraduate audiology students. These experts were known to the researcher and emailed to request permission to form part of the expert panel. Experts who accepted needed to return a signed information letter and consent form (see Appendix 4). The researcher then sent an instruction email to experts (see Appendix 5) with the survey and rating sheet which further outlined the objectives of the study (see Appendix 6). Experts were required to rate the survey questions on three aspects, which included relevance, clarity and essentialness. Experts rated on a 4 point-Likert scale for relevance, a 3 point-Likert scale for clarity/essentialness and commented suggestions for improvement (see Appendix 6)**.**

To measure content validity, the content validity index (CVI) was calculated at an item level (I-CVI) for relevance and clarity. An item with an I-CVI < 0.70 was considered irrelevant and deleted. For relevance, scale level (S-CVI) was also reported. S-CVI was reported using two methods namely universal agreement (S-CVI/UA) and average CVI (S-CVI/AVE) and should have values of ≥0.8 and ≥0.9 respectively, to indicate excellent content validity (Rodigrues et al., 2017) (see Table 3).

Table 3

I-CVI Values for Each Item Calculated Based on the Number of Experts (n=5) Giving a Rating of 3 or 4 for Relevancy

Item	Number of experts rating 3 or 4	I-CVI	Interpretation

1	5	1	Relevant
2	5	1	Relevant
3	5	1	Relevant
4	5	1	Relevant
5	5	1	Relevant
6	5	1	Relevant
7	4	0.8	Relevant
8	5	1	Relevant
9	5	1	Relevant
10	5	1	Relevant
11	5	1	Relevant
12	5	1	Relevant
13	5	1	Relevant
	S-CVI/AVE =	0.98	Excellent
	S-CVI/UA =	1.00	Excellent

Note. S-CVI/Average - Scale Content Validity Index Average, S-CVI/UA – Scale Content Validity Index Universal Agreement

An item with a I-CVI of < 0.70 for clarity was considered unclear and edited accordingly (Zamanzadeh et al., 2015). Together with supervisors, the researcher edited items 3-7 (questions 11-15) to improve the clarity thereof for the final version of the survey (see Table 4).

Table 4

I-CVI Values for Each Item Calculated Based on the Number of Experts (n=5) Giving a Rating of 3 for Clarity

Item	Number of experts rating a 3	I-CVI	Interpretation
1	5	0.8	Clear
2	5	1	Clear
3	5	0.6	Needs revision
4	5	0.6	Needs revision
5	5	0.6	Needs revision
6	5	0.6	Needs revision
7	4	0.6	Needs revision
8	5	0.8	Clear
9	5	1	Clear
10	5	1	Clear
11	5	1	Clear
12	5	1	Clear
13	5	0.8	Clear

The content validity ratio (CVR) was calculated for the essentialness of an item. An item with a CVR of ≥0.78 was considered essential. As seen in the table all CVR values were above this threshold and were therefore included in the final version of the survey (see Table 5).

Table 5

CVR Values for Each Item Calculated Based on the Number of Experts (n=5) Giving a Rating of 3 for Essentialness

Item	Number of experts rating 3	CVR	Interpretation
1	5	1	Essential
2	5	1	Essential
3	5	0.8	Essential
4	5	0.8	Essential
5	5	1	Essential
6	5	1	Essential
7	4	0.8	Essential
8	5	1	Essential
9	5	1	Essential
10	5	1	Essential
11	5	1	Essential
12	5	1	Essential
13	5	1	Essential

Based on the panelists comments, two questions were also added to the final version of the survey to further explore certain aspects of the topic.

Pilot Study

The survey was piloted after the validity was established. The main purpose of the pilot study was to identify errors in data collection and analysis. Additionally, response latency and internal reliability was also measured. The pilot study consisted of 10 participants purposively sampled via email by the researcher according to the eligibility criteria of the main study. Participants needed to return a signed information letter and consent form to participate (see Appendix 7) before receiving further instructions to complete the survey and google form online and to submit within two weeks of receipt.

Errors in Data Collection and Analysis

After completing the survey, participants completed a google rating sheet consisting of multiple-choice questions regarding any technical difficulties experienced (see Appendix 8). Most of the participants completed the survey on a laptop/desktop or mobile phone. There were no technical difficulties or difficulties related to the wording of questions reported (See Appendix 9). There were also no difficulties in the collection of data. In terms of data analysis, the form in which data was collected was checked to ensure the researcher was able to perform the necessary statistics. Furthermore, it was noted that a particular screening question “Have you been in active clinical practice/clinical education in the last 24 months?” caused confusion amongst some of the pilot study participants. This screening question was therefore rephrased together with the research supervisors to prevent confusion for eligible participants and thereby prevent reduced responses.

Response Latency

Responses from the pilot study participants were used to determine the average time needed to complete the survey. The average time needed to complete the survey was 19:31 minutes.

Reliability

Internal consistency is a form of reliability which refers to the consistency of measurement across items within a scale (Taherdoost, 2016b). Internal consistency was measured by calculating Cronbach alpha values for two subscales (Resources and Perceptions) within the survey.

Both subscales initially produced low Cronbach alpha values (0.41 and 0.57). On further analysis, it was found that alpha values could be improved with the elimination of the following items: "There are sufficient documents and guidelines available to assist audiologists in SA in the implementation of tele-audiology in practice." from the resource's subscale and "Tele-audiology services will continue to be offered post Covid-19 pandemic" from the perceptions subscale. With each item deleted, Cronbach alpha values for the resources and perceptions subscales were 0.61 and 0.65, respectively (see Appendix 10). According to Taber (2018) Cronbach alpha values between 0.6 and 0.7 are considered acceptable levels of internal consistency. The Cronbach alpha values were also considered acceptable given the small number of items per subscale (4 items per subscale) (Tavakol & Dennick, 2011). Internal consistency can be underestimated in scales with less than 10 items (Taber, 2018; Tavakol & Dennick, 2011).

Data Collection

Prior to data collection, ethical approval was obtained through the University of Cape Town Human Research Ethics Committee [HREC REF: 690/2021] (see Appendix 11).

Instrumentation

Data was collected using a descriptive survey (see Appendix 3). Surveys are valuable tools in the collection of data detailing varying traits of a population in a time-efficient manner (Ponto, 2015) and were therefore appropriate based on the aims and research design for this study. Surveys may use quantitative, qualitative or mixed strategies to collect and analyse data (Ponto, 2015).

Therefore, the survey was developed to gather quantitative data through multiple choice and agree/disagree questions and qualitative data through an open-ended question. Research by Eikelboom & Swanepoel (2016) and Saunders & Roughley (2020) guided the development of the initial survey. These studies surveyed audiologists worldwide and in the United Kingdom respectively, on their use of and attitudes towards tele-audiology in practice. As opposed to the survey items used in these studies, survey items developed for the current study provided a description of services, populations being offered tele-audiology services and tools audiologists were using to deliver these services. Questions were also developed to determine participants awareness of resources and guidelines for the development of tele-audiology programs. Additionally, an open-ended question was created to explore the impact of Covid-19 on audiologists' perceptions of tele-audiology. The 22-item survey, designed in the English language only, therefore consisted of five sections: demographics, employment information, application of tele-audiology, tele-audiology resources and perceptions of tele-audiology.

Collection Procedure

The researcher guided by supervisors designed a survey on Microsoft forms. An expert panel of 5 audiologists were contacted to assess the content validity of the survey. Thereafter, 10 participants were recruited to participate in the pilot study. Internal reliability of the survey was measured during the pilot study. The pilot study concluded once the survey was deemed reliable and valid and data collection for the main study occurred between May-September 2022. Participants were recruited by advertising the study and link to the questionnaire on social media platforms such as Whatsapp and Facebook groups which were known to have audiologists in South Africa as members. The researcher also requested that the South African Association of Audiologists distribute the survey link to all members in their database via email and permission

was granted to post the survey link on their Facebook page. Data was then analysed using appropriate statistical methods in SPSS software.

Data analysis

Quantitative Data

Quantitative data was analysed with descriptive and inferential statistics.

Descriptive Statistics. Frequency of responses for all data were visually displayed on a percentage frequency table. Measures of central tendency reported for ordinal and nominal data, was the mode (Madadizadeh et al., 2015). For continuous data the mean was reported, and measures of variability included the range and standard deviation (Kaur et al., 2018).

Inferential Statistics. Inferential statistics were applied to answer two questions:

1) Is there an association between audiologists' employment sector and whether they provide tele-audiology services?
2) Is there an association between whether an audiologist provides tele-audiology services and whether they view tele-audiology as a sustainable means of delivering HHC services?

Statistical analysis was performed using SPSS Statistics 28.0. A Chi-square test of independence and fishers exact test was performed to determine whether there was an association between the above categorical variables. Results were considered statistically significant if $p < .05$. These tests were appropriate given that both variables were categorical data (Kim, 2017).

Qualitative Data

Textual responses to question 25 were analysed in Microsoft excel using thematic analysis. The process for conducting a thematic analysis developed by Braun and Clarke (2006) was applied and is detailed in table 6 below.

Table 6

Process of Analysis at Each Stage in Thematic Analysis Framework for Question 2, Section E Textual Responses

Stage in thematic analysis	Process of analysis
Data familiarization	The researcher made notes of initial thoughts of the data to prevent researcher bias during analysis (Nowell et al., 2017). Thereafter, the researcher familiarized herself with the data to identify patterns (Braun & Clarke, 2006).
Code generation	To simplify the data, initial codes were created by highlight interesting certain phrases which could be grouped into a theme (Nowell et al., 2017).
Theme search	Codes were combined to represent a broader theme. Where a code did not match a theme, it was temporarily grouped into a miscellaneous theme (Braun & Clarke, 2006).
Theme review	The codes were reviewed to determine if the pattern was consistent (Braun & Clarke, 2006). This allowed the researcher to determine whether existing codes and themes needed to be refined (Nowell et al., 2017).
Name and define identified themes	The identified themes were defined in relation to the research question. The research supervisors reviewed the definitions to ensure the description was clear. The process of data analysis was finalized once the definition of each theme was clear (Nowell et al., 2017).

Ethical Considerations

Given that the research required human participants, ethical principles were based on the updated 2013 version of the Declaration of Helsinki published by the World Medical Association.

Ethical Clearance

This research study was approved by the Human Research Ethics Committee of the Faculty of Health Sciences at the University of Cape Town before data collection commenced (Reference no.815/18) (see Appendix 11).

Informed Consent

A participant must voluntarily provide informed consent before data dan be collected (Cosac, 2017). All participants including those participating in the pilot study and expert panel needed to read the study information letter and consent form and provide electronic consent. Participants were not timed at any point to ensure sufficient time and privacy to provide consent.

Autonomy

Autonomy in ethics relates to a participants' freedom of choice to participate in research (Cosac, 2017). To ensure autonomy, all information letters and consent forms stated that participants may choose to withdraw at any point without consequence.

Justice

To ensure justice, participants were sampled from the population that would benefit from this research (Al Tajir, 2018). Distributive justice specifically was also addressed in this research. Distributive justice refers to ensuring that no participants benefit or are exposed to more risks than others during participation (Al Tajir, 2018). To ensure distributive justice, a standard inclusion and

exclusion criteria was used for all potential participants from the population of audiologists regardless of demographics or socioeconomic status.

Confidentiality

To maintain confidentiality, participants completed the survey online in their own space and time. Participants were not required to provide any identifying information. Survey data was stored online on a password protected file. The researcher and supervisors had access to these files using their unique login credentials for online editing only (Vanclay et al., 2013). Expert panel and pilot study consent forms were stored on a separate password encrypted file to which only the researcher had login details. The data files were restricted to prevent the researcher and supervisors from being able to download, copy or print the file onto their personal devices. All emails between the researcher and all participants including the expert panel were encrypted to ensure confidentiality.

Beneficence and Non-maleficence

There were no foreseeable risks or direct benefits to participating in this research study. The research was instead beneficial in adding to the knowledge of tele-audiology practices and potentially provide insight for the development of guidelines regarding implementation of tele-audiology practices in South Africa.

Chapter 4: Results

Introduction. The following chapter presents the results obtained from the current study. Data is presented in order of the aims and objectives of the study.

Demographic Information

A total of 50 participants took part in this study, most were female (n = 42, 84%) aged from 28 to 50 years old (M = 30.5 years; SD = 6.7) with an average of 9 years of working experience (SD = 10.5). All provinces in South Africa, except for the Northen Cape, were represented in the sample with most participants being employed in the Western Cape (n = 19, 38%), working in the public sector (n = 30, 60%) and in a hospital setting (n = 24, 39%). The majority were qualified as audiologists (n = 38, 76%) with a bachelor's degree (n = 36, 72%). See Table 7 for more participant demographic details.

Table 7

Demographic information of participants (n = 50)

Characteristic	N	%
Sex		
Female	42	84
Male	8	16
Province of workplace		
Western Cape	19	38
Gauteng	11	22
Kwa-Zulu Natal	7	14

Limpopo	5	10
Eastern Cape	4	8
North West	2	4
Mpumalanga	1	2
Free State	1	2
Northern Cape	0	0
Primary qualification		
Audiologists	38	76
Speech Therapist and Audiologist	12	24
Highest level of qualification		
Bachelors	36	72
Masters	11	22
PhD	2	4
Other	1	2
Employment sector		
Public	30	60
Private	20	40
Employment setting		
Hospital	24	39
Private practice	23	38
Academia	7	11
School-based	4	7
Clinic	2	3

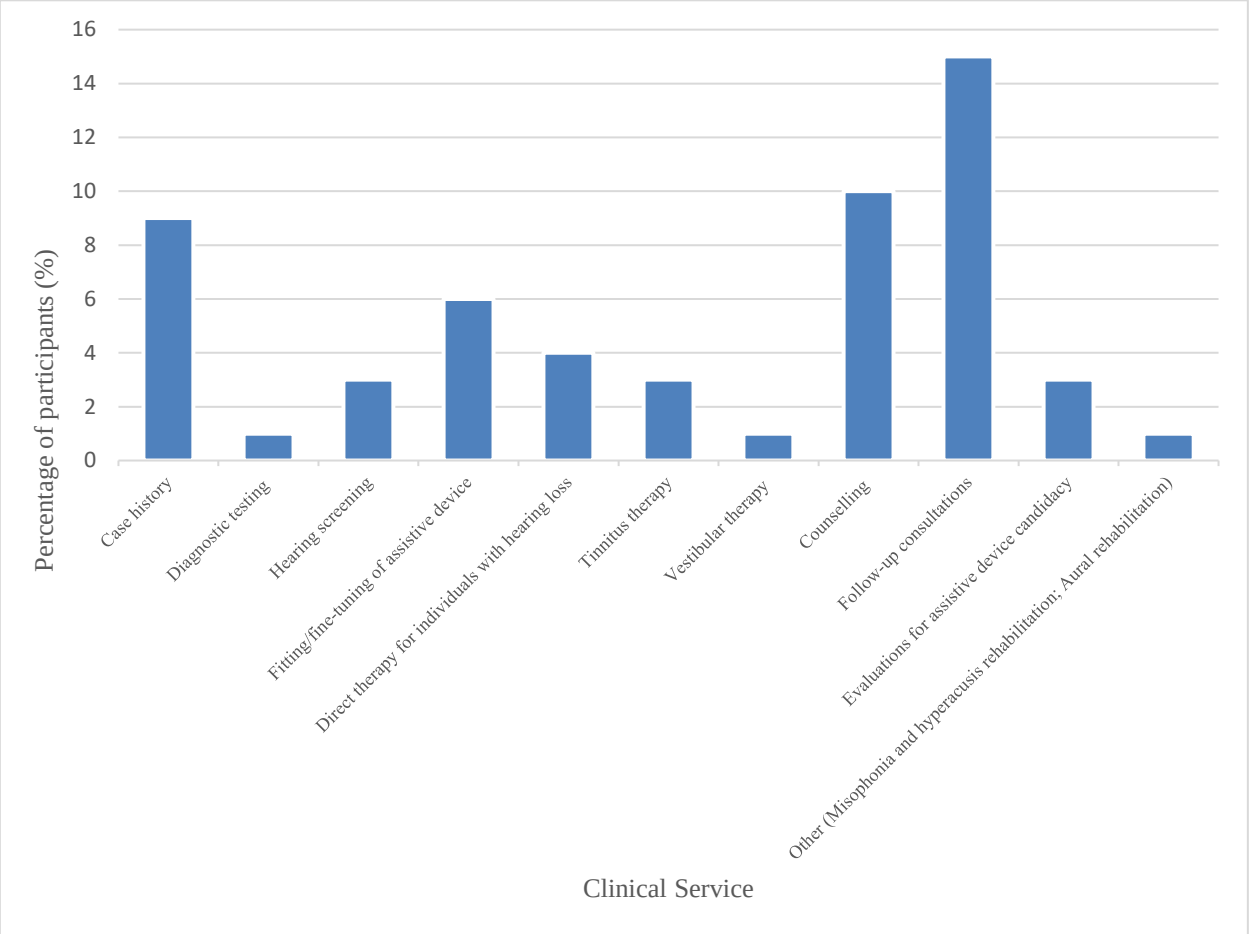
Other (hospital)	1	2

Application of Tele-audiology

Of the 50 participants, 19 (38%) indicated that they provided tele-audiology services in clinical practice. Tele-audiology services provided by these participants in clinical practice are presented in Figure 1.

Figure 1

Percentage of Participants Offering Each of the Clinical Services Through Tele-audiology

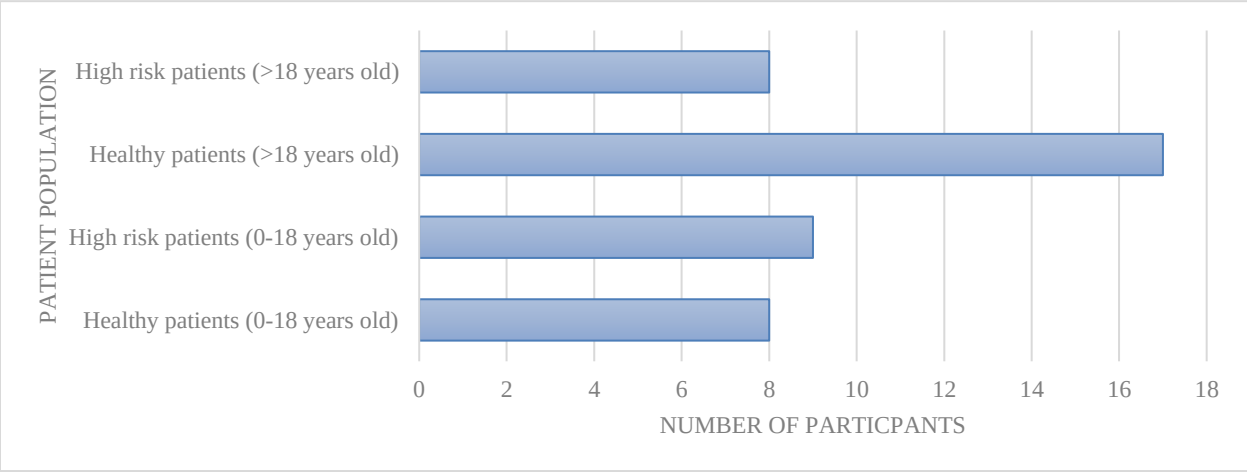


Participants indicated that healthy patients over 18 years old were the most common group to whom tele-audiology services were provided (n = 17, 40%) whereas high risk patients over 18

years old and healthy patients between 0-18 years old accounted for the smallest proportion (see Figure 2).[1]

Figure 2

Number of Participants Providing Tele-audiology to Each Patient Population



Participants selected multiple tools and platforms that were used to provide tele-audiology services and most reported that their patients did not require off-site assistance (see Table 8).

Table 8

Characteristics of Tele-audiology Services Offered in Clinical Practice

Characteristic	N	%
Tools used to provide tele-audiology services		
Mobile phone	15	32
Computer/laptop	13	28

[1] Healthy referred to the patient being in good physical health while high-risk patients were defined as individuals with co-morbidities and/or active infections etc.

Telephone	8	17
Screening equipment	4	9
Assistive device equipment	3	6
Tablet	2	4
Diagnostic equipment	2	4
Other	0	0
Platforms used to provide tele-audiology services		
Phone calls	14	28
Social media (Facebook/Instagram/WhatsApp)	10	20
Emails	9	18
Online meeting platforms	9	18
SMS	7	14
Other (Hearing aid software)	1	2
Off-site assistance[2] for patient during tele-audiology sessions		
My patients do not require offsite assistance	14	50
Family member/friend/caregiver	9	32
Teacher	2	7
A second audiologist on-site with the patient	1	3.5
Other health professional	1	3.5
Community worker/Community rehabilitation worker	1	3.5

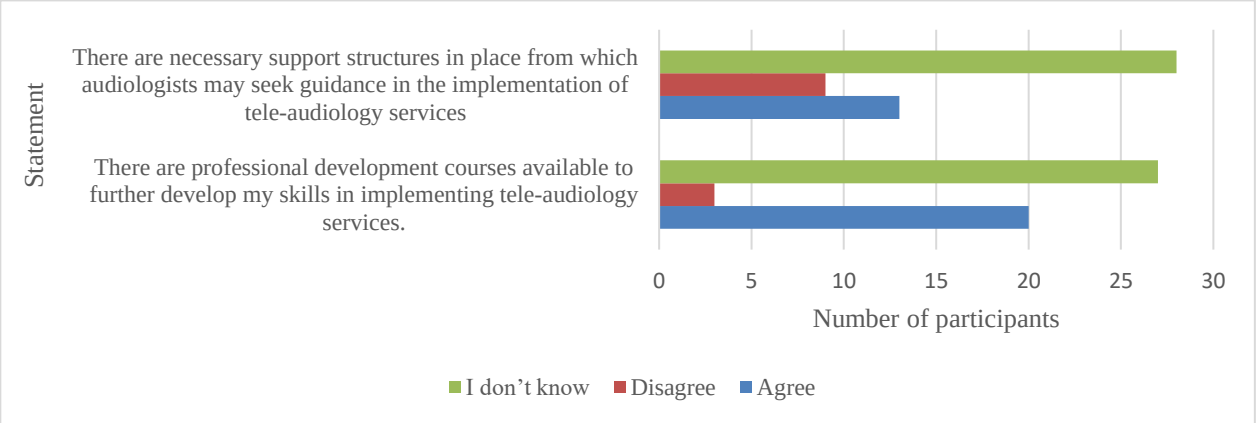
[2] Off-site assistance refers to assistance provided by an individual, other than the primary audiologist rendering the service, to a patient receiving tele-audiology services from a remote location.

Tele-audiology Resources

Most participants indicated that they were aware of available guidelines to assist with the implementation of tele-audiology in practice (n = 31, 32%). However, majority of participants indicated they were unaware of professional development courses for skills development (n = 28, 56%) and support structures (n= 27, 54%) to assist in the implementation of tele-audiology services (see Figure 3).

Figure 3

Number of Participants who Responded Agree/Disagree/I Don't Know to Statements Regarding Tele-audiology Resources

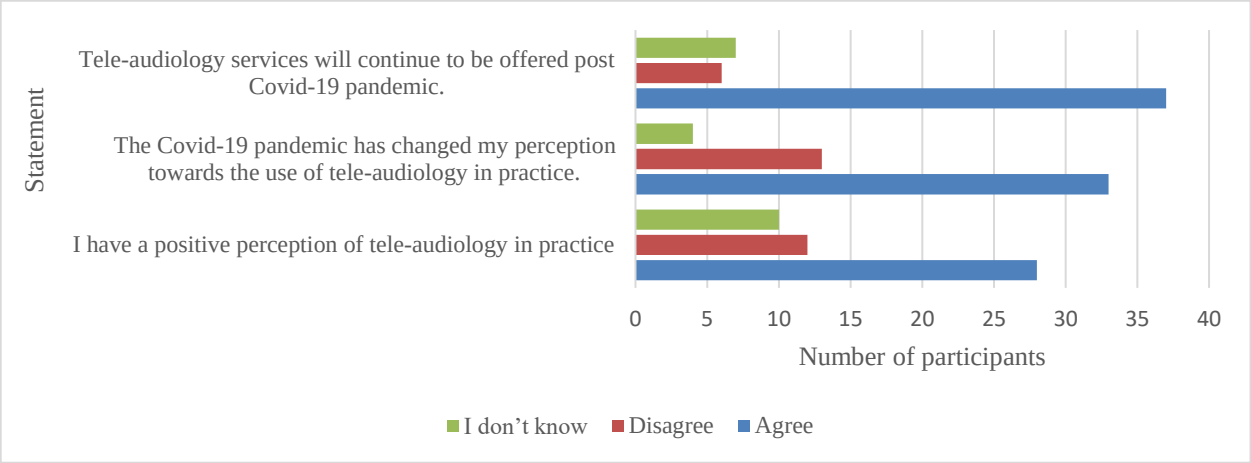


Perceptions of tele-audiology

Most of the participants (n = 37, 74%) believed tele-audiology services would be offered post Covid-19, that their perception (n = 33, 66%) of tele-audiology has changed during the pandemic with more than half indicating they have a positive perception of tele-audiology (n = 28, 56%) (see Figure 4).

Figure 4

Number of Participants who Responded Agree/Disagree/I Don't Know Regarding Their Perceptions of Tele-audiology



Association Between Audiologists' Employment Sector, Views on Tele-audiology and Provision of Tele-audiology Services

The Chi-square test of independence revealed that there was no significant association between participant's employment sector and whether they provided tele-audiology services, χ^2 (1, N= 50) = 0.69, p = .40. The Fisher's exact test also revealed no significant association between participants' provision of and views on the sustainability of tele-audiology services (two tailed p = .45).

Role of Tele-audiology in Clinical Practice

Themes were identified to describe audiologists' perceptions of 1) the opportunities/challenges in the implementation of tele-audiology services and 2) tele-audiology as a sustainable means of increasing access to HHC beyond the COVID-19 pandemic. Table 9 shows themes identified.

Table 9

Participants Thoughts on the Use and Role of Tele-audiology in Clinical Practice

Emerging code	Theme
Overcoming barriers to access Providing care for infectious diseases Allows audiologists to work remotely Aural rehabilitation	Improved access to HHC
Supplements in-person care Allows for efficient clinical practice Not applicable to all patient cases	Augmentative service delivery model
Tele-audiology will become the new standard of practice Tele-audiology is temporary Not useful in clinical practice Unknown role in clinical practice	Sustainability of tele-audiology in clinical practice
Complex nature of implementation Diagnostic accuracy of tele-audiology Lack of research on implementation of tele-audiology	Factors limiting use of tele-audiology in clinical practice
Availability of resources Digital literacy of population Knowledge of tele-audiology services	Considerations for successful implementation of tele-audiology in clinical practice

Theme 1: Improved Access to HHC

This theme related to the various ways participants described tele-audiology had enabled improved access to clinical services. Tele-audiology enabled participants the opportunity to provide services to patients despite various barriers such as physical and geographical barriers which were most cited by participants. Participant 2 mentioned how the use of tele-audiology improved affordability of their clinical services stating, “It improved access and sometimes reduced costs, to hearing healthcare for my patients”. Participants also mentioned the valuable use of tele-audiology in rehabilitation, follow-up consultations and problem-solving of amplification suggesting a possible reduction in costs related to follow-up care as stated by participant 15 “It is most valuable in rehabilitation and counselling as well as for problem solving with amplification” and participant 9 “mostly use it for follow up consults with audiology patients via zoom or whatsapp video calls”

Participants recognized convenience of accessing services particularly for working class South Africans as highlighted by participant 34 who stated that “tele-audiology is useful for working individuals that cannot make time to visit the practice and would thus be beneficial and convenient for them”. Participant 49 elaborated on the positive relationship between convenience and attendance rate highlighting that being able to connect remotely with patients had a “direct correlation to patient attendance” particularly in follow-up care. Some participants also highlighted the benefit of tele-audiology to continue service delivery where events such as pandemics physically restrict access to audiological care as stated by participant 11 that “if used correctly, it has the potential to reach many people and that was evident during the early stages of the pandemic”. Participants mentioned that patients may still access care remotely when relocating as expressed by participant 44 “It’s a great idea for private practices where patients relocate to

different provinces or countries". This suggested that patients may be able to continue audiological care with their existing audiologist when relocating.

As with Covid-19 and measures to curb the spread of disease, participant 5 stated "I believe that tele-audiology could assist during the assessment and management of patients with TB and other infectious diseases". This suggested the potential of tele-audiology to improve infection control measures in clinical practice and in cases where an ill patient is unable to attend in person appointments.

In addition to physical, financial, and geographical barriers to accessing care, participants were also aware of the impact tele-audiology would have on the lack of human resources as stated by participant 10, "Tele-audiology can be a good way to overcome some of the barriers faced in our country including the scarcity of audiologists in different parts of the country".

Theme 2: Augmentative Service Delivery Model

This theme described participants views of tele-audiology as a service delivery model used to augment face-face clinical services.

Participants described that tele-audiology was used to support in-person clinical practice to allow for efficient service provision as stated by participant 1, "I think COVID_19 has accelerated the perception of the value technology can have on augmenting our service provision as a profession and I too now value using technology to work smarter and not harder".

Some participants mentioned that carefully selecting specific services would impact on the success of tele-audiology services. Participant 49 specifically mentioned using tele-audiology to be efficient in clinical practice and commented, "using tele-audiology as a platform to obtain case history can shorten in-person appointment times and waitlists". Some participants expressed a

resistance to tele-audiology and in-person services were perceived as the standard for service delivery as commented by participant 17, “It is a plaster for the interim before they can get to you”. In addition to a possible preference for in-person clinical practice, some participants highlighted that their patients also preferred in-person interactions with participant 47 stating, “But I experience patients most appreciative of face-to-face interaction possible due to the real connections we make vs artificial”. It appeared that participants were willing to use a hybrid approach to service delivery in clinical practice as opposed to a standalone service as stated by participant 36 “It is complementary to existing relationship with patient and shouldn’t be done in isolation”.

Participants highlighted that tele-audiology was not suitable for all patients and noted the importance of offering tele-audiology on a case-by-case basis with participant 11 stating, “In my opinion, Tele-audiology must not be regarded as a gold standard in service delivery as this model is contextual base and not applicable in every setting or patient case, hence, it must be used to augment services where applicable”.

Theme 3: Sustainability of Tele-audiology in Clinical Practice

The theme described participants various opinions in relation to the future of tele-audiology in clinical practice.

Some participants acknowledged the impact of global movements on the future of clinical practice being in a technologically oriented profession. Participant 12 commented “with the approaching 4IR and being a tech driven profession it’s important that we become accustomed and make use of tele-audiology”. For other participants, Covid-19 created an opportunity to implement tele-audiology to overcome the barriers faced by the measures used to curb the spread of the disease. As a result, some participants viewed tele-audiology as having a temporary role in clinical

practice as highlighted by participant 47 who stated, “I think people including audiologists are trend followers”. Some participants believed that tele-audiology had no role in clinical practice whilst others grappled uncertainty of the role of tele-audiology in clinical practice as stated by participant 10, “I am also not sure what the role of tele-audiology is in the bigger scheme of things”.

For one participant, tele-audiology provided the opportunity to consider alternative models of employment such as working from home:

[Participant 43]: “I’m willing to work from home as long as the electricity is on, and the broadband is less expensive and accessible to both patient and clinician”.

Theme 4: Factors limiting use of tele-audiology in clinical practice

Participants highlighted multiple factors which limited the role of tele-audiology in practice. Participant 30 specifically mentioned the complex nature of tele-audiology programs had in limiting the use of tele-audiology stating, “I do believe the value of tele-practice is being lost because of the myth that it is difficulty to implement (costly, difficulty to run etc.)”. With the complex nature tele-audiology programs, participants also suggested the need for multiple stakeholders to become involved to ensure successful implementation of tele-audiology services as expressed by participant 19 “a lot of parties need to come into play in order for it to be a success”.

Participants commented on the lack of research on implementation of tele-audiology in clinical practice with participant 46 who stating, “I am currently researching the area but haven’t come across audiology specific information. I would like some guidance in this area”. Participant 20 further suggested a lack of trust in the diagnostic accuracy of tele-audiology services

particularly diagnostic hearing assessments stating, “I would never trust a hearing test done remotely”.

Theme 5: Considerations for Providing Tele-audiology Services in Clinical Practice

The theme describes various considerations for implementing tele-audiology services that were highlighted by participants. Participant 11 stated, “To deliver effective Tele-audiology services, one must consider availability of resource from the audiology clinic and the end user such as mobile phones, computers etc.” For some participants, barriers faced in the provision of in-person care made branching into tele-audiology not attainable with participant 32 stating, “we are barely coping with face-to-face audiology so branching into Teleaudiology is near impossible. Especially because the computers and telephones we use are so old. Perhaps we need to upgrade our computers first, perhaps after that we can have effective Teleaudiology”.

Participants acknowledged resource constraints faced by patients which included lack of access to technology and network coverage. Some participants were also cognisant of the realities faced by patients in South Africa where the lack of basic needs outweigh the need for resources to implement tele-audiology.

[Participant 10]: “if we consider our context many people do not have access to basic human needs such as clean running water and so internet access and the infrastructure for tele-audiology is highly unlikely”.

Participants highlighted digital literacy as another consideration for the implementation of tele-audiology in clinical practice especially amongst rural communities and elderly populations. However, participants did not provide explicit comments on how they obtained this information of digital literacy in their patient population.

[Participant 11]: “In a rural context, Tele-audiology is rarely used as most rural communities are saturated with a population that is minimally or not digital literate”.

[Participant 31]: “We work predominantly with an elderly population who struggle with technology. Therefore, with the use of tele-audiology a lot of misunderstandings slip in”.

Participants noted that education of both the clinician and patient should be considered to increase the use of tele-audiology with participant 50 stating, “Support in terms of training and resources (for patients and clinicians) could increase uptake”.

Chapter 5: Discussion

Introduction. This chapter will provide a discussion of the research findings, the implications thereof and directions for future research.

The purpose of this research study was to describe tele-audiology services implemented by audiologists working within clinical practice in South Africa and to investigate the impact of the Covid-19 pandemic on audiologist's perceptions on the use of tele-audiology in practice.

Tele-audiology Implemented in South African Clinical Practice

In this study, 1 in 3 audiologists (38%) implemented tele-audiology in their clinical practice. Eikelboom and Swanepoel (2016) noted that audiologists service a high caseload without the capacity to provide additional services such as tele-audiology. Yet this finding suggested that audiologists are attempting to extend the reach of HHC services.

More than half of the participants in this study indicating use of tele-audiology were employed in the public sector. A recent study by Bhamjee et al. (2022) which explored audiologists' perceptions of tele-audiology in the public sector reported approximately 19.6% of their participants were implementing tele-audiology services in the public sector in South Africa. Although the proportion of audiologists were higher in the present study, the differences may be due to their initial phase of data collection occurring during lockdown level 1, sample size, eligibility criteria for the study and differing definitions of tele-audiology. Despite these differences, this is an important finding as socioeconomic conditions such as lack of basic needs and high unemployment levels have continued to create inequality in the South African healthcare system (de Villiers, 2021). Financial costs remain a major challenge for those seeking audiological care (D'Onofrio & Zeng, 2022). These include the high cost of hearing technology, transport costs

and needing to take leave days to access health facilities for continued care (D'Onofrio & Zeng, 2022). As a result, more than 84% of South Africans access healthcare in the state funded public sector as opposed to the private sector (de Villiers, 2021). For the audiologist, the cost of equipment and maintenance thereof also impacts on the ability to provide all services (D'Onofrio & Zeng, 2022). Resource inequality has often raised the question of feasibility for tele-audiology implementation in the public sector (Bhamjee et al., 2022). Yet the finding of more participants providing tele-audiology being employed in the public sector may imply that audiologists can navigate these challenges to successfully implement tele-audiology services. With an overburdened public health system audiologists may ensure more efficient service delivery in the public sector and thereby increase provision of more comprehensive HHC (de Villiers, 2021). It is also important to consider that most of the participants employed in the public sector lived in the Western Cape where 89% of the population reside in urban areas (Statistics South Africa, 2022). There continues to be a gap in addressing inequalities in urban versus rural areas in South Africa (Masenya, 2021). However, tele-audiology has the potential to overcome geographical challenges to increase the provision of HHC to approximately 64.7% of the South African population who reside in rural areas (Mahlathi & Dlamini, 2015). Increasing the provision of HHC through tele-audiology will ensure early identification and treatment of ear-related conditions and reduce the impact of disabling hearing loss at both an individual and societal level (Muñoz et al., 2020).

Tele-audiology Services Offered in Clinical Practice

In this study, most tele-audiology services offered in clinical practice were non-technical services which were conversational in nature including case history, counselling, and follow-up consultations. In contrast, technical clinical services offered via tele-audiology were few. Perhaps

participants do not consider non-technical services to be as important as technical services. Hull (2018) noted that more audiologists prefer diagnostic services as opposed to services which are conversational in nature and attributed this to audiologists fearing the personal nature of providing aural rehabilitation. This is despite research showing similar reliability for in-person and technical procedures such as hearing screening and diagnostic testing (Dhamar et al., 2015; Ramkumar et al., 2019).

The research also found that audiologists were mainly providing tele-audiology services to young healthy and high-risk adults over 18 years of age. Individuals particularly in this age group are immersed in a digital world daily prior to the Covid-19 pandemic (Bacalja et al., 2022). Participants also noted that elderly patients would have difficulty with tele-audiology services due to a lack of digital proficiency. However, in a study conducted by Ratanjee-Vanmali et al. (2020) using a mobile and computer digital proficiency questionnaire to screen patients prior to appointments, it was revealed that digital proficiency did not limit the uptake of tele-audiology services by patients. As opposed to the current study findings, Bacalja et al. (2022) have suggested that digital proficiency may not necessarily be age dependent but experience dependent. Audiologists would therefore need to establish their patient's digital proficiency to determine whether tele-audiology services would be appropriate (Ratanjee-Vanmali et al., 2020). Doing so may further ensure patient-centred care (Ratanjee-Vanmali et al., 2020).

Audiologists in this study further noted that most of their patients did not require off-site assistance during a tele-audiology consult. This may be since the population receiving tele-audiology services were mostly young healthy individuals. Another reason may be due to most services offered being conversational in nature. Previous research has highlighted the importance of an off-site assistant for technical tele-audiology services such as diagnostic testing to direct the

patient (Khoza-Shangase, 2022; Coco et al., 2020). The use of an off-site assistant may be of benefit in non-technical services as well. An off-site assistant may be able to gather information from patients for case history purposes, counselling, and follow-up care. Doing so, may act as a means of triaging patients that require an online versus in-person consultation with an audiologist (Khoza-Shangase, 2022). Ratanjee-Vanmali et al. (2020) found with patients who had poor digital proficiency, their screening identified support who could assist and thereby allow for tele-audiology services.

Tools and Platforms Used in the Provision of HHC

Most audiologists in this study reported using a mobile phone (n = 15, 32%) and computer (n = 13, 28%) to provide tele-audiology services. Audiologists mainly provided these services via a phone call (n = 14, 28%) or on social media platforms (n = 10, 20%). This may be due to improved access to smartphones and internet coverage globally but also in South Africa (Percept, 2020; Statistics South Africa, 2022). Although the smartphone can facilitate most of the non-technical tele-audiology services audiologists in this study provided, it is also promising for conducting technical services.

Nkuliza et al. (2022) recently conducted a systematic review of smartphone applications for diagnosis and management of vertigo and found numerous applications. Paglialonga et al. (2015) found that there are 203 smartphone apps for hearing screening, intervention, rehabilitation, education, and assistive tools. allowed for early identification and intervention of confirmed hearing loss (Ramkumar et al., 2019). Ratnanather et al. (2021) developed a self-directed mobile application, Speech Banana, taking users through various auditory exercises to improve speech comprehension. The authors concluded that auditory training apps were useful for supplementing in-person care (Ratnanather et al., 2021). Hearing aid smartphone applications have also enabled

remote hearing aid fine tuning for patients with compatible devices (Çelikgün & Büyükkal, 2023). Depending on the hearing aid brand, these adjustments can be made in real-time or asynchronously by the audiologist (Çelikgün & Büyükkal, 2023). A study conducted by Malmberg and Hagberg (2024) found remote fine-tuning of hearing aids in first time hearing aid users to be as effective as in-person adjustments. Self-directed screening applications have also been found to increase the likelihood of individuals booking a comprehensive audiological assessment (Amlani, 2015).

Smartphone technology may allow individuals to take initiative and engage in the management of their health (Fan & Zhao, 2022). Additionally, the use of smartphone technology can be a cost-effective and time-efficient means of disease prevention, early diagnosis, and effective long-term monitoring of chronic conditions such as hearing loss, tinnitus, and vertigo in resource constraint areas (Majumder & Deen, 2019). According to Galal (2022), approximately 47 million South Africans which accounts for more than 80% of the population, access the internet through a mobile device. There is therefore an existing and increasing opportunity to provide remote HHC through smartphone applications to a large proportion of the population in South Africa (Timmer et al., 2021).

The Sustainability of Tele-audiology Services

The present study found that 74% (n = 37) of participants indicated they would continue to offer tele-audiology services post Covid-19. The current study found no significant association between whether participants provided tele-audiology and their views of sustainability. This is an important finding as it may suggest that audiologist's practices are not necessarily driven by preference but what may be best suited for the patient population they are serving.

Participants in this study highlighted tele-audiology as an augmentative approach to service delivery. This finding may suggest that participants prefer in-person services and a perception of

in-person services being gold standard. A study by Ballachandra (2020) noted that audiologists were hesitant to move away from in-person services and attributed the scarcity of tele-audiology services to this. Research by Alexander et al. (2020) expressed audiologists concerns that tele-audiology would reduce the quality of patient relationships whilst Ballachandra (2020) noted that self-employed audiologists perceived tele-audiology as a threat to business profits should face-to-face services be replaced entirely. Considering these findings, a hybrid approach may be a more feasible approach to increase the uptake and sustainability of tele-audiology (Nielsen & Campos, 2022). In a recent South African study conducted in the public health sector, implementation of a hybrid approach in the provision of audiological rehabilitation services required minimal time and costs whilst producing improved outcomes in hearing aid benefit and listening skills for participants (Khatib & Hlayisi, 2022). Additionally, a study conducted in South Africa found that 88.7% of patients reported high levels of satisfaction with a hybrid approach (Ratanjee-Vanmali et al., 2020). Using a hybrid approach further allows audiologists to encourage patients to manage their daily hearing needs independently (Nielsen & Campos, 2022). Tele-audiology can therefore be a means of delivering patient-centred care by achieving patient independence and behaviour change (Brice & Almond, 2022).

Support for the Implementation of Tele-audiology

In the current study, most participants indicated that they were unaware of support structures, professional development courses and guidelines available to expand their knowledge and aid implementation of tele-audiology practices. This is consistent with the findings of Ramkumar et al. (2023) who, as previously mentioned, found poor reporting of guidelines/frameworks used in the implementation of tele-audiology programs. Participants also highlighted a lack of training in tele-audiology as a challenge for implementation. Similar findings

were reported by Govender and Mars (2018) who attributed the scarcity of uptake to a lack of training and reduced clinical competence as a result. Bishop (2021) noted that audiologists are most likely to receive training in tele-audiology from clinical work. There is therefore an opportunity for universities to refine their teaching curriculum to include formal training in tele-audiology at an undergraduate level (Bhattarai et al., 2022). As previously mentioned, 20% of participants in this study used social media platforms to provide tele-audiology services. This is not in line with the current HPCSA guidelines for telehealth which advise against the use of these platforms (Blackwell et al., 2021). The finding therefore suggested that health professional bodies are not cognisant of the environment in which audiologists are practicing. To protect patient confidentiality and privacy, audiologists need to ensure tele-audiology services comply with POPIA (Rabe, 2022). Audiologists are responsible for ensuring platforms and tools used for tele-audiology services are password protected with regular updates for antivirus software (Rabe, 2022). Audiologists may also refer to the Allied Health Professions Council of South Africa guideline on applicable software which may be used (Allied Health Professions Council of South Africa, 2020). Additionally, the HPCSA notes that practitioners such as audiologists should ensure tele-audiology services have a protocol of minimum requirements for processing of patient information which are compliant with POPIA (HPCSA, 2021a).

Considering that most participants indicated tele-audiology services would continue post Covid-19, support through training and revision of legislation and guidelines will be invaluable for audiologists who will navigate patient care in an evolving technological landscape (Haleem et al., 2021).

Research Implications and Recommendations for Future Research

Increasing research output which shows the impact of tele-audiology in clinical practice will be a driving force for implementation and revision of regulations and guidelines for tele-audiology with the goal to increase access to HHC. The current study highlighted the need to develop standard measures to investigate tele-audiology practices. Being a broad term, tele-audiology requires a standard definition in the literature to ensure thorough exploration of the topic. Additionally, the research highlighted the need for engagement amongst various stakeholders to collaborate in the planning and implementation of tele-audiology practices in key areas summarized by Coco and Marrone (2020) which include: laws, regulations, payment, type of services, equipment, software, environmental factors, patient safety and privacy. Future research may use this framework suggested by Coco and Marrone (2020) to explore existing tele-audiology clinics or to plan and pilot a clinic in a LMIC which provides HHC solely through a tele-audiology service delivery model. Furthermore, it is also important to consider the reshaping of traditional work environments as remote working evolves across many industries including healthcare (Gavarand, 2022). Tele-audiology may be a means for audiologists to explore the flexibility remote work can offer and the topic should be explored in future research studies as this may further impact on the sustainability of tele-audiology.

Challenges and Limitations

The departmental ethical review process presented as a challenge in this study as the process delayed data collection and the timeline for the research project. Another limitation of the study was the small sample size. The Covid-19 pandemic sparked an increased interest on the topic of tele-audiology. Additionally, due to physical distancing many researchers turned to online data collection methods such as surveys (de Koning et al., 2021). As a result, targeted populations may

have experienced survey fatigue. Many fields of research have experienced survey fatigue which have resulted in reduced responses. de Koning et al. (2021) mentioned that this particularly happens when participants are part of a small population and as a result are over-researched. This is an important consideration for future research to consider and venture into other target populations to focus audiological studies on.

Conclusion

The current research study highlighted that there are audiologists implementing tele-audiology services in clinical practice. Although the implementation of tele-audiology differed across settings, the research findings indicated that tele-audiology in LMIC's such as South Africa is feasible despite resource challenges and is reflective of the evolving technological landscape globally. There is therefore a need to create equal acceptance of alternative service delivery models such as tele-audiology in clinical practice. Engagement with various stakeholders is needed in the planning and implementation of tele-audiology services. Refined guidelines and regulations for tele-audiology will positively impact on the sustainability of tele-audiology in clinical practice into the future.

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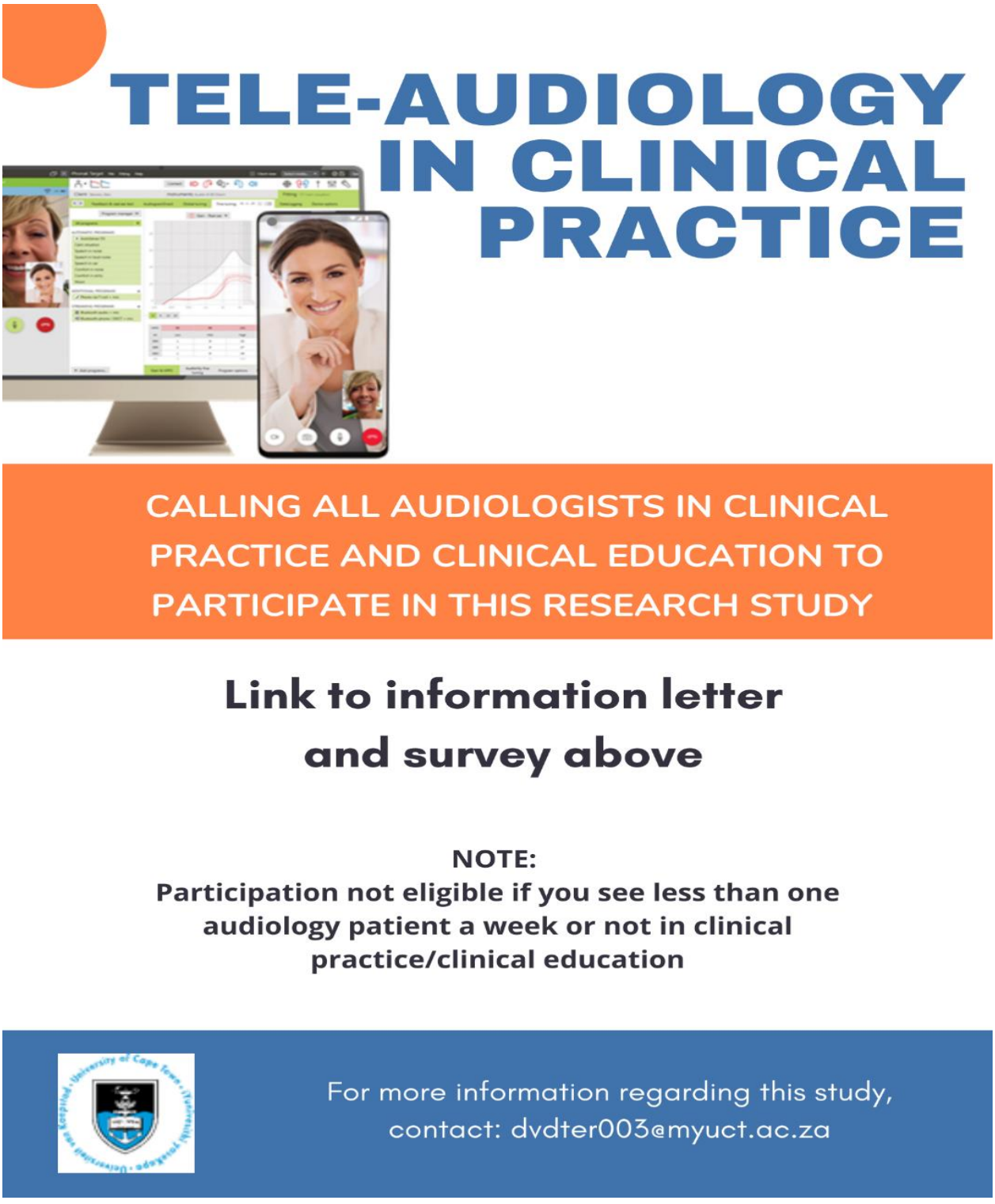
Appendices

Appendix 1

Recruitment Advertisement



Appendix 2

Information Letter and Consent Form for Main Study

Please read the information letter and consent form below

My name is Tersia Davids, I am a postgraduate student at the University of Cape Town currently completing my Master of Science in Audiology. In completion of this degree, I am required to conduct a research study.

I am inviting you to participate in this study by completing an online survey should you meet the eligibility criteria. Your participation in this study is voluntary and may choose to withdraw participation at any point without penalty.

The online survey will take approximately 19:31 minutes of your time to complete and will be open for two months between May-July. You may complete the survey at your own time and in the privacy of your own space. Your responses will be recorded once you submit your completed form. Questions will include: multiple-choice, agree/disagree questions on demographics, employment, and application of tele-audiology in practice and will also include an open-ended question regarding your opinion of tele-audiology. Submission of your survey will mark the end of your participation in the study. You will be prompted to provide electronic consent before being able to proceed to the screening questions. If you pass the screener, you will be directed to complete the survey. If you do not pass the screener, you will be automatically directed to a page stating this.

Confidentiality and Privacy Measures
Your anonymized results will be stored on a password-protected UCT Cloud file to which only myself and my supervisors will have access through each of our unique institutional login details. The data file settings will prevent us from downloading, copying, or printing the data file onto any personal device.

Risks/benefits
There are no risks or direct benefits associated with participating in this study.

Storage of Data
Your data will be stored on an online password-protected file for the duration of the research study. On graduation, I will transfer your de-identified survey data to the institutional depository, ZivaHub, where it will be stored for 15 years. The thesis write-up will be available for your viewing online on OpenUCT at the end of the study.

Contact information
Should you have any questions at any point regarding this research study, please contact Tersia Davids (dvdter003@myuct.ac.za (mailto:dvdter003@myuct.ac.za); Contact number: 060 857 8767), Vera-Genevey Hlayisi (vera.hlayisi@uct.ac.za (mailto:vera.hlayisi@uct.ac.za); Contact number: 021 650 5540) or Lucretia Petersen (lucretia.petersen@uct.ac.za (mailto:lucretia.petersen@uct.ac.za); Contact number: 021 406 6993).
You may also contact the UCT Faculty of Health Sciences Human Research Ethics Committee at the following number, 021 406 6338, or the UCT Faculty of Health Sciences Human Research Ethics Committee Chairperson Prof Marc Blockman (hrec-enquiries@uct.ac.za (mailto:hrec-enquiries@uct.ac.za)).

Information letter and Consent Form

Electronic Consent Form

- I have read the attached information letter stating important information regarding this study.
- I understand that the data collected from my participation will be used for research purposes only.
- I understand and accept all measures put in place by the researcher to protect my confidentiality at all times.
- I have been advised that there are no direct benefits/risks to participating in this study.
- I understand that my participation is completely voluntary and am free to withdraw from the study at any point without penalty.
- I may at any point contact the researcher or supervisors on the contact details above should I have any questions or complaints about this research study. I may contact the UCT Faculty of Health Sciences Human Research Ethics Committee or Chairperson on the above contact details if I have any questions relating to my rights and welfare participating in this research.

1

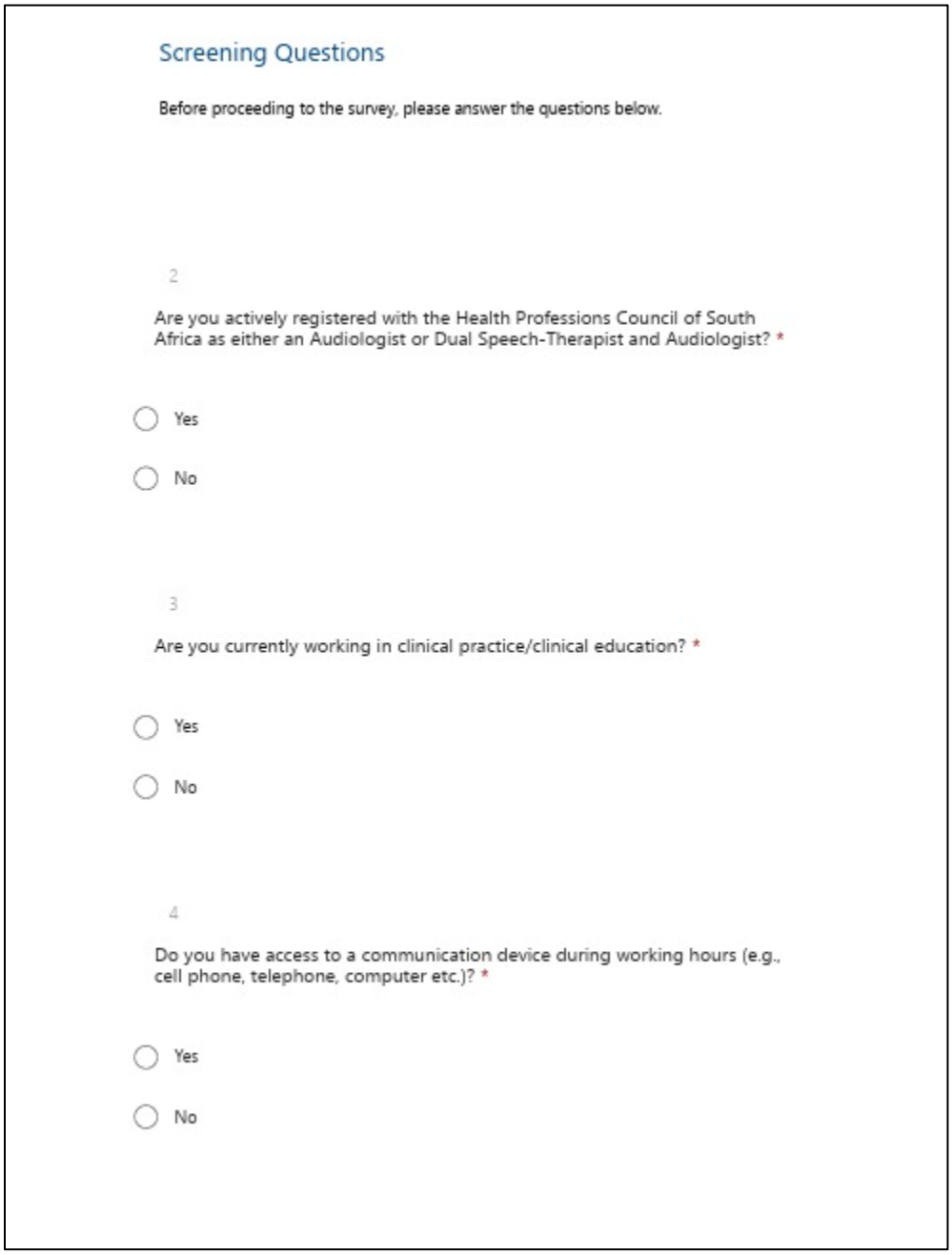
Please tick the appropriate box below. By clicking "agree" I have read the above and provide my consent to participate in this research.
*

◯ Agree

◯ Disagree

Appendix 3

Revised Survey



Screening Questions

Before proceeding to the survey, please answer the questions below.

2

Are you actively registered with the Health Professions Council of South Africa as either an Audiologist or Dual Speech-Therapist and Audiologist? *

- Yes
- No

3

Are you currently working in clinical practice/clinical education? *

- Yes
- No

4

Do you have access to a communication device during working hours (e.g., cell phone, telephone, computer etc.)? *

- Yes
- No

5

On average, how many times a week do you provide audiology services? *

- ◯ At least once a week
- ◯ Less than once a week
- ◯ Most days of the week

Demographic Information

6

Which sex do you identify as? *

- ◯ Female
- ◯ Male
- ◯ Prefer not to say
- ◯ Other

7

What is your age? *

8

In which province do you currently work? *

- ◯ Eastern Cape
- ◯ Northern Cape
- ◯ Western Cape
- ◯ KwaZulu-Natal
- ◯ North West
- ◯ Gauteng
- ◯ Mpumalanga
- ◯ Limpopo
- ◯ Free State

9

What is your primary qualification? *

- ◯ Audiologist
- ◯ Dually registered speech therapist and audiologist

10

In which year did you complete your undergraduate studies? *

The value must be a number

11

What is your highest qualification level? *

- ○ Bachelors
- ○ Masters
- ○ PhD
- ○ [ ]
  Other

12

How many years of experience do you have in clinical practice in audiology? *

[ ]

The value must be a number

Employment Information

13

In which sector do you work in most of the time? *

- ○ Private sector
- ○ Public sector

14

In which setting are you employed? *

- ☐ Academia
- ☐ Hospital
- ☐ Clinic
- ☐ Industrial
- ☐ Private practice
- ☐ School-based
- ☐ Other

Application of tele-audiology

In this section, Tele-audiology services are defined as any part of the patient consultation, assessment and management provided without face-face interaction.

15

Do you provide any tele-audiology services in clinical practice? *

- ◯ Yes
- ◯ No

16

Which of the following tele-audiology services do you provide? (Tick all that apply) *

- ☐ Case history
- ☐ Diagnostic testing
- ☐ Hearing screening
- ☐ Fitting/fine tuning of assistive device
- ☐ Direct therapy for individuals with hearing loss
- ☐ Tinnitus therapy
- ☐ Vestibular therapy
- ☐ Counselling
- ☐ Follow-up consultations
- ☐ Evaluations for assistive device candidacy
- ☐ _____

Other

17

To which populations are tele-audiology services provided? (tick all that apply)
[Please note: Healthy refers to the physical health of the patient] *

- [ ] Healthy patients (0-18 years old)
- [ ] High-risk patients (0-18 years old with co-morbidities, active infections etc.)
- [ ] Healthy patients (>18 years old)
- [ ] High risk patients (>18 years old with co-morbidities, active infections etc.)

18

Which tools do you use to provide tele services? (Tick all that apply) *

- [ ] Mobile phone
- [ ] Tablet
- [ ] Telephone
- [ ] Computer/laptop
- [ ] Diagnostic equipment
- [ ] Screening equipment
- [ ] Assistive device equipment
- [ ] Other

19

Which communication systems are used in the provision of tele services? (Tick all that apply) *

- [ ] Social media (Facebook /Instagram/WhatsApp)
- [ ] Phone calls
- [ ] SMS
- [ ] Emails
- [ ] Online meeting platforms (e.g. Zoom, Skype, Microsoft teams)
- [ ] Other

20

Who assists your patient off-site during tele-audiology sessions? (Tick all that apply) *

- [ ] A second audiologist off-site with the patient
- [ ] Family member/friend/caregiver
- [ ] Teacher
- [ ] Other health professional
- [ ] My patients do not require offsite assistance
- [ ] Community worker/community rehabilitation worker

Tele-audiology resources

In this section, please state whether you agree or disagree with the following statements

21

I am aware of guidelines available to assist in the implementation of tele-audiology *

- ◯ Agree
- ◯ Disagree

22

There are professional development courses available to further develop my skills in implementing tele-audiology services. *

- ◯ Agree
- ◯ Disagree
- ◯ I don't know

23

There are necessary support structures in place from which audiologists may seek guidance in the implementation of tele-audiology services. *

- ◯ Agree
- ◯ Disagree
- ◯ I don't know

Perceptions of tele-audiology

24

I have a positive perception of tele-audiology in practice *

- ◯ Agree
- ◯ Disagree
- ◯ I don't know

25

The Covid-19 pandemic has changed my perception towards the use of tele-audiology in practice. *

- ◯ Agree
- ◯ Disagree
- ◯ I don't know

26

Please describe your current thoughts on the use and role of tele-audiology in clinical practice? *

27

Tele-audiology services will continue to be offered post Covid-19 pandemic. *

- ◯ Agree
- ◯ Disagree
- ◯ I don't know

Appendix 4

Expert Panel Participants Information Letter and Consent Form

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Division of Communication Sciences and Disorders

My name is Tersia Davids, I am a postgraduate student at the University of Cape Town currently completing my Master of Science in Audiology. In completion of this degree, I am required to conduct a research study.

Purpose of research study

I am conducting a research study to describe tele-audiology services provided in clinical practice in South Africa and how the Covid-19 pandemic has impacted audiologists' perceptions of tele-audiology as a model of service-delivery. A survey will be used to gather this data and will sample those who meet the following eligibility criteria

- actively registered with the HPCSA as an Audiologist/Dual Speech Language Therapist and Audiologist
- patient-facing; practicing
- either in the public or private sector and/or
- providing clinical training to patient-facing undergraduate students.

Invitation to participate in expert panel

I am inviting you to participate in the expert panel to determine the validity of the survey before proceeding with the pilot study as I determined you to be an expert in the field of audiology based on your years of experience. The expert panel will consist of 5 audiologists. You will be emailed a copy of the survey, aims and objectives of the study and the content validity rating sheet with instructions. You will then rate each question on a 4 point-Likert scale for relevance and clarity of wording and a 3 point-Likert scale for essentialness. You will also be allowed to provide comments for suggestions to improve on each question in the survey. The rating sheet will need to be completed and returned to myself, the student researcher (dvdter003@myuct.ac.za) within 14 days. Submission of the rating sheet will end your participation in the expert panel.

Participation

Your participation in this expert panel is voluntary. You may choose to withdraw at any point without penalty. Should you choose to withdraw, you will no longer form part of the expert panel and your data will not be used in the measurement of the content validity for the survey.

Confidentiality and Privacy Measures

You will complete the survey rating sheet in your own time and privacy. You will not be required to provide any identifying information. Your consent form and rating sheets will be stored on a password protected UCT Cloud file to which only myself and my supervisors will have access through our unique institutional login details. The data file settings will prevent any of us from being able to download, copy or print the data file onto any personal device. All email communications are encrypted to further ensure your confidentiality.

Risks/benefits

There are no risks or direct benefits associated with participating in this expert panel.

Storage of Data

Your data will be stored on an online password-protected file for the duration of the research study. On graduation, I will transfer all data to the institutional depository, ZivaHub, where it will be stored for a duration of 15 years. I will also delete your consent forms at the end of the study. The thesis write-up will be available for your viewing online on OpenUCT at the end of the study.

Contact information Should you have any questions at any point regarding the expert panel, please contact me, Tersia Davids (dvdter003@myuct.ac.za; Contact number: 060 857 8767) or any of my research supervisors, Vera-Genevey Hlayisi (vera.hlayisi@uct.ac.za; Contact number: 021 650 5540) and Lucretia Petersen (lucretia.petersen@uct.ac.za; Contact number: 021 406 6993). Should you have any queries with regards to your rights and welfare as a participant in this expert panel, you may also contact the UCT Faculty of Health Sciences Human Research Ethics Committee at the following number, 021 406 6338, or the UCT Faculty of Health Sciences Human Research Ethics Committee Chairperson Prof Marc Blockman (hrec-enquiries@uct.ac.za).

Consent form: I provide consent to form part of the expert panel to determine the content validity of the instrument for this research study. I understand the purpose of the proposed research study and what is required of me should I consent to participate in this expert panel. I may withdraw from the panel at any point and am aware of measures put in place by the researcher and supervisors to protect my confidentiality. I understand that there are no risks or direct benefits should I consent to participate. I am aware that I may contact the researcher or supervisors with any questions I may have on the above-stated details.

Date: _____ Signature: _____

Please return this form to the researchers email address: DVDTER003@myuct.ac.za within 7 days

Appendix 5

Template of Instruction Email for Expert Panelists

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Division of Communication Sciences and Disorders

RE: EXPERT PANEL FOR TELE-AUDIOLOGY RESEARCH STUDY

Dear audiologist,

Thank you for agreeing to participate in the expert panel.

A copy of the survey and rating sheet with instructions is attached. The research aims and objectives are also listed in this document. If you could please return the rating sheet within 2 weeks.

Once again, please feel free to contact me (dvdter003@myuct.ac.za) or any of the research supervisors, Vera-Genevey Hlayisi (vera.hlayisi@uct.ac.za) and Lucretia Petersen (lucretia.petersen@uct.ac.za) should you have any queries or require assistance.

Kind regards,

Tersia Davids

Attachments: Survey.pdf; Rating sheet for expert panel

Appendix 6

Rating Sheet for Expert Panel

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Division of Communication Sciences and Disorders

Instructions

Please score each question for relevancy, essentialness, and clarity based on the scoring chart. Insert your score in the blank spaces provided for each question. Additional suggestions for improvement of the question may be added under the comments section should you have any. Please refer to the research aims and objectives when scoring.

Aims	Objectives
To describe tele-audiology services implemented by audiologists working within a clinical setting in South Africa.	➢ To describe various characteristics (audiology services offered via tele-audiology, populations offered these services, tools/platforms used to provide tele-audiology services, offsite assistance) of tele-audiology services implemented in clinical practice. ➢ To identify resources accessed by audiologists to support the implementation of tele-audiology services.

	➢ To describe differences/similarities of tele-audiology services between the private and public sectors.
To determine the impact of the Covid-19 pandemic on South African audiologists' perceptions of the use of tele-audiology for the provision of hearing healthcare (HHC) services.	➢ To describe audiologists' perceptions of the opportunities/challenges associated with the implementation of tele-audiology services. ➢ To highlight audiologists' views of tele-audiology as a sustainable means of increasing access to HHC beyond the COVID-19 pandemic.

Please refer to this <u>scoring</u> chart when rating each survey question.

Please note: Relevancy is scored on a 4-point scale, whereas essentialness and clarity can only be scored 1-3.

Relevancy of question	**Essentialness of question**	**Clarity of wording**	**Score**
Irrelevant	Not essential	Unclear	1
Item needs revision	Somewhat essential, requires revision	Wording to be revised	2
Relevant but requires minor revision	Essential	Very clear	3
Very relevant			4

Question Number	Relevancy of question	Essentialness of question	Clarity of wording	Comments
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

20				
21				
22				
23				
24				
25				
26				
27				

Please return this form to dvdter003@myuct.ac.za within 2 weeks

Appendix 7

Pilot Study Information Letter and Consent Form

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Division of Communication Sciences and Disorders

F46 Old Main Building.

Groote Schuur Hospital, Observatory, 7925

My name is Tersia Davids, I am a postgraduate student at the University of Cape Town currently completing my Master's in Audiology. I am conducting a study to describe tele-audiology services provided in clinical practice in South Africa and to determine what influence the Covid-19 pandemic has had on audiologists' perceptions of tele-audiology in addressing barriers to hearing healthcare.

Before I commence with the collection of data for the main study, I am conducting a pilot study. The purpose of the pilot study is to identify any errors in the data collection and analysis process as well as to determine the average amount of time needed to complete the survey.

Invitation to participate in research study

I am inviting you to participate in this pilot study by completing an online survey should you meet the following eligibility criteria:

- Actively registered with the HPCSA as an Audiologist/Dual Speech Language Therapist and Audiologist
- Patient-facing
- Practicing either in the public or private sector and/or
- Providing clinical training to patient-facing undergraduate students.

Exclusion criteria:

- Sees less than one audiology patient a week
- Not practicing in clinical audiology/clinical education

The pilot study will take place over a month (time period). Once you begin, you may complete the survey at your own time and in the privacy of your own space. Your responses will only be recorded once you submit your completed form which will also mark the end of your participation in the pilot study. Questions will include multiple choice and agree/disagree questions on demographics, employment, and application of tele-audiology in practice. The survey will also include an open-ended question regarding your opinion of tele-audiology.

You will be prompted to provide electronic consent again before being able to proceed to the screening questions. If you pass the screener, you will be directed to complete the survey. If you do not pass the screener, you will be automatically directed to an end page stating this. Once you have completed the survey, you will be required to complete a short google forms where you will provide information regarding how long it took to complete the survey, type of device used and multiple-choice questions regarding any technical difficulties you experienced.

Should you agree to participate, please sign the consent form at the end of the information letter. Once signed, please return the form to the email address within 7 days (dvdter003@myuct.ac.za). I will then email you with instructions and a link to the survey and rating form which you will need to complete online within 14 days. The form will automatically be sent to me once you submit.

Participation

Your participation in this pilot study is voluntary. You may choose to withdraw at any point without penalty. Should you choose to withdraw, any responses you have submitted will not be included in the pilot study analysis.

Confidentiality and Privacy Measures

You will complete the survey online in your own time and privacy. Your anonymised results will be stored on a password protected UCT Cloud file to which only myself, the researcher, and my supervisors will have access through our unique institutional login details. The data file settings prevent us from downloading, copying, or printing the data file onto any personal device. Additionally, all emails are encrypted to always ensure your confidentiality.

Storage of Data

Your data will be stored on an online password-protected file for the duration of the research study. On graduation, I will transfer your research data to the institutional depository, ZivaHub, where it will be stored for a duration of 15 years. At the end of the study, I will also delete all HPCSA numbers and consent forms. The thesis write-up will be available for your viewing online on OpenUCT at the end of the study.

Risks/benefits

There are no risks or direct benefits associated with participating in this pilot study.

Contact information

Should you have any questions or require more information regarding any aspect of this pilot study, please contact me, the student researcher, Tersia Davids (dvdter003@myuct.ac.za; Contact number: 060 857 8767) or any of my research supervisors, Vera-Genevey Hlayisi (vera.hlayisi@uct.ac.za; Contact number: 021 650 5540) and Lucretia Petersen (lucretia.petersen@uct.ac.za; Contact number: 021 406 6993). We will revert with a response as soon as possible. Should you have any queries with regards to your rights and welfare as a pilot study research participant in the proposed study, you may also contact the UCT Faculty of Health Sciences Human Research Ethics Committee at the following number, 021 406 6338, or the UCT Faculty of Health Sciences Human Research Ethics Committee Chairperson Prof Marc Blockman (hrec-enquiries@uct.ac.za).

Consent Form

- ☐ I have read the attached information letter stating important information regarding this pilot study.
- ☐ I understand that the data collected from my participation in this pilot study will be used for research purposes only.
- ☐ I am aware of confidentiality measures put in place by the researcher to ensure my confidentiality is upheld at all times.
- ☐ I have been advised that there are no direct benefits/risks to participating in this pilot study.

- I understand that my participation is completely voluntary and am free to withdraw from the pilot study at any point without penalty.
- I understand the purpose of the proposed research and what is required of me should I choose to participate in the pilot study.

Please tick the appropriate box below. By clicking “agree” I have read the above and provide my consent to participate in this pilot study.

- Agree
- Disagree

Date: _____ Signature: _____

Please return this form to the researchers email address: DVDTER003@myuct.ac.za within 7 days

Appendix 8

Google Forms Rating Sheet for Pilot Study Participants

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Division of Communication Sciences and Disorders

Please complete the following form after completing the survey within 14 days of receipt of this email. Please note the form will be automatically forwarded to the researcher on completion.

1. Please insert the amount of time taken to complete the entire survey.

2. On which device did you complete the survey? (Please tick the appropriate box)

    - ☐ Laptop/Computer
    - ☐ Mobile phone
    - ☐ Tablet

3. Did you experience any technical difficulties when completing the survey on this device?

    - ☐ Yes
    - ☐ No

4. If yes, which of the following technical difficulties did you experience?

    - ☐ Could not properly view the survey

- ☐ I had difficulty providing consent
- ☐ My selected answers were not saved when I moved on to the next question
- ☐ I was not directed to the appropriate question based on my previous answer
- ☐ Other (Please specify)

5. Please specify any other difficulties you may have experienced whilst completing the survey.

Appendix 9

Summary of pilot study participants review forms

Respondent	On which device did you complete the survey? (Please tick the appropriate box)	Did you experience any technical difficulties when completing the survey on	If yes, which of the following technical difficulties did you experience? (Tick all that apply)	Please specify any other difficulties you may have experienced whilst completing the survey (Wording of questions etc.)
1	Mobile phone	No		None.
2	Laptop/Computer	No		None. Questions clearly stated.
3	Mobile phone	No		N/A
4	Laptop/Computer	No		no difficulties experienced
5	Laptop/Computer	No		I think there should be an option to add any comments on the survey questions.
6	Laptop/Computer	No		NA
7	Laptop/Computer	No		None
8	Mobile phone	No		None
9	Mobile phone	No		None
10	Laptop/computer	No		None

Appendix 10

Internal Consistency Measurement of Cronbach Alpha for Subscales, Resources and Perceptions

Scale: Resources Subscale (Reliability Analysis)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.406	.360	4

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Awareness of guidelines	4.90	2.100	.524	.581	.143
Sufficient guidelines for implementation	5.90	3.211	-.218	.181	.612
CPD availability	5.50	1.167	.488	.650	.086
Support Structures	5.30	1.789	.218	.191	.354

Scale: Perceptions Subscale (Reliability Analysis)

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.567	.578	4

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Positive perception	4.70	2.900	.469	.281	.391
Changed perception	5.30	3.789	.283	.359	.545
Continuation of tele-audiology services	5.20	3.511	.172	.239	.655
Covid-19 pandemic will increase tele-audiology services	5.20	2.844	.531	.305	.340

Appendix 11

Ethical Approval Letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 45, E-52- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

16 November 2021

HREC REF: 690/2021

Ms V Hlayisi
Division of CSD
F45 OMB
Email: Vera.Hlayisi@uct.ac.za
Student: DVDTER003@myuct.ac.za

Dear Ms Hlayisi

PROJECT TITLE: CURRENT TELE-AUDIOLOGY SERVICES IN CLINICAL PRACTICE AND THE INFLUENCE OF THE COVID-19 PANDEMIC ON AUDIOLOSTS' PERCEPTIONS OF TELE-AUDIOLOGY-MSC CANDIDATE-MISS TERSIA DAVIDS

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study, subject to the following: -

- The HREC believe that the step regarding the verification of the audiologist participants' status with HPCSA is unnecessary, potentially invasive of privacy and could fall foul of the POPIA legislation. Suggest that this step is excluded from the procedure. If the participant provides their registration number that should suffice.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020; 06 July 2020 & 01 July 2021.

Approval is granted for one year until the 30 November 2022.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Miss Tersia Davids will also be involved in this study.

Please quote the HREC REF 690/2021 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

HREC/REF 690/2021sa

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

HREC/REF 690/2021sa