



**Hearing Health Awareness among Medical Practitioners Managing Patients
with Diabetes in South Africa**

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Abstract

Background. Research has shown that auditory symptoms can occur as diabetes mellitus (DM) related complications. DM related auditory symptoms can include hearing loss (HL), tinnitus and balance disorders. The negative impact of DM on hearing health in context of the rise in the prevalence of DM, lends impetus for audiological assessment and management of patients with diabetes (PWD). It is unknown as to whether medical practitioners (MPs) managing PWD are aware of DM related auditory symptoms and in turn counsel and refer PWD for audiological assessment and management.

Aim and Objectives. The study had four aims and several objectives per aim. The first aim was to determine South African MPs' awareness of DM related auditory symptoms. The objectives for this aim included determining the proportion of MPs who are aware of DM related auditory symptoms, which DM related auditory symptoms MPs are aware of and how MPs became aware of the symptoms. The second aim was to determine whether MPs refer for DM related auditory symptoms and the objective to achieve this aim was to determine the proportion of and reasons for DM related auditory symptom referrals. The third aim was to investigate the relationship between awareness of and referral for DM related auditory symptoms among MPs. The objectives for this aim included investigating if there is a correlation between awareness of and referrals for DM related auditory symptoms and referrals of PWD and determining if MPs years of experience influenced awareness of and referrals for DM related auditory symptoms. The fourth and last aim of the study was to describe counselling practices of MPs on DM related auditory symptoms. The objectives for this aim were to determine whether information regarding DM related auditory symptoms is included in counselling sessions, MPs' familiarity on the audiologist's role in the

management of DM related auditory symptoms and the relationship between MP's familiarity with the role of an audiologist and counselling on DM related auditory symptoms.

Research design. The study employed a descriptive cross sectional survey design. Purposive sampling was utilised, and prospective participants were recruited online through the data bases of various medical associations in South African as well as social media. An 18-item online survey questionnaire was designed for this study, covering A) demographic details B) awareness of DM related auditory symptoms and C) referral information. The survey questionnaire was content validated and piloted prior to the main data collection. Data collection was facilitated online through SurveyMonkey™, over a four-and-a-half-month period. Data was analysed quantitatively using descriptive and non-parametric methods as well as qualitatively using content analysis.

Results. A total of 379 participants consented to contribute to the survey and 236 responses were eligible for use in analysis. Most participants (n=46; 12.1%) were excluded for non-completion. Of the 236 participant responses analysed, majority were unaware (n=141; 59.7%) of, did not refer (n=119; 51.5%) for and *never* counselled (n=148; 65%) on DM related auditory symptoms. Majority of participants (n=102, 44.9%) were not at all familiar with the role of audiologists in the management of PWD.

With participants who were aware of DM related auditory symptoms (n=95, 40.3%), there was an increased likelihood to refer PWD to an audiologist and/or ENT ($p<0.001$). Furthermore, counselling on DM related auditory symptoms was found to be significantly dependent on participant's familiarity with the role of audiologists in DM management ($p<0.001$).

Conclusion. A high proportion of MPs were unaware of and do not refer or counsel PWD for DM related auditory symptoms. It was also found that majority of MPs were unaware of the role of audiologists in DM management. The findings of the study suggest the need to promote awareness

surrounding DM related auditory symptoms among South African MPs, which in turn could improve management of DM related auditory symptoms in PWD. In addition, the study underscores the need to promote the multidisciplinary collaboration between audiologists and MPs in the management of PWD.

Keywords: diabetes mellitus (DM), medical practitioners (MPs), audiology, hearing loss (HL), hearing impairment, referrals, awareness.

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Key Abbreviations:

CVI- Content Validity Index

DM- Diabetes Mellitus

HL- Hearing Loss

HPCSA- Health Professionals Council of South Africa

I-CVI- Item Content Validity Index

IDF- International Diabetes Federation

LADA- Latent Autoimmune DM in Adults

LMICs- Low Middle Income Countries

MODY- Maturity-Onset-Diabetes of the Young

MPs- Medical Practitioners

NCDs- Non-communicable Diseases

PWD- Patients with Diabetes

WHO- World Health Organisation

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Chapter 1: Introduction

Introduction: There has been an increase in research studies linking DM to HL and a few reports of poor awareness of HL as a possible comorbidity of DM among health care professionals. However, there has been limited research evidence as to whether MPs are aware of DM related auditory symptoms. Awareness on the topic of DM and hearing health is required for appropriate referrals to audiologists for hearing impairments by MPs managing PWD. Therefore, this study sought to investigate MPs awareness of and referrals for DM related auditory symptoms, from a South African context. This chapter provides the study's background and rationale by presenting a global and local prevalence reports on DM, with emphasis on the link between DM and hearing health.

Non-communicable diseases

According to the World Health Organisation (WHO) (2022), non-communicable diseases (NCDs) are listed as one of the major causes of disability and deaths globally. The rising burden of NCDs has been reported to be responsible for 73% of deaths globally (Mercer *et al.*, 2019), and is further expected to surpass neonatal, maternal and communicable diseases (Bigna & Noubiap, 2019). Additionally, it has been estimated that the mortality rate from NCDs in low-middle income countries (LMICs) is approximately 80%, with the burden of NCDs in Sub-Saharan Africa being larger than the global average (Ajaero, Wet-Billings, Atama, Agwu & Eze, 2021).

Disabilities caused by NCDs can directly have a negative impact on cognitive and psychological domains (Prynn & Kuper, 2019). Compromised cognitive and psychological domains increase the possibility of impairments, which can in turn reduce physical activities and participation (Prynn & Kuper, 2019).

The Global Burden of Diseases found an increase of approximately 11.2% in disability adjusted years of life due to NCDs within Sub-Saharan Africa between 1990 and 2017 (Gouda *et al.*, 2019). Although the surge in disability adjusted years of life can also be caused by population growth and ageing, NCDs was almost on par to that of communicable, neonatal, nutritional and maternal diseases (Gouda *et al.*, 2019). The exponential growth in the prevalence of NCDs and its impact on disabilities has invariably resulted in exorbitant health care costs related to NCDs treatment in LMICs (WHO, 2022). Such costs have negatively impacted on poverty reduction initiatives as a result of increased household costs associated with health care (WHO, 2022).

Diabetes Mellitus

DM is a non-communicable chronic disorder that is caused by abnormally elevated blood glucose serum levels (hyperglycemia) as a result of poor insulin secretion and/or action (American Diabetes Association, 2014). DM is typically categorised into type 1, type 2, and gestation DM (Tayde, 2019). Type 1 DM, also known as insulin dependent DM, is a chronic condition which occurs when the pancreas produces little or no insulin (WHO, 2021). While type 2 DM, the most common form of DM, occurs among adults when the body becomes resistant to or does not produce a sufficient amount of insulin (WHO, 2021). Gestation DM is a term used to describe blood glucose levels which are above normal but below the norm for diagnosing DM (WHO, 2021). Gestation DM commonly occurs during pregnancy and increases the possibility of developing type 2 DM later in life (Tayde, 2019).

There has recently been two new forms of DM that have been identified: Maturity-Onset Diabetes of the Young (MODY), which is a type of monogenic DM caused by gene mutations, and Latent Autoimmune DM in Adults (LADA), which is a variation of Type 1 DM (Tayde, 2019). The overall treatment regimen for PWD typically involves following a healthy diet,

increasing physical activity and lowering blood glucose levels (WHO, 2021). Patients with type 1 DM require insulin, while type 2 DM patients can be managed with oral medication, and may require insulin in certain cases (WHO, 2021).

Although glycaemic control has been improved through medical advancements, many PWD are suffering an ongoing burden of long-term complications (Graves & Donaghue, 2020). DM is therefore considered to be a multi-system disease (Mozaffari, Tajik, Ariaei, Ehyaii & Behnam, 2010). The long-term complications of DM are the leading cause of life-threatening micro and macrovascular complications, such as cardiovascular diseases, renal disease, retinal disease and neuropathy (International Diabetes Federation, 2020). Additionally, although it has been underreported, DM related complications can compromise hearing health (Mozaffari *et al.*, 2010).

Prevalence of Diabetes

According to estimates from the WHO, there are 1 billion individuals living with DM, including those who are undiagnosed (Prynn & Kuper, 2019). The International Diabetes Federation (IDF) 10th edition atlas estimated that 537 million adults between the ages of 20-79 years have been diagnosed with DM, with the majority of PWD living in LMIC's (IDF, 2021). It has been estimated that this figure will increase to 643 million by 2030 (IDF, 2021). Within the IDF Africa region, there are reportedly 24 million adults living with DM and this figure is estimated to rise to 33 million by 2030 and 55 million by 2045 (IDF, 2021). Within Sub-Saharan Africa, South Africa has been reported to have the second largest number of PWD with approximately 4.5 million South Africans living with DM (Hill *et al.*, 2020 & IDF, 2019). Moreover, over 2 million of the 4.5 million South African PWD were estimated to be undiagnosed (IDF, 2019). To date, South Africa is listed in the top 10 countries for absolute rise in the

prevalence of DM (IDF, 2019). Rapid urbanisation of communities within the African continent has contributed towards the growing prevalence of DM, thus resulting in a surge of PWD (Assah & Mbanya, 2009).

Complications related to Diabetes

The surge in the prevalence of DM invariably increases the risk of DM complications such as neuropathy, nephropathy, atherosclerotic diseases, retinopathy, and foot ulceration (Papatheodorou, Banach, Bekiari, Rizzo & Edmonds, 2018). These complications can result in several physical limitations, for example a systematic review from 105 articles reported that between 12.2%-54.5% of PWD experience difficulties with daily activities such as bathing, eating and dressing (Lisy, Campbell, Tufanaru, Moola & Lockwood, 2018).

Furthermore, several research studies have found that PWD are at risk of acquiring a gradual onset of bilateral, progressive sensorineural HL as well as tinnitus and balance disorders (Lapira, 2017; Akinpelu, Mujica-Mota & Daniel, 2013; Hong, Buss & Thomas, 2013; Morrison, Morar, Morrison, Purewal & Weston, 2014; Olusanya, Neumann & Saunders, 2014; Kim., 2015; Kim, 2017; Kumar & Kumar, 2015; Gupta *et al.*, 2018; Hlayisi, Petersen & Ramma, 2019; Kauffman, 2021). Despite this evidence, the Centers for Disease Control and Prevention have reported that auditory symptoms are often disregarded in DM care (Dowd, 2019).

Auditory impairments, particularly when untreated, can have several damaging consequences on one's ability to absorb and integrate information, thus affecting social interactions, psychological wellbeing, work ethic and overall quality of life (Khoza-Shangase, Pillay & Moolla, 2013). However, in spite of the damaging effects of auditory impairments, most efforts in the management of PWD are focused on managing the disease itself and less is

directed towards the sequelae of complications associated with the multi-morbidities in PWD (Dorkar & Satpute, 2019).

Audiological Management of PWD

The suggested best practice for comprehensive management of PWD involves a multidisciplinary team and holistic approach (Hlayisi *et al.*, 2019). Research has supported the recommendation of auditory assessments and management as a standardised component of DM care, and that HL, as one of the DM related auditory symptoms, should not be disregarded as a complication of DM (Bainbridge, 2009). It is therefore necessary that audiologists form part of the multidisciplinary team managing PWD (Hlayisi *et al.*, 2019). With increasing research evidence linking DM and auditory impairments, it is vital that medical specialists who manage PWD be cognisant of the impact DM has on the auditory system (Morrison *et al.*, 2014). Such awareness will thus enable early identification, referral for and timely intervention of DM related auditory symptoms (Morrison *et al.*, 2014).

The results obtained from this study aim to offer valuable insights in DM management especially in the area of DM related auditory symptoms.

Chapter 2: Literature review

Introduction: This chapter reviews existing literature linking DM and auditory symptoms as well as describing the impact of DM on hearing/auditory system. This chapter further discusses the role and significance of audiology services in the management of PWD.

Hearing loss and Diabetes

There are several research findings that support the association of HL in PWD across varying contexts. In the United Kingdom, Morrison *et al.* (2014) conducted a cross-sectional study of patients with type 2 DM (n=82) and identified HL in 92% of PWD, with the majority (84.1%) presenting with a high frequency sensorineural HL. A similar study conducted in China compared healthy controls (n=100) with type 2 PWD (n=160), where the prevalence of HL was found to be 67.5%, with the majority of participants presenting with a high frequency HL (Ren *et al.*, 2017). Thiago and Heraldo (2009) conducted a cross sectional study in Brazil involving PWD (n=50), where pure tone test results presented with 63% abnormal audiogram results.

In South Africa, Hlayisi, Petersen and Ramma (2019) compared healthy controls (n=82) with PWD (n=110), where the prevalence of HL was found to be 55% among PWD and 20% among the control group. Another study conducted in South Africa by Pillay, Msimang and Naidoo (2021) further reported that 52% (n=296) of PWD had a hearing impairment. Both Hlayisi *et al.* (2019) and Pillay *et al.* (2021) concluded HL as a comorbidity associated with DM, thus highlighting the need for DM related auditory symptoms to be managed in PWD.

Furthermore, numerous studies have reported that HL in PWD is caused by a microvascular disease of the cochlear (microangiopathy), as well as the involvement of smaller vessels in the inner ear (Hong *et al.*, 2013; Morrison *et al.*, 2014; Kumar & Kumar, 2015). According to Kumar and Kumar (2021), limited blood flow/supply to the cochlear (vascular

insufficiency) has been postulated to be one of the primary causes of HL in PWD. However, microcirculation of the cochlear cannot be investigated. This is due to the cochlear being positioned within the temporal bone, and therefore the only existing anatomical evidence of the microcirculation of the cochlear is that of post-mortem studies (Morrison *et al.*, 2014). Further post-mortem research studies of adults with DM showed loss of hair cells, thicker vessel walls of the stria vascularis and basilar membrane, sclerosis of the internal auditory artery, atrophy of the spiral ganglion and demyelination of the cochlear nerve (Morrison *et al.*, 2014). Thus, illuminating the impact of DM on the auditory system.

Diabetes related vestibular complications

In addition to cochlea damage, DM also affects the neighbouring vestibular system (Diabetes Focus eMag, 2020). Hlayisi, Rogers and Ramma (2019), in a cross-sectional study, investigated the fall risk of PWD between the ages of 20-55 years in South Africa. It was found that young to middle aged PWD had an increased fall risk compared to those without DM. The Dynamic Gait Index assessment indicated that the fall risk of the cohort group was 22% (n=110), whereas the fall risk in the control group was merely 1% (n=82) (Hlayisi *et al.*, 2019). Moreover, the Modified Clinical Test of Sensory Integration further found that 56% of the cohort group had a fall risk, as opposed to the control group which had a fall risk of 21% (Hlayisi *et al.*, 2019). Moreover, Piker and Romero (2019) reported that the prevalence of vestibular dysfunction in PWD was particularly identified in those that had DM for a prolonged duration and with poor glucose control.

There is limited clinical evidence regarding which specific structure of the vestibular system is affected as it consists of multiple complex structures which are expensive and challenging to assess thoroughly (Piker & Romero, 2019). However, pathophysiologic evidence

has indicated that DM has a direct adverse impact on the vestibular system (Piker & Romero, 2019). Animal studies have further identified structural and functional changes in the vestibular system resulting from DM (D'Silva, Lin, Staecker, Whitney & Kluding, 2016).

Falls may not always cause physical injury, however the fear of falling can lead to reduced physical activity and therefore increase the patients fall risk (Diabetes Focus eMag, 2020). It is thus imperative that fall risk among PWD be assessed in order to allow for early identification and rehabilitation (Hlayisi *et al.*, 2019).

DM and Tinnitus

Tinnitus is a physical condition that is commonly defined as the perception of sounds, such as ringing, humming or buzzing in the absence of external acoustic stimulus (Taneja, 2017). There are various causes of tinnitus, including HL, exposure to excessive noise, hypertension and certain medication (Hlayisi, 2016). Furthermore, tinnitus is considered to be a side effect of high levels of insulin and is therefore also identified as a cause of DM (Taneja, 2017). High levels of insulin is known as hyperinsulinemia, which is often associated with Type 2 DM. The inner ear metabolism relies on the supply of glucose and oxygen from blood circulation (Taneja, 2017). Changes in the glucose metabolism can alter the functioning of neuronal and non-neuronal cellular maintenance and can also affect the generation of neurotransmitters (Mergenthaler, Lindauer, Dienel & Mieisel, 2013). These changes in turn can reduce the processing of complex sounds resulting in the occurrence of tinnitus with HL (Taneja, 2017).

There are studies that support the association between tinnitus and DM. Mousavi *et al.* (2021) conducted a study in Iran, where the likelihood of tinnitus in patients with type 2 DM was examined. It was found that there was a 26% likelihood of tinnitus occurrence among patients with type 2 DM and a significant dependent relationship ($p < 0.05$) between patients' age and severity of

tinnitus (Mousavi *et al.*, 2021). Furthermore, Hlayisi (2016) conducted a cross-sectional study in South Africa with 110 PWD and 82 healthy controls. The results from this study found that 4 in 10 participants with DM self-reported the presence of tinnitus, while only 1 in 10 participants in the control group self-reported the presence of tinnitus (Hlayisi, 2016).

There is limited treatments available for disturbing tinnitus (Mousavi *et al.*, 2021). Although tinnitus is not always disabling, it can be a debilitating condition particularly when endured alongside pre-existing conditions, such as DM (Hlayisi, 2016).

Impact of multimorbidity

Multimorbidity applies to the coexistence of two or more chronic conditions (Koné Pefoyo *et al.*, 2015). There has been a rise in the global prevalence of multimorbidity, which poses a significant concern, particularly with the older patient population (Valderas, Starfield, Sibbald, Salisbury & Roland 2009), who are the highest users of health care systems (Koné Pefoyo *et al.*, 2015).

Multimorbidity can increase the risk of mortality and disability as well as reduce patients' quality of life and functional status (Koné Pefoyo *et al.*, 2015), and as a consequence this has led to an exponential increase in health care costs (Valderas *et al.*, 2009). The rise in such expenditures is a result of the need for additional specialist physician access as well as hospital admissions (Hajat & Stein, 2018). Managing the surge in the prevalence of multimorbidity has thus become a global challenge which many governments and health care organisations are facing (Laires & Perelman, 2018). It is further expected that the aging population will worsen the scenario, therefore future projections on anticipated multimorbidity are necessary to plan public health policies (Laires & Perelman, 2018). Additionally, it should be noted that the burden associated with

multimorbidity among patients and health care systems can be reduced through the implementation of primary prevention strategies (Hajat & Stein, 2018).

Patients who are diagnosed with DM and auditory impairments are considered to have multimorbidity. Thus, there is a need for a concerted effort in the prevention of multiple morbidities in PWD. Primary prevention strategies, such as increasing early detection and intervention of auditory symptoms in PWD through multidisciplinary DM management is necessary.

Auditory management of PWD in South Africa

There is a critical need for action to preclude DM related auditory symptoms, particularly in PWD where these can be preventable and its negative impact minimised (Khan, Adhikari & Joseph, 2018). However, there are a few challenges impeding audiological care for PWD including 1) knowledge of DM related auditory symptoms by health professionals in DM care, 2) limited number of Audiologists and 3) low health literacy and health seeking behaviour for audiological care in the general public.

Primary health care facilities for the majority of South Africans, PWD included, are typically the first point of contact they have with the health system (Khan *et al.*, 2018). Primary healthcare is the provision of diagnosing, treating, and managing health conditions, including chronic conditions such as DM. General practitioners, nurses, pharmacists, and allied health providers are considered as primary health care providers (WHO, 2023).

However, early auditory symptom detection and intervention has remained low due to lack of knowledge and or awareness on DM related auditory symptoms (Khan *et al.*, 2018). The poor attention to DM related auditory symptoms thus delay the intervention for PWD (Joubert,

Sebothoma & Kgare, 2017). Therefore, it is important to focus on increasing awareness of DM related auditory symptoms to health care professionals, especially those managing PWD.

Furthermore, alongside other third world countries, hearing health care professionals and audiological resources in South Africa is limited (Joubert *et al.*, 2017). According to the Health Professionals Council of South Africa (HPCSA) iRegister in May 2022, there were only 2231 registered audiologists in South Africa (HPCSA iRegister, 2022) and the majority were accessible only in secondary or tertiary health facilities. In relation to the South African population in need of audiological care, PWD included, a disproportionate ratio of audiologist to patients pose a challenge to the management of PWD with DM related auditory symptoms. This is coupled with the reported poor awareness by the general public regarding auditory care and the role of audiologists (Joubert *et al.*, 2017).

A multi-disciplinary team approach

Interactive relationships in the health care system can be fostered through multidisciplinary health care teams, which involve several health care professionals who share their resources and knowledge to deliver comprehensive, patient centred care (Izham *et al.*, 2021).

PWD are often at risk for various complications, which can negatively impact on their quality of life and increase their chances of mortality (Conca *et al.*, 2018). Common complications which are frequently reported on, include DM retinopathy, peripheral neuropathy, cardiovascular complications and kidney failure (Abejew, Belay & Kerie, 2015; Obirikorang *et al.*, 2016; Conca *et al.*, 2018; Nabina & Raj, 2019; Sheleme *et al.*, 2020). Such complications are unable to be managed by one health care professional group and therefore require a multidisciplinary health care team for optimum clinical outcomes (Izham *et al.*, 2021). The multidisciplinary health care team's treatment goals for PWD are to delay or prevent such complications and to enhance the patient's

quality of life (Draznin *et al.*, 2022). However, auditory symptoms are often overlooked as a DM complication and thus there is minimal, if any, involvement of audiologists in the multidisciplinary DM health care team.

Prevention strategies for diabetes related hearing impairments

Health care providers managing PWD need to be cognizant that DM elevates the risk of acquired forms of hearing impairments in addition to the common DM chronic diseases and symptoms (Dowd, 2020). This will then enable the implementation of the first step to primary prevention, which is to educate PWD regarding the risk of HL. Secondary prevention is aimed at early detection of HL by health care workers, including MPs, which will enable timely intervention (Spankovich & Yerraguntla, 2019). A fundamental element of secondary prevention involves an audiologist establishing the patient's baseline hearing status in order to track changes in hearing sensitivity. Thereafter, tertiary prevention refers to the treatment and management of hearing impairments (Spankovich & Yerraguntla, 2019). This would therefore involve fitting patients with appropriate hearing aid devices as well as conducting aural rehabilitation to enhance their quality of life (Spankovich & Yerraguntla, 2019). Moreover, DM can have a negative impact on vision and sense of touch, which can result in patients encountering difficulties with hearing aid use and maintenance (Dowd, 2020). In order to overcome such physical limitations, audiologists can formulate management plans and select hearing amplification devices specific to the patient's needs (Kauffman, 2021). Audiologists therefore naturally form part of the multidisciplinary DM care team through devising patient centred management plans, advising MPs regarding patients hearing impairments/status and providing effective means of communication with patients (Kauffman, 2021).

Study rationale

There is limited research as to whether all primary health care professionals are aware of the impact of DM on hearing health, however, the focus of this study was given to exploring MPs knowledge on the topic considering that appropriate diagnosis, referrals and management of PWD are primarily made by MPs, such as general practitioners, who manage PWD.

In South Africa, it is unknown as to whether MPs who are registered with the HPCSA and manage PWD are aware of, counsel and refer PWD for DM related auditory symptoms. Investigating such awareness and referrals is necessary in determining the need for promoting knowledge surrounding DM related auditory symptoms and the collaboration of audiologists with MPs in the management of PWD. The proposed study therefore aims to explore hearing health awareness and referrals among MPs managing PWD in South Africa.

Chapter 3: Methodology

Introduction: This chapter presents the aims, objectives, methodological aspects and how research data obtained was analysed. The chapter lastly outlines ethical considerations adopted by the study.

Research Question

Are MPs aware of DM related auditory symptoms, and do they refer PWD for auditory assessments?

Aims and objectives

- 1) To determine South African MPs' awareness of DM related auditory symptoms.
 - a) Determine the proportion of MPs who are aware of DM related auditory symptoms.
 - b) Determine the DM related auditory symptoms MPs are aware of.
 - c) Determine how MPs became aware of the symptoms indicated in 1b.
- 2) To determine whether South African MPs refer PWD to an Audiologist and/or ENT specialist for DM related auditory symptoms.
 - a) Determine the proportion of referrals to an Audiologist and/or ENT specialist.
 - b) Determine the reasons for referrals.
- 3) To investigate if there is a relationship between and influencing factors towards awareness of and referral for DM related auditory symptoms among South African MPs.
 - a) Investigate the correlation between awareness of DM related auditory symptoms and referrals of PWD to audiologists.
 - b) Determine if MPs years of experience influence awareness of and referrals for DM related auditory symptoms.
- 4) To describe counselling practices of MPs on DM related auditory symptoms.

- a) Determine whether information regarding DM related auditory symptoms is included in counselling sessions of newly diagnosed PWD.
- b) Describe MPs' familiarity of an audiologist's role in the management of PWD.
- c) Investigate the relationship between familiarity with the role of an audiologist and counselling of PWD on DM related auditory symptoms.

Research design

The study employed a descriptive cross sectional survey design, as it is suitable for providing data to describe the status of the phenomena at a specific point in time (Ihudiebube-Splendor & Chikeme, 2020). This allowed for the current study to collect data through surveys to describe the current awareness of DM related auditory symptoms among MPs in South Africa. Furthermore, cross sectional designs allow for examination of the relationship between a health-related state and alternate variables of interest within a population at a specific point in time (Gaille, 2018). This allowed for the study to examine the current relationship between the variables of interest as outlined in the objectives.

Cross sectional designs also provide a suitable basis for descriptive analysis, it is relatively easy to conduct, inexpensive and involves less time constraints (Gaille, 2018). In this study, data was sought through surveys and not equipment which carries less costs. Research studies surrounding awareness, namely, “Public Awareness of Audiology”, “Hearing and Hearing Health in the Limpopo Province” (Joubert *et al.*, 2017) and “Public Awareness of Ear Health and HL in Jeddah, Saudi Arabia” (Alshehri, Alqulayti, Yaghmoor & Alem, 2019), have similarly employed a cross sectional survey design. Hence, by adopting a similar approach it makes the study findings comparable. The researcher did not employ a detailed mixed methods approach given that study survey was mainly based on quantitative research, with a few qualitative questions.

Instrumentation

The survey questions were developed based on studies which indicated that audiological symptoms are often disregarded in DM care, despite numerous research indicating the risk of DM related audiological symptoms (Bainbridge, 2009; Dowd, 2019; Hlayisi *et al.*, 2019). Furthermore, there appears to be limited research as to whether MPs who manage PWD are aware of, counsel and refer PWD for DM related auditory symptoms. Therefore, the researcher self-developed a descriptive survey tool that was used to collect research data surrounding concerns related to awareness, counselling and referrals ([see Appendix A](#)).

The survey initially included a total of 18 questions, which were subdivided into three sections. Section A consisted of 5 questions pertaining to the inclusion criteria and demographic details of the participants. Section B consisted of 3 questions which were based on awareness of DM related auditory symptoms. Section C consisted of 10 questions related to the referrals of PWD to audiologists and awareness of the role of audiologists in the management of PWD. However, after validating the content of the survey, certain items were eliminated. Details outlining content validity and the exclusion of items are further discussed in the validity section below. At the end of the survey, participants were provided with a DM and HL information sheet as well as a link directing them to a website for further information.

Validity

Validity refers to the extent of how accurately an instrument measures what it is intended to measure (Heale & Twycross, 2015). Content validity of the survey was measured by calculating the item content validity index (I-CVI), which is commonly used to establish content validity of an instrument (Zamanzadeh *et al.*, 2015). This approach required an expert panel of at least five members in the field of study (Yaghmale, 2009). The I-CVI score was calculated using the formula

$I-CVI = (\text{number of expert rating an item as "3"/"4"}) / (\text{total number of experts})$ (Yusoff, 2019). An item is considered to be appropriate should it achieve an I-CVI score $>79\%$. A score between 70-79% suggests that an item should be revised and $<70\%$ suggests that an item should be eliminated (Zamanzadeh *et al.*, 2015).

Five qualified audiologists were approached to form part of the expert panel. Two audiologists had a doctorate degree in audiology in the field of quantitative research involving public health and non-communicable diseases, two had a master's degree in audiology and were in active clinical practice, and one had a bachelor of science degree in audiology and was also in active clinical practice. The audiologists were recruited via the email addresses available on their institutional websites. ([see Appendix B](#)). Once the approached audiologists provided their consent to participate, they were required to independently complete a content validity questionnaire ([see Appendix C](#)). This involved rating each survey item on a 4-point ordinal scale as per its relevance to the purpose of the study (Zamanzadeh *et al.*, 2015). Ratings from the expert validators were documented on a table ([see Appendix D](#)) and the I-CVI for each item was calculated.

Items 3.2, 4.3 and 5.3 achieved an I-CVI score of 60%, thus requiring these items to be eliminated. The remaining items were all considered to be appropriate as they achieved an I-CVI score $>79\%$.

Pilot study

Pilot testing a survey assesses time and budget constraints which can occur prior to conducting the main study (Teijlingen & Hundley, 2002), as well as addresses the likelihood of poorly structured/unclear items and identify errors in the methods of data collection and analysis (Mohajan, 2017).

According to Moore, Carter, Nietert and Stewart (2011), a pilot study of 12 participants is considered appropriate for early-stage investigators, who are focusing on average values for planning a larger subsequent study. Therefore, 12 MPs who were known by the researcher and fitted the eligibility criteria of the main study were requested to participate via an email letter ([see Appendix E](#)). Participants who agreed to participate in the pilot study were emailed a link which directed them to an information letter, consent form, the survey and lastly the wording clarity questionnaire.

The wording clarity questionnaire involved pilot participants rating the wording clarity of each item on a 4-point ordinal scale ([see Appendix F](#)). The pilot participants' responses to each item were analysed by calculating the I-CVI. All items achieved an I-ICV score of 83%, thus requiring no changes to be made to the wording of the survey questions ([see Appendix G](#)).

Participants

Sampling. A non-probability sampling technique was used in the current study, in which research participants were purposively sampled through the databases of established medical organizations via email. Purposive sampling involves selecting participants with qualities which will enable them to assist with the relevant research (Etikan, 2016). This sampling method therefore ensured that only those who met the eligibility criteria participated.

Purposive sampling has previously been employed in studies with a similar topic and focus on DM and HL, namely “Diabetes Mellitus and Sensorineural Hearing Loss among Non-elderly People” (Mozaffari *et al.*, 2010) and “Hearing Status in Patients with Type 2 Diabetes Mellitus according to Blood-Sugar Control” (Sajedi Kia, Nemati, Hassanzadeh & Mehrdad, 2018). This method of sampling is cost effective, easy to apply and involves less time constraints (Showkat & Parveen, 2017). However, should the researcher's judgment be misconceived, purposive sampling

can be subject to selection bias (Sharma, 2017). The researcher aimed to overcome subjective bias in the current study by following the pre-set inclusion and exclusion criteria, which was used for all research participants.

The study later employed snowball sampling; whereby existing research participants referred other potential participants from their circle of colleagues (Statistical Aid, 2017). The researcher incorporated snowball sampling for the purpose of locating a larger sample of MPs to participate. Snowball sampling therefore served as a convenient and cost-effective method for reaching a larger sample of MP in South Africa (Raina, 2015). However, a disadvantage of snowball sampling is the uncertainty as to whether the sample matches that of the target population (Raina, 2015). The researcher overcame this disadvantage by adhering to strict inclusion and exclusion criteria. The SurveyMonkey™ platform automatically disqualified participants should they had indicated otherwise of what was stipulated in the inclusion and exclusion criteria.

Survey incentives are useful in boosting the participant response rate, reducing the incidence of missed items and showing gratitude towards the participants' time and effort in contributing towards the study (Lipps, Herzing, Pekari & Stähli, 2019). Therefore, all participants had the option to enter a lucky draw to win an R1000 online voucher by providing their contact details at the end of the survey. Entry into the lucky draw was dependent on all survey items being answered and if contact details were provided. The lucky draw took place once the data collection procedure was concluded. The winner was selected by inserting participant numbers into an online lucky draw tool called "Wheel of names", which selects a random winner.

Target participants. Potential participants were eligible to complete the survey based on self-report of the inclusion criteria. Section A of the survey assisted in determining whether participants met the inclusion criteria:

- Qualified and licensed MPs of South Africa.
- MPs who are registered with the HPCSA under the titles of “Medicine”, “Public Health Medicine”, “Community Health” or “Family Medicine”.
- MPs who are practicing in private and/or public health sectors.
- MPs who frequently manage PWD (practitioners who self-report that >10% of their case load involves management of PWD).
- MPs with minimum experience level of 3 years. (Independent practitioners post internship and community service).

Sample size. The HPCSA iRegister portal (HPCSA iRegister, 2022) was used to find the total number of MPs who were qualified to manage PWD. The search categories selected included “Medicine,” “Family Medicine,” “Community Health” and “Public Health medicine.” This provided a total population estimate of 11983.

The sample size was calculated using the Raosoft (2004) online sample size calculator. A 5% margin of error, 95% confidence level and 50% response distribution were selected, providing an estimated sample size of 373 participants. A “Required sample size” table developed by Boyd (2006) was used to cross-check the accuracy of the estimated sample size. According to Boyd (2006), a population of 10 000-25 000 participants, using a 5% margin of error and 95% confidence level, requires a sample size between 370-378 individuals. Thus, this correlated with and confirmed the Raosoft (2004) sample size estimate.

Recruitment. The researcher initially created an advertisement poster which included the access link to the survey. However, due to technical difficulties with participants accessing the link on the poster, the researcher resorted to circulate a short briefing via email and social media which included the survey link. The survey link directed participants to the information letter ([see](#)

[Appendix H](#)) and an electronic consent form ([see Appendix I](#)). Participants who provided their consent, by clicking “agree”, were thereafter directed to the survey.

Established medical associations in South African (Hospital Association South Africa, South African Medical Association and Public Health Association) were contacted via email to disseminate the electronic survey link to registered MPs on their data bases ([see Appendix J](#)). Unfortunately, many organizations declined to advertise or disseminate the survey link due to the Protection of Personal Information (POPI) Act, which negatively impacted the survey response rate. However, The South African Medical Association responded positively and agreed to disseminate the survey link to their registered MPs and offered to send out reminders.

Although this assisted with increasing the response rate, it was rather slow compared to what the researcher had anticipated. The researcher further contacted doctors’ groups and pages on social media to advertise the survey briefing and link to increase the response rate. Towards the latter end of the data collection procedure, Prince Mshiyeni Memorial Hospital in KwaZulu-Natal had assisted in disseminating the survey link to MPs at the hospital. All participants contacted were encouraged to forward the link via social media platforms, such as WhatsApp, to their colleagues and other medical groups they engaged with.

Data Collection

1. Ethical approval was first obtained from the Faculty of Health Sciences Human Research Ethics committee, University of Cape Town (HREC REF: 611/2021) ([see Appendix K](#)).
2. Following ethical clearance, the survey was validated by an expert panel. The researcher identified and approached five qualified audiologists to form part of the expert panel, who were required to complete a content validity questionnaire.

3. Once the survey was validated, a pilot study was conducted with 12 South African MPs who met the inclusion criteria of the study. Pilot study participants were required to complete the survey as well as a wording clarity questionnaire. All items achieved an I-ICV score of 83%, thus requiring no changes to be made to the survey questions.
4. Once the pilot study was concluded, the validated survey was uploaded on SurveyMonkey™, an online survey platform.
5. Relevant medical associations were contacted via email to disseminate an electronic survey link with a short description via email to their registered MPs on their databases. The researcher also encouraged doctors to personally circulate the message to their colleagues via social media platforms.
6. The researcher anticipated closing the survey after four months, once the target sample was reached. However, due to the slow response rate, the survey remained open for an additional 3 weeks to reach the target sample.
7. Once the target sample was achieved, the researcher closed the survey. Thereafter each participant's HPCSA number was cross-checked using the HPCSA iRegister website. This was done to ensure that all participants were registered with the HPCSA under the relevant fields as outlined in the inclusion criteria. All HPCSA numbers were then deleted from the raw data in aims for maintaining the anonymity of the research participants.
8. Data was then analysed using quantitative and qualitative methods of data analysis. The closed ended questions in the survey were analysed quantitatively, through descriptive and inferential statistical analysis. The open-ended questions were analysed qualitatively, using content analysis.

9. All the data that was collected was stored in UCT's online storage platforms and managed in agreement with South African Good Clinical Practice Guidelines (Department of Health, 2006).
10. An internal report of the current research findings will be disseminated to medical associations and to the wider research community in the form of a peer-reviewed scientific journal article.

Data management

The study adhered to the UCT Data Management Policy (2018). All participant responses were securely stored on SurveyMonkey™ SOC2 accredited data centres. The data collected was only accessible with the researcher's login details. Once the data collection procedure was concluded, all data was exported from SurveyMonkey™ and transferred to a Microsoft Office Excel spreadsheet on OneDrive. Thereafter all data was immediately deleted off SurveyMonkey™.

Participants were required to provide their HPCSA number as part of the survey. This allowed the researcher to cross check whether all survey participants were registered with the HPCSA under the relevant fields as outlined under the inclusion criteria. Once all the data was transferred on a Microsoft Excel document and once the researcher cross checked that all participants were registered under the relevant fields, the HPCSA numbers of all participants were deleted off the Microsoft Excel spread sheet. Prior to commencing data analysis, each participant was assigned a number to uphold anonymity of all participant information and responses.

Raw data and personal information, such as participant contact details and HPCSA numbers, were stored on a password-protected computer and uploaded on Microsoft OneDrive.

This information was only accessible to the researcher and the research supervisor with their respective login details.

Data Analysis

Qualitative analysis. Open-ended items of the survey (Section B questions 2 and 3; Section C question 2.1, 5.2 and 5.3) were analysed on Microsoft Excel using content analysis for ***Aim 1; objective b and Aim 2; objective c.*** Content analysis involves systematically and reliably analysing qualitative data that has been collected (Haggarty, 2009). It allows for generalisations to be made from the data in relation to the categories of interest to the researcher (Haggarty, 2009). The researcher followed the steps listed below for each open-ended question during content analysis:

Step 1: Decontextualisation

The researcher familiarised herself with the data by reading through all the open-ended questions before breaking it down into smaller meaning units. A meaning unit refers to some of the insights the researcher requires in relation to the study aim (Bengtsson, 2016).

Step 2: Recontextualisation

Once the meaning units were sorted, the researcher ensured that all aspects of the content had been covered in relation to the aim by re-reading the original text, alongside the list of meaning units. The researcher then considered whether unmarked texts should be included or excluded during analysis. The unmarked texts which provide answers to the research question are required to be included and the remaining excluded (Bengtsson, 2016).

Stage 3: Categorisation

Themes and categories were identified by condensing meaning units. Condensing meaning units involves reducing the number of words in the meaning unit without losing the content of the unit (Bengtsson, 2016).

Stage 4: Compilation

The researcher summarised themes, categories, and subcategories in a tabular form in order to have a quick overview of the results (Bengtsson, 2016).

Quantitative data analysis. Closed ended items of the survey were analysed by using descriptive and inferential methods of statistical analysis.

Descriptive statistics provides a summary of research data in an organised manner (Sharma, 2019). It forms a key component in all quantitative data analysis when combined with graphics analysis (Kaur, Stoltzfus & Yellapu, 2018). Quantitative data of the study was first exported to excel in the form of nominal, ordinal and continuous variables as specified in Appendix A. Data was then handed to a statistical consultant who analysed the data using descriptive methods of analysis. *Aim 1; objectives a and c, Aim 2; objectives a and b and Aim 4; objective a* was analysed through measures of frequency (percentages). The researcher then illustrated the results of the descriptive statistics in the form of graphs, including bar graphs and pie charts.

Aim 3; objectives a and b were analysed by the statistical consultant using the chi-square non-parametric test, which is a powerful inferential statistic when measuring the association between nominal variables (McHugh, 2013). The Fishers Exact Test is typically used for small sample sizes, when determining whether or not there is a significant association between two dichotomous categorical variables (Kim, 2017). This test was used by the statistical consultant for *Aim 4; objective b*, to investigate the correlation between MPs counselling PWD regarding DM

related auditory symptoms and their familiarity with the role of audiologists in the management of PWD.

Ethical Considerations

The current study was designed and abided by the ethical principles summarised in the Declaration of Helsinki (World Medical Association, 2013).

Informed consent

The autonomy of all research participants was safeguarded through informed consent. All participants were provided with a statement outlining the study details, their purpose as well as participation risks and benefits. Prior to commencing with the survey, participants were required to electronically indicate their consent to participating. Participants were made aware of their right to withdraw from the study at time without any penalties. Furthermore, contact details of the researcher, research supervisor and the UCT Faculty of Health Sciences Human Research Ethics Committee were made available to participants for any questions or concerns they may have had regarding the study and their participation.

Confidentiality

Participants were required to provide their HPCSA numbers as part of the survey and only participants who wished to participate in the lucky draw were required to provide their contact details. HPCSA numbers and contact details of participants were stored on a password-protected computer and document. The documents pertaining these details were only accessible to the researcher and research supervisor via their respective login details. Once the researcher had cross-checked that the research participants were registered under the relevant fields, HPCSA numbers were immediately deleted. Furthermore, prior to commencing data analysis, each participant was assigned a number to uphold the confidentiality of all participant responses.

Beneficence

The beneficence principal requires the researcher to maximise benefits and minimise potential risks of participants (Wassenaar, 2006). There was no direct benefit for participating in the study, however, participants had an option to enter a lucky draw to win an online voucher at the end of the survey.

Non-maleficence

Non-maleficence guides the researcher to ensure that no harm befalls research participants (Wassenaar, 2006). There were no direct or indirect risks for participants in this study.

Justice

Justice is an act that represents equal allocation of risks and benefits unless there is substantial reason to discriminate (Morrison & Eileen, 2009). All research participants who provided their consent and met the inclusion criteria for the study were permitted to participate. Furthermore, research findings will be made available to the medical associations in the form of an internal report and will be disseminated to the wider research community in the form of a peer-reviewed scientific journal.

Chapter 4: Results

Introduction: This chapter presents the participant description and the research findings, in order of the study aims. The findings will be presented in written format, tables and figures.

Inclusion and Exclusion Process:

A total of 379 South African MPs consented to participate in the study. After the exclusion process, the final sample size for the study was 236. Most of the prospective participants were excluded for non-completion (n=46). Figure 1 below illustrates a breakdown of sample inclusion and exclusion process. The completion rate of the survey was found to be 62.3%. This was calculated by dividing the total number of participants who answered the survey (n=236) by the number of participants who entered the survey (n=379).

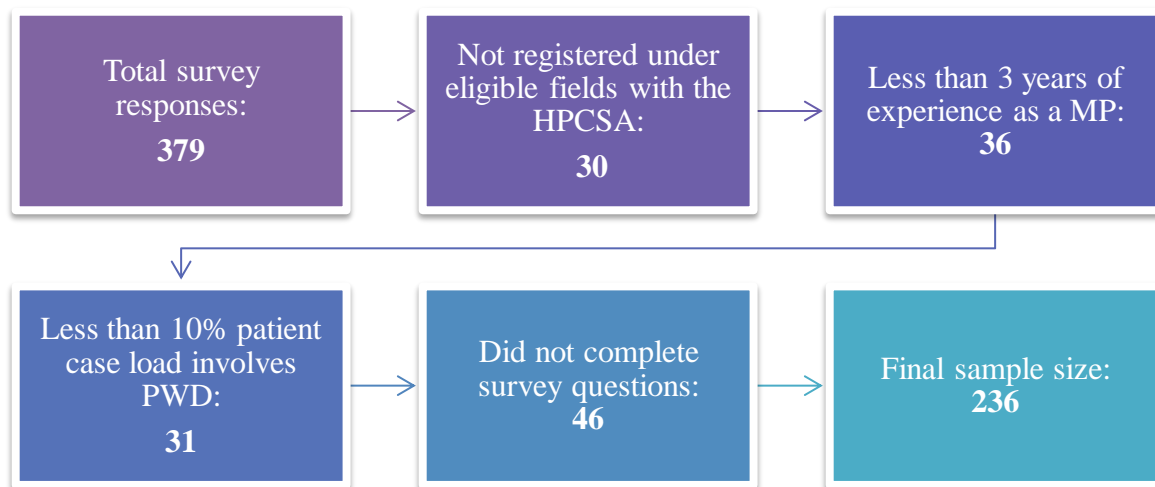


Figure 1: *Participant sample inclusion and exclusion process.*

Participant Description:

No identifying demographic data was collected in the study. Of the 236 participants in the current study, majority were registered with the HPCSA within medicine (66.5%) category,

practicing in the private health sector (47%), with more than 20 years practice experience (48.7%) and managed a case load of $\geq 20\%$ (55.9%) of PWD per annum (see Table 1).

Table 1

Participant description.

HPCSA Registration Category	n=236 (More than 1 answer provided by some)
<i>Medicine</i>	<i>n=157 (66.5%)</i>
<i>Public Health Medicine</i>	<i>n=10 (4.2%)</i>
<i>Community Health</i>	<i>n=9 (3.8%)</i>
<i>Family medicine</i>	<i>n=86 (36.4%)</i>
Health Sector	n=236
<i>Private</i>	<i>n= 111 (47.0%)</i>
<i>Public</i>	<i>n=86 (36.4%)</i>
<i>Both</i>	<i>n=39 (16.5%)</i>
Years of Experience	(n=236)
<i>3-10</i>	<i>n=69 (29.2%)</i>
<i>11-20</i>	<i>n=52 (22%)</i>
<i>>20</i>	<i>n=115 (48.7%)</i>
Average proportion of PWD within case load per Annum	(n=236)
<i>10-20%</i>	<i>n=104 (44.1%)</i>
<i>$\geq 20\%$</i>	<i>n=132 (55.9%)</i>
Average number of PWD managed per Annum	(n=236)
<i><50</i>	<i>n=24 (10.2%)</i>
<i>50-100</i>	<i>n=67 (28.4%)</i>
<i>>100</i>	<i>n=145 (61.4%)</i>

1) Awareness of DM related auditory symptoms

The majority of participants (n=141) were not aware of any DM related auditory symptoms (see Figure 2). Those that were aware of DM related auditory symptoms (n=95) indicated some of the symptoms they were aware of, with some participants providing more than one answer. There were five commonly reported symptoms (see Figure 3).

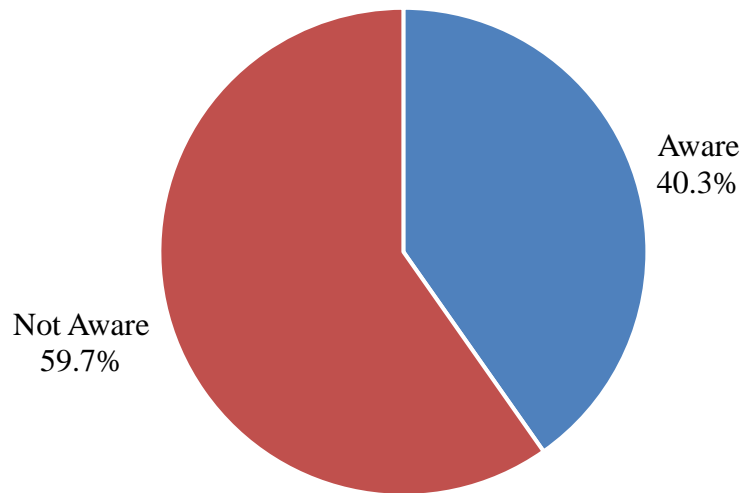


Figure 2: Awareness of DM related auditory (n=236).

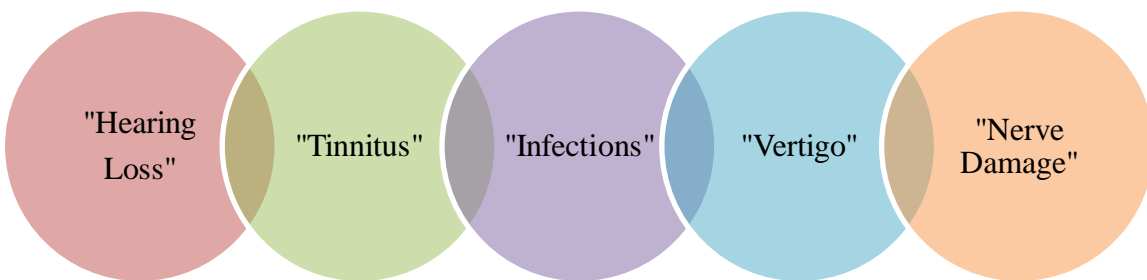


Figure 3: Known DM related auditory symptoms (n=95).

The most common cited sources of knowledge on DM related auditory symptoms included journal articles followed by medical school (see Figure 4). Participants were given the option to provide alternate answers as to how they became aware of DM related auditory symptoms, in which some mentioned through contact with patients, webinars, team meetings as well as through their own research. Some participants provided more than one answer.

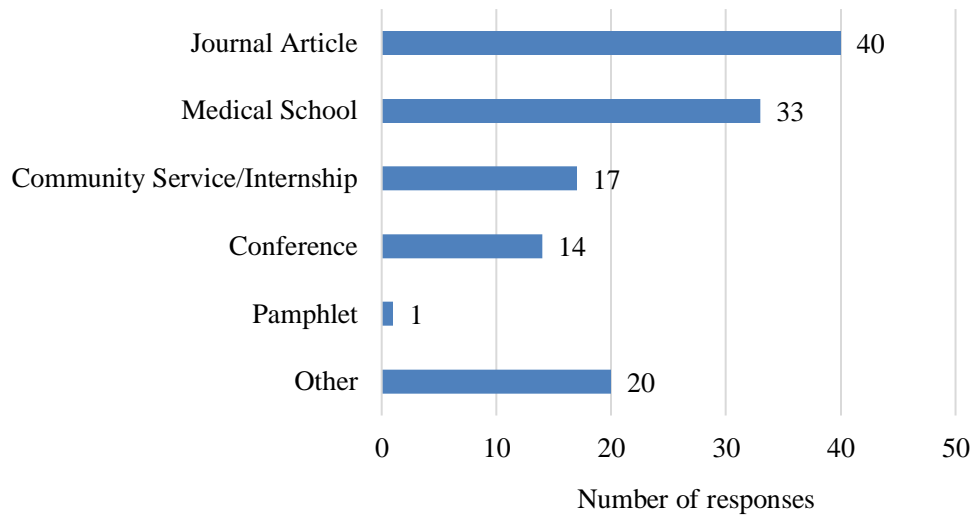


Figure 4: *Knowledge sources on DM related auditory symptoms (n=95).*

2) Referrals of PWD to Audiologists and/or ENTs

It was found that most of the participants (n=119) do not refer PWD for DM related auditory symptoms (see Figure 5).

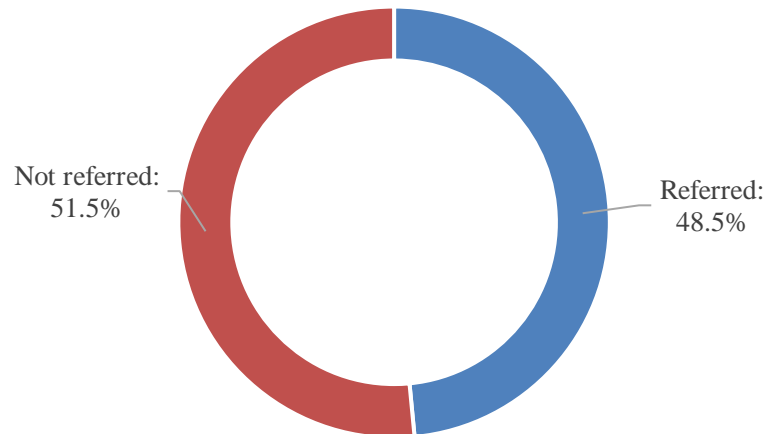


Figure 5: *Referrals for DM related auditory symptoms (n=231)*

The most commonly reported purpose of referral for DM related auditory symptoms was due to patients reporting signs of hearing deterioration followed by complaints of tinnitus or otalgia (see Figure 6). Participants were also given the option to provide their own answers, in which some mentioned that otitis media/infections were a common purpose of referral for DM related auditory symptoms. Some participants selected more than one response.

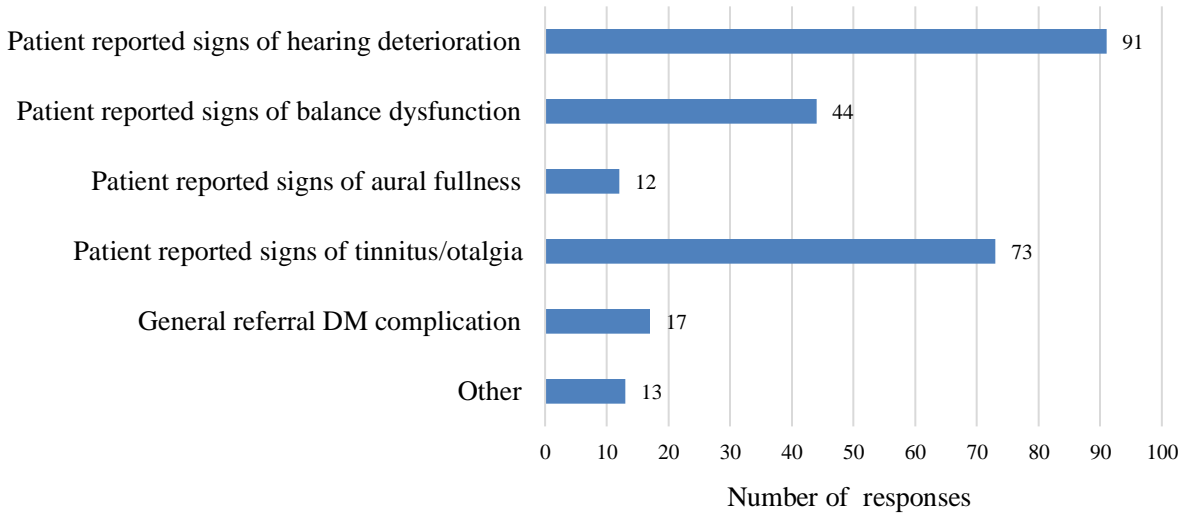


Figure 6: Purpose of DM related auditory referrals (n=112).

3) Relationship between awareness of and referrals for DM related auditory symptoms

A chi-square test of independence showed a significant ($p < 0.001$) dependent relationship between awareness of and referral for DM related auditory symptoms (see Table 2).

Table 2

Awareness of and referrals for DM related auditory symptoms.

	Aware of DM related auditory symptoms, n (%)	Unaware of DM related auditory symptoms, n (%)	<i>p</i> -value
Has referred	65 (71.4%)	47 (33.6%)	<0.001
Has not referred	26 (28.6%)	93 (66.4%)	

It was found that most participants who referred PWD to an audiologist and/or ENT were aware of DM related auditory symptoms (see Figure 7).

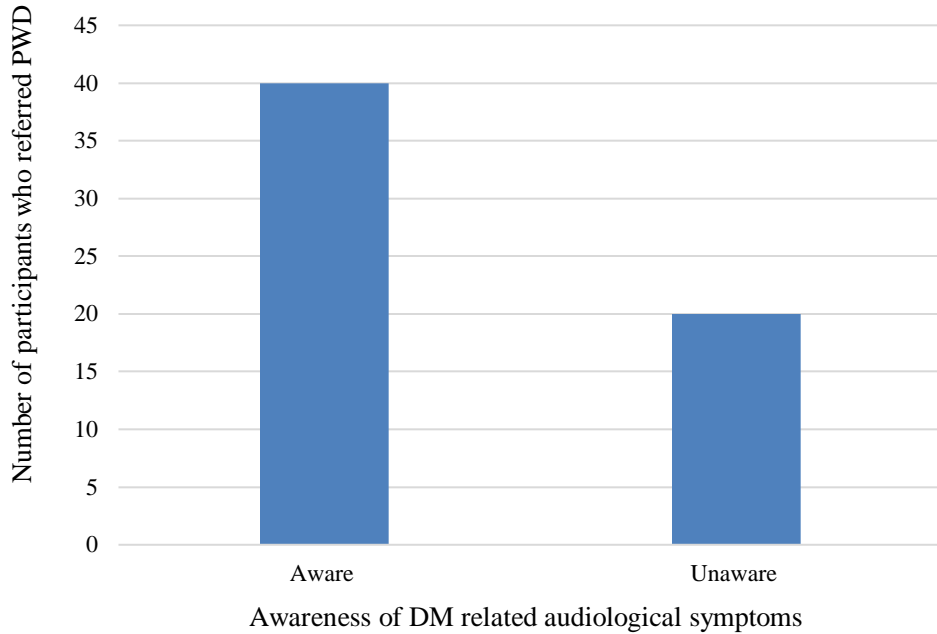


Figure 7: *Difference in referrals based on awareness of DM related auditory symptoms.*

A chi-square test of independence showed that there was no significant relationship ($p=0.94$) between participants' years of experience and awareness of DM related auditory symptoms, thus indicating that these two variables are independent of one another (see Table 3).

Table 3

Years of experience and awareness of DM related auditory symptoms.

	3-10 years of experience, n (%)	11-20 years of experience, n (%)	>20 years of experience, n (%)	<i>p</i> -value
Aware of DM related symptoms	27 (39.1%)	22 (42.3%)	46 (40.0%)	0.94
Unaware of DM related symptoms	42 (60.9%)	30 (57.7%)	69 (60.0%)	

A significant ($p=0.05$) dependent relationship was found between participants' years of experience and referrals (see Table 4).

Table 4

Years of experience and referrals for DM related auditory symptoms.

	3-10 years of experience, n (%)	11-20 years of experience, n (%)	>20 years of experience, n (%)	<i>p</i> -value
Has referred PWD	31 (44.9%)	32 (64.0%)	49 (43.8%)	0.05
Has not referred PWD	38 (55.1%)	18 (36.0%)	63 (56.3%)	

4) Counselling PWD regarding DM related auditory symptoms

Most participants indicated that they had *never* discussed DM related auditory symptoms with PWD (n=148) (see Figure 8). Those who indicated that they *always* (n=8) or *sometimes* (n=72) discussed auditory symptoms with PWD, reported that the discussion was mainly prompted by PWD indicating concerns with some auditory symptoms (see Figure 9). Some participants provided more than one answer.

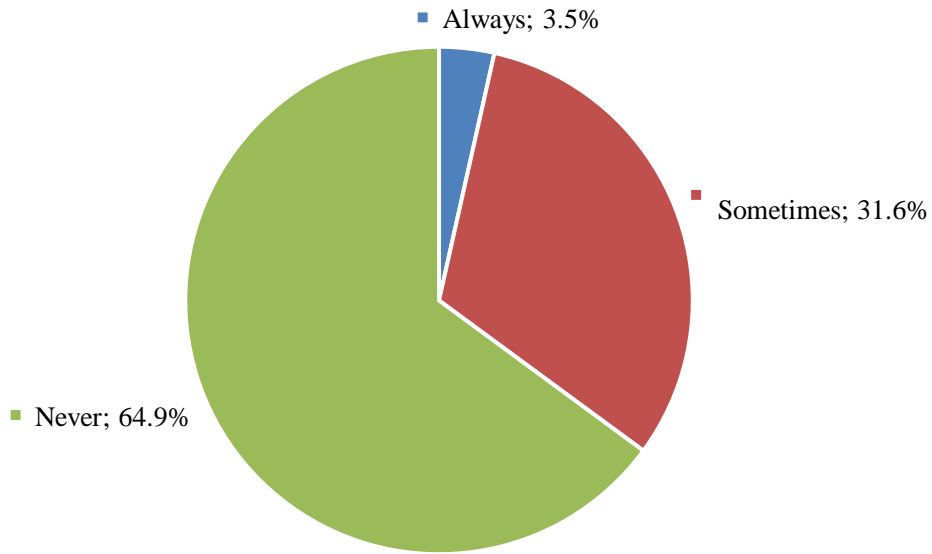


Figure 8: *Counselling of PWD on DM related auditory symptoms (n=228).*

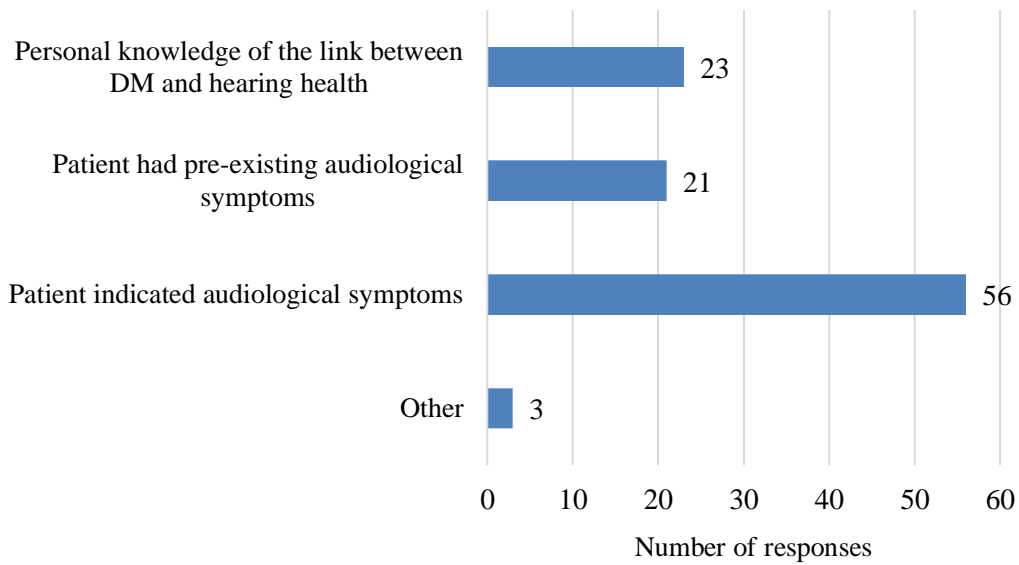


Figure 9: *Prompts for counselling on DM related auditory symptoms (n=79).*

Participants were asked to specify how familiar they were with the role of an audiologist in the management of PWD. It was found that most participants (34.4%) were not so familiar or

not familiar at all (44.9%) with the role of an audiologist in the management of PWD (see Figure 10).

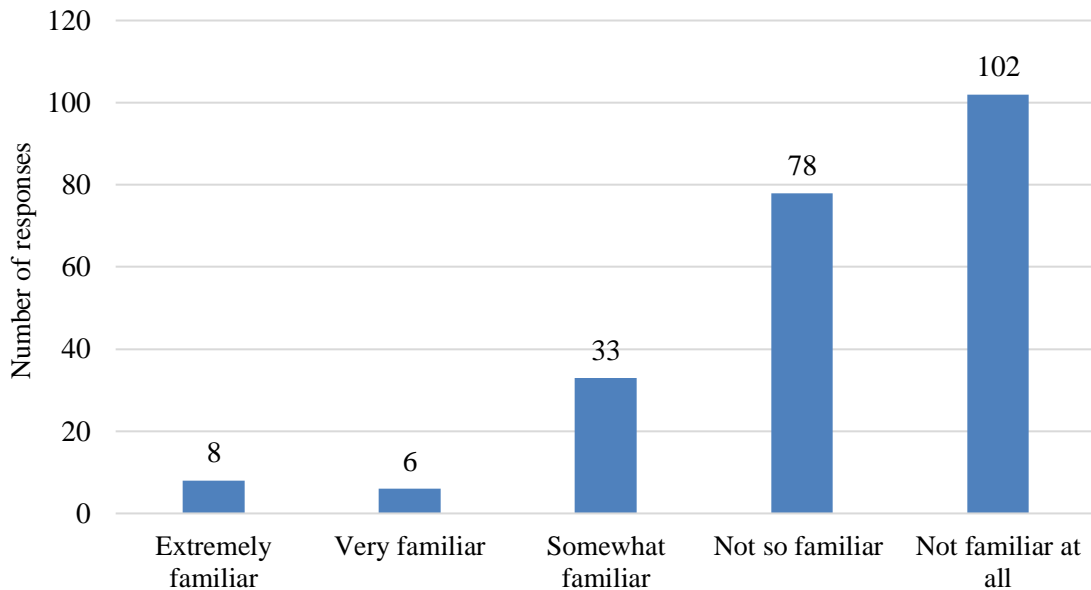


Figure 10: *Familiarity on audiologist’s role in DM management (n=227).*

Those who indicated that they were either “extremely familiar”, “very familiar” or “somewhat familiar” were thereafter requested to indicate what their opinion was on the role of audiologists in the management of PWD. There were 3 commonly occurring responses (see Figure 11). Many participants provided more than one response, with the majority of participants indicating that the role of audiologists in the management of PWD is to “assess” and “manage” HL.

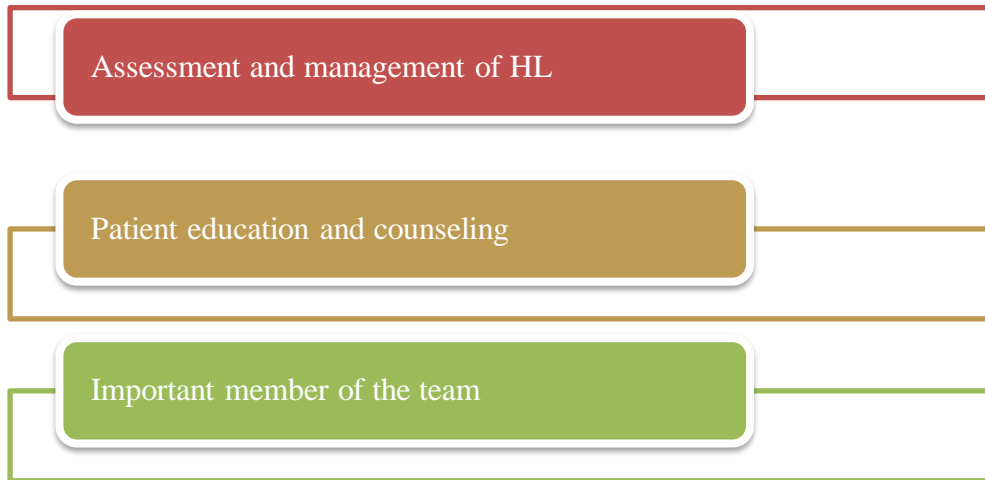


Figure 11: *Knowledge of audiologists role in the management of PWD.*

A Fishers exact test showed a significant ($p < 0.001$) dependent relationship between familiarity with the role of an audiologist and counselling PWD on DM related auditory symptoms (see Table 5). Participants who were *extremely familiar* with the role of audiologists almost *always* counselled PWD regarding DM related auditory symptoms. However, the majority of participants who are *not at all familiar* with the role of audiologists and *never* counselled on DM related auditory symptoms.

Table 5

Familiarity with the role of audiologists and counselling.

Counselling on DM related auditory symptoms	Familiarity with the role of audiologists					p-value
	Extremely familiar, n (%)	Very familiar, n (%)	Somewhat familiar, n (%)	Not so familiar, n (%)	Not at all familiar, n (%)	
Always	3 (37.5%)	1 (16.7%)	1 (3.0%)	3 (3.9%)	0 (0%)	<0.001
Sometimes	4 (50%)	4 (66.7%)	25 (75.8%)	29 (37.7%)	8 (7.8%)	
Never	1 (12.5%)	1 (16.7%)	7 (21.2%)	45 (58.4%)	94 (92.2%)	

5) Additional comments related to the survey

Participants were given an option to provide any additional comments they may have had regarding the topic of DM and auditory symptoms. There were 3 commonly occurring responses (see Figure 12). Some of the direct quotes from participants included “More information is required on this topic” and “It’s an area of which we generally have very little awareness and have learned little about it”.

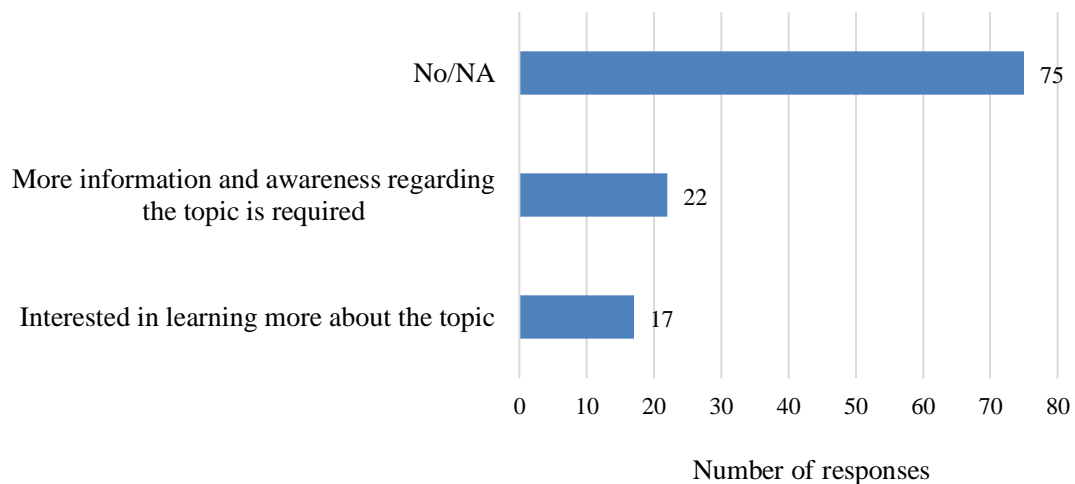


Figure 12: *Additional comments (n=114).*

Chapter 5: Discussion and conclusion

Introduction: This chapter highlights the current study's findings and expands on any links to existing literature within the topical theme of this research. In addition, the chapter discusses the strengths and weaknesses of the current study, outlines conclusions and clinical implications, and ends with suggested directions for future research.

The current study sought to determine awareness of and referrals for DM related auditory symptoms by South African MPs. The study further aimed to investigate the relationship between awareness of and referrals for DM related auditory symptoms. The overall findings of this study revealed that most participants were unaware of (n=141, 59.7%) and did not refer (n=119, 51.5%) PWD for DM related auditory symptoms. Moreover, most participants (n=148, 64.9%) never counselled PWD about DM related auditory symptoms.

Participants awareness of DM related auditory symptoms

Several researchers have reported a possible lack of awareness of HL as a comorbidity of DM by health care professionals who manage PWD (Bainbridge, 2009; Dowd, 2019; Hlayisi *et al.*, 2019). Similarly, the current study found that only one third of the participants (n=95, 40.3%) were aware of DM related auditory symptoms. Given that there are numerous publications in the last decade and a half providing scientific research evidence establishing DM related auditory symptoms, MPs lacking awareness is telling on the access to and uptake of research knowledge into clinical practice (Akinpelu *et al.*, 2013; Hong *et al.*, 2013; Morrison *et al.*, 2014; Olusanya *et al.*, 2014; Kim *et al.*, 2015; Kumar & Kumar, 2015; Gupta *et al.*, 2018; Hlayisi *et al.*, 2019; Kauffman, 2021). Moreover, with the potential damaging consequences of PWD living with multi-morbidities, it is crucial that there are efforts to ensure MPs managing PWD are aware of DM related auditory symptoms (Morrison *et al.*, 2014). Future researchers should explore how MPs

obtain/learn new information outside of scientific journals in order to find and use the most effective method to raise awareness on DM related auditory symptoms. This in turn would be a catalyst to move towards referrals for treatment of DM related auditory symptoms.

Referrals of PWD for DM related auditory symptoms

The findings from the current study revealed that the majority of participants (n=119; 51.5%) did not refer PWD to an audiologist and/or ENT. The poor referral rate would be expected as it correlates with the lack of awareness about DM related auditory symptoms. This is a novel finding, as to the knowledge of the researcher, there has not been any previous studies exploring referral information of PWD for DM related auditory symptoms. The low proportion of MPs referring for DM related auditory symptoms may imply that there is a limited knowledge on the role of audiologists in DM management among health care professionals. Poor knowledge on the role of audiologists would invariably prevent or delay early identification and management of auditory symptoms in PWD and thus increasing the possibility of multimorbidity.

A method to increase referrals for DM related auditory symptoms could be in developing annual DM care checklists for MPs, with a list of probable screening assessments such as audiological screening post DM diagnosis. One such example is highlighted in the work undertaken by *The Audiology Project* (TAP). TAP is currently working on advocating audiological monitoring for PWD in collaboration with the American Academy of Audiology and The American Association of Diabetes Educators and The Academy of Doctors of Audiology (“The Audiology Project”, nd). They have developed several educational materials, one of which includes an audiology referral checklist to assist doctors in identifying DM related auditory symptoms to refer PWD to audiologists (“The Audiology Project”, nd). Efforts by TAP are crucial given the disregard of auditory symptoms in DM care (Dowd, 2019).

In the current study, only 15.2% (n=17) of participants reported that they referred PWD to an audiologist and/or ENT as a general referral for *a possible DM complication*. It was further found that the common reason for referrals was predominantly a result of patients reporting signs of auditory symptoms. Thus, there is a need for realignment of DM care to be a multidisciplinary team effort, which is inclusive of audiologists. In order to address the low referral rate for DM related auditory symptoms and increasing awareness on audiologists role in DM care, it is hereby recommended that educational programs in the form of workshops and seminars can be incorporated to increase multi-disciplinary DM care (Hlayisi *et al.*, 2019).

Relationship between awareness of and referrals for DM related auditory symptoms

A significant dependent relationship ($p < 0.001$) was found between participants awareness of and referrals for DM related auditory symptoms. This suggests that participants who were aware of DM related auditory symptoms were more likely to refer and vice versa. The relationship between awareness and referrals was expected, as without being aware of DM related auditory symptoms, participants would not be expected to request for appropriate referrals.

The existence and publication of research on DM related auditory symptoms alone, has not translated the benefits in implementation of said knowledge into clinical practice. A crucial step towards increasing patient referrals would be to identify barriers that impede the effectiveness of patients referrals (Akbari-Sari, Seyed & Ahmadi, 2021). The implementation of an effective referral system requires a close affiliation amid all levels of health care with the objective of ensuring the best possible care provided to patients (Akbari-Sari *et al.*, 2021).

The findings from the current study highlight that awareness of the role of audiologists is a critical component. It can therefore be suggested that to increase referral of PWD for DM related auditory symptoms, a more interactive relationship be developed between primary care physicians

and audiologists. According to Louw, Swanepoel, Eikelboom and Hugo (2018), physicians managing PWD who have an interactive relationship with audiologists can enable early identification and management of DM related auditory symptoms and thus help alleviate the burden and expenses linked to multimorbidity.

Health professionals should be provided with a broader and continuing academic education program regarding the importance of including audiologists in the multidisciplinary health care team when managing PWD (Hackett & Popp, 2002). Continuing academic education programs will require strategic planning and identification of program goals as well as clear descriptions of care pathways in order to be effective (Louw *et al.*, 2018). Such efforts should contribute towards increasing the number of PWD referred from primary health care for assessment and management of DM related auditory symptoms (Hackett & Popp, 2002).

Audiological management of PWD

The current study found that the majority of participants (n=148; 64.9%) never counselled PWD regarding the possibility of DM related auditory symptoms, and those who always (n=8; 3.5%) or sometimes (n=72; 31.6%) counselled patients were mainly due to patient reports of experiencing auditory symptoms. This finding is consistent with the previous results of the current study which indicated that a high proportion of MPs are not aware of and not referring PWD for DM related auditory symptoms.

According to Spankovich and Yerraguntla (2019), the first step to primary prevention of hearing impairment as a DM complication is the education/counselling of PWD with regard to the increased risk of hearing impairment. The absence of counselling will invariably delay/prevent early intervention for DM related auditory symptoms, which may result in detrimental consequences for PWD living with multi-morbidities. Given that primary health care facilities for

the majority of South African PWD are the first form of contact they have with the health care system (Khan *et al.*, 2018), it consequently becomes the responsibility of primary care physicians (such as MPs) to counsel PWD regarding DM related complications including auditory symptoms. Hence, it is imperative that the importance of counselling PWD on DM related auditory symptoms be strongly encouraged by audiologists, in collaboration with the National Department of Health, targeted at MPs.

PWD should understand how healthy interventions can improve their present and long-term health status (Paterick *et al.*, 2017). Paterick *et al.* (2017) suggested that by encouraging patient education and participation in their health care, they too can increase their help seeking behaviour. Such counselling can in turn increase the likelihood of patients self-reporting to MPs on experiencing auditory symptoms.

Participants familiarity with the role of audiologists in DM care

Most participants were either not so familiar (n=78; 34.4%) or not familiar at all (n=102; 44.9%) with the role of audiologists in the management of PWD. This finding was not surprising given the general lack of awareness of DM related auditory symptoms among participants.

The findings of poor familiarity with the role of audiologists in the management of PWD further raises the question of MPs and perhaps all health professionals' general awareness of the role and responsibilities of audiologists in the health care system. Bhuminathan *et al.*, (2020) conducted a survey study in India related to MP's awareness of audiologists and speech language pathologists. Their findings revealed that 51.1% of participants had inadequate knowledge on audiologists and speech language pathologists (Bhuminathan *et al.*, 2020).

In addition to assessment and management of hearing and balance related disorders, audiologists are involved in providing counselling for communication strategies; educating the

patient on psychological consequences and how to cope with their hearing impairments on a daily basis; including family members during the rehabilitation process as well as providing tinnitus related counselling (Kramer, Kapteyn, Kuik & Deeg, 2002). However, it is unfortunate that early hearing detection and intervention of auditory impairments have been reported to remain elusive amid several South African primary health care facilities (Khan *et al.*, 2018). This validates the poor awareness of the role and responsibilities of audiologists in the health care system.

According to Spankovich and Yerraguntla (2019), it is necessary for PWD to undergo a comprehensive auditory evaluation and follow up every 2 years at minimum. Therefore, future research should potentially be conducted among South African health professionals regarding the awareness of and role of audiologists. Such findings can provide information on how educational programs can build the knowledge and understanding on the role and responsibilities of audiologists.

In addition to health professionals' knowledge of audiologists in the health system, it is important to educate the general public, including PWD, on audiological care. In a recent South African study conducted in the Limpopo Province, it was discovered that out of 297 households, only 14% were aware of the audiology occupation (Joubert *et al.*, 2017). The public's understanding of the audiology profession in the health care system should be addressed in order to enable the general community, with or without DM, to take the onus upon themselves to seek audiological assessment and management. The National Department of Health can assist in this endeavour by developing useful strategies to increase South African patient education regarding the services provided by audiologists and other rehabilitation professions.

The results of the current study further indicated that participants counselling PWD on DM related auditory symptoms had a significant ($p < 0.001$) dependent relationship on their familiarity

of the role of audiologists in the management of PWD. These results were expected, in that if one is not aware of the role of the other healthcare professionals, the importance of said professional as a contributor in holistic management, would invariably not be communicated to patients.

Audiologists as health care professionals should further increase education on their role in the management of PWD. Universities in South Africa can contribute through educating students to develop context-relevant strategies related to raising awareness of the audiology profession, which includes the role and responsibilities of audiologists in the management of PWD.

Impact of work experience to awareness and referrals

The current study found that participants' years of experience ($p=0.94$) was not significantly dependent to participants' awareness of DM related auditory symptoms. This finding was unexpected in that clinical expertise would be thought to be gained through cumulative experience (Elstad *et al.*, 2010). However, studies investigating the impact of work experience and other aspects, such as quality of care, found an inverse relationship between years of experience and quality of care (Elstad *et al.*, 2011). Ajmi and Aase (2021) analysed fifty-two studies reporting 63 evaluations of the relationship between medical professional's clinical experience and healthcare quality. It was found that there was no clear relationship between medical professional's clinical experience and healthcare quality (Ajmi & Aase, 2021). These studies, along with the findings of the current study indicate that years of experience does not necessarily increase the knowledge, or the quality of care provided to patients. Furthermore, the current study findings challenge the notion of cumulative clinical experience among health professionals. Moreover, one of the key areas highlighted for critical review by these findings is the effectiveness of continuing medical education/professional development to keep healthcare professionals abreast with new and relevant evidence for their clinical practice (Elstad *et al.*, 2011).

Strengths and Limitations of the study

Strengths

- *Investigation of a novel aspect:* The current study investigated awareness of and referrals for DM related auditory symptoms among participants who manage PWD. Previous studies primarily focused on providing evidence of the impact of DM on hearing and balance function. However, there was limited research related to health care professionals' awareness of such evidence. Consequently, this empirical study adds to the knowledge base in this research area.
- *Reliability and Validity of study:* Content validity of the survey instrument was measured by calculating the I-CVI with an expert panel of five audiologists prior to piloting the instrument for interrater reliability.

Limitations

- *Barriers to accessing research participants, POPI Act:* Although several medical associations in South Africa were approached to circulate the survey link via email to their registered MPs, the majority declined to participate due to the POPI Act. This resulted in time delays and a reduced response rate than anticipated.
- *Incomplete surveys:* Many participants only answered the demographic section of the survey questionnaire and did not proceed with completing the main survey questions. This resulted in many survey responses being considered as incomplete and thus eliminated during the data analyses process, which then reduced the anticipated response rate.

Clinical Implications

There are a few clinical implications emerging from the current study:

1. There is a need to raise awareness among MPs regarding DM related auditory symptoms.
It is also to be considered that the WHO and IDF form a significant collaborative role in the dissemination of DM information, education, and research. However, key fact sheets from these organizations (WHO and IDF) related to DM comorbidities include information which primarily focuses on neuropathies related to vision and limbs, as opposed to other sensory impairments. Several studies have documented auditory symptoms as a comorbidity of DM. Thus, it is crucial for the WHO and IDF to introduce this topic of DM and hearing impairments in their fact sheets.
2. Most participants in the current study, who suggested that they were aware of DM related auditory symptoms, indicated that they became aware of the topic through journal articles and medical school. It can therefore be suggested that awareness regarding the topic be elevated through more publications in journal articles and more emphasis placed on the topic in medical schools in South Africa.
3. There is a need to raise awareness regarding referrals of PWD for annual auditory assessments as part of an early identification and management strategy for auditory impairments. This can be achieved by educating MPs through health screening and awareness campaigns.
4. There is a dire need for audiologists to be recognized within the multidisciplinary team in the care of PWD. Future research should investigate South African health professionals' knowledge on the role of audiologists in the management of PWD. This will assist in determining how educational programs can build the knowledge on audiologist's function.

5. PWD should be educated on the possibility of auditory symptoms occurring as a comorbidity of DM. Patient education regarding DM related auditory symptoms is therefore recommended to be reinforced by MPs during counselling sessions. This will increase patient's help seeking behavior and their likelihood of self-reporting auditory symptoms to MPs.

Recommendations for future research

It is hereby recommended that future research studies focus on the following:

- Investigate the knowledge of and practice patterns among health professionals such as nurses in managing DM related auditory symptoms.
- Collaborative research with multiple disciplines such as MPs, nurses, and endocrinologists, should focus on effective methods towards increasing awareness of DM related auditory symptoms.

Conclusion

The current study established that there is a high proportion of MPs who are not aware of and do not refer or counsel PWD for DM related auditory symptoms. Furthermore, MPs were not aware of the role of audiologists in DM management. Referrals for and counselling on DM related auditory symptoms were found to be dependent on MPs awareness thereof and their familiarity on the role of audiologists in the management of PWD. The findings from the current study suggest the need to increase awareness on DM related auditory symptoms among South African MPs as well as increased collaboration between audiologists and MPs in the management of PWD.

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Appendix A: Survey questions

Section A: Demographic Details	Response Type	Variable
<p>1) Kindly click on one of the boxes below.</p>	<p>Multiple choice:</p> <p>1) I hereby agree to participate in the study.</p> <p>2) I hereby do not agree to participate in the study.</p>	<p>NA</p>
<p>2) Please provide your HPCSA number. (This will be used to cross-check whether all participants are registered under the necessary fields. Prior to data analysis all HPCSA numbers will be destroyed in order to uphold the anonymity of all research participants)</p>	<p>Numeric answer</p>	<p>NA</p>

<p>3) Select your registration category. (Please select all applicable options)</p>	<p>Multiple choice:</p> <ol style="list-style-type: none"> 1) "Medicine" 2) "Public Health Medicine" 3) "Community Health" 4) "Family Medicine" 5) Other (Please specify) 	<p>Nominal and text</p>
<p>4) Which sector are you currently practicing in?</p>	<p>Multiple choice:</p> <ol style="list-style-type: none"> 1) Private 2) Public 3) Both 	<p>Nominal</p>
<p>5) Please indicate how many years of experience you have as a medical practitioner.</p>	<p>Multiple choice:</p> <ol style="list-style-type: none"> 1) <10 	<p>Nominal</p>

	<p>2) 3-10</p> <p>3) 11-20</p> <p>4) >20</p>	
<p>6) Please select your average case load involving management of patients with diabetes per annum.</p>	<p>Multiple choice:</p> <p>1) <10%</p> <p>2) 10-20%</p> <p>3) ≥20%</p>	Nominal
<p>7) On average, how many patients with diabetes do you manage per annum?</p>	<p>Multiple choice:</p> <p>1) <50</p> <p>2) 50-100</p> <p>3) >100</p>	Nominal
<p><u>Section B</u></p>		
<p>1) Are you aware of any diabetes related auditory symptoms?</p>	<p>Multiple choice:</p>	Nominal

	<p>1) Yes</p> <p>2) No</p> <p>(If <i>no</i>, please proceed to section C)</p>	
<p>2) Please list the diabetes related auditory symptoms you are aware of.</p>	<p>Open-ended question</p>	<p>Text</p>
<p>3) How did you become aware that the auditory symptoms listed above may be linked to diabetes?</p>	<p>Multiple choice: (Please select all applicable options)</p> <p>1) Journal article</p> <p>2) Pamphlet</p> <p>3) Conference</p> <p>4) Medical school</p> <p>5) During community service and/or internship</p> <p>Open-ended question:</p>	<p>Nominal and text</p>

	<p>6) Other: (Please type in your response here) </p>	
<p><u>Section C</u></p>		
<p><i>Question 1</i></p>		
<p>1.1) Have you referred any of your patients with diabetes to an audiologist and/or Ear Nose and Throat specialist (ENT)?</p>	<p>Multiple choice: 1) Yes 2) No (If <i>no</i>, please proceed to question 3)</p>	<p>Nominal</p>
<p><i>Question 2</i></p>		
<p>2.1) What was the purpose of your referrals to an audiologist and/or ENT specialist?</p>	<p>Multiple choice: (Please select all applicable options)</p>	<p>Nominal and text</p>

	<p>1) Patient reported signs of hearing deterioration.</p> <p>2) Patient reported signs of balance dysfunction.</p> <p>3) Patient reported signs of tinnitus and/or Otagia.</p> <p>4) Patient reported signs of aural fullness.</p> <p>5) General referral as a possible diabetes complication.</p> <p>Open-ended question:</p> <p>6) Alternate purpose of referral: (Please type in your response here) </p>	
<i>Question 3</i>		

<p>3.1) Do you discuss diabetes related auditory symptoms when counselling patients with diabetes?</p>	<p>Multiple choice:</p> <ol style="list-style-type: none"> 1) Always 2) Sometimes 3) Never 	<p>Nominal</p>
<p>3.2) What prompted the discussion?</p>	<p>Multiple choice:</p> <p>(Please select all applicable options)</p> <ol style="list-style-type: none"> 1) Personal knowledge of the link between diabetes and hearing health. 2) Patient had pre-existing auditory symptoms. 3) Patient indicated auditory symptoms. 4) Other (Please specify) 	<p>Nominal</p>

Question 4		
4.1) How familiar are you with the role of an audiologist in the management of patients with diabetes?	<p>Multiple choice:</p> <p>1) Extremely familiar</p> <p>2) Very familiar</p> <p>3) Somewhat familiar</p> <p>4) Not at all familiar</p>	Nominal
5.2) What in your opinion is the role of an audiologist in the management of patients with diabetes.	Open-ended question	Text
5.3) Do you have anything to add with regards to the topic of diabetes and hearing health	Open-ended question	Text

END OF SURVEY

Thank you for participating in this short online survey! Should you wish to enter a lucky draw to win an R1000 online voucher, kindly provide your email address and/or contact number below.

Email address:

Contact number:

For more information about diabetes and hearing impairment, kindly find the fact sheet below.

Diabetes and Hearing Loss: 5 Facts You Need to Know

1. There is a proven link between diabetes and hearing loss in adults over the age of 60.
The same microvascular changes which often lead to nephropathy and retinopathy in diabetic patients, can lead to damage to the microstructures of the cochlear. One recent peer reviewed survey¹ indicates that 21% of diabetics had hearing loss, compared to 9% of non-diabetic adults. For diabetic patients over the age of 60 the prevalence of high frequency hearing loss rose to 54%, compared to 32% of non-diabetic adults of similar age.

2. Diabetic patients should have their hearing screened when identified with diabetes.
Given the relationship between diabetes and hearing loss, when patients are identified as diabetic they should have their hearing screened by a licensed professional.

3. Diabetic patients can have a progressive hearing loss.
It's possible that diabetic patients can have normal or near-normal hearing at the time of the initial identification of diabetes, only to suffer from a progressive form of sensorineural hearing loss.² Therefore; diabetic patients should have their hearing screened annually.

4. Hearing loss of adult onset often contributes to social isolation, cognitive loss and depression.
Studies indicate that adults with mild to moderate-severe hearing loss are more likely to suffer the effects of social isolation and withdrawal, including depression, cognitive loss and psychosis.^{3,4}

5. Hearing aids can help.
A peer reviewed study conducted by the National Council on Aging of over 2000 participants with hearing loss provides evidence of the benefits of hearing aids, including improved overall health, better interpersonal relationships and a reduction in frustration, anxiety and depression.⁵

The evidence suggests diabetic patients need to have their hearing screened annually.

References
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5. The consequences of untreated hearing loss in adults. May, 1999 National Council on Aging, White paper.



unitron.

Further recourses on diabetes and hearing health can be found via the website www.theaudiologyproject.com

Appendix B: *Expert panel recruitment letter*

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Divisions of Communication Sciences and Disorders,

Researcher: Email: JNBDIV001@myuct.ac.za

Telephone: 0796382488

Dear Sir/madam

RE: EXPERT PANEL NEEDED FOR DIABETES AND HEARING HEALTH STUDY

My name is Divaksha Jinabhai and I am a master's student from the University of Cape Town. I am interested in conducting a study to determine hearing health awareness among medical practitioners who manage patients with diabetes.

My study will involve administering a survey directed to medical practitioners in South Africa who manage patients with diabetes. The survey will consist of questions that will assist in determining medical practitioners' awareness of diabetes related auditory symptoms and whether referrals of patients with diabetes are made to hearing health services.

You are invited to form part of an expert panel of five audiologists to assist in identifying whether the research survey questions are relevant to the purpose of the study. The expert panel will consist of two audiologists who are experts particularly in the field of quantitative research involving public health and non-communicable diseases, and three audiologists who are in active clinical practice.

Participation criteria:

- Qualified and licensed audiologist.
- Five or more years of clinical experience.
- Active in clinical practice OR an expert in the field of quantitative research involving public health and non-communicable diseases.

Procedure and expectations:

1. A copy of the survey, along with a content validity evaluation questionnaire will be sent to you via email.
2. The questionnaire will comprise of a scale which requires you to independently rate each item on the survey according to its relevance to the study.
3. The questionnaire will be required to be completed and returned to the researcher within 10 days upon receipt of the survey document and content validity evaluation questionnaire.

Please note that your participation in forming part of the expert panel is on a voluntary basis and that there will be no risks or benefits associated with your participation. Your identity and personal information will remain anonymous and will only be available to the researcher and research supervisor. You may also withdraw your participation from the study at any given point without any consequences.

Should you wish to participate in the study, kindly complete the consent form attached below and return it to the researcher via email at JNBDIV001@myuct.ac.za.

For further questions or assistance, do not hesitate to contact me via the email address listed above.

Thank you in advance for your cooperation with this matter.

Research supervisor:

Contact person:

Vera Hlayisi

Contact telephone number: 0216505540

Address: Division of Communication Sciences and Disorders, F45
Old Main Building, Groote Schuur Hospital,
Observatory, 7925

UCT Faculty of Health Sciences Human Research Ethics Committee Contact Details:

Address: E52.24, Old Main Building, Groote Schuur Hospital

Contact telephone number: 021 406 6338

Fax: 021 406 6411

Kind Regards,

Divaksha Jinabhai

Attached consent form for expert panel:

**Division of Communication Science and Disorders Department of Health and Rehabilitation
Sciences Faculty of Health Sciences, F45 Old Main Building Groote Schuur Hospital**

Telephone: 0796382488, Email: divaksha.j@gmail.com

Study Title: Hearing Health Awareness among Medical Practitioners Managing Patients with
Diabetes in South Africa.

This is to confirm that I..... (Name and surname), agree to volunteer to be part of
this study as a member of the expert panel of audiologists. The study purpose and my involvement
have been clearly explained via an email briefing. I have understood all the explanations. It is also
understood that my participation can be withdrawn at any time without any consequences.

Audiologist Name:

.....

Signature:

.....

Appendix C: Content validity questionnaire (expert panel)

The purpose of this questionnaire is to establish whether the content of the survey is suitable and relevant to the purpose of the proposed study.

Kindly refer to the survey and rate the relevance of each question on the table below:

	Relevance of survey item: 1= Irrelevant 2= Somewhat relevant 3= Quite relevant 4= Highly relevant
Section B	
1.1	
1.2	
1.3	
Section C	
1	
2	
3.1	
3.2	
4.1	
4.2	
4.3	
5.1	
5.2	
5.3	

Appendix D: Table documenting expert panel ratings on the relevance of survey items

	Expert panel members						
	1	2	3	4	5	Experts in agreement:	I-CVI score:
Section B							
1.1	4	4	4	4	4	5	100%
1.2	3	3	2	4	4	4	80%
1.3	3	4	4	4	2	4	80%
Section C							
1	3	4	4	1	4	4	80%
2	3	4	2	4	4	4	80%
3.1	2	3	4	3	3	4	80%
3.2	2	2	4	4	3	3	60%
4.1	4	4	4	4	4	5	100%
4.2	4	4	4	4	4	5	100%
4.3	2	3	2	4	3	3	60%
5.1	4	3	4	3	4	5	100%
5.2	4	3	4	3	4	5	100%
5.3	4	2	4	2	3	3	60%

Appendix E: Pilot participants recruitment email letter

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Divisions of Communication Sciences and Disorders,

Researcher: Email: JNBDIV001@myuct.ac.za

Telephone: 0796382488

Dear Sir/madam

RE: PILOT STUDY PARTICIPANTS NEEDED FOR DIABETES AND HEARING HEALTH RESEARCH

My name is Divaksha Jinabhai, and I am a Master's student in Audiology at the University of Cape Town. I am interested in conducting a study to determine hearing health awareness among medical practitioners managing patients with diabetes.

My study will involve administering a survey questionnaire directed to medical practitioners in South Africa who manage patients with diabetes. The survey will consist of questions that will assist in determining the awareness of diabetes related auditory symptoms and whether referrals of diabetic patients are made to hearing health services.

You are invited to form part of the pilot study on a voluntary basis where you will be required to assist in evaluating whether the survey items and instructions are clearly worded.

Participation criteria:

- Qualified and licensed South African Medical practitioner.
- Registered with the HPCSA under the titles of “Medicine”, “Public Health Medicine”, “Community Health” or “Family Medicine”.
- Frequently manage patients with diabetes.
- Minimum experience level of 3 years (independent practitioners post internship and community service).

Procedure and expectations:

1. Once you have provided consent to participate in the pilot study, you will be emailed a link.
2. The link will direct you to an information letter and thereafter the survey which you will be required to complete.
3. You will then be directed to a rating sheet where you will be required to rate each of the survey items on a 4-point Likert scale based on the clarity of wording. Please note that you will need to provide recommendations if you have scored an item “1” or “2”.
4. The survey and rating sheet is expected to be completed within 10 days upon receiving the link of the survey.

Please note that your participation is on a voluntary basis and that there are no risks or benefits associated with your participation. Your identity and personal information will remain anonymous and will only be available to the researcher and research supervisor. You may also withdraw your participation from the study at any given point without any consequences.

Should you wish to participate in the study, kindly complete the attached consent form and return it to the researcher via email at JNBDIV001@myuct.ac.za.

For further questions or assistance, please do not hesitate to contact me via the email address above.

Thank you in advance for your cooperation with this matter.

Research supervisor:

Contact person: Vera Hlayisi

Contact telephone number: 0216505540

Address: Division of Communication Sciences and Disorders, F45
Old Main Building, Groote Schuur Hospital,
Observatory, 7925

UCT Faculty of Health Sciences Human Research Ethics Committee Contact Details:

Address: E52.24, Old Main Building, Groote Schuur Hospital

Contact telephone number: 021 406 6338

Fax: 021 406 6411

Kind Regards,
Divaksha Jinabhai

Attached consent form for pilot study participants:

**Division of Communication Science and Disorders Department of Health and Rehabilitation
Sciences Faculty of Health Sciences, F45 Old Main Building Groote Schuur Hospital**

Telephone: 0796382488, Email: JNBDIV001@myuct.ac.za

Study Title: Hearing Health Awareness among Medical practitioners Managing Patients with
Diabetes.

This is to confirm that I..... (Name and surname), agree to volunteer to be part of
this study as a participant of the pilot study. The study purpose and my involvement have been

clearly explained via an email briefing. I have understood all the explanations. It is also understood that my participation can be withdrawn at any time without any consequences.

Name:

.....

Signature:

.....

Appendix F: Pilot participants wording clarity table

	Wording clarity of survey items:	Recommendations:
	1= unclear 2= wording needs to be revised 3= minor changes required 4= clear	Should you score an item “1” or “2”, kindly provide recommendations for improvement.
Section B		
1.1		
1.2		
1.3		
Section C		
1		
2		
3.1		
3.2	Question removed	
4.1		
4.2		
4.3	Question removed	
5.1		
5.2		
5.3	Question removed	

Appendix G: Table documenting pilot participants ratings on wording clarity of survey items

	Participant ratings on clarity of item wording													
	1	2	3	4	5	6	7	8	9	10	11	12	Participant s in agreement	I-CVI score
Section B														
1.1	4	3	4	4	4	4	4	4	4	4	4	4	12	100%
1.2	4	3	4	4	4	4	4	4	4	4	4	4	12	100%
1.3	4	3	4	4	4	4	4	4	3	4	4	4	12	100%
Section C														
1	4	2	4	4	4	4	4	4	4	4	3	4	11	92%
2	4	3	4	4	4	4	4	4	4	4	4	4	12	100%
3.1	4	1	4	4	4	4	4	4	4	4	2	4	10	83%
3.2	Question removed													
4.1	4	3	4	4	4	4	4	4	4	4	4	4	12	100%
4.2	4	4	4	4	4	4	4	4	4	4	4	4	12	100%
4.3	Question removed													
5.1	4	3	4	4	4	4	4	4	4	4	4	4	12	100%
5.2	4	3	4	4	4	4	4	4	2	4	4	4	11	92%
5.3	Question removed													

Appendix H: Participant information sheet

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Divisions of Communication Sciences and Disorders,

Researcher: Email: JNBDIV001@myuct.ac.za

Telephone: 0796382488

Dear Sir/Madam,

You are invited to participate in a short online survey looking into awareness related to a particular phenomenon in diabetes health care.

Who is allowed to take part in this study?

- Qualified and licensed medical practitioners who are registered with the Health Professionals Council of South Africa.
- Medical practitioners who self-report that at least 20% of their case load involves management of patients with diabetes.
- Minimum experience level of 3 years (independent practitioners post internship and community service).

What will you have to do?

Following this briefing, you will be required to provide your consent to participate in the study via an electronic consent form. Upon providing your consent, you will be directed to the survey which comprises of 18 questions. The survey will take x minutes to complete.

Please note that your participation is entirely voluntary, and you may withdraw your participation at any given time without explanation or prejudice.

All personal information and survey responses will only be used for the purpose of this study and will not be traced back to you.

What are the risks of the study?

The study does not anticipate any harm to befall research participants.

Are there any benefits to you for being in the study?

You will have the option to enter a lucky draw to win an R1000 online voucher by providing your email address and/or contact number at the end of the survey. Entry into the lucky draw will be dependent on ALL survey questions being answered and if a contact number and/or email address have been provided. The winner will be announced during XXX 2022 once the data collection procedure has concluded.

Payments and expenses.

You will not be paid for participating in the study nor do you do not have to pay to participate in the study.

What personal information is required from participants and how will responses remain anonymous?

You will be required to provide your HPCSA number as part of the survey. This will allow the researcher to cross check whether all survey participants are registered with the HPCSA and are practicing under the relevant fields as outlined in the survey advertisement. Once the HPCSA numbers of all participants have been cross checked, they will be deleted. Thereafter, prior to commencing with data analysis each participant will be assigned a number to uphold anonymity of all participants responses.

How will personal information be safely stored?

Personal information and survey responses will be stored on a password-protected computer and will ONLY be accessible to the researcher and research supervisor.

Who reviewed or approved this study?

The research study has been approved by a registered Research Ethics Committee (HREC REF: 611/2021). The University of Cape Town's Faculty of Health Sciences Human Research Ethics Committee can be contacted on 021 406 6338 should you have any ethical concerns or questions regarding your participation rights or welfare.

Should you have any questions or concerns regarding the survey, please do not hesitate to contact me via email at JNBDIV001@myuct.ac.za.

Researcher:

Contact person: Divaksha Jinabhai

Email address: JNBDIV001@myuct.ac.za

Research supervisor:

Contact person: Vera Hlayisi

Email address: vera.hlayisi@uct.ac.za

UCT Faculty of Health Sciences Human Research Ethics Committee Contact Details:

Address: E52.24, Old Main Building, Groote Schuur Hospital

Contact telephone number: 021 406 6338

Fax: 021 406 6411

Kind Regards,

Divaksha Jinabhai

Appendix I: *Participants electronic consent form*

Division of Communication Science and Disorders Department of Health and Rehabilitation Sciences Faculty of Health Sciences, F45 Old Main Building Groote Schuur Hospital

Telephone: 0796382488, Email: JNBDIV001@myuct.ac.za

Study Title: Medical practitioners managing patients with diabetes.

Electronic Consent Form:

This is to confirm that I agree to volunteer to be part of this study. The study purpose and my involvement in it have been clearly explained to me via an electronic briefing and I understand all the explanations given to me. I understand that I can withdraw my participation from the study at any time without any consequences.

(Kindly click on one of the boxes below)



I hereby agree to participate in the study.



I hereby DO NOT agree to participate in the study

Appendix J: Recruitment letter for South African medical associations

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Department of Health and Rehabilitation Sciences

Divisions of Communication Sciences and Disorders,

Researcher: Email: JNBDIV001@myuct.ac.za

Telephone: 0796382488

Dear Sir/madam

RE: PARTICIPATION REQUIRED FOR DIABETES AND HEARING HEALTH RESEARCH.

My name is Divaksha Jinabhai, a master's student from the University of Cape Town. I am interested in conducting a study survey to determine hearing health awareness among medical practitioners managing patients with diabetes.

XXX Association is invited to participate in the research by advertising the online survey to registered medical practitioners managing patients with diabetes. The participation of the association is entirely voluntary, and participation can be declined at any given time without explanation or prejudice.

Title of research project: Hearing Health Awareness among Medical practitioners Managing Patients with Diabetes

Why is the study being done?

There is a growing body of research linking the negative impact of Diabetes Mellitus on hearing health. The International Diabetes Federation has projected that by 2045 the African continent will experience the highest increase in diabetes globally. It has been suggested that medical practitioners often overlook auditory symptoms as a diabetes complication, thus suggesting possible non-management of diabetes related auditory symptoms. However, it is unknown within the South African context whether there is awareness of the need for and referrals to audiologists among medical practitioners managing patients with diabetes. The study therefore aims to explore hearing health awareness and referrals among medical practitioners managing patients with diabetes in South Africa.

What will participation of the association involve?

To disseminate the advertisement below to medical practitioners who are registered with the association.

Volunteers needed for Research Study on Diabetes and Hearing Health

You may qualify to participate if you

- Are a qualified and licensed general practitioner engaging in active clinical practice.
- Registered with the Health Professionals Council of South Africa under the titles of "Medicine", "Family Medicine", "Public Health Medicine" or "Community Health".
- At least 20% of your caseload involves management of patients with diabetes.
- Independent practitioner post internship and community service.

Participation involves
Completing a short online survey.

How long will it take?
Approximately x minutes.

Where can the survey be accessed?
By clicking on the following link:
XXXXXXXXXX

Participants will receive
A chance to win an online voucher valued at R1000.

FOR MORE INFORMATION
Please contact researcher Divaksha Jinabhai at JNBDIV001@myuct.ac.za
OR
Research supervisor Vera Hlayisi at vera.hlayisi@uct.ac.za



Who and how many participants are required for the study?

The sample size for the study is 373 participants. Participants will include licensed medical practitioners managing patients with diabetes who meet the criteria outlined in the survey

advertisement above. The survey will be open over four months from (date) to (date) until the required number of responses is obtained.

What will happen if the association wants to leave the study?

The association may withdraw from the study at any time without any consequence.

What are the risks and discomforts of the study?

The study does not anticipate any risks to befall XXX Association or research participants.

Rewards, payments, and expenses.

XXX Association will not have to pay to partake in the study nor will there be payment or rewards issued for the associations' participation in the study. However, participants will have the option to enter a lucky draw to win a R1000 online voucher by providing their email address and/or contact number at the end of the survey. Entry into the lucky draw will be dependent on ALL survey questions being answered and if the relevant contact details have been provided. The winner will be announced during XXX 2022 once the data collection procedure has concluded.

What personal information is required from participants and how will responses remain anonymous?

Participants will be required to provide their HPCSA number as part of the survey. This will allow the researcher to cross check whether all participants are registered with the HPCSA and are practicing under the relevant fields as outlined in the survey advertisement. Once the HPCSA numbers of all participants have been cross checked, they will be deleted. Thereafter, prior to commencing with data analysis each participant will be assigned a number in order to uphold anonymity of all participant responses.

How will personal information be safely stored?

Personal information and responses of all participants will be stored on a password-protected computer and will ONLY be accessible to the researcher and research supervisor.

Who reviewed or approved this study?

The research study has been approved by a registered Research Ethics Committee (Reference number HREC REF: 611/2021). The University of Cape Town's Faculty of Health Sciences Human Research Ethics Committee can be contacted on 021 406 6338 in case you have any ethical concerns or questions about your rights or welfare as a participant on this research study.

Should you wish to participate in the study, kindly sign the attached consent form and return it to the researcher via email at JNBDIV001@myuct.ac.za.

For further questions or assistance, please do not hesitate to contact me via the email address mentioned above.

Thank you in advance for your cooperation with this matter.

Researcher:

Contact person: Divaksha Jinabhai

Contact number: (079) 638 2488

Research supervisor:

Contact person: Vera Hlayisi

Contact telephone number: 0216505540

Address: Division of Communication Sciences and Disorders, F45
Old Main Building, Groote Schuur Hospital,
Observatory, 7925

UCT Faculty of Health Sciences Human Research Ethics Committee Contact Details:

Address: E52.24, Old Main Building, Groote Schuur Hospital

Contact telephone number: 021 406 6338

Fax: 021 406 6411

Kind Regards,
Divaksha Jinabhai

Attached consent form to medical associations:

Division of Communication Science and Disorders Department of Health and Rehabilitation Sciences Faculty of Health Sciences, F45 Old Main Building Groote Schuur Hospital

Telephone: 0796382488, Email: JNBDIV001@myuct.ac.za

Study Title: Hearing Health Awareness among Medical Practitioners Managing Patients with Diabetes.

This is to confirm that (insert organization name) agrees to volunteer to be part of this study. The study purpose and the involvement of the association have been clearly explained via an email briefing. All the explanations have been understood. It is also understood that association's participation can be withdrawn at any time without any consequences.

Signature:

.....

Appendix K: Ethics approval, UCT HREC



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



Room G50- 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

30 September 2021

HREC REF: 611/2021

Miss V Hlayisi

Department of Health & Rehab Sciences
F-45 OMB
Email: vera.hlayisi@uct.ac.za
Student: JNBDIV001@myuct.ac.za

Dear Miss Hlayisi

**PROJECT TITLE: HEARING HEALTH AWARENESS AMONG GENERAL PRACTITIONERS
MANAGING PATIENTS WITH DIABETES IN SOUTH AFRICA-MSC CANDIDATE-MISS
DIVAKSHA JINABHAI**

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.

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 September 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 Divaksha Jinabhai will also be involved in this study.

Please quote the HREC REF 611/2021 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 611/2021sa

Yours sincerely

Signed by candidate

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 611/2021sa