The role of culture in mobile application adoption amongst diabetes patients in previously disadvantaged communities in the Western Cape

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Plagiarism Declaration

Declaration

Hereby I, Mariam Jacobs, declare that *"**The role of culture in mobile application adoption amongst diabetes patients in previously disadvantaged communities in the Western Cape"*** is my own original work and that all sources have been accurately reported and acknowledged, and that this document has not previously in its entirety or in part been submitted at any university in order to obtain an academic qualification.

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November 2020

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Abstract

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Introduction: Diabetes mellitus is a global health problem with a high mortality rate. Self-management is an essential part of diabetes management and it includes self-care behaviour tasks such as healthy eating, being active and taking prescribed medication. In the current digital age, the use of technology for self- management of the disease is an important consideration. As a first step towards this, individuals have to first accept and use the technology. However, the literature indicates low levels of technology use amongst diabetic patients in environments with low socio- economic indicators and amongst minority groups. Previous studies suggest that there are many factors that influence technology acceptance such as economic, social and cultural factors.

Mobile health (m-health) received recognition in healthcare literature in recent years and are known for delivering effective and efficient interventions to patients with chronic conditions such as diabetes. An investigation into m-health acceptance for diabetes management is vital as it impacts the achievement of development goals, including the United Nations' SDG 3. This research posits that the culture of patients is a possible reason for the low acceptance and use of technology. Research based on the proliferation of culture as a determinant for diabetes self-management at an individual level is limited, especially in the South African context. The main research question pursued in the study reported in this thesis is *How does culture influence m-health acceptance of diabetic patients in disadvantaged communities?*

Research design and methodology: Using an interpretivist paradigm, a case study research design provided the basis to collect data from 20 diabetes patients in Mitchells Plain and Strandfontein. The theoretical model that was used as a lens for investigation comprised a juxtaposition of Hofstede's cultural dimensions and Unified- Theory of Acceptance and Use of Technology 2 (UTAUT2). The analysis of the qualitative data was undertaken with Atlas Ti, using a thematic content analysis process.

Results: Eight themes emerged from the data and key results of the study indicate that opinions towards medical practitioners, which reflects power distance has a positive impact on users and non-users. Diabetic patients comply with the opinions of their doctors as they fear disagreeing with them. As such, this may result in having a positive influence on a participant's ability to adopt and use mobile applications. Caregiver influence, which reflects femininity, has a negative influence on users as a result of diabetic patients being responsible for taking care of their family and others are both home carers and providers for their families. This indicates that patients are more concerned with the quality of their life and family than with the adoption mobile applications.

Future work: It is recommended that research should be conducted in other areas in the Western Cape, specifically in the Cape flats to see whether the same sorts of results will be achieved in different communities. This could help policymakers and application developers tailor mobile applications for this target population.

Key words: technology acceptance, mobile health (m-health), diabetes self-management, culture Hofstede's cultural dimension, technology adoption, previously disadvantaged communities, diabetes mellitus, South Africa, Western Cape.

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Dedications

This thesis is dedicated to my darling husband, **Saadiek** for his continual and endless love & support. Shukran for being on this journey with me and for always being by my side throughout it all.

To mom and dad, you always encouraged me to tie my camel, trust in Allah SWT & strive for excellence. Shukran for making me see this journey through to the end.

I love you all

❤

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List of Acronyms

DM	Diabetes Mellitus
DSM	Diabetes self-management
ICT	Information Communication Technologies
NIP	South African National Infrastructure Plan
SIPs	Strategic Integrated Projects
LMIC	Low-Middle Income Countries
UN	United Nations
NCD	Non-Communicable Diseases
SDGs	Sustainable Development Goals
AADE	American Association of Diabetes Educators
WC	Western Cape
ADA	American Diabetes Association
PDAs	Personal Digital Assistants
M-HEALTH	Mobile health
TRA	Theory of Reasoned Action
TPB	Theory of Planned Behaviour
TAM	Technology Acceptance Model
UTAUT	Unified- Theory of Acceptance and Use of Technology
PBC	Perceived Behavioural Control
PDI	Power Distance
IDV	Individualism- Collectivism
MAS	Masculinity- Femininity
UAI	Uncertainty Avoidance
LTO	Long-Term orientation- Short-Term Orientation
IR	Indulgence- Restraint
DoH	Department of Health

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Chapter 1: Introduction and overview of the study

1.1 Introduction and background

In the last two decades, disparities with respect to accessibility to and availability of the internet have reduced, due to technological advances and lower-cost access to broadband internet (Tennant et al., 2015). The prevalence of Information Communication Technology (ICT) and infrastructure is greater than it was a decade ago. Mobile technologies are no longer limited to specific demographics, as they are made increasingly affordable to all in developing countries. Globally, there are estimated to be 4.1 billion internet users (International Telecommunications Union, 2019). In Africa, there are a total of approximately 522.81 million internet users (Statista, 2019), 32.62 million of which are South African users (Statista, 2020). In South Africa (SA), 64.7% of internet users can access the internet from anywhere, of which 72.4% reside in the Western Cape (Statistics South Africa, 2018). Furthermore, 61.7% of people in the Western Cape can access the internet from their mobile phones (Statistics South Africa, 2018).

The South African Government has developed a South African National Infrastructure Plan (NIP) consisting of 18 Strategic Integrated Projects (SIPs) to improve the social and economic infrastructure across provinces. The knowledge SIP comprising SIP 15 involves increasing access to "communication technology" by providing broadband coverage to everyone not later than the year 2020, by integrating the network into rural areas (Presidential Infrastructure Coordinating Commission, 2012). Access to broadband internet has also greatly improved with several local government public Wi-Fi programmes, and public access centres, e.g. The Smart Cape programme of the City of Cape Town. The improved access to devices and the internet provides an improved opportunity for technology to address various social ills, including health.

ICT such as mobile health (m-health) applications (Appendix D: example of a diabetes mobile application –Mysugr on page 164), can serve as a useful tool in the health care sector, as they can help people manage their chronic conditions. Since the advent of mobile phones, m-health has come to the attention of the healthcare system as something that could transform the way health care has been viewed, managed, and delivered (Nasi, Cuccinello & Guerrazzi, 2015). Mobile health (m-health) has emerged as an aspect of electronic health (e-health) and received recognition in health care literature in recent years. M-health applications is defined as a software that provides health services to individuals through mobile technologies such as smartphones and

tablets (World Health Organization, 2011).

There are several examples in the literature of the role of ICT on health-related matters. M-health application plays a significant role in cancer supportive care by enabling early detection and intervention (Nasi, Cucciniello and Guerrazzi, 2015). ICT has been used in the prevention and early detection of cervical and breast cancers in low- and middle-income countries. The use of smartphones by Community Health Workers improved breast health promotions as well as uptake of clinical breast examination (Ginsburg et al., 2014; DiCarlo et al., 2016). In addition, ICT plays an important role in supporting the achievement of health-related goals such as improving glycaemic levels of diabetes patients (Waki et al., 2014).

Of the many important health problems in society, diabetes mellitus (DM), an international pandemic, is a health problem in the 21st century (Müller, 2016). Diabetes is a chronic disease with a high-level mortality rate. Worldwide 493 million people are living with diabetes, of which 19 million reside in Africa (International Diabetes Federation, 2019). Furthermore, in 2019, there are estimated to be 4.6 million cases of diabetes in South Africa (SA). Eighty-nine thousand eight hundred of all deaths are attributable to diabetes (International Diabetes Federation, 2019). People living with diabetes come from both middle and low-income nations (World Health Organization, 2018). Statistics show that in 2017, 10.4% of the Western Cape populace have succumbed to diabetes (Statistics South Africa, 2016a). Out of 9 provinces, the Western Cape has the third highest prevalence of diabetes (Statistics South Africa, 2019). The growing prevalence of diabetes in low-middle income countries (LMIC) is believed to be associated with many factors, including cultural and social changes (Dunachie & Chamnan, 2019). At an international level, governments, under the auspices of the United Nations, have committed to combat social ills, such as the delivery of healthcare, through the development of the 2030 Sustainable Development Goals (SDGs).

The 2030 SDGs have been developed to achieve the United Nations (UN) “integrated and divisible” goals across social, environmental and economic dimensions (United Nations, 2015). This agenda comprised of 17 SDGs and 169 targets. The focus on health is evident in the seventeen 2030 Sustainable Development Goals (SDGs) (UNESCO, 2014). The third SDG focuses on ensuring and promoting a healthy lifestyle and wellbeing for people of all ages. The treatment for Non- Communicable Diseases (NCD), such as diabetes, has received specific focus due to the burden it places on health systems (United Nations, 2015). It is widely accepted that

ICTs must be leveraged to attain the SDGs, as ICT can help accelerate progress towards every single one of the 17 UN SDGs (ITUNews, 2018). This suggests that ICT is an enabler to achieve the SDG and ICT, such as mobile technologies, should be used to accelerate diabetes self-management.

Self-management is an essential part of diabetes management, and the tasks include healthy eating, exercise and taking prescribed medication (Duke & Wigley, 2016). Essentially, poor self-management can result in poor quality of life and significant mortality (Reyes et al., 2017). The risk factors associated with diabetes are comprised of, —but are not restricted to—tobacco use, alcohol consumption and unhealthy eating (World Health Organization, 2018). These risk factors could lead to complications such as cardiovascular disease, amputations, and blindness (American Association of Diabetes Educators, 1997). Therefore, it is imperative that diabetic patients follow guidelines such as the seven self-care behaviour activities of the American Association of Diabetes Educators (AADE). These consist of healthy eating, being active, monitoring, taking prescribed medication, problem-solving, healthy coping and reducing risks (American Association of Diabetes Educators, 1997). There are AADE-accredited Diabetes Self-Management Education and Support (DSMES) programs in the US, in states such as Virginia (American Association of Diabetes Educators, 2019). In South Africa (SA), the SA diabetes organisation educates and supports diabetic patients and their families as well as promote prevention through public awareness of diabetes, its symptoms and risk factors (Diabetes South Africa, 2021).

There is evidence that mobile applications are an ideal platform for delivering effective and efficient interventions, which can help decrease Non-Communicable Disease (NCD) risk factors (Zhao, Freeman & Li, 2016). However, for individuals to self-manage their conditions, they have to first accept and use the technology (Dou et al., 2017). Technology adoption is described as the acceptance or the first use of a technology (Khasawneh, 2008). It has been stated that users must first make use of technology, such as m-health applications, before the sought-after results can be attained (Venkatesh, Thong & Xu, 2016). Technology acceptance is widely investigated and understood in the Information Systems (IS) literature. Of the models for user acceptance, many researchers have applied the Unified- Theory of Acceptance and Use of Technology (UTAUT) (e.g., Phichitchaisopa & Naenna, 2013; Hoque & Sorwar, 2017; Bawack & Kala Kamdjoug, 2018) and the Technology Acceptance Model (e.g., Al-jumeily & Hussain, 2014; Hoque & Bao,

2015; Zayyad & Toycan, 2018) to investigate technology adoption problems. Of the several technology adoption problems, research indicates that a link exists between technology adoption and culture. Culture can either enable technology acceptance (Sriwindono & Yahya, 2012) or hinder technology adoption (Hasan and Ditsa, 1999).

There are several factors that have an influence on the adoption of technology, including those in relation to culture. For example, individuals from all parts of the world communicate in different languages, practice diverse religious obligations, have a variety of eating habits and implement diverse social customs. Therefore, these factors point to there being additional influences that affect the adoption of mobile health (m-health) applications (Abdulrehman et al., 2016; Ung, 2017). As stated by Hofstede, (1980) culture is defined as "the collective programming of the mind which distinguishes the members of one human group from another" (Hofstede, 1980:13). According to Dehzad et al. (2014), cultural beliefs of people are known to be key factors that influence technology uptake and adoption. Socio-cultural factors in the health care sector affect the adoption of m-health services (Beratarrechea et al., 2014). The relationship between culture and technology use is an established area in IS research (Martinsons & Davison, 2007; Al-jumeily & Hussain, 2014; Sun, Lee & Law, 2019). Culture comprises beliefs, customs, and norms fostered within the society of one's birthplace (Scupin, 2008). Essentially, the cultural background influences a number of aspects of people's lives, including beliefs, behaviour, perception and attitudes towards health (Swierad, Vartanian & King, 2017).

Over the years, there has been extensive research pertaining to the link between cultural factors and the uptake of technology (Kovačić, 2005; Srite & Karahanna, 2006; Barton, 2010; Al-jumeily and Hussain, 2014; Tarhini et al., 2017). These studies illustrate that cultural backgrounds play an imperative role in influencing the uptake and use of technology (Masimba, Appiah & Zuva, 2019). Additionally, numerous researchers have used Hofstede's cultural dimensions in technology acceptance and adoption models (Caporarello, Magni & Pennarola, 2014; Hoque & Bao, 2015). Furthermore, Dwivedi et al. (2016) have found that culture is unique to geography and may not be seen in isolation. Although cultural values on technology acceptance have been widely studied from a national perspective, the studies focussed at an individual level are limited (Sun, Lee & Law, 2019). The literature indicate that many factors influence whether people accept and use technology and cultural factors plays a role in technology uptake. The role of culture on the acceptance and use of m-health apps ought to be

investigated to understand how it influences people in disadvantaged communities.

A recent study has found that there are low levels of technology use amongst diabetes patients in low socioeconomic or disadvantaged communities in the Western Cape (Petersen, Pather & Tucker, 2018). Petersen, Pather & Tucker, (2018) has found that high behavioural intention did not translate into the usage of ICT, as almost 70% of the sample population did not use forms of ICT, such as m-health for their diabetes self-management. These authors have argued that other factors could affect the acceptance and use of m-health applications. Behavioural intention is a strong indicator of actual use and as culture is a belief of people's values, ethics, and behaviour, it can influence health management behaviour which can impact technology uptake and use.

In light of the foregoing, a similar question may also be posed in respect of the role of culture on mobile health (m-health) adoption amongst diabetic patients. Therefore, research into the role of culture on diabetic patients' adoption of ICT such as m-health is warranted given that the previous studies have shown that behavioural intention on its own is not a predictor of uptake.

1.2 Research problem

There has been extensive research conducted regarding technology acceptance with respect to national culture (Al-jumeily & Hussain, 2014; Hoehle, Zhang & Venkatesh, 2015) but there is a dearth of literature in respect of the effect of culture on an individual's level of diabetes self-management. Additionally, the effect of culture on technology acceptance has not been studied in this context[1]. This research, therefore, fills the gap by assessing the cultural factors that influence m-health acceptance and use in a South African Context, more specifically, from a Western Cape perspective.

The findings already referred to by Petersen, Pather & Tucker (2018), concerning the low levels of technology acceptance amongst diabetic patients in low socio-economic environments, therefore bring to the fore further questions about technology adoption, which warrants further investigation.

To provide insight into the population of this research problem, the context of the area under investigation will be discussed.

[1] *The following is a conclusion based on an extensive review of over 30 articles from the following databases conducted between Jan 2019 and December 2020: Scopus, World of Science, Google Scholar*

1.3 Context of Mitchells Plain and Strandfontein in Cape Town

Figure 1: Map of Mitchells Plain (Source: Google Maps, 2020)

Mitchells Plain is positioned in the City of Cape Town, within Western Cape Province, and is one of the largest townships in Cape Town (Figure 1). Mitchells Plain is situated on the Cape Flats and is approximately 20km away from Cape Town City Centre (South African History Online, 2020), positioned on the False Bay Coast between Khayelitsha and Muizenberg. Mitchells plain is a predominantly 'Coloured' township in Cape Town with a population of approximately 310 485 (Statistics South Africa, 2013). The phrase 'Coloured' was created at the beginning of Apartheid in South Africa. The racial classification, 'Coloured', is a multiracial group who have descendants from Malaysian slaves, Khoisan (Mthembu, 2015) and European settlers (Morse & Peele, 1973).

The Group Areas Act of 1950 introduced a policy created by the apartheid government that assigned people from urban areas, such as District Six, into racially segregated districts (South African History Online, 2011a). Due to Apartheid, many families ("Non- white") were forcibly removed from District Six into areas such as Mitchells Plain (Bähre, 2014) and the forced removals have left Cape Town as a segregated city. Mitchells Plain was established in the early 1970s for poor-middle income families. The living areas developed for these communities were based on insufficient infrastructure and inadequate general service delivery. Since then, Mitchells Plain has been recognized as one of the most over-crowded, disadvantaged and crime- ridden

townships in the Western Cape. “Serious social problems such as a high rate of unemployment and disturbing levels of illegal gang activities contribute to these communities remaining highly poverty stricken” (Manasse, 2019:2). Mitchells Plain has been found to have the highest unemployment rate of all the townships on the Cape Flats. Research indicates that nearly 63% of households in this township have a monthly income of less than R4166 and approximately 16,5% of this population are unemployed (have no source of income) (Western Cape Government, 2017).

The Western Cape (WC) is one of the largest provinces in the country by both population and land area. In 2016, approximately 6,3 million people called the Western Cape their home (Statistics South Africa, 2016b). The research indicates that the Western Cape is the province with the largest population of ‘Coloured’ people (47,5%) (Statistics South Africa, 2016b) and statistics indicate that the Western Cape has a very high incidence of diabetes in South Africa, with approximately 259 000 diabetic patients (Statistics South Africa, 2018). One in four Coloured’s of the WC population may have diabetes (Erasmus et al., 2012). This indicates that the ‘Coloured’ population is a group that must also have a high prevalence of diabetes in the Western Cape. It is therefore important to understand the culture of this population and how this influences the use of m-health applications.

1.4 Research objectives

The main objective of this study is to determine which cultural factors affect the acceptance and use of m-health for diabetes self-management. In particular, the study investigates how does culture influence m-health acceptance of diabetic patients in previously disadvantaged communities?

In the process of realising the primary objective, several secondary objectives are also identified. Below is a table illustrating the research question, the associated sub-questions, and their alignment with the research objectives. The table further describes, at a high level, the methods used to attain the specific objective.

Table 1: Alignment of the research questions, sub-questions and objectives

Research question: How does culture influence m-health acceptance of diabetic patients in previously disadvantaged communities?		
Sub-Questions	**Methods used to answer sub questions**	**Research Objectives**
1.1 What are the models and theories that have been used to study technology adoption?	Analysis of literature	1. To identify which user acceptance models are appropriately aligned to a study of culture
1.2 Which user acceptance models can be applied to understand the role of culture in relation to adoption?	Analysis of Literature	
2.1 What is culture?	Analysis of Literature	2. To derive a framework that defines the concept of culture
2.2 How can the concept of culture be operationalised?	Analysis of Literature Development of questionnaire instrument	
3.1 How do the dimensions of Hofstede influence technology adoption amongst diabetic patients in previously disadvantaged communities?	Analysis of qualitative evidence (from Semi-structured interviews)	3. To determine which cultural factors affect the acceptance and use of m-health for diabetes self-management.
4.1 What recommendations can be made to improve the adoption of m-health for diabetic patients in previously disadvantaged communities?	Interpretation of findings	4.To recommend interventions that might lead to improvements in m-health acceptance for diabetic patients.

1.5 Delineation: The scope of the study

This study is geographically confined to the Western Cape (WC) population, specifically diabetic patients residing in Mitchells Plain and Strandfontein, because statistics show that in the WC many of the diabetic patients succumbed to diabetes (Statistics, South Africa, 2016a). The WC shows the third highest prevalence of diabetes out of 9 Provinces (Statistics South Africa, 2019).

In selecting the Western Cape, we examined the rate of diabetes incidences all over the country and whilst the Western Cape was selected for the reason just mentioned, it simply serves as a region that exhibits the phenomenon of diabetes. The findings of the study will therefore serve to inform other situations of marginalised communities where diabetes is prevalent and where technology adoption is at a low level. The intention of the study is not to simply contribute to further understanding on this geographical region, but to advance our understanding in respect of the relationship between culture and technology adoption in similar communities who are from

impoverished areas and poor social economic backgrounds. This will be achieved by restricting questions to culture, the acceptance of m-health and the use of m-health for diabetes self-management.

Due to the COVID-19 pandemic, this research was conducted telephonically instead of face-to-face. This presented a challenge as further efforts have had to be done to ensure that individuals understood what this study involves and what an m-health application comprises of. As this research was only conducted in previously disadvantaged communities, the findings are only applicable to other populations of similar social and economic status. Another limitation that emerged from this study was that many of the participants were not using an m-health application to self-manage their condition and could not form a habit to use an m-health application. Therefore, while analysing data, more than one code could not emerge under the category “continuous discipline”.

1.6 Significance of the study

Further investigation into m-health in the context of DM (diabetes mellitus) management is important, as it has a bearing on several stakeholders. For example, this research can provide scholars, people within the healthcare industry, and policymakers such as the United Nations, to develop an improved insight pertaining to specific cultural values of groups within previously disadvantaged communities. The outcome of the study will serve to inform and improve current m-health related interventions, which could result in the improved or successful adoption and uptake of ICT, specifically m-health applications among diabetic patients in previously disadvantaged communities.

There is a gap in the literature with respect to the understanding of culture in m-health acceptance and use for diabetes self-management. To achieve diabetes self-management, cultural factors need to be taken into consideration. This study contributes to a better understanding of culture and technology adoption and how the cultural constructs influence the perceptions of the UTAUT2 model in the context of m-health adoption and diabetes self-management. In the long term, this study could contribute to improved diabetes self-management which can also contribute to the Sustainable Development Goal 3 amongst disadvantaged populations in the area of diabetes self-management. What makes this research important is that it will assist researchers and government to provide m-health interventions that can be successfully implemented in

communities that are rich in their cultural beliefs and traditions. The main contribution of the study is an understanding of the application of the conceptual framework in the health context.

1.7 Layout of the dissertation

To answer the main research question "How does culture influence m-health acceptance of diabetic patients in previously disadvantaged communities?" The thesis will be structured in a sequential manner that stems from the research sub-questions to ensure a logical flow. By doing so, the research objectives will be achieved. This thesis presents research on culture and technology adoption within the context of m-health adoption of diabetic patients, which is framed within the 5 chapters below:

Chapter 1: Nature and scope of the study

Chapter one provides a 'roadmap' of the whole dissertation. This chapter starts by providing a background to the study and the topics that this study sets out to investigate. Furthermore, the chapter sets out the main research questions, sub-questions, and research objectives. This is followed by providing the research design and methodology that underpins this study.

Chapter 2: Literature review

This chapter reviews literature based on previous studies pertaining to the research phenomena. An overview of diabetes mellitus is presented in the first section. This includes m-health for diabetes self-management and the advantages of diabetes self-management. In order to understand technology acceptance and use amongst DM patients, the models for user acceptance that have been used to study human behaviour are reviewed.

To define and understand the term "culture" broadly, various definitions by authors are identified and discussed. Thereafter, the cultural models that have been identified in the literature are presented. Culture and diabetes self-care management are discussed, as well as South African culture and culture on the Cape Flats. Previous studies of culture and technology acceptance are reviewed. Furthermore, the literature review indicates that there is a distinction between culture at a national level and individual level, and therefore this is also explored. This chapter concludes with a review regarding which of the cultural models and technology adoption models have been chosen to investigate the research problem and the theoretical framework underpinning this study

is depicted.

Chapter 3: Research design and methodology

This chapter emphasises the research design and methodology of this study. The research design that this study employs is a case study design. A case study is defined as a systematic investigation of a single individual case, a group of people or community that a researcher examines (Woods & Catanzaro, 1988). A case study design has been followed to investigate type 2 diabetic patients. The researcher has identified two cases: Mitchells Plain and Strandfontein communities.

This study is exploratory and descriptive, as the aim of this research was to gain a more in-depth insight into the cultural dimensions of diabetic patients in previously disadvantaged communities. Semi-structured interviews were used to gather insights from diabetic patients in previously disadvantaged communities. Mitchells Plain and Strandfontein were chosen to collect data from, as there are diabetes support groups within these communities. Strandfontein Diabetes Support Group and Westridge Diabetes Support Group were approached to gather data. In addition, social media were used to gather more participants. Data were gathered telephonically by having a number of one-on-one interviews with type 2 diabetic patients. Participants were approached at the diabetes support groups and were called before the interview to arrange and suggest a suitable time to conduct the interview.

Chapter 4: Research findings and discussion

This chapter represents the research findings, based on the interview guide, concerning the acceptance and use of m-health amongst diabetic patients in two areas of the Western Cape. This is followed by thematic content analysis. The findings are discussed in terms of the outcomes of this study. The main research finding was based on the two models underpinning the study: the Unified- Theory of Acceptance and Use of Technology 2 and Hofstede's cultural dimensions. The findings will provide answers to the main research question, research objectives and will be linked to the current relevant literature.

Chapter 5: Conclusions and recommendations

In this chapter, the research findings are summarised, a framework for understanding how culture

influences m-health acceptance and use by diabetic patients is depicted and discussed and the attainment of the research objectives is discussed. This discussion is conducted to ensure that sub-questions and objectives have been met. Before concluding this thesis, an evaluation of the research is discussed, the contribution of this research is stated, the limitations of this study are addressed, and the recommendations for future research are summarised. Figure 2 depicts the layout of this thesis.

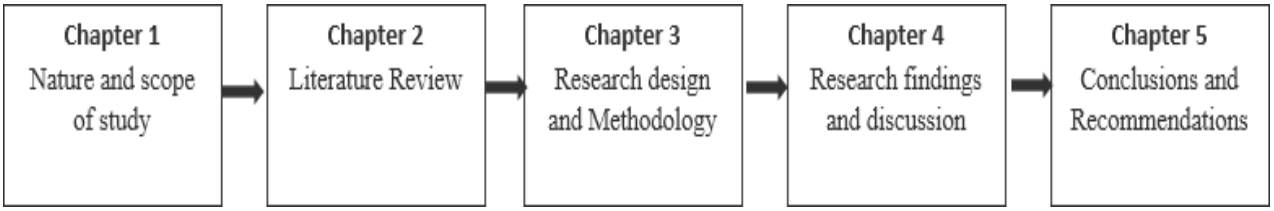

Figure 2: Thesis Layout

1.8 Chapter summary

This chapter provided an in-depth background and introduction to the research domain "*the influence of culture on m-health acceptance on diabetes self-management amongst previously disadvantaged communities*". This chapter set out the research problem that there is a dearth of literature in respect of the effect of culture on an individual level for diabetes self- management. This chapter has also presented the primary research question with its sub-questions as well as an outline of the research objectives. Furthermore, the population under investigation has been described to provide context to the research undertaken. Following on this, the importance of the study has been discussed which addressed the contribution to the SDG 3 for individuals in disadvantaged communities. In addition, the main contribution of the study has been identified. The chapter concludes by providing a layout of the thesis, which will provide a logical flow of the dissertation. This will serve to diminish any possible misunderstandings. The following chapter discusses the literature pertinent to the area this study is investigating.

Chapter 2: Literature review

2.1 Introduction

This chapter reviews the literature from previous research related to mobile health (m-health) and technology adoption in relation to culture. In this chapter the researcher will discuss the following literature. In section 2.1, a brief discussion of diabetes mellitus will be discussed to understand the two types of diabetes, its risk factors and the diabetes self-care behaviours. Sections 2.3 and 2.4 discusses m-health for diabetes self-management and its benefits. This is to understand the use of ICT in healthcare and identify the benefits that m-health applications provide for diabetes patients. The following section (2.5) draws on the extant literature of technology adoption. The models for user acceptance are discussed to establish which technology adoption models could be used to answer the research objective. The discussion proceeds by including a review of studies that have utilised the models in healthcare and culture. The chapter then continues to discuss the concepts of technology adoption and culture. The chapter seeks to advance a view in respect of the role of culture in technology adoption.

In section 2.6, the notion of culture is operationalised by providing definitions from various scholars. In addition, the cultural models are discussed to identify a suitable model to examine culture and technology adoption. Furthermore, the application of these models in relation to diabetes self-management are discussed. Following on from this discussion, section 2.7 examines culture and diabetes self-management to provide context to the research problem. As culture is context specific, section 2.8 focuses on South African culture and section 2.9 focuses on culture in the Cape Flats. This is to provide further context to the study. In section 2.10 and 2.11, the relationship between technology adoption and culture is discussed. Following on this discussion, user acceptance models and cultural models are discussed in section 2.12 to identify the similarities between them. In the following section (2.13), a methodological review is presented to identify methodologies and models used in different studies on culture and technology adoption. Section 2.14 provides a comparison of Hofstede's cultural dimensions between developed and developing countries. This provides a basis to conduct the empirical work. The chapter concludes with section 2.15, a conceptual framework that merges two existing models which is used to answer the research question and achieve the research objectives.

2.2 Diabetes Mellitus

Diabetes mellitus is defined as an atypically high level of sugar glucose in the blood. Diabetes occurs either when the body produces insufficient insulin (which is made by the pancreas), or where there is inadequate sensitivity of cells in the body to use the insulin it produces (World Health Organization, 2016). The two types of diabetes are diabetes type 1 and diabetes type 2. Type 1 diabetes mellitus (T1DM), commonly known as juvenile diabetes as well as insulin-dependent diabetes mellitus (IDDM) is described as an autoimmune disease where the pancreas produces little or no insulin (World Health Organization, 2016). It typically develops more quickly than other forms of diabetes and occurs in children and youths. Patients with type 1 diabetes are required to administer insulin medication daily as the body cannot function without insulin (American Diabetes Association, 2019). On the other hand, type 2 diabetes mellitus (T2DM) formerly known as adult-onset diabetes, but which of late has been diagnosed in children (World Health Organization, 2016), is a chronic condition in which the body ineffectively uses the insulin. The pancreas makes insulin, yet the body is unable to use the glucose-controlling hormone, which results in the pancreas being unable to produce as much insulin as the body requires (World Health Organization, 2016).

Self-management is an essential part of diabetes management. Self-management is defined as the process whereby patients are actively involved in the long-term care of managing their chronic condition (Kayyali et al., 2017; Iregbu & Iregbu, 2016; El-Gayar et al., 2013). Diabetes self-management (DSM) refers to actions taken by the patient in regulating diabetes mellitus– that is its treatment– and disease escalation prevention (Maniam & Dhillon, 2015).

There are several risk factors associated with diabetes, and these include inter alia age, ethnicity, socio-economic status and lifestyle factors (World Health Organization, 2016). These factors are prevalent in minority racial/ethnic populations, where the prevalence of diabetes is high (Parrinello et al., 2015). Although the pervasiveness of diabetes varies with socio-economic status, the disparities can be worsened by the poor lifestyles adopted by individuals (Mukong, Van Walbeek & Ross, 2017).

Lifestyle activities such as healthy eating, physical activity and sufficient sleep are imperative in order to prevent the onset of Type 2 diabetes (World Health Organization, 2020). Unhealthy lifestyles are among the reasons for the high prevalence of diabetes in South Africa, with type 2

diabetes being over 90% of all cases (Mukong, Van Walbeek & Ross, 2017). This is because people from lower socio-economic groups have factors such as their socio-economic status and a lack of knowledge that increases the prevalence of diabetes (Petersen et al., 2019; Petersen, Jacobs & Pather, 2020). In addition, limited access to healthy food is another of the challenges faced by people of low socio-economic status, and this situation increases their chances of developing diabetes.

In South Africa, the pervasiveness of T2DM may be attributed to unhealthy lifestyle factors (Pheiffer et al., 2018) and negative attitudes toward diabetes (Roux et al., 2018) as well as to the beliefs and behaviours of others influencing the health behaviours of individuals (Ajzen et al., 2011). Therefore, patients need to be able to implement self-care practices in their daily lives, as morbidity and mortality are preventable through medication adherence and risk factor modification (Beratarrechea et al., 2014).

Proper diabetes management improves the quality of life and may prevent diabetes complications and early fatalities (World Health Organization, 2016). Effective interventions are essential characteristics of diabetes care (Kebede & Pischke, 2019). For the patient, self-managing their condition is multi-dimensional and requires a range of activities (Hartz, Yingling & Powell-Wiley, 2016).

The American Association of Diabetes Educators (ADA) has identified seven behavioural activities that diabetes patients should follow to improve their health outcomes. These seven behaviours are: healthy eating, being active, health monitoring, taking prescribed medication, problem-solving, healthy coping, and reducing risks. These have been identified as the seven essential behaviours for improving diabetes self-management (American Association of Diabetes Educators, 1997). Adhering to these self-care behaviour activities can positively impact the quality of life of type 2 diabetic patients. However, integrating them into a patients' life can become challenging and often difficult to maintain in the long run. To assist with this, self-management programs for type 2 diabetes are available through smartphone technologies.

2.3 Mobile health for diabetes self-management

The use of Information Communication Technology (ICT) has become increasingly popular in recent years for medical self-care. Numerous technological advances have emerged to address

health-related issues of patients (Esposito et al., 2018). Mobile health (m-health) has emerged as a significant aspect of electronic health (e-health) (World Health Organization, 2011) and has received lots of attention in the health care literature in recent years (Zhao, Ni & Zhou, 2018) M-health is defined as "medical and public health practice supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wearable devices" (World Health Organization, 2011:6).

M-health has been developed to improve care by making health information and practices easily accessible through mobile communication technologies (e.g., tablets and smartphones), for patients with long term conditions such as diabetes (Kayyali et al., 2017; Alanzi, 2018). The focus on m-health is thriving due to the increasing number of mobile broadband subscriptions increasing in developing countries (International Telecommunication Union, 2016), making mobile applications affordable to all (Müller, 2016). Mobile phones are available to almost all strata of society irrespective of their social or economic groups. M-health solutions, such as m-health applications (Appendix D: example of a diabetes mobile application –Mysugr on page 164), have been proposed as an important emerging technology to assist in patient self-care. The literature indicates that wearable devices and mobile applications are two of the most prominent m-health technologies used in type 2 diabetes self-management (Hartz, Yingling & Powell-Wiley, 2016).

The emergence of m-health applications has shown great potential for diabetes self-management (Bene et al., 2019). M-health applications are known to deliver effective and efficient interventions to patients with chronic conditions (Zhao, Freeman & Li, 2016). In this study, an m-health application is defined as a software application that supports an individual in the delivery of healthcare, treatment, and monitoring services to self-manage their condition via mobile devices. To effectively self-manage diabetes, patients are required to make lifestyle adjustments to reduce long-term complications that come with diabetes (Iregbu & Iregbu, 2016).

Many m-health applications exist today that offer options to support self-management activities. Many of these applications are free, while others require a once-off or monthly subscription fee (Hartz, Yingling & Powell-Wiley, 2016). Research indicates that diabetes applications support patients in improving their knowledge regarding their condition and include awareness of diabetes complications and competencies for their self-management (Hou et al., 2016). Evidence

suggests that diabetes self-management applications are associated with higher self-care behaviours (Kebede & Pischke, 2019). Also, the findings indicate that diabetes applications have the potential to improve diabetes self- management and overall develop healthier patient lifestyles (Kebede & Pischke, 2019). These findings are consistent with the finding from El-Gayar et al. (2013). These authors have found that m-health applications improve diabetes self-care behaviour. A more recent study by Aminuddin et al. (2019) has found that self-care activities improved with smartphone-based self- management interventions. The authors further state that "this is attributed to behavioural change techniques providing feedback on performance and education on consequences of behaviour in the smartphone-based self-management" (Aminuddin et al., 2019:7). In addition, even though m- health applications improve self-care activities, usage is low.

The literature shows that even though many diabetes self-management applications exist, only a few patients use it (Rossmann et al., 2019). Low usage could be due to demographic characteristics such as age, ethnicity or geographical location, and socio-cultural factors appear to influence access to, uptake of and satisfaction with any m-health application (Feroz, Kadir & Saleem, 2018). To integrate mobile health applications successfully in the healthcare system, factors such as social values, and socio-cultural factors need to be considered (Beratarrechea et al., 2014), especially for individuals in low-income regions and racial/ethnic minorities (Nelson et al., 2016) as these factors may differ from one context to another.

2.4 Advantages of mobile health applications for diabetes self-management

Medical interventions and self-management are vital to ensure the well-being of patients that suffer from NCDs (Othman et al., 2018). Diabetes self-management is crucial for patients as it facilitates the prevention of diabetes complications. Health care provided via mobile applications provides countless benefits when applied to patients with diabetes (Jo et al., 2017). M-health applications are especially advantageous in developing countries because they require low start-up costs, and mobile applications are even affordable to people residing in more impoverished areas (Dutta et al., 2018).

The usage of m-health applications has the potential of improving the self-management of patients with type 2 diabetes as it enables them to adhere to self-care activities (Aminuddin et al., 2019). Diabetes self-management improves health outcomes by providing lifestyle modifications

such as diet, exercise and medication adherence. All these activities can be improved through mobile applications since m-health helps a user to achieve lifestyle modification (Jo et al., 2017). Even though patients have the required knowledge and skills to cope with diabetes (Maniam & Dhillon, 2015), they may acquire more knowledge from m-health applications and thus be provided with continuous motivation (Izahar et al., 2017).

M-health has been considered a useful tool to deliver essential services for diabetes self-management. The literature indicates that diabetes self-care can be improved with mobile phone applications as it offers many opportunities to prevent disease complications (Scheibe et al., 2015) thereby improving patients' quality of life (Hoque, 2016). It has been found that for patients with type 2 diabetes, m-health applications have the ability to reduce their glycated haemoglobin levels (Aminuddin et al., 2019).

The clinical benefit that diabetes self-management provides to patients is that it empowers patients to engage in managing their condition, thereby promoting self-efficacy (Istepanian & Al-anzi, 2018). Self-efficacy has been found to influence self-care behaviours of patients. Individuals– and in this context– diabetes patients are likely to partake in activities they perceive to encompass high self-efficacy. It is, therefore, imperative to develop self-efficacy to improve adherence to self-care activities.

M-health applications can also provide patients with better decision making, including insulin administration (Kayyali et al., 2017). This is consistent with research by the World Health Organization (2011). M-health applications are used to provide patient care, better decision making, access to health and general health services, enhance clinical diagnosis and treatment adherence, as well as many other benefits that can help patients manage their daily activities associated with living independently (World Health Organization, 2011).

Many researchers have identified that m-health applications can provide patients access to their health information at any time and any place, and can therefore reduce the time and cost associated with dealing with chronic conditions (Deng et al., 2018; Istepanian & Al-anzi, 2018; Zhao, Ni & Zhou, 2018; Baig, GholamHosseini & Connolly, 2015). Additionally, remote access to care provides the opportunity for patients living in rural and limited resourced areas to connect to quality individualised care (Modzelewski, Stockman & Steenkamp, 2018). This entails that m-health applications are readily available without the constraint of a geographical barrier (El-

Sappagh et al., 2019).

M-health applications can provide patients with tools that enable them have access to proper diabetes management; tools that have "portability, mobility, personalisation, and ubiquity" (Akter, D'Ambra & Ray, 2010). M-health applications can augment medical resources that are available in healthcare facilities (Zhao, Ni & Zhou, 2018). For example, blood glucose data can be collected, analysed, stored and be presented to the patient in real-time (El-Sappagh et al., 2019), making health information readily available for diabetic patients (Kayyali et al., 2017).

Another benefit of m-health applications relates to health education (Deng et al., 2018). M-health applications provide better health outcomes by providing patients with increased knowledge about their condition (Iribarren et al., 2017). M-health applications can create a smart environment where patients can engage in the management of their health, which supports the transition from clinic-centric to patient-centric healthcare (El-Sappagh et al., 2019). Fundamentally, the adoption of m-health can improve the self-care activities that patients undertake, such as exercise, food intake, blood sugar levels and their health behaviours (Hoque, 2016).

The preceding section has presented several benefits of m-health in diabetic patient self-management. The literature provides evidence that m-health applications can provide several health care interventions and prevent diabetes complications. This therefore underscores the research objective of this study which seeks to explore how diabetic patients accept and use m-health for diabetes self- management. The succeeding section is set out to discuss the technology adoption models to identify which model is best suited to study the acceptance of m-health applications amongst diabetic patients.

2.5 User acceptance models

In a study on m-health acceptance, technology acceptance is essential to consider. Technology acceptance is defined as a user's intention to use and continue making use of a particular IT product (Davis, 1989) (e.g., a mobile phone or computer).

Technology acceptance has been an important subject in IS research. It has been studied since the 1970s in the field of computer science where studying the adoption, acceptance and use of information systems is an area of study in the software engineering field (Momani & Jamous,

2017). The mainstreaming of technology and the importance of the people dimension in terms of gaining benefit from the use of technology rose to the fore when researchers such as Venkatesh et al. (2003) found that users were not deriving benefits from technology.

Historically, this area of research focuses on the problem that the availability of technology does not necessarily convert into adoption and use. Understanding the reasons why users accept or reject information technology is one of the crucial areas in IS research (Venkatesh, Davis & Morris, 2007). In the study of m-health acceptance, understanding technology adoption and usage is essential. Venkatesh, Thong & Xu, (2016) have stated that users must first use technology before the desired outcome can be achieved.

Technology adoption models have been developed to understand how users understand, accept and use technology (Venkatesh et al., 2003). In addition, these models introduce factors that can affect user decisions to adopt new technologies. Models such as the Technology Acceptance Model developed by (Davis, 1989) explain user acceptance of new technologies. Even though there have been many studies conducted using technology adoption models, it is crucial to understand how the models have evolved throughout the years as this reveals the similarities and differences between them.

This section of the literature review will draw on the extant literature in terms of what we understand by technology acceptance, as this is a dominant concept in this research problem. Thereafter, this section discusses the user acceptance models and theories and the dominant technology models in the area of m-health. These are assessed in terms of how they may inform a study of the role of culture. Below is a graphic representation based on the prominent Technology Acceptance Models and how they have evolved (Figure 3).

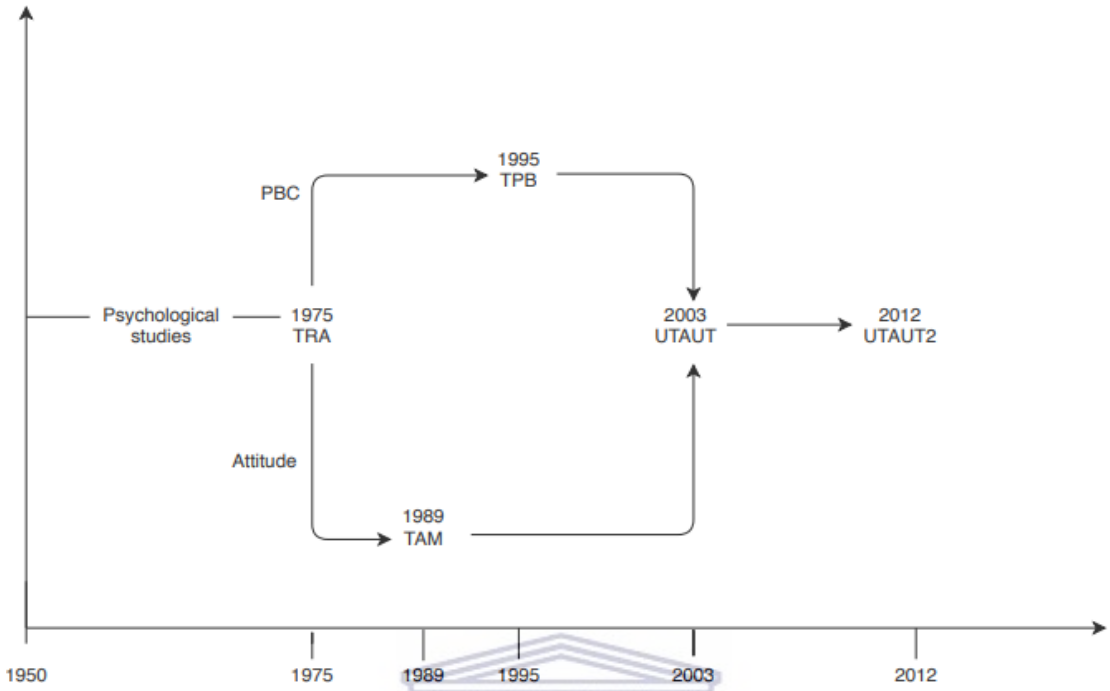

Figure 3: Models for user acceptance over time

2.5.1 Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA), developed by Fishbein & Ajzen, (1975) is drawn from social psychology and gives insight into varied human behaviours. This model suggests that, before people make any decision, they should consider the implications of their actions (Ajzen & Fishbein, 1980). The two crucial constructs of the Theory of Reasoned Action are the individuals' attitude toward behaviour ("the individual's positive or negative evaluation of performing the behaviour of interest") (Ajzen, 2005:118) and subjective norms ("the person's perception of the social pressures put on him to perform or not perform the behaviour in question") (Ajzen, 2005:188). Subjective norms may be viewed as a manifestation of culture because an individual may perform a specific task or exert a particular behaviour due to the influence of people who they deem to be influential. In addition, attitudes towards behaviour and subjective norms can be the determining factors of any particular behaviour. Despite the Theory of Reasoned Action being widely used in IS research to study technology adoption, it has several disadvantages.

The model fails to address the role of habit and cognitive deliberation (Taherdoost, 2018). The

authors of the model posit that an individual's belief is solely dependent on the intent on how the individual behaves (Ajzen, 1985). Essentially, the Theory of Reasoned Action does not postulate that certain beliefs will be vital in a "context like IT adoption" (Ducey, 2013:9). This, therefore, indicates that the Theory of Reasoned Action is unable to forecast individual behaviour until the users' intention to use a specific technology is known. Evidence suggests that the Theory of Reasoned Action has explained less variance in behavioural intention to use technology for tasks than the technology acceptance model (Venkatesh et al., 2003). The section below discusses the technology acceptance model and studies that have utilized the Technology Acceptance Model in relation to culture.

2.5.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), adapted from the Theory of Reasoned Action (Surendran, 2012) has been primarily developed to establish the users' behavioural intention towards the acceptance of new technology (Davis, 1989). It demonstrates that perceived usefulness and perceived ease of use affect the decision making of individuals, based on reasons as to why they use and adopt the technology (Ahlan & Ahmad, 2014). Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989:320). In contrast, the perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989:320). Research indicates that if a technology is perceived as difficult to use, potential users tend to dislike using it even if they believe that the technology is useful (Ozturk et al., 2016). The Technology Acceptance Model has been critiqued for not being able to explain how individual differences (age and gender) influence the user's attitude about technology, aspects which may well influence the intention to use a technology (Straub, 2009).

The Technology Acceptance Model has been widely used to study technology adoption in the healthcare sector (Albar & Hoque, 2019; Zayyad & Toycan, 2018; Alloghani et al., 2016). Alloghani et al. (2016) have investigated the factors that influence a user's acceptance of m-health services. The Technology Acceptance Model has been modified to include external variables (perceived security and perceived trust). It has been found that perceived usefulness, perceived ease of use, perceived security and perceived trust directly influence the intention to use m-health services**.** Albar & Hoque (2019) have conducted a study based on patient

acceptance of e-health services in Saudi Arabia. The authors have combined the Technology Acceptance Model and the Theory of Planned Behaviour. The results show that the constructs perceived usefulness and perceived ease of use have a significant effect on attitude towards usage. Additionally, this study has found that attitude and subjective norms influence behaviour and intention to use e-health (Albar & Hoque, 2019). This indicates that the Technology Acceptance Model can be applied to evaluate m-health users' acceptance.

In the context of culture, the Technology Acceptance Model has been used to study this phenomenon. Straub, Keil & Brenner, (1997) have used the Technology Acceptance Model to describe the relationship between various cultural dimensions and an individual's IT adoption behaviour. The study postulates that the more closely the culture conforms to uncertainty avoidance, the less frequently individuals will adopt a technology, and the more closely people conform to an individualistic culture, the more likely they are to use the technology. The more people conform to a masculinity culture, the less they would tend to adopt the technology.

Mohamed, Tawfik, Norton & Al-Jumeily, (2011) have assessed the applicability of TAM in the e-health field "E-TAM". Perceived usefulness and perceived ease of use have been used to assess the influence on intention to use electronic health (e-health) services. Cultural and social factors such as power, distance, masculinity, uncertainty avoidance, trust and subjective norms have also been used. The authors have found that perceived usefulness and perceived ease of use have a positive correlation on the intention to use e-health services. Additionally, evidence suggests that cultural and social constructs, subjective norms, uncertainty avoidance and trust are extensively linked to the use of e-health services. Mohamed et al. (2011), have extended their previous research E-TAM by employing the standard constructs from TAM to investigate m- health acceptance. M-health applications acceptance (MohTAM) have included cultural, social and technological constructs. The results have indicated that there is "direct relationship between social, cultural and technological constructs and the intention to use m-health applications" (Mohamed et al., 2011:13).

Hoque & Bao (2015) have investigated the role of cultural factors in the adoption and use of e-health. The authors have used the Technology Acceptance Model and Hofstede's cultural dimensions. This study has found that Hofstede's power distance, masculinity have a significant impact on intention to use e-health whereas uncertainty avoidance, collectivism have no

significant impact on intention to use. The model that was developed after the technology acceptance model is the theory of planned behaviour and this will be discussed in the section below.

2.5.3 Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) was developed based on the Theory of Reasoned Action. This theory urged researchers to consider the behaviour of people towards using technology (Ajzen, 1991). The Theory of Planned Behaviour expanded the Theory of Reasoned Action by including a third component, perceived behavioural control (PBC) as a construct to predict behaviour. The PBC was included due to the Theory of Reasoned Action being unable to deal with behaviours where individuals have "incomplete volitional controls" (Fishbein & Ajzen, 1975). PBC is comparable to Bandura's self-efficacy. Self-efficacy refers to the "beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments" (Bandura, 1997:3) and a persons' ability to use their skills and trust themselves to overcome any challenges (Mohebi et al., 2013). Self- efficacy will lead to successful adherence to self-care activities in type 2 diabetes mellitus. On the other hand, PBC reflects the "perception of internal and external constraints on behaviour" (Taylor & Todd, 1995:149), which is defined as "perceived ease or difficulty of performing the behaviour" (Ajzen, 1991:188).

The Theory of Planned Behaviour (TPB) has been widely used in the area of health research, technology adoption and studies based on cultural orientation (Akbar, Anderson & Gallegos, 2015; Arpaci, 2016). For many years, studies have been conducted using health behaviour theories such as the TPB. The TPB has been used to acquire an improved understanding of the cognitive mechanisms underlying the adoption of health-related behaviours (Akbar, Anderson & Gallegos, 2015).

In terms of health research, the TPB has been used to predict self-care behaviours in people who are at risk of diabetes and those who have been diagnosed with type 2 diabetes (Boudreau & Godin, 2014; Traina et al., 2016). In addition, it has been found that the TPB constructs are imperative predictors of "intent to carry out self-care behaviour in persons with type 2 diabetes" (Gatt & Sammut, 2008:1531). In a more recent study, the TPB has been tested quantitatively to understand the factors that influence the acceptance and use of ICT for diabetes self-management. The authors have found that all three key constructs of the TPB model are

determinants of behavioural intention (Petersen, Pather & Tucker, 2019). Based on the findings, the TPB model can study culture and the influence it has on diabetic patients' m-health acceptance and use.

The cultural values that an individual possesses are not only determined that individual's behaviour but also by their social environment (Triandis, 1989). A study by Arpaci (2016) has investigated the cultural orientation and behavioural intention for students towards collaborative learning. He has found that attitudes towards use and subjective norms are strongly related to students' collaborative learning (Arpaci, 2016).

Studies of TPB have examined the relationship between the TPB constructs and intentions across different cultures (Yun & Park, 2010; Park & Lee, 2009). Individualism/collectivism dimensions are relevant to the cross-cultural comparison of TPB. As stated by Triandis (1995), individuals who form part of an individualistic culture perceive themselves to be independent as they are likely to perform an intention based on their preferences (e.g., attitude). Individuals who form part of collectivistic cultures value interconnectedness and norms within their social groups (Triandis, 1995). This indicates that subjective norms may be more critical to collectivist cultures. A recent study has been conducted examining the TPB constructs and healthy behaviour intentions in individualistic and collectivistic cultures (Shukri, Jones & Conner, 2016). The authors have found supporting evidence for the impact of culture on the relationship between the constructs of TPB and physical activity intention in Malaysia and the United Kingdom (Shukri, Jones & Conner, 2016). Evidence suggests that in the United Kingdom sample, attitude was found to predict physical intention significantly, and in the Malaysian culture, it was not. It was mainly women who reported a high intention to eat healthier compared to men (Shukri, Jones & Conner, 2016). This indicates that the theory of planned behaviour can be used to study culture and technology adoption. The succeeding section discusses the Unified-Theory of Acceptance and Use of technology model that was developed from the preceding models.

2.5.4 Unified- Theory of Acceptance and Use of Technology (UTAUT)

The Unified- Theory of Acceptance and Use of Technology (UTAUT) model has been developed based on the eight models (TAM, IDT, TRA, the motivational model, TPB, a model combining the TAM and TPB, the model of PC utilization and the social cognitive theory). Three

of these models have been previously discussed. Venkatesh et al. (2003) have argued that there are many similar constructs found in other Technology Acceptance Models. Researchers tend to opt for a favoured model while ignoring other models. Venkatesh et al. (2003) have synthesised the constructs from each of the eight acceptance theories. Venkatesh et al. (2003) have found that "the eight models explained between 17% and 53% of the variance in users' intention to use Information Technology" (2003:425) and the Unified- Theory of Acceptance and Use of Technology model outperformed the eight models, using the original data set it explained 70% of the variance in behavioural intention to use technology (Venkatesh et al., 2003).

The Unified- Theory of Acceptance and Use of Technology model has been developed to understand and predict the acceptance and use of information technology by the user (Venkatesh et al., 2003). This model consists of four core independent constructs: performance acceptance, effort acceptance, social influence, facilitating conditions and four moderating factors, gender, age, experience and voluntariness of use (Venkatesh et al., 2003).

Even though research indicates that the Unified- Theory of Acceptance and Use of Technology model has reached its practical threshold of explaining individual technology acceptance and use (Venkatesh, Thong & Xu, 2016), it has continuously been used (Venkatesh, Thong & Xu, 2012). This model has been applied in many studies and contexts (e.g., e-health and m-health (Nuq & Aubert, 2013) as well as tested with other technology models (Venkatesh, Thong & Xu, 2016) In addition, the Unified- Theory of Acceptance and Use of Technology has been used in various studies on mobile phones and health adoption (Phichitchaisopa & Naenna, 2013; Sambasivan et al., 2012; Dwivedi et al., 2016; Cilliers, Viljoen & Chinyamurindi, 2017; Hoque & Sorwar, 2017).

Cillers, Viljoen & Chinyamurindi (2017) have used the UTAUT to explore students' acceptance of mobile phones to seek health care information. This study has found that the model was able to predict 36% of the variance in behavioural intention to use mobile devices. Additionally, Hoque & Sorwar (2017) have found that the constructs performance expectancy, effort expectancy and social influence have an impact on users' behavioural intention to adopt m-health services. This indicates that this author has confirmed the applicability of the UTAUT model in the context of m-health in developing countries.

Alshare and Mousa (2014) have explored the influence of espoused national cultural orientations

on a consumer's intention to use mobile payment devices. The authors have used a juxtaposition of UTAUT and Hofstede's cultural dimensions. Alshare & Mousa (2014) have found that uncertainty avoidance, masculinity, and collectivism have moderating effects and espoused power distance is not significant as a moderator in this study. Social influence, however, is a greater predictor of consumers' intentions.

As mentioned before there are low levels of technology acceptance amongst diabetic patients in low socio-economic environments (Petersen, Pather & Tucker, 2018). Petersen, Pather & Tucker (2018) have found that the key UTAUT constructs do not sufficiently explain the low levels of adoption of ICT, as almost 70% of the sample population in that study do not use m-health for their diabetes self-management. The authors argue that there are other factors, such as facilitating conditions that could affect the acceptance of m-health applications.

Even though the UTAUT provides a comprehensive model for acceptance and use of technology, it has several drawbacks (Negahban & Chung, 2014). Despite being used in studies related to technology adoption in healthcare, its capability in forecasting technology adoption in health care is doubtful, particularly in developing countries (Venkatesh, Thong & Xu, 2012). Furthermore, it has been found that focusing on a single subject such as a community, country and culture is reported as the most significant constraint of the Unified- Theory of Acceptance and Use of Technology model (Alam, Hu & Barua, 2018; Alam et al., 2020). In health care studies, authors have either used the Unified- Theory of Acceptance and Use of Technology model along with other theoretical models or by assessing the moderators of key determinants (Gagnon et al., 2012). Venkatesh et al. (2003) have stated that the Unified- Theory of Acceptance and Use of Technology measures a specific self-efficacy towards a certain technology as opposed to measuring a complete computer self-efficacy. Based on these limitations, Venkatesh, Thong & Xu, (2012) have developed the UTAUT2, which is presented below.

2.5.5 Unified- Theory of Acceptance and Use of Technology 2 (UTAUT2)

Unified- Theory of Acceptance and Use of Technology (UTAUT) was believed to be a complete model to forecast IT acceptance (Martins, Oliveira & Popovič, 2014) until Unified- Theory of Acceptance and Use of Technology 2 was developed. The Unified- Theory of Acceptance and Use of Technology 2 model (Figure 4) is an extension of the Unified- Theory of Acceptance and Use of Technology model for understanding consumer acceptance of new technology better, and

it is centred on the individuals' perspectives of technology adoption (Venkatesh, Thong & Xu, 2012). The Unified- Theory of Acceptance and Use of Technology 2 includes three additional moderators: hedonic motivation, price value and habit.

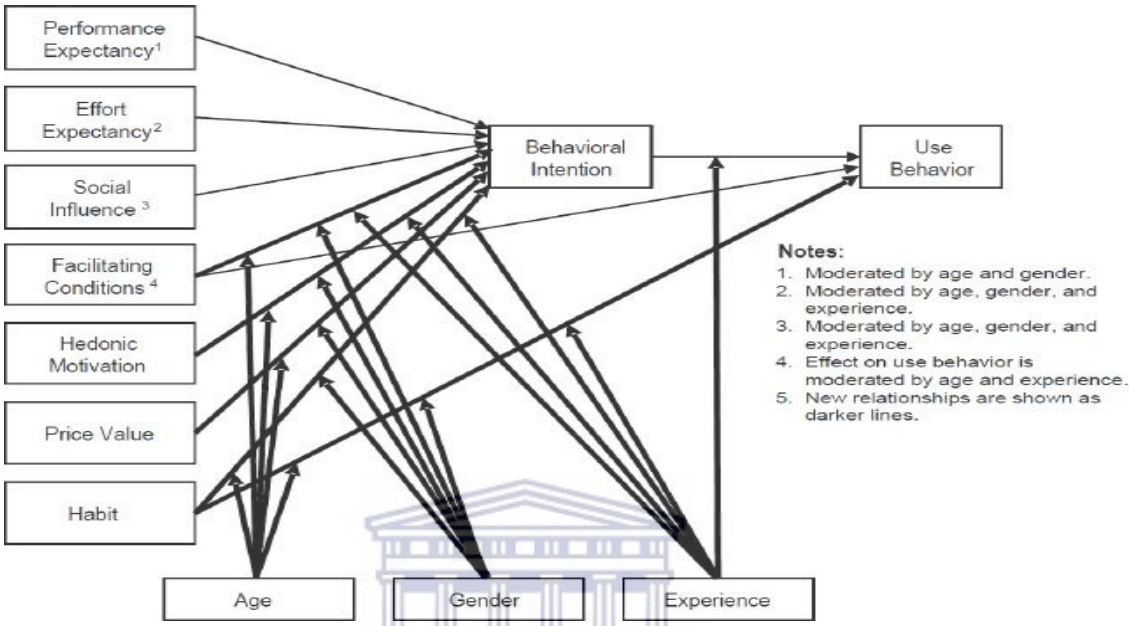

Figure 4: The Unified-Theory of Acceptance and Use of Technology 2 (UTAUT2) (Source: Venkatesh, Thong & Xu, 2012:160)

The UTAUT2 core constructs are defined below:

- Performance expectancy (PE): "is the degree to which an individual believes that using the system will help him or her to attain gains in job performance." (2003:447)
- Effort expectancy (EE): "is the degree of ease associated with the use of the system." (2003:450)
- Social influence (SI): "is the degree to which an individual perceives that important others believe he or she should use the new system." (2003:451)
- Facilitating conditions (FC): "is the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system." (2003:453)
- Hedonic Motivation (HM): is defined as "the fun or pleasure derived from using a technology." (Venkatesh, Thong & Xu, 2012:161)

- Price Value (PV): Referring to Dodds, Monroe & Grewal, (1991), PV is defined as "consumers' cognitive trade-offs between the perceived benefits of the applications and monetary costs for using them" (Venkatesh, Thong & Xu, 2012:161)
- Habit (HT): "the extent to which people tend to perform behaviours automatically because of learning." (Venkatesh, Thong & Xu, 2012:161)

Hedonic motivation was regarded as a significant predictor in prior research (Venkatesh et al., 2003), and it was integrated into the Unified- Theory of Acceptance and Use of Technology 2 for more stressing utilities. Research indicates that hedonic motivation is a vital construct in technology acceptance (Davis, Bagozzi & Warshaw, 1992; Venkatesh & Davis, 2000). The price value construct was introduced in the Unified- Theory of Acceptance and Use of Technology 2 model as the quality of the product, cost and utility compared with the price will in turn influence adoption decisions (Hennigs, Wiedmann & Klarmann, 2013). Currently in the application market, free, paid and freemium exist as price schemes (Yuan et al., 2015), and users carry the price linked with the service use (Baptista & Oliveira, 2015). On the other hand, habit is a significant predictor of mobile internet use (Venkatesh, Thong & Xu, 2016; Venkatesh, Thong & Xu, 2012). Habit has appeared to be the strongest determining factor of individual technology use (Tamilmani, Rana & Dwivedi, 2020). In the UTAUT2, habit is assumed to directly influence both behavioural intention and use behaviour (Hwang, Al-Arabiat & Shin, 2016). These newly added constructs have been verified in previous research as crucial contributing factors for users' technology adoption (Huang & Kao, 2015). The moderating variables influence the main constructs, whereas experience directly influences behavioural intention (see Figure 4). This model includes a direct relationship between facilitating conditions and use behaviour (Baptista & Oliveira, 2015).

The UTAUT2 model has been used to explore various research problems, such as smart mobile device adoption, self- technology service, as well as the healthcare industry. In comparison to earlier models, Venkatesh et al., (2012) have stated that UTAUT2 provides a significant improvement in the behavioural intention and technology use field of research. "The variance explained in both behavioural intention (74%) and technology use (52%) are substantial" (Venkatesh, Thong & Xu, 2012:172).

Yuan et al. (2015) have investigated the determinants of health and fitness applications grounded

on the UTAUT2 model. The results indicate that the constructs performance expectancy, hedonic motivation, price value and habit predicted an individuals' intention to continuously use health and fitness applications. On the other hand, effort expectancy and facilitating conditions did not have a substantial role in affecting an individuals' intention to continuously use a health and fitness app (Yuan et al., 2015). This could be due to the participants being young and therefore, relatively comfortable with technology.

Dwivedi et al. (2016) have assessed the behavioural intention for m-health adoption behaviour. They have applied the key constructs of the UTAUT2, performance expectancy, effort expectancy, social influence, facilitating conditions, price value and hedonic motivation. They have found that the four key constructs of the Unified- Theory of Acceptance and Use of Technology, as well as price value and hedonic motivation, are significant factors influencing behavioural intention leading to m-health adoption behaviour (Dwivedi et al., 2016:180).

Despite the UTAUT2 being developed to understand consumer technology acceptance better, it still faces criticisms. Tamilmani, Rana & Dwivedi (2017) employed a combination of "systematic review" and "meta-analysis" techniques to synthesise previous research that utilised UTAUT2. By systematically reviewing 650 articles, no more than 147 (22%) employed at best only one UTAUT2 construct. The outstanding 503 (77%) articles did not cite UTAUT2 in any significant way (Tamilmani, Rana & Dwivedi, 2020; Tamilmani, Rana & Dwivedi, 2017). Even though cultural factors play a role in technology adoption, it is overlooked in many of the models for user acceptance. The UTAUT2 model has been critiqued for not including cultural variables and lacks cultural awareness in non-Western countries (Khan & Qudrat- Ullah, 2021). Therefore, when studying culture with technology adoption, many authors extend the models by including cultural models such as Hofstede's cultural dimensions.

Baptista & Oliveira (2015) have investigated the factors that affect the acceptance of mobile banking and how culture influences individual use behaviours. The authors combined Unified-Theory of Acceptance and Use of Technology 2 with the cultural moderators of Hofstede's. Research shows that the factors that influence mobile banking acceptance are performance expectancy, hedonic motivation and habit. These factors are the most significant antecedents of behavioural intention. In addition, the results indicate that effort expectancy, social influence, facilitating conditions, and price value did not have a significant influence on behavioural

intention. In terms of culture, power distance, collectivism, uncertainty avoidance, and short-term orientation have been found to be the most significant cultural moderators for behavioural intention.

The preceding section has presented several models for user acceptance in the context of m-health and culture. The literature provides evidence that technology adoption models can be used as a method to study culture. The researcher has identified the Unified- Theory of Acceptance and Use of Technology 2 as a suitable model for this study. This therefore answers the research objective of this study which seeks to identify which user acceptance model is appropriately aligned to a study of culture. The succeeding section will define culture and discuss the different culture models to identify a suitable culture model that can be used as a basis for the empirical work.

2.6 Culture and Models

The previous section provided an overview of the prominent models for user acceptance. Amongst other essential points identified in the literature, the notion of culture was identified as being one of the main conceptual gaps of the Unified- Theory of Acceptance and Use of Technology model (UTAUT).

Researchers have investigated the culture and the role of cultural differences in the adoption and acceptance of information technology. Research indicates that cultural backgrounds play an imperative role in affecting the uptake and use of technology (Al-jumeily & Hussain, 2014; Tarhini et al., 2017; Masimba, Appiah & Zuva, 2019). In addition, cultural beliefs are factors that influence technology acceptance and use (Dehzad et al., 2014).

The notion of culture is imperative to grasp when discussing the influence it has on peoples' daily lives. To address the concept of culture, it needs to be conceptualised. The concept of culture is quite broad and as such difficult to delineate. It comprises a range of definitions provided by various anthropologists. This section will, therefore, introduce the concept of culture by first providing its definition. This section commences by exploring the cultural models and their criticisms. Hofstede's cultural dimensions are covered in detail and justified as the model of choice. Next, the distinction between culture at a national level and individual level will be presented. In the final section that follows, culture in South Africa and culture in the Cape Flats will be discussed, and the theoretical framework underpinning this study will be depicted.

2.6.1 Definition of culture

Culture is important in explaining behavioural differences within individuals, nations and organisations. Culture is, however, a broad concept and one of the most difficult terms to define and quantify (Williams, 1985; Hasan & Ditsa, 1999).

There are various definitions of culture provided by various anthropologists. One hundred and sixty-seven interpretations of culture have been developed (Kroeber & Kluckhohn, 1952). Definitions of culture by anthropologists date back to the 1800s as being inclusive of "knowledge, beliefs, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of the society" (Tylor, 1871:1). Culture can be viewed as crucial in clarifying how individuals differ from social groups. Moreover, culture is no more just a set of values. Culture may vary in its value orientations (Kluckhohn & Strodtbeck, 1961).

Rohner (1984:119) describes culture as "the totality of equivalent and complementary learned meanings maintained by a human population, or by identifiable segments of a population, and transmitted from one generation to the next". He further mentions that an entire society does not precisely share cultural meaning. Two people from the same society may have different explanations for the same occurrence or share the same explanation with other people from a given society but not with each other (Rohner, 1984).

Culture can also be perceived as thoughts and behaviours that distinguish one person from another or shared by a group of individuals which can impact their daily lives (Hofstede, 1980a). Each group of people conveys a set of shared cognitive programs that represent their group culture.

Hofstede's definition of culture is broad and has been widely accepted in IS literature. He defines culture as "the collective programming of the mind which distinguishes the members of one human group from another" (Hofstede, 1980:13). Hofstede, Hofstede & Minkov (2010) argue that culture is learned and not inherent. By the term "learned" they indicate that people's culture is adopted by the effect of social values and personal incidents that are unique to an individual (Hofstede, Hofstede & Minkov, 2010). However, it is argued that even though individual members perceive culture based on what they see or hear, culture can also be transmitted consciously or unconsciously from one generation to another. Beukman (2005) states that culture is two dimensional. It can either be explicit or implicit. Explicit consists of behavioural patterns

in a given situation and implicit is a manifestation of attitudes, values, beliefs and norms, which collectively give meaning to explicit behaviour.

Hofstede posits that culture is made up of six different layers. It can exist at a "national level or country level, a regional and/or ethnic and/or religious level, a gender level, a social class level, an organisational level, and lastly an individual level" (Hofstede, Hofstede & Minkov, 2010:18). At a country level, culture functions through religions, languages, and social structures (Hassan, Shiu & Parry, 2016). Some markers distinguish one individual from another in a given society such as their demographics, educational background, religion, location and income status (Hodgetts, Luthans & Doh, 2005).

2.6.2 Hofstede's conceptualisation of culture

According to Hofstede, Hofstede & Minkov (2010), cultural differences are displayed on different levels of depth such as symbols, heroes, rituals and values (Figure 5).

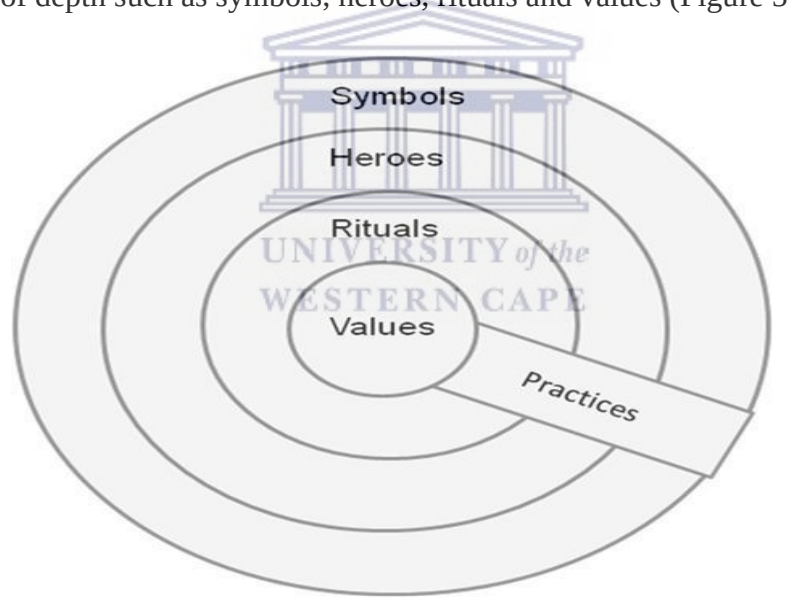

Figure 5: Hofstede Onion model of Culture (Source: Hofstede, Hofstede & Minkov, 2010)

The levels of depth are defined below:

- **Symbols:** In the first, outermost layer, are pictures, words and jargons that contain a specific meaning that is understood by those people who form part of the same culture (Hofstede, Hofstede & Minkov, 2010).
- **Heroes:** The second layer is defined as people dead or alive that possesses qualities that are glorified by people in a particular society, (Hofstede, Hofstede & Minkov, 2010) for

example, Nelson Mandela, the first president post- apartheid.

- **Rituals:** The third layer is collective activities that are seen as socially essential (Hofstede, Hofstede & Minkov, 2010). The ways of greeting, social and religious ceremonies are examples of rituals.
- **Values:** The fourth, innermost layer, are wide-ranging terms that prefer certain states as opposed to others, for example, good rather than evil (Hofstede, Hofstede & Minkov, 2010).

As culture exists differently in all parts of the world, American, Asian, European and African culture is unique in all forms and expressions (Yavwa & Twinomurinzi, 2018). Culture, as a social concept, has been studied for many years. Research findings have found that there is a link between culture and technology adoption. Culture can either impede technology adoption (Hasan and Ditsa, 1999) or can facilitate technology acceptance (Sriwindono & Yahya, 2012). It is, therefore, vital to incorporate culture into the models of user acceptance.

Several researchers have indicated that cultural backgrounds play an imperative role in affecting the adoption and use of technology (Kovačić, 2005; Srite & Karahanna, 2006; Barton, 2010; Al-jumeily & Hussain, 2014; Tarhini et al., 2017). In addition, cultural beliefs are factors that influence technology acceptance and use (Dehzad et al., 2014). Although the role of cultural values on technology acceptance has been widely studied from a national perspective, there is little evidence on its role on technology acceptance at an individual level (Sun, Lee & Law, 2019).

2.6.3 Cultural models

The section above discussed the concept of culture. The term culture can be categorised into a national, organisational and individual level. To understand how culture is interpreted, the culture models will be defined, and the constructs of the models will be explored. There are various cultural models, and all of these cultural models use their own variables to identify culture attributes (Tarhini, 2013). An assessment will be made based on the critiques of each of the respective models to examine which of these models will be applicable in order to study the dimensions of culture of diabetic patients in Mitchells Plain and Strandfontein.

2.6.3.1 Trompenaars Cultural Model

Trompenaars Cultural model (Trompenaars, 1993) was developed to explain cultural differences

based on the challenges people encounter when forming social communities. According to Trompenaars, “culture is the way in which a group of people solve problems and reconcile dilemmas” (Trompenaars & Hampden-Turner, 1997:6). He further states that preferences differentiate people into various cultural dimensions. These dimensions were then developed to illustrate the differences between one culture compared to another and how culture relates to societal level characteristics. The dimensions illustrated by this model are useful in comprehending how people from different national cultures interact.

The Trompenaars & Hampden-Turner (1997) model consist of seven dimensions:

Individualism versus Communitarianism: In Individualistic cultures, people make their own informed decisions and take care of themselves. Also, Individualistic people value personal freedom and reward personal accomplishments. Therefore, within an individualistic culture, people believe that they are more important than the group itself. Individualism describes cultures where ties between individuals are loose. The individual rather than any group norms determine decision making on lifestyle. In Communitarian cultures, groups are considered to be the most important, unlike individuals. As Communitarian refers to groups, rewards are given to group performance, decisions are taken collectively, and individual performances are not publicly praised (Trompenaars & Hampden-Turner, 1997:9).

Universalism versus Particularism: In a Universalistic culture, people abide by standards that are collectively decided upon by all who form part of this culture. This culture consists of laws, values and rules and which are applied to everyone. Alternatively, in Particularistic cultures, personal relationships are valued as a substitute for laws and rules (Trompenaars & Hampden-Turner, 1997:9).

Specific versus Diffuse: In a specific culture, people believe that their private lives ought to be kept separate from their professional lives. People who form part of this culture see their lives as parts which should remain separate. With that said, specific orientated cultures believe they can work well with others without having a personal relationship. In a diffuse oriented culture, personal and professional relationships overlap. Individuals who form part of a diffusely oriented culture are more rounded and view all aspects of their life as a whole with each element related to every other element (Trompenaars & Hampden-Turner, 1997:9).

Affectivity versus Neutrality: In Affectivity cultures, people are allowed to display their

emotions to others and may partially allow emotions to influence their decision. In addition, people are expected to open up to their others in their culture emotionally. While in neutral cultures, individuals should practice self-control regarding their emotions (Trompenaars & Hampden-Turner, 1997:69). Additionally, actions should be influenced by reason rather than emotions.

Internal direction versus External direction: In internal-directed cultures, to achieve goals people deem that they can control their surroundings while in external direction, people deem that they are controlled by their surroundings (Trompenaars & Hampden-Turner, 1997).

Achieved Status versus Ascribed Status: In achievement cultures, status is given based on how well people perform at a particular task. While in Ascription culture, people are endorsed on what or who they are. Status may be conferred according to demographics, family and racial group (Trompenaars & Hampden-Turner, 1997:102).

Sequential Time versus Synchronic Time: In a sequential time culture, people tend to be inflexible. The sequence of events is of utmost importance in this regard, as individuals value planning and punctuality as imperative. In contrast, people who view plans and obligations as flexible form part of a Synchronic time as they work on multiple tasks at once (Trompenaars & Hampden-Turner, 1997:124).

An assessment of the above indicates that, in relation to the study, Trompenaars & Hampden-Turner (1997) cultural dimensions may be a relevant model to study culture in this context.

Individualism versus Communitarianism may be relevant. For example, if a DM patient subscribes to an “Individualistic culture”, the patient might be inclined to seek out solutions in relation to making their own informed decision and take care of themselves.

Universalism versus Particularism may be relevant. For example, if DM patients subscribe to a “Universalism culture”, the individual may make diabetes self-care decisions based on their values and beliefs.

Specific versus Diffuse may be relevant. For example, if a DM patient subscribes to a “Specific culture”, they may share their thoughts and feelings about their diabetes self-care activities and decision-making with others.

Affectivity versus Neutrality may be relevant. For example, if a DM patient subscribes to an "Affective culture", the patient may express and share their emotions and feelings to their doctors about their diabetes self-care activities.

Internal direction versus External direction is not relevant to this study. People who form part of an internal direction culture believe they can control their environment to achieve their goals.

Achieved Status versus Ascribed Status may be relevant. For example, if a DM patient subscribes to an ascribed status, their demographics (race, age and gender) may influence their diabetes self-management decision.

Sequential Time versus Synchronic Time may be relevant. People who form part of a sequential culture may prefer to have a detailed agenda of activities and would perform one activity at a time.

2.6.3.2 Hofstede's Cultural dimensions

Hofstede (1980) developed a model to measure work-related values based on the data collected from IBM units between 1967 and 1973. The data consisted of 116,000 survey responses from seventy-two distinct countries in twenty languages. The survey was not initially aimed at studying cross-cultural differences. In his analysis, however, Hofstede identified variations in how respondents from different parts of the world responded to specific groups of questions. Furthermore, Hofstede (1980) developed an index model and presented four cultural values of culture: Power Distance, Individualism versus Collectivism, Masculinity versus Femininity, and Uncertainty Avoidance. Hofstede then included Long-Term versus Short-Term Orientation as a fifth dimension (Hofstede, 2001). He later added Indulgence versus Restraint as a sixth dimension (Hofstede, Hofstede & Minkov, 2010). Hofstede has addressed culture by focusing merely on disparities between cultures (Hofstede, 1980a). Additionally, Hofstede associates the notion of culture with assessing the 'value orientation characteristic' of persons from diverse nations (Nakata, 2009).

Hofstede, Hofstede & Minkov (2010) have defined cultural values as follows:

- **Power distance (PD)** – "extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally" (2010:61**)**.

- **Individualism- collectivism (IDV)** – "refers to societies in which the ties between individuals are loose: everyone is expected to look after him or herself and his or her immediate family. Collectivism as its opposite pertains to societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty" (2010:92).
- **Masculinity- femininity (MAS)** – Masculinity refers to a "society in which emotional gender roles are clearly distinct" (2010:519). Femininity is seen as a "society in which emotional gender roles overlap: both men and women are supposed to be modest, tender, and concerned with the quality of life" (2010:517).
- **Uncertainty avoidance (UA)** – "the extent to which the members of a culture feel threatened by ambiguous or unknown situations" (2010:191).
- **Long-term orientation- Short-term orientation (LTO)** – "the fostering of virtues oriented toward future rewards—in particular, perseverance and thrift." (2010:239). Short-term orientation "the fostering of virtues related to the past and present—in particular, respect for tradition, preservation of face, and fulfilling social obligations" (2010:239).
- **Indulgence- restraint (IR)** – Indulgence refers to a "society that allows relatively free gratification of basic and natural human desires related to enjoying life and having fun" (2010:519). Restraint refers to a "society that suppresses gratification of needs and regulates it by means of strict social norms" (2010:521).

An assessment of the above indicates that in relation to this study's research problem, Hofstede's cultural model is a relevant model to study culture. The application to diabetic patients will be discussed in section 2.14.

Hofstede's culture framework has been extensively studied in the areas of Information Systems and Information Technology studies (e.g., Sriwindono & Yahya, 2012; Sriwindono & Yahya, 2014; Lee, Trimi & Kim, 2013; Tarhini et al., 2017). These studies suggest that a significant relationship exists amongst national culture and the rate of technology adoption and acceptance. In a study carried out by Sriwindono & Yahya (2012), long-term orientation has been found to have the highest effect on Perceived Usefulness of technology, then followed by power distance and individualism on perceived ease of use of technology. Hofstede's model became popular, as all six values can collectively study all national cultures as opposed to only a subset of national

culture. Hofstede's cultural theory is deemed to be an appropriate framework for empirical research as it assesses every person of a particular culture (Ta'amneh, 2012).

Although Hofstede's cultural values have been influential in many disciplines, they have not escaped criticism. Hofstede work has been criticised for a lack of generalisability and over-simplifying culture (Ng, Lee & Soutar, 2007). Furthermore, Hofstede (1980) stated that a country-level analysis is unable to predict individual behaviour. However, national cultural values have been examined as being espoused at the individual level in previous research (Srite & Karahanna, 2006; Teo & Huang, 2018; Sun, Lee & Law, 2019). Later, Hofstede recommended that culture should be investigated at the social level and values should be studied at the individual level (Hofstede, 2001). He further claimed that cultural values are the foundation of daily practices (Figure 5- the onion model), and daily practice was affected by a person's cultural values (Hofstede, 2001).

Despite the criticism, the Hofstede (1980, 2010) model of cultural dimension is more applicable in this study than any other model. The model is useful in understanding which cultural dimension has a link with technology acceptance. Culture can be a facilitating condition or an inhibiting condition as it affects people's attitudes and beliefs. Mutunda (2017) suggests that culture is rooted in the many traditions and practices which are focused on family and different ethnicities. The African culture, however, goes beyond the six dimensions that are described in the Hofstede model. In Africa, culture emerges as spiritual beliefs (Tchombe, 1995), respect for authority and the elders, communal life, and tradition (Kanu, 2010). Previous studies have ascertained that culture plays a central role in health-related behaviours (Jia et al., 2017; Levesque & Li, 2014). Jia et al. (2017) postulate that culture affects people's behaviour and thinking, and therefore influences health management behaviour. Also, findings by Levesque & Li (2014) suggest that culture has a significant impact on health conceptions, which in turn influence health practices. It is imperative therefore to study the influence of culture on the acceptance of an m-health application. Culture is, therefore, one of the factors that will be discussed to provide answers for diabetes self-management.

The preceding section unpack cultural models identified in the literature review. It has been found that some of Trompenaars cultural dimensions are similar to Hofstede's cultural dimensions and not all of Trompenaars cultural dimensions are applicable to a study of m-health

of diabetes self-management. This section above was used to answer the research objective which is to derive a framework that defines the concept of culture.

To provide context to the research problem, culture and diabetes self-management is examined to understand the impact that culture has on diabetic patients and their self-management.

2.7 Culture and diabetes self-management

It has been observed from the findings discussed above (Jia et al., 2017) that cultural influences play a vital role in determining people's attitudes and beliefs hence, culture has an effect on attitudes and beliefs regarding diabetes self-management. Diabetic patients' perceptions, religion, cultural beliefs and values may hinder the proper use of insulin in particular racial and ethnic minority groups (Rebolledo & Arellano, 2016), and may influence self-management of diabetes. Cultural influences may have a direct impact on patients' self-management behaviour via the perception of health management of their condition and how an informed decision is made (Barbara & Krass, 2013; Tseng et al., 2013). Cultural factors may include cultural health beliefs (Tseng et al., 2013; Zeng et al., 2014) and dietary preferences (Zeng et al., 2014). These factors have been shown to influence diabetes self-management of culturally diverse populations (Eh et al., 2016). Despite self-management having a positive impact on a patients' overall health outcome (Kueh et al., 2015), successfully managing diabetes solely depends on the patients' willingness to perform self-management activities daily. The self-management behaviour is influenced by the patients' culture and practices, including health-seeking behaviour and understanding of the condition (Choi et al., 2015; Barbara & Krass, 2013). Therefore, culture must be understood in the context being studied. Research indicates that culture is unique to geography and may not be viewed in isolation (Dwivedi et al., 2016). Therefore, culture in South Africa will be discussed to provide context to this study.

2.8 South African culture

South Africa, known as a Rainbow Nation Country, is seen as a diverse and complex nation consisting of various values, norms, and belief systems. As in any geography, traditions and practices are based on the belief systems of the citizens. The belief in, and people's perceptions about the traditions and practices play an important role in the cultural orientation of individuals, which is conveyed from one generation to the next (Banda, 2012), and these cultural orientations have a strong influence on behaviour and behavioural intention (Durmaz, 2014). Understanding

culture in a South African context is an important consideration in this study.

Culture and ethnic diversity is a challenging phenomenon in the healthcare sector, particularly in LMICs (Reid et al., 2018). South Africa is a culturally diverse country and may have a good appreciation of the effects of culture on healthcare management. It is therefore vital to look at a holistic view of culture in South Africa. South Africa is characterised by diversity requiring sensitivity towards culture (Reid et al., 2018). The cultural backgrounds influence patients' choices, and it is crucial for health care providers to understand the influence of culture (Meier & Hartell, 2009). A study carried out by Abdulrehman et al. (2016), for example, has found that cultural influences play a vital role in diabetes self-management, especially in low resource areas.

Patients' culture may determine how they define health, identify ailment, and seek treatment. As culture dramatically influences health, the perceptions of people regarding healthcare and health-seeking behaviour, it is important to consider cultural factors when designing health promotion studies (Al-Bannay et al., 2014). In South Africa, the health care sector lacks culturally appropriate communication strategies to address healthcare concerns to encourage awareness and self-management (Reid et al., 2018). Therefore, "it cannot be assumed that m-health interventions developed in one culture can simply be translated into another culture without consulting the cultural context in which they should operate" (Müller, 2016:295). As such, an m-health intervention employed in a developed country can not necessarily be successfully implemented within a developing country without taking into consideration cultural differences (Müller, 2016) because cultures may vary between the countries (Chung, 2015).

Understanding patients' self-management, cultural and value systems is a significant factor for constructing effective self-care interventions that could ultimately influence self-care behaviours, i.e. their diet and exercise choices (Ayele et al., 2012). Culture may influence diabetes self-management (Sachdeva et al., 2015). Research indicates that culture and socio-economic status shapes diabetic patient eating patterns (Matima et al., 2018).

The preceding section has provided context to the study. It presented insight into South Africa, the culture and beliefs of this population. The literature provides evidence that culture influences diabetes patients and their diabetes management. This therefore underscores the research objective of this study which seeks to explore how diabetic patients accept and use m-health for

diabetes self- management.

2.9 Culture in the Cape Flats

While the previous section looked at South African culture in general, this section is a presentation of the Cape Flats culture. The society is predominantly of the "Coloured" race (Statistics South Africa, 2013). Research suggests that in the City of Cape Town, where this study is being conducted, 405 989 (23.9%) of individuals are unemployed (Statistics South Africa, 2011). M-health "interventions seem to be developed and implemented in a socio-cultural vacuum - the templates for many m-health interventions are mainly interventions from developed countries" (Müller, 2016:295).

Since culture exists differently in all parts of the world, culture is context-specific and cannot be seen in isolation. Culture cannot be overlooked if the technology is to be adopted successfully in a community (Masimba, Appiah & Zuva, 2019). The impact of culture may be significant, especially amongst populations such as those in marginalised communities, which hold unique health behaviours that may differ significantly from the cultural norms of the general South African population.

In South Africa, racial and ethnic minorities who are marginalised, disadvantaged and mistreated socially, economically, culturally are deemed as categories of poverty. Culture in different environments has a local context. In South Africa, societies consist of different racial and ethnic groups, and each of them forms a separate community with its own culture and traditions (Becker, 2015). In addition, people from diverse racial/ethnic groups may share comparable cultural values due to living with similar lifestyles and socio-economic circumstances (Belkhamza & Wafa, 2014). Further research has found that older adults survive off social grants which are used to support their relatives. This shows that they cannot afford to purchase food items that are suitable for diabetic patients (Booysen & Schlemmer, 2015). As such, people with limited or no income are restricted in terms of food choices and are more susceptible to eating unhealthy meals (Dinbabo et al., 2017).

Research based on culture in the Cape Flats has found that "the Coloured community is a separate racial grouping with its own identity and its own culture" (Nilsson, 2016:83). This serves as evidence that there are cultural differences amongst ethnic groups. The customs and practices of people are based on their convictions (Yavwa & Twinomurinzi, 2018). Sachdeva et

al. (2015) have found that perception about diabetes is influenced by tradition, customs and ethos (Sachdeva et al., 2015).

In the Cape Flats area, there is a strong (influential) culture of religious activities (Farrar et al., 2019). Research indicates that participation in these religious activities appears to be more evident amongst Muslims than adherents to other religions (Farrar et al., 2019). Also, it is more prominent amongst the senior citizens as compared to the younger population (Farrar et al., 2019). Studies suggest that culture and religion have a strong influence on different health behaviours (Adejumo et al., 2015).

Culture can also play an essential role in the foods that people choose to eat. Dietary habits and practices are influenced by culture and religion, as well as economic conditions (Sachdeva et al., 2015). Individuals stated that their ethnic or religious background influenced their choice of healthy foods (Dinbabo et al., 2017). A study based on diabetes in the Cape Flats found that although patients follow a healthy diet and healthy techniques of making meals, the participants found it expensive and time-consuming to cook more than one meal at a time. This is due to the rest of the family refusing to eat food that they regard as diabetic food (Booysen & Schlemmer, 2015). In addition to this, many participants mentioned that they eat healthy during the week and would indulge on weekends.

A study based on the food choices in the Cape Flats area has found that people in Khayelitsha and Mitchells Plain are not exercising because they live in unsafe communities. It was found to be unsafe to walk around for exercising or to visit the clinic early in the morning (Dinbabo et al., 2017). This is consistent with a study conducted in another marginalised community, Bishop Lavis. It was found that diabetic patients in Bishop Lavis are unable to partake in physical activity due to crime (Booysen & Schlemmer, 2015). This indicates that low-income communities have a high level of crime which inhibits physical activity. Crime, especially cyber-crime influences the confidence and the use of mobile applications by users (Behl, Pal & Tiwari, 2019). Therefore, failure to understand the setting where a specific technology is intended to be implemented similarly indicates failure of the technology adoption process (Masimba, Appiah & Zuva, 2019).

The main points that the previous section emphasises is that culture is specific to a particular context and should not be viewed in isolation. In South Africa, the Cape Flats societies form part

of different ethnic groups which consists of their own cultural values and their own traditions (Becker, 2015). Nevertheless, individuals from different ethnicities may share similar cultural values and beliefs due to having similar socio-economic situations (Belkhamza et al., 2014). What may thrive in a developed country may not necessarily be successful in a low-income country. The impact of culture on m-health acceptance can have a significant impact on marginalized communities and therefore, the population under investigation needs to be understood for m-health applications to be implemented successfully.

2.10 Cultural values on an individual level

Numerous studies have investigated the relationship between culture and technology. Many of these studies have just operationalised cultural value orientations at the national or organisational level (Lai et al., 2016). Most of the literature focuses on the influence of culture on technology acceptance at a national or organisational level (Tarhini, Hone & Liu, 2015). In contrast, there has been scant literature published concerning the effects of culture on an individual level. There appears to be a consensus that cultural values from a national level cannot be used to determine individual values (Straub, Keil & Brenner, 1997; Hasan & Ditsa, 1999).

Hofstede's cultural model was operationalised by Dorfman and Howell (1988) to study culture at an individual level. Research conducted by Srite & Karahanna (2006) followed this recommendation by testing the model in two studies on computing technology acceptance (one on the use of personal computers (PCs), and another on personal digital assistants). It was found that "social norms are stronger determinants of intended behaviour for individuals who espouse feminine and high uncertainty avoidance cultural values" (Srite & Karahanna, 2006:679). The findings illustrate that people's cultural values affect their technology acceptance (Srite & Karahanna, 2006).

From the models stated in section 2.5, the TRA, TPB, TAM and UTAUT and UTAUT2 models were analysed together with Hofstede's cultural dimensions (Baptista & Oliveira, 2015; Arpaci, 2016; Srite & Karahanna, 2006; Tarhini et al., 2017).

An example of another study that integrated culture and the Technology Acceptance Model (TAM) is that of Tarhini et al., (2017). The authors combined Hofstede's cultural dimensions (1980), and the Technology Acceptance Model by Davis (1989) to investigate the research problem. They assessed the effect of individual-level culture on the acceptance of e-learning

tools. Subjective norms were added to the TAM to overcome the limitations posed by using TAM in a developing country. The authors found that perceived ease of use and perceived usefulness to be important factors of behavioural intention and the use of e-learning for both the British and Lebanese students. In terms of cultural dimensions, it was found that there is a stronger relationship among users with high collectivistic cultures (Tarhini et al., 2017). This is due to Individualism/collectivism, which moderates the relationship between subjective norms and behavioural intention. In addition, this study found that British and Lebanese students are likely to be persuaded by the sentiments of their teachers and classmates when deciding whether or not to accept technology (Tarhini et al., 2017). As such, it provided evidence that culture plays a role in technology acceptance.

Teo & Huang (2018) investigated espoused cultural values and the behaviour intention of lecturers to use technology in Chinese universities. Hofstede's four cultural dimensions were assessed at the individual level, "as technology acceptance was considered an individual concern" (Teo & Huang, 2018:1). The results indicated that the extended TAM model was suitable to understand the role of cultural values in describing the behavioural intention of educators. The study found that educators' behavioural intention was affected by their subjective norms and their espoused cultural values (Teo & Huang, 2018).

A more recent study has examined the influence of cultural values at an individual level. Sun, Lee & Law (2019) have investigated cultural values at an individual level in the context of the hotel industry. It has found that two of Hofstede's key constructs collectivism and long-term orientation have been positively correlated to perceived usefulness and perceived ease of use. "While national culture is a macro-level phenomenon, the acceptance of technology by end-users is an individual-level phenomenon" (Tarhini et al., 2017:308). The cultural characteristics from an individual's national culture may be influenced by their ethnicity, social groups and religion that each have their own unique culture (Lee et al., 2007). Therefore, conceptualising culture at the individual level manifests the multi-layered cultural values accumulated in the self.

This section above shows the relationship between the technology adoption models and Hofstede's cultural dimensions model. Many studies have shown how the cultural dimensions fit into the acceptance models. This study will, therefore, use the UTAUT2 model of technology adoption and add the Hofstede cultural dimensions to the analysis. Technology acceptance will

be understood in the context of the UTAUT2 model with cultural dimensions as an extension of the model.

2.11 Technology adoption versus culture

To understand how users', accept new technology, such as mobile applications, it is necessary to understand the many variables that affect an individual's decision. The factors that affect technology uptake and use are an individual's attitudes towards using the technology, the ease of use associated with the new technology and socio-cultural factors (Beratarrechea et al., 2014).

Technology adoption is a cultural matter just as it is a cognitive process of reaching a decision (Im, Hong & Kang, 2011). It has been found that cultural beliefs are a crucial factor in technology acceptance (Dehzad et al., 2014). Individualism-collectivism is found to be one the most explored cultural dimensions in technology adoption (Lai et al., 2016). The literature indicates that cultural factors have a significant role in ICT acceptance (Sriwindono & Yahya, 2014; Sriwindono & Yahya, 2012). This is due to technology being often used in cultural contexts of users. Im, Hong & Kang (2011) indicate that culture plays an essential role in technology adoption, as cultural factors are significant in explaining IT usage behaviour (Straub, Keil & Brenner, 1997). Research indicates that cultural dimensions may influence how people perceive technology (Huang et al., 2019). Lin (2014) indicates that the influence of Hofstede's power distance is related to social influence in the Unified- Theory of Acceptance and Use of Technology model. Therefore, it is crucial to review technology adoption models to identify a suitable model that could be used in health and culture research.

Research indicates that the Unified- Theory of Acceptance and Use of Technology model was unable to predict usage. It was found that behavioural intention did not translate into the usage of Information Communication Technologies (ICT). Other factors such as facilitating conditions could affect uptake and usage (Petersen, Pather & Tucker, 2018). This is consistent with recent research that has found that uptake of diabetes self-management applications is low (Garabedian et al., 2019) and continued use is also low (Deacon et al., 2017), possibly due to other factors affecting adoption such as culture (Petersen et al., 2019), It was found that sociocultural factors affect adoption and use (Petersen et al., 2019) and cultural beliefs are fundamental for technology acceptance and use (Dehzad et al., 2014). Research shows that low health literacy is related to poorer health outcomes (Anderson & Emmerton, 2016) and thus has a significant

impact on people's ability to self-manage their condition (Dao et al., 2019). Therefore, interventions such as "A Patient-centred communication style that incorporates patient preferences, assesses literacy and numeracy, and addresses cultural barriers to care" (American Diabetes Association, 2015:S5) should be addressed to improve health outcomes.

Several researchers (e.g., McCoy, Galleta & King, 2005; Srite, 2006; Park, Yang & Lehto, 2007) state that cultural influences need to be taken into account when researching technology acceptance as the way people use Information Systems is influenced by their culture (Im, Hong & Kang, 2011; Sriwindono & Yahya, 2012). Srite & Karahanna (2006) support this by stating that cultural values act as a significant moderator in technological acceptance. The acceptance and user behaviour towards technology can be influenced by cultural, individual differences and social influences (Tarhini, Hone & Liu, 2014). Furthermore, it has been found that people's cultural beliefs are a key factor for technology uptake and adoption (Dehzad et al., 2014), and cultural backgrounds can also influence technology acceptance (Peek et al., 2014; Masimba, Appiah & Zuva, 2019).

Within the context of diabetes and diabetes self-management, there are a host of factors that influence self-management of diabetes such as religious, social factors as well as cultural values and beliefs, all of which influence how people understand and treat their condition (Abdulrehman et al., 2016). Concerning technology acceptance, in certain cultures, people are more family-oriented and thus have a negative view on technology, as it is seen as a potential threat to family and social life. As South Africa is an individualistic society (Hofstede, 2019), the social pressure to perform a certain behaviour is relatively less than in a collectivist society (Bandyopadhyay & Fraccastoro, 2007). For example, technology uptake and usage are acted upon within a cultural and social context and these influences how people behave towards technology (Masimba, Appiah & Zuva, 2019).

Many authors have investigated the effect of cultural values using the Technology Acceptance Model constructs' (Srite & Karahanna, 2006; Hoque & Bao, 2015; Tarhini et al., 2017). Thowfeek & Jaafar (2013) have indicated that in feminine cultures, individuals are expected to be mindful of the opinion of others as they are deemed more people- oriented. Hoque & Bao (2015) have explored the impact of culture on the adoption of electronic health services in Bangladesh. This study used items from Davis (1989) and incorporated Hofstede's cultural

dimensions. It found that perceived usefulness is a significant factor of e-health adoption in Bangladesh. In contrast, it found that perceived ease of use appeared to have no significant effect on adoption of e-health (Hoque & Bao, 2015).

In terms of culture, this study also found that power distance and masculinity have a significant influence on the intention to use e-health. This indicates that people who have a high position in an organisation, with enough money and power have better access to e-health services in Bangladesh. In addition, the adoption of e-health was significantly influenced by people who form part of a masculinity culture. It has also been found that uncertainty avoidance and collectivism have no significant effect on the intention to use e-health. This suggests that in public and private hospitals, electronic health is not well developed to face impending uncertainties. Additionally, it can be assumed that people (Bangladeshis) are independent and are not loyal to a group. Restraint was found to have a significant negative relationship with intention to use e-health adoption decision (Hoque & Bao, 2015).

Tarhini et al. (2017:321) found that power distance, masculinity–femininity, uncertainty avoidance and individualism–collectivism "were found to be significant moderators of this relationship". This result supports the view formulated by Srite & Karahanna (2006:321) that "social environment is a significant mechanism via which culture affects individual behaviour".

A study on the relationship between culture and technology acceptance found that low power distance and low levels of uncertainty avoidance but a high individualist culture, tend to adopt and accept new technology quickly (Özbilen, 2017). The author further revealed that people in countries with a high masculinity score give more consideration to achieving their goals, as success is important to them. This indicates that they are presumed to have a stronger inclination to adopt new technology. In contrast, countries with cultures that score high in power distance, collectivism and uncertainty avoidance, tend to resist accepting new technology (Kirsch, Chelliah & Parry, 2012).

A recent study by Petersen et al. (2019) uses the Technology Acceptance Model to identify the impediments to ICT adoption of diabetes self-management. It was found that socio-cultural factors are some of the factors that hinder the ICT adoption of diabetes self-management. The authors further recommended that culture in the use of m-health acceptance for diabetes self-management could be explored in future research. On the other hand, irrespective of the possible

influence on the acceptance of information technology, culture has not been foremost in technology acceptance research, particularly in low-middle income countries (Sriwindono & Yahya, 2014).

The section above provides insight into technology adoption and culture and how culture influences acceptance and use. The key point that this section brings forth is that Hofstede's cultural dimensions can influence technology acceptance and use. In addition, previous studies of Hofstede's culture dimensions and technology adoption were cited, which indicates that Hofstede's cultural dimensions can be used to study technology adoption as they have a significant effect on an individuals' uptake and use of technology.

The succeeding section therefore provides a comparison between the models for user acceptance and cultural models, to indicate the similarities and difference between the models. This will provide a basis for the researcher to identify the models to use for the empirical investigation.

2.12 Comparison of user acceptance models with the cultural models

Table 2 presents the four prominent models of user acceptance, together with the cultural models. This includes the key constructs of the user acceptance models and those cultural models which were found to have some alignment to this study's research problem.

Table 2: Comparison of the user acceptance models with the cultural models

	TRA [1]	TPB [2]	TAM [3]	UTAUT [4]	UTAUT2 [5]	HOFSTEDE [6]	TROMPENAARS [7]
Key constructs							
Attitude towards behaviour refers to "an individual's positive or negative feeling about performing the target behaviour" [1].	✔	✔	✔ PU construct is similar.	✔ PE and EE are similar.	✔ PE and EE are similar.		
Subjective norms refer to "the person's perception that most people who are important to him think he should or should not perform the behaviour in question" [1].	✔	✔		✔ SI construct is similar.	✔ SI construct is similar.		
Perceived behavioural control refers to "perceived ease or difficulty of performing the behaviour" [2].		✔	✔ PEOU construct is similar.	✔ EE construct similar.	✔ EE construct similar.		
Perceived ease of use refers to the "degree to which a person believes that using a particular system would enhance his or her job performance" [3]		✔ PBC construct is similar.	✔	✔ EE construct is similar.	✔ EE construct is similar.		

	TRA [1]	TPB [2]	TAM [3]	UTAUT [4]	UTAUT2 [5]	HOFSTEDE [6]	TROMPENAARS [7]
Perceived usefulness refers to the "degree to which a person believes that using a particular system would be free of effort"[3]		✔ Attitude towards behaviour is similar.	✔	✔ PE construct is similar.	✔ PE construct is similar.		
Performance expectancy refers to "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" [4].				✔	✔		
Effort expectancy refers to "the degree of ease associated with use of the system" [4].				✔	✔		
Social influence refers to "the degree to which an individual perceives that important others believe he or she should use the new system" [4].				✔	✔		
Facilitating conditions refers to "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" [4].		✔		✔	✔		
Hedonic Motivation refers to "the fun or pleasure derived from using a technology" [5].					✔		
Price value refers to "consumers' cognitive trade-offs between the perceived benefits of the applications and monetary costs for using them" [5].					✔		

	TRA [1]	TPB [2]	TAM [3]	UTAUT [4]	UTAUT2 [5]	HOFSTEDE [6]	TROMPENAARS [7]
Habit (H) refers to "the degree to which consumers tend to perform the usage of technologies or the usage of technology products behaviors automatically because of learning"[5]							
Behaviour	✔	✔	✔	✔	✔		
Use Behaviour	✔	✔	✔	✔			
Power distance refers to "the extent to which individuals expect and accept differences in power between different people" [6]						✔	
Masculinity-femininity refers to "the extent to which traditional gender roles are differentiated"[6]						✔	✔ Similar to Trompenaars Affectivity / Neutrality.
Uncertainty avoidance refers *to* "the extent to which ambiguities and uncertainties are tolerated"[6]						✔	
Individualism versus Communitarianism "Do we function as a group or as individuals?" [7]						✔ Similar to Hofstede individualism-collectivism	✔

	TRA [1]	TPB [2]	TAM [3]	UTAUT [4]	UTAUT2 [5]	HOFSTEDE [6]	TROMPENAARS [7]
Universalism versus Particularism "What is more important – rules or relationships?" [7]						✔ Similar to Hofstede individualism-collectivism	✔
Specific versus Diffuse "How far do we get involved? [7]							✔
Affectivity versus Neutrality" Do we display our emotions"? [7]							✔
Nature Orientation "Do we control our environment or work with it?" [7]							✔
Achieved Status versus Ascribed Status "Do we have to prove ourselves to receive status or is it given to us?"[7]							✔
Sequential Time versus Synchronic Time "Do we do things one at a time or several things at once" [7]							✔

Through the comparison of the user acceptance models, the TRA is similar to that of the TPB. The TPB can be compared to the UTAUT model as the key constructs (PE, EE and Social Influence) of the UTAUT model is similar to that of the TPB model. An examination of the definitions of the constructs indicates that "attitude" represents "performance expectancy" and "effort expectancy" constructs in the UTAUT model because PE AND EE are attitudinal constructs. "Subjective norm" in the TAM is similar to the Social Influence (SI) construct in the UTAUT model, and the "perceived behavioural control" construct is similar to that of facilitating conditions in the UTAUT model (Sun et al., 2013). Furthermore, both the TPB and UTAUT models have been used in the area of health research and Information Technology adoption, and the models for user acceptance is imperative to determine which cultural factors affect acceptance and use of m-health for diabetes self-management.

In contrast, the UTAUT model outperforms the other models by seventy percent of the variance in explaining behavioural intention to use a technology (Venkatesh et al., 2003). With regards to the Technology Acceptance Model (TAM), it is evident that performance expectancy (PE) construct is like that of perceived usefulness (PU), and the effort expectancy (EE) construct is similar to that of perceived ease of use (PEOU). It is also noted that all four models capture behavioural intention. However, forecasting self-care behaviours to create diabetes self-management interventions models are most effective when they are constructed based on health behaviour theories (Akbar, Anderson & Gallegos, 2015; Glanz & Bishop, 2010). Venkatesh, Thong & Xu (2012) revised the UTAUT model to come up with the UTAUT2. In this revised model, the authors introduced three new constructs: Hedonic Motivation, Price and Habit, and they excluded voluntariness of use from the moderating variables. Habit is an important level in Hofstede, the onion model of culture. As mentioned previously, researchers have assessed the behavioural intention for m-health adoption behaviour (Hoque and Sorwar, 2017; Dwivedi et al., 2016; Baptista & Oliveira, 2015). Hoque and Sorwar (2017) found that the constructs of UTAUT have an influence on users' behavioural intention to adopt m-health services. Baptista & Oliveira (2015) merged UTAUT2 and Hofstede's cultural dimensions and the results indicate that these models combined can investigate the acceptance of mobile applications. This provides the researcher with evidence that the UTAUT2 can be used to study m-health acceptance and use of diabetes patients.

Regarding the cultural dimensions, Trompenaars', Individualism versus Communitarianism and

Universalism versus Particularism dimensions are similar to Hofstede's cultural individualism–collectivism dimensions. In addition, Affectivity versus Neutrality is similar to Hofstede's cultural masculinity–femininity. As previously mentioned, Hofstede's constructs have been used to study the relationship between culture and technology adoption. Based on the cultural dimension of individualism versus collectivism, culture may likely have some influence on attitude toward technology use (Bandyopadhyay & Fraccastoro, 2007). Both men and woman can exhibit masculine and feminine traits (Cyr, Gefen & Walczuch, 2017) and this can influence technology adoption. Furthermore, Hofstede's construct, uncertainty avoidance has received much attention in the field of technology adoption (Özbilen, 2017). It has been found that informational influence from family can encourage people in uncertainty avoidance cultures to adopt and use technologies (Alhirz & Sajeev, 2015). On the other hand, Trompenaars & Hampden-Turner (1997) has received little attention. Furthermore, this framework does not provide an applied approach to measure culture (Su & Sauers, 2009).

The section above provided a comparison between the adoption models and cultural models. By a review of the similarities and differences between these constructs, the UTAUT2 is an extension of the UTAUT model and all the other models for user acceptance (TRA, TPB and TAM) are extensions of the UTAUT model. In relation to the cultural models, Hofstede and Trompenaars have constructs that are similar to each other however, Hofstede's cultural dimensions have been used in the field of IS and the constructs have been found to play a significant role in technology adoption. Trompenaars cultural model on the other hand has been criticised for not providing a means to measure culture.

The succeeding section provides studies that have used technology adoption models together with cultural models. This is executed to identify which models and methodologies were used in previous studies in order to identify the methodology most suited for this research problem. This section supports the research objective of this study which seeks to derive a framework that defines the concept of culture.

2.13 Integrating culture at an individual level with the models for user acceptance

Table 3 represents the user acceptance models that have been used together with cultural models to answer various research questions.

Table 3: Studies on culture and technology in different contexts

Author	Constructs used in this study	Methodology and models used
Sun, Lee & Law, (2019)	Individual-level Culture Hofstede cultural dimensions Perceived usefulness Perceived ease of use	Technology Acceptance Model Hofstede **Questionnaire**
Zhang, Weng & Zhu (2018)	Performance expectancy Effort expectancy Social influence	Unified- Theory of Acceptance and Use of Technology Hofstede's cultural dimensions
	Perceived risk Trust Hofstede's cultural dimensions	**Questionnaire**
Yavwa & Twinomurinzi, (2018)	Performance expectancy Effort expectancy Social influence Facilitating conditions Spirituality Communalism Respect Behavioural intention E- filing usage E-payment usage	Unified- Theory of Acceptance and Use of Technology **Questionnaire**
Huang & Teo (2018)	Hofstede cultural dimensions Perceived ease of use Perceived Usefulness Attitude towards use Behavioural intention	Extended Technology Acceptance Model Hofstede cultural Model **Questionnaire**
Lu, Yu, Liu & Wei (2017)	Age, gender, experience Hofstede's cultural dimensions Perceived effort expectancy Perceived performance expectancy Perceived mobile social influence Perceived privacy protection	Espoused cultural dimension of Hofstede Unified- Theory of Acceptance and Use of Technology **Questionnaire**
Tarhini *et al.* (2017)	Individual-level culture Perceived ease of use, Subjective norms quality of work-life Behavioural Intention	Technology Acceptance Model **Questionnaire**
Lai, C. *et al.* (2016)	Long-term orientation Collectivism Power Distance Uncertainty avoidance Performance expectancy Effort expectancy Social influence Hedonic Motivation Facilitating conditions	Hofstede cultural dimensions UTAUT2 **Survey**
Baptista & Oliveira, (2015)	UTAUT2 Hofstede cultural dimensions Behavioural intention Use behaviour	UTAUT2 Hofstede cultural dimensions **Questionnaire**

Author	Constructs used in this study	Methodology and models used
Hoehle, Zhang & Venkatesh, (2015)	Uncertainty avoidance, Perceived usefulness Perceived ease of use Perceived usefulness	Collected data from consumers using ICT in four countries, Hofstede cultural dimensions
Al-jumeily & Hussain, (2014)	Individualism-Collectivism, Uncertainty Avoidance, Power Distance Perceived usefulness Perceived ease of use	Technology Acceptance Model Hofstede cultural dimensions **Survey**
Al-Gahtani, Hubona & Wang, (2007)	Hofstede cultural dimensions Unified- Theory of Acceptance and Use of Technology Behavioural intention Use behaviour	Unified- Theory of Acceptance and Use of Technology Hofstede cultural dimensions **Survey**
Srite & Karahanna, (2006)	Perceived usefulness Perceived ease of use, Subjective norms Behavioural intention Hofstede's cultural dimensions	Technology Acceptance Model Hofstede cultural dimensions **Questionnaire**

By an assessment, it can be noted that Hofstede's cultural dimension can be used in studies of culture and technology adoption (Table 3). The methodology that many of the studies adopted has been a questionnaire method approach. Previous studies have used the Technology Acceptance Model (TAM) and the Unified- Theory of Acceptance and Use of Technology (UTAUT) as a lens for analysis. However, it has been found that the TAM model is unable to forecast technology use across every culture (Straub, Keil & Brenner, 1997). To understand diabetes self-management in marginalised communities, challenges such as cultural backgrounds and beliefs should also be considered.

Hofstede cultural model has been used in studies relating to technology adoption in various contexts as Hofstede's cultural dimensions aid researchers to comprehend what motivates technology adoption and use (Hoehle, Zhang & Venkatesh, 2015; Leidner & Kayworth, 2006) Additionally, Hofstede's constructs allow scholars to study issues in a variety of phenomena (Hoehle, Zhang & Venkatesh, 2015). Literature indicates that many studies focusing on culture and technology adoption have used Hofstede's cultural dimensions (e.g., Srite & Karahanna, 2006; Tarhini et al., 2017 and Sun, Lee, Law, 2019). A recent study by Alam et al., (2020) explored factors affecting the adoption of m-health in a developed country. The authors recommend that further research ought to be done in different socio-economic groups, rural areas and other cultures and groups with different religious beliefs. Petersen et al. (2019) conducted a

study on barriers to ICT adoption of diabetes self-management. This study was conducted in the Western Cape, the same province where the current research is undertaken as well as in the same context. The authors found that socio-cultural factors impede ICT adoption of diabetes self-management. Petersen et al. (2019) proposed that culture in the use of m-health acceptance for diabetes self- management be explored in future research. Petersen et al. (2019) research provides insight into the relevance of the current study and improves the researchers' understanding of the socio-cultural impediment. Taking into account that the manner in which people use mobile health applications is influenced by their culture, as expressed in the literature review, Hofstede's cultural values underpinned this research.

Although cultural values on technology acceptance have been widely studied from a national perspective, there is very little evidence of the influence of culture on technology acceptance at an individual level (Sun, Lee & Law, 2019). In addition, there is a lack of empirical studies that investigate the influence of culture on the m-health acceptance within the context of diabetes patients. Given the results of Sun, Lee & Law (2019), this study will, therefore, apply Hofstede's cultural model (1980, 2010) to examine the dimensions of culture and use this model as a basis to explore the influence culture has on an individual's intention to accept and use technology. This study will combine the Unified- Theory of Acceptance and Use of Technology (UTAUT2) and Hofstede's cultural dimensions. This is an appropriate way of conducting this study, as the UTAUT2 has been used in the area of health research, and Hofstede's cultural dimensions have been used in IT adoption. A study done by Dwivedi et al. (2016) concluded that the four key constructs of the UTAUT model and, price-value (from the UTAUT2 model) are significant determinants of behavioural intention to adopt m-health and this would lead to adoption behaviour (Dwivedi et al., 2016). The study found the effect of cultural differences in the role played by hedonic motivation and this variable was found to be a significant factor of behavioural intention in Bangladesh, while in the USA and Canada it was not found to have a significant effect (Dwivedi et al., 2016).

The section above indicates that Hofstede's cultural dimensions and the UTAUT model have been used in the area of technology adoption and culture. The key point that was made above is that there are cultural differences between developed and developing countries, especially, Bangladesh, USA and Canada. The succeeding section therefore sets out the different scores of each country according to Hofstede's insights

2.14 Comparison of Hofstede's cultural dimensions

Figure 6 depicts a comparison between Hofstede's cultural dimensions between developed and developing countries.

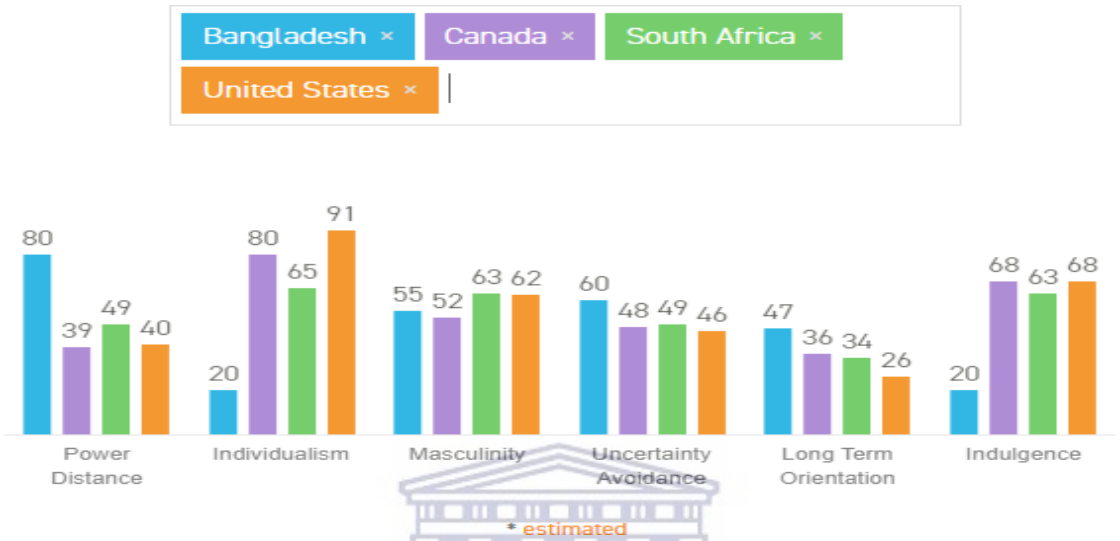

Figure 6: Hofstede model analysis (Source: Hofstede, 2019)

The table below (Table 4) illustrates how SA culture differs from developed countries (Canada and United States) and a developing country (Bangladesh) in using m-health for diabetes self-management. It should be noted that the estimates for SA culture are based on people who are classified as White South Africans. An assessment of Hofstede's cultural dimensions indicates that, in relation to the study, these dimensions may be a relevant model to study culture in this context. The application of the dimensions will provide a basis to conduct the empirical study and answer the research question.

Table 4: Application of Hofstede's cultural dimensions

Dimension	Application	Countries
Power distance	If a DM patient subscribes to a power distance culture, they may only trust their doctors or prefer visiting a doctor. The patient would prefer professional assistance and advice from a health care professional rather than using an m- health application.	**High Power distance** Bangladesh **Moderate Power distance** South Africa **Low Power distance** Canada United States

Dimension	Application	Countries
Individualism - collectivism	If a DM patient forms part of an individualistic society, they will make their own informed decision as to how to manage their condition. If a DM patient who forms part of collectivistic culture, they will make health-related decisions based on the values and beliefs of their society.	**High Individualism** South Africa Canada United States **Low Individualism** Bangladesh
Masculinity-Femininity	If a DM patient subscribes to a masculine society, the individual may not self-manage their condition effectively as working is a means of survival and success. If a DM patient subscribes to a femininity culture, they will be viewed as nurturers who care for others. These patients will make informed health decisions to assist others in leading healthier lifestyles. This suggests that they cannot manage their condition as they must see to the needs of others.	**High Masculinity** South Africa Bangladesh Canada United States
Uncertainty Avoidance	If a DM patient subscribes to an uncertainty avoidance society, the patient may find it difficult to self-manage their diabetes due to factors such as crime and the fear of making an error which could result in someone obtaining their personal information.	**High UA** Bangladesh **Moderate UA** Canada South Africa United States
Long term orientation	If a DM patient subscribes to a long- term orientation culture, they will plan their diabetes self-care activities to ensure enough finances are available to maintain their condition. If a DM patient subscribes to a short- term orientation culture, the patient will follow the traditions of their society in terms of managing their condition.	**Moderate LTO** Bangladesh **Low LTO** South Africa Canada United States
Indulgence - Restraint	If a DM patient subscribes to an indulgence society, they will make health-related decisions that are satisfactory to them to ensure that they are happy. If a DM patient subscribes to a restraint culture, they will not take the initiative to make their own health-related decision as rules are essential in following a diabetes self- management regime.	**High Indulgence** South Africa Canada United States **Low Indulgence** Bangladesh

The previous section provided a comparison between developing and developed countries using Hofstede's scores. This application of Hofstede's cultural dimensions is done in relation to m-health for diabetes self-management, it was conducted to understand how diabetic patients will react to m-health applications in different cultural dimensions. This therefore underscores the research objective of this study which seeks to explore how diabetic patients accept and use m-health for diabetes self- management.

The succeeding section will provide the research model that will be used for the empirical

investigation of this study. This research model will assist in achieving the objective *to determine which cultural factors affect the acceptance and use of m-health for diabetes self- management.*

2.15 Conceptual framework

The theoretical research framework of this study (Figure 4 indicated on page 28) and Hofstede's cultural dimensions (discussed on page 37-39) was based on the review of the extant literature. These frameworks will be used for the empirical investigation to answer the research question. The framework below (Figure 7) merged two models (UTAUT2 and Hofstede's cultural dimensions) to explore how the dimensions of culture, as identified by Hofstede (1980, 2010), influence technology adoption (as depicted by UTAUT2) amongst diabetic patients in previously disadvantaged communities.

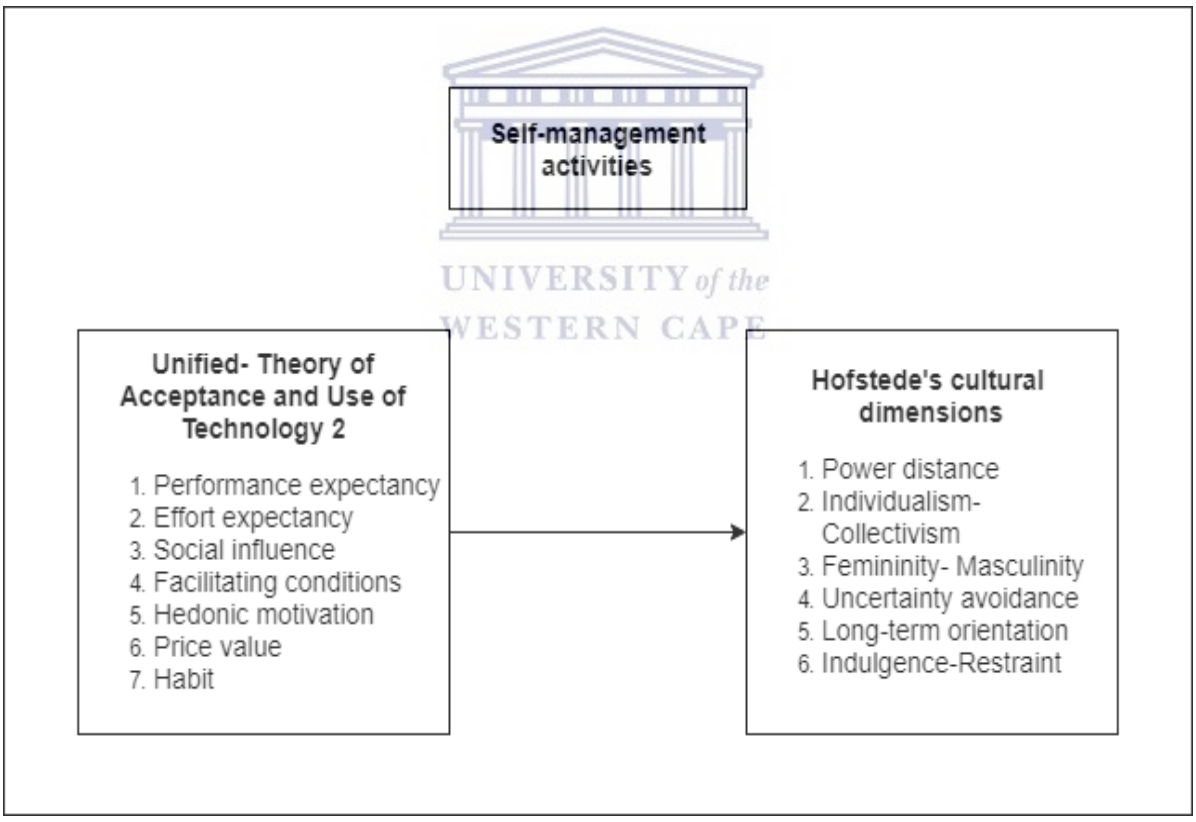

Figure 7: The research framework

The literature review presented evidence that the UTAUT2 is the best suited model to study technology adoption and culture. After reviewing literature on culture, Hofstede's cultural dimensions have been deemed as the best cultural model to study culture in the context of technology acceptance. To address the research objective, the researcher merged the models to provide empirical evidence for this thesis. Below is an explanation as to how the two theoretical models will be utilized to achieve the research objective *to determine which cultural factors affect the acceptance and use of m-health for diabetes self-management.*

Unified-Theory of Acceptance and Use of Technology 2: will be used to provide insight into participants' acceptance and usage of m-health to self- manage their condition.

Hofstede's cultural dimensions model: will be used to understand whether diabetes patients' culture influences their self-care behaviours and whether their culture influences their m-health acceptance and usage for their self-management.

Self- management activities: will be used to understand the diabetic patients' self-care behaviours. Furthermore, this model will also be used to gain insight into diabetes patients' acceptance and use of m-health applications for their self-care behaviours.

2.16 Chapter summary

This chapter reviewed existing literature regarding diabetes mellitus, culture and technology adoption. The literature was based on technology adoption in the area of health and culture. It was found that there are low levels of technology adoption amongst people in disadvantaged communities. There are many aspects that has an impact on technology adoption and literature indicates that culture is an essential component to technology adoption. Although culture plays a key role in technology adoption, there is inadequate literature that comprises of the link between culture and technology adoption at an individual level. The main aim of this chapter was to discuss the current research in this domain and to build up a theoretical background concerning the culture and the influence it has on uptake and usage. Different cultural models and user acceptance models were discussed to find models best suited to investigate the research problem. Hofstede's cultural model and the Unified-Theory of Acceptance and Use of Technology 2 are the best-suited frameworks for this study. These were chosen based on previous studies, prior research and a process of elimination whereby a comparison of the models has been discussed.

Chapter 3: Research methodology

3.1 Introduction

In the previous chapter of this document, the researcher made a case, based on the extant literature, that culture does indeed influence technology acceptance. As such, this substantiated the research problem which pointed to a need to determine how culture influences diabetic patients m-health acceptance. This Chapter presents the research design, which is a "blueprint on how you intend conducting a research" (Babbie & Mouton, 2008:74). The chapter describes how the main research question, *How does culture influence m-health acceptance of diabetes patients in disadvantaged communities?*, is to be investigated.

This chapter presents the research philosophy, research choice and research strategy underpinning this study. The sub-section that follows discusses the choice of case, data collection and instrument administration. In the succeeding sections, the research population and sample size are defined, the data collection steps are detailed, the data analysis is discussed, and the ethical considerations are explained.

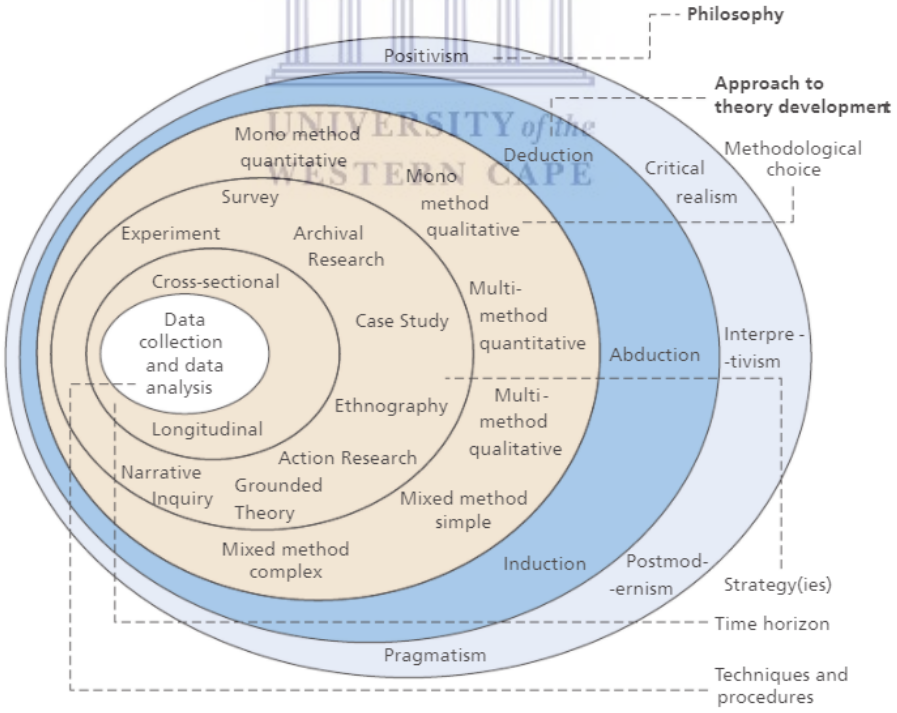

Figure 8: The research onion (Source: Saunders, Lewis and Thornhill, 2019:130)

The research onion represented in Figure 8 depicts the various stages that the average researcher

passes through when developing a practical methodology. On the right-hand side of the figure, the research choices are displayed. At each step of the process, researchers make the most logical methodological decision that is in line with the problem that is being investigated. Saunders, Lewis & Thornhill (2012) have expressed that while passing through the various stages of the research process, one must start from the outermost layer and finish at the most inner layer. The outermost layer depicts the data research philosophies, and the innermost layer represents the data collection and data analysis, which are the last stages of the research process. Below these choices are defined in detail.

3.2 Research philosophy: Interpretivism

Research philosophy, also known as a research paradigm, alludes to a set of beliefs and assumptions of the reality being investigated (Saunders, Lewis & Thornhill, 2016). That is, what is adequate knowledge by the investigator and the method through which knowledge is refined (Saunders, Lewis & Thornhill, 2012).

Kuhn (1962) refers to a research paradigm as a set of common beliefs and assumption shared within a community of scientists about how problems ought to be comprehended and approached. "To ensure a strong research design, researchers must choose a research paradigm that is congruent with their beliefs about the nature of reality" (Mills, Bonner & Francis, 2006:2). Positivism, critical realism and interpretivism are the three most well-known research paradigms in Information Systems (IS) research (Orlikowski & Baroudi, 1991; Myers, 1997). This study follows an interpretivism philosophy

"Interpretive research has become an important aspect of Information System (IS) research, as it can assist IS researchers to understand human thought and action in social and organizational contexts" (Klein & Myers, 1999:67). In addition, it is guided by the scholars' worldviews and how it ought to be understood and investigated (Denzin & Lincoln, 2007). According to Klein & Myers (1999), Orlikowski & Baroudi (1991) and Walsham (1993), interpretivism focuses on comprehending the personal meanings that people appoint to a given phenomenon in a specific unique context. Interpretivism is used to generate new insights and explanations of social worlds. Research conducted in the Information Systems field is viewed as interpretive when it is presumed that information is achieved through languages, shared meanings and efforts to understand a specific phenomenon through given meanings ascribed by participants (Klein &

Myers, 1999). More specifically, Interpretivism highlights that individuals from diverse cultural backgrounds and under various situations have different meanings which generate different social realities (Saunders, Lewis & Thornhill, 2016).

As the research questions are exploratory and descriptive, the paradigm that underpins this study is that of Interpretivism. Interpretivism is best suited for research in sociology and anthropology (Creswell, 2013). Interpretivism highlights that reality consists of peoples' subjective experiences and that realities are socially constructed (Lewis, Saunders & Thornhill, 2009). Furthermore, interpretive research centres on the intricacy of human sense-making as the status quo develops, rather than dependent and independent variables that are predefined (Kaplan & Maxwell, 1994). Therefore, it is a suitable paradigm for this research, as it seeks to understand and interpret diabetic patients' culture and the perceptions of individuals acceptance and use of m-health applications.

3.3 Inductive versus deductive approach

Two types of research approaches exist namely, inductive and deductive. An inductive approach is concerned with generating new theories evolving from the data that relates to the literature (Burns & Grove, 2005). "If your research starts by collecting data to explore a phenomenon and you generate or build theory (often in the form of a conceptual framework), then you are using an inductive approach" (Saunders, Lewis, & Thornhill, 2016:145). Based on the definitions by Burns and Grove (2005) and Saunders, Lewis, & Thornhill (2016), an inductive approach was not used as this study is using existing theories to answer the research question. On the other hand, a deductive approach refers to using existing theories to formulate the research objectives and the research question (Yin, 2014). Besides, the literature is essential when following a deductive approach as it identifies ideas and theories to answer the research problem (Saunders, Lewis, Thornhill, 2016). In this research, the deductive research approach is followed as the researcher merged two frameworks based on the extant literature which was then tested through the collection of data (Saunders, Lewis, & Thornhill, 2016). "If your research starts with theory, often developed from your reading of the academic literature, and you design a research strategy to test the theory, you are using a deductive approach" (Saunders, Lewis, & Thornhill, 2016:145). The Unified-Theory of Acceptance and Use of Technology 2 were used to provide insight into participants' acceptance and usage of m-health to self- manage their condition and

Hofstede's cultural dimensions model were used to understand whether diabetes patients' culture influences their self-care behaviours and whether their culture influences their m-health acceptance and usage for their self-management.

3.4 Qualitative research choice

Various research approaches exist to conduct a study. Research approaches can be broadly classified into quantitative and qualitative. "Quantitative research approach examines relationships between variables, which are measured numerically and analysed using a range of statistical and graphical techniques" (Saunders, Lewis & Thornhill, 2016:166). This research approach attempts to measure variables existing in the social world. In other words, it answers questions such as how much and how many. Rasinger (2013) has stated that quantitative studies answers questions of "how much or how many there is/are of whatever we are interested in" (Rasinger, 2013:119). Qualitative research, on the other hand, encompasses an interpretive approach to its area of study. This method attempts to study different groups of people and their community in their natural setting. "Qualitative researchers study things in their natural settings, attempting to make sense of or to interpret phenomena in terms of the meanings people bring to them" (Denzin & Lincoln, 2011:3). This study follows a qualitative approach, the rationale for which is described in the next section.

According to Myers (1997:3), "Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live". This definition is consistent with definitions by other authors. Orb, Eisenhauer & Wynaden, (2001) and Creswell (2014) state that qualitative research involves exploring and examining people in their natural setting and interpreting a phenomenon grounded on the meaning individuals bring to it. Kaplan & Maxwell (1994) have argued that participants' viewpoint of a phenomenon is lost when textual data is measured. This is due to qualitative research providing the researcher with rich, insightful meaning and understanding of the participants.

Qualitative research provides researchers with rich descriptions of participants, emotions, experiences, thoughts and translates the meanings of their actions (Denzin, 1989). In agreement with Denzin (1989), Qualitative research focuses on obtaining an in-depth understanding of individual behaviours, attitudes and views (Creswell, 2014). Furthermore, it provides knowledge about the opinions, behaviours and beliefs of individuals (Mack et al., 2005).

As stated by Strauss & Corbin (1990), a qualitative research approach is appropriate in understanding social and cultural contexts. This is consistent with Mack et al. (2005:1), who argue that "Qualitative research is especially effective in obtaining culturally specific information about the values, opinions, behaviours, and social contexts of particular populations". According to Mack et al. (2005), qualitative research methods are beneficial in recognising gender roles and social norms of participants. Kaplan & Maxwell (2005), mention that a qualitative method is helpful when the researcher wants to "investigate the influence of social, organizational, and cultural context on the area of study" (2005:31). Given the definitions of qualitative research, it is appropriate for this study to employ a qualitative research approach to collect data, as it is concerned with gathering information that cannot be measured numerically, since it is concerned with the culture of people living with type 2 diabetes and their attitudes and experiences towards using technology to manage their condition.

3.5 Case study research strategy

A research strategy is "defined as a plan of how a researcher will go about answering her or his research question" (Saunders, Lewis & Thornhill, 2016:177). A research strategy draws together the research philosophy, the research approach and the methodological choice to gather and analyse data (Denzin & Lincoln, 2011). Several research strategies exist to answer a research question. Saunders, Lewis & Thornhill (2016:178) have identified eight research strategies: "experiment, survey; archival and documentary research, case study, ethnography, action research, grounded theory, narrative inquiry". Each strategy has a specific scope of practice and set of procedures when conducting a study. In reviewing previous studies on technology adoption and culture, studies have employed ethnography, action research and case studies. Having assessed the various options, this study took a case study approach. In the next section the case study approach and the grounds for its selection are discussed.

Case studies can be quantitative or qualitative in nature. The principal objective of a case study approach is to perform a thorough analysis of a problem, in the context of the research problem from the perspective of participants (Yin, 2014; Yin, 2018; Simons, 2009; Merriam, 2009; Stake, 2006).

According to Yin (2018), "a case study is an empirical method that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the

boundaries between phenomenon and context may not be clearly evident" (2018:45). In essence, a case study is considered an 'empirical inquiry' that explores cases by addressing the "how" or "why" inquiries regarding a phenomenon (Yin, 2018). If the researcher's interest lies with answering the "why" and "how" questions, then case studies are an appropriate strategy. A case is defined as an entity (e.g., organisation, community, a person, or group) (Yin, 2018). In this study, the case comprises a single community which aligns to the attributes of being "disadvantaged". This study aims to examine selected cases to understand the cultural dimensions of diabetic patients and how these influences their m-health acceptance and use.

According to Merriam (1998:13), a qualitative case study is defined as "an intensive, holistic description and analysis of a bounded phenomenon such as a program, an institution, a person, a process, or a social unit". A case study design is used to examine a phenomenon in its natural setting (Benbasat, Goldstein & Mead, 1987) and in this case, diabetic patients in the disadvantaged communities. Case study research is an appropriate strategy as it is a widely used qualitative method in Information Systems (Petersen, 2011; Alavi & Carlson, 1992; Orlikowski & Baroudi, 1991). "Case study research is now accepted as a valid research strategy within the IS research community. The principles proposed in this stream of work have become the de facto standard against which most case study research in IS is evaluated" (Klein & Myers, 1999:68).

Additionally, case studies provide a rich, "thick description" of the case being studied (Merriam, 1998). A case study design is suitable for exploratory studies (Benbasat, Goldstein & Mead, 1987). In this research, a case study design helps to generate concepts that determine the influence culture has on m-health adoption. Subsequently, this research strategy will uncover more in-depth insider perspectives on the cultural dimensions of diabetic patients, than would have been possible through a broad survey of diabetes patients in several communities. More specifically, the research seeks to understand the phenomenon of culture and its influence in a social context through the perception of diabetic patients and the meanings assigned by them.

3.6 Selection of cases

The rationale for selecting the Western Cape was informed by diabetes being the third highest prevalence in this province (Statistics South Africa, 2019) and thus made it a good choice amongst 9 possible provinces. Petersen et al. (2019) conducted a study on m-health and technology adoption in the Western Cape and recommended that further research on culture the

use of m-health acceptance for diabetes self- management could be explored. In addition, the researcher is based in the Western Cape and therefore it made sense to conduct the study in this province.

Following on the delineation of the research problem, the researcher considered what comprises the characteristics of being disadvantaged. The researcher considered the type of communities that aligned with these characteristics in which potential study participants could be found.

According to the Local Government Handbook (2017), the City of Cape Town Metropolitan Municipality is situated in the Southern Peninsula of the Western Cape Province. Examples of suburbs that form part of this municipality are Athlone, Belhar, Khayelitsha and Mitchells Plain (The Local Government Handbook, 2017).

Following on this, the communities that comprise the Cape Flats were considered suitable. According to South African History Online (2011b), it is mainly the previously disadvantaged communities who reside in the Cape Flats. The Cape Flats is made up of predominantly 'Coloured' areas such as Manenberg and Mitchells Plain. A number of areas make up the Mitchells Plain suburb, Strandfontein is one of them (Statistics South Africa, 2013).

Mitchells Plain and Strandfontein, as the selected cases, were the communities in which the study explored how Hofstede's cultural dimensions influence mobile health acceptance and use. As diabetes is the leading cause of morbidity amongst low-and middle-income areas (LMIC), it impacts people from disadvantaged populations more than individuals who are living in higher-income countries (World Health Organization, 2016). Research indicates that in 2017, 10.4% of the Western Cape populace had succumbed to diabetes (Statistics South Africa, 2016a). According to Statistics South Africa (2013), The census shows that in 2011, 310 485 people resides in Mitchells Plain, and the population is predominantly 'Coloured' (Statistics South Africa, 2013). Similar to Mitchells Plain, the majority of the Strandfontein residents are 'Coloured'.

The prevalence rate of type 2 diabetes differs between the diverse racial groups in South Africa. Research indicates that the prevalence of diabetes has increased significantly in the Coloured community (Erasmus et al., 2012). Evidence suggests that approximately 28.2% of individuals over the age of forty have diabetes, or are at risk of developing diabetes (Erasmus et al., 2012).

Residents of Mitchells Plain and Strandfontein who suffer from diabetes are supported by Diabetes SA (https://www.diabetessa.org.za) which has support groups in both these communities. Therefore, from amongst the various possible communities, the researcher chose, Mitchells Plain and Strandfontein as appropriate sites of study that could provide good case studies through which to investigate the research problem.

3.7 Population

"The full set of cases or elements from which a sample is taken is called the population" (Saunders et al., 2016:274). In this study, two case studies Mitchells Plain and Strandfontein communities formed part of this study population. The research population was made up of type 2 diabetic patients from the diabetic support groups in these disadvantaged areas and included both males and females of all ages.

This study identified the two communities as separate cases.

3.8 Sampling and sampling size

After an agreement was reached with the support groups, and once participants had responded via social media, the researcher used purposive sampling to select respondents. According to Saunders et al. (2016), purposive sampling is suitable when the researcher uses their judgement to select cases that would enable them to answer the research question. Purposive sampling is a suitable method as this study will be focusing on a specific type of population, this being diabetic patients in the Strandfontein and Mitchells Plain communities.

The researcher was searching for people with different perspectives, and a support group allows for a diverse set of people dealing with the same condition to reflect on their experiences. The best way to identify diabetic patients in Mitchells Plain and Strandfontein Community is by approaching a diabetes support group established in the area. The researcher reached out to the Strandfontein, and Mitchells Plain diabetes support group and the founder of the support group provided the researcher with insights into the type of diabetic patients in the community and whether or not these patients manage their condition. The support groups provided the researcher with contact details of diabetic patients who regularly attend the monthly support group sessions, which then enabled the researcher to identify suitable respondents.

The sample for the study was type 2 diabetic patients within Strandfontein and Mitchells Plain. These participants were selected for their specialized knowledge in the research area. In

qualitative studies, the sample size is typically smaller than studies that are quantitative (Mason, 2010). Sandelowski (1995) advises that a sample size should be adequate to allow the developing of a "new and richly textured understanding of the phenomenon under study, but small enough so that the in-depth, case-oriented analysis" (1995:183) is not excluded. Merriam (1998) has indicated that the sample size is relative and depends on the objectives and purpose of the research as well as the methodology used to conduct the study. This study aims to determine how culture influences m-health usage of diabetic patients. This research problem is quite specific and will, therefore, require a relatively small sample size. Based on a study done by Marshall et al. (2013) on eighty-three IS qualitative studies, it was found that approximately 69% of studies sampled for this study employed fewer than thirty interviews. The authors recommend that "single case studies should generally contain 15 to 30 interviews" (2013:31). Desveaux et al. (2018) has conducted a study on diabetes self-management. The study is based on a mobile application and how it can improve self-management of individuals with type 2 diabetes. Desveaux et al. (2018) conducted one-on-one semi-structured telephonic interviews with sixteen participants. The participants were purposely sampled, and in total, twenty-six interviews were conducted (fourteen baselines and twelve follow-ups) (Desveaux et al., 2018). Furthermore, data saturation was reached after 20 interviews had been conducted in the latter study. The foregoing provides an indicative understanding of the sample size that was required. In addition, it was decided that interviews would continue until data saturation was reached. Fusch & Ness (2015) describes data saturation as the point in the research process where no new information can be found in the data analysis and additional coding is not feasible.

Through purposive sampling a total of twenty participants (Table 5), were interviewed, until data saturation was achieved. The participants in the sample were representative of all ages and genders. Table 5 below illustrates the sample of participants involved.

Table 5: Profile of respondents

Age / Gender	18-25 years	26-35 years	36-49 years	50-65 years	Total-Actual interviews
Male	0	1	2	3	6
Females	1	2	3	8	14

3.9 Identification of research participants

Merriam (1998) has proposed that researchers analysing qualitative case studies use three data

collecting techniques such as interviews, observations and analysing documents. This case study made use of interviews only. Interviews "provide a unique opportunity to uncover rich and complex information from an individual" (Cavana, Delahaye & Sekaran, 2001:138). Myers & Newman (2007) suggest that conducting qualitative interviews is an excellent way of collecting data, and these have been extensively used in IS research. Three types of interview methods exist; "structured interviews, semi-structured interviews and unstructured or in-depth interviews" (Saunders et al., 2016:390).

Primary data was collected using semi-structured interviews. Semi-structured interviews are detailed interviews where the participants answer predetermined open-ended and close-ended questions (Jamshed, 2014). This technique was used to gain a broader perception of the cultural dimensions that influence participants' technological capabilities and their choices to accept m-health applications.

The principal researcher gathered the data via telephonic interviews. Interviews with respondents were conducted using semi-structured interviews with type 2 diabetic patients in the Mitchells Plain and Strandfontein areas. The instrument comprised of questions which were framed around several categories of cultural dimensions and technology acceptance. Please refer to the research instrument (interview guide) in Appendix C and see section 3.11 for more information on the development of the instrument.

Table 6: Research methods, data collection and their objectives

Research method	Data collection	Objective	Number
Interview	Semi-structured interviews	To conduct a PILOT study to test the instrument developed for this study.	Three people for a semi-structured interview
Interview guide	Semi-structured interviews	To use Hofstede cultural dimensions and the UTAUT2 to collect evidence on how culture influences technology acceptance of participants.	20 participants

3.10 Process of identifying participants

The researcher contacted support groups in Strandfontein and Mitchells Plain to find suitable respondents. In addition, the researcher posted a message on social media platforms such as Facebook, WhatsApp, Instagram and LinkedIn to invite people to participate in this study and approached friends, family and social media influencers to share the advertisement in order to gain more participants. Social media was mainly used to get the word around about the study.

Facebook and Instagram followers told their parents and grandparents about the study and reached out to the researcher.

A request for participation, included the criteria that respondents had to meet to be included in the study. Once participants replied to the invitation, the researcher decided whether or not the participant was eligible. The researcher contacted participants via WhatsApp messenger to explain what the study entailed as well as to provide participants with the information sheet and consent form. Older participants were sent a voice note to explain the purpose of this study. This was done to ensure that participants understood the aim of the study and to ensure that they understood what an m-health application is. Once all participants understood the purpose of this study, and had agreed to take part, appointments for interviews were setup telephonically. Prior to the interviews, screenshots of a diabetes application with a description of each screenshot were distributed to participants (refer to screenshots in Appendix D).

3.11 Instrument Design and Testing

The interview guide was compiled based on two theoretical frameworks. The investigation comprised a juxtaposition of: 1) Hofstede's cultural dimensions (Hofstede, 1980; 2010) and 2) the Unified- Theory of Acceptance and Use of Technology 2 (Venkatesh, Thong & Xu, 2012) (Appendix, C). The rationale for inclusion of these two frameworks is as follows:

- Hofstede's cultural dimensions: have been used to understand whether diabetic patients' culture influences their self-care behaviours and whether their culture influences their m- health acceptance and usage for their self-management.
- The Unified Theory of Acceptance and Use of Technology 2: has been used to provide insight into participants' acceptance of m-health to self-manage their condition.

The constructs of culture and technology acceptance and use were validated in prior research and adapted in this study to answer the research question. Hofstede's cultural dimensions have been taking from Hofstede, (1980, 2010) the Unified- Theory of Acceptance and Use of Technology 2 was taken from Venkatesh et al., (2003) and Venkatesh, Thong & Xu (2012).

As the research instrument is key to reliability of the findings, this research reports on the commonly accepted canons for assessing qualitative research (See section 5.6 page 129-131).

Lastly, a pilot test was conducted with three participants to assist the researcher in determining whether there was any ambiguity, vagueness, limitations or weaknesses within the interview guide (Kvale, 2007), and to determine whether the questions were clear, coherent and easily understood by those residing in the Mitchells Plain and Strandfontein communities. Once the testing has been completed, the research questions were refined before implementing the study within the field.

3.12 Delineation

The research focuses on culture and how it influences diabetic patients' m-health acceptance and use. The scope of the study is limited to type 2 diabetic patients, and to two case studies, that have been geographically confined to the Mitchells Plain and the Strandfontein communities. The delimitations and scope of the study determine the scientific application of the results. Therefore, the findings only apply to communities that have similar demographics and socio-economic characteristics as the selected cases.

3.13 Data analysis

Primary data has been collected through semi-structured interviews from diabetic patients. The data have been collected based on prior research identified in chapter 2 and have been analysed employing thematic content analysis. Thematic Content Analysis (TCA) "is a descriptive presentation of qualitative data" (Anderson, 2007:1). Content analysis is a method of analysing textual or verbal messages and is used to identify patterns across the data (Cole, 1988). Thematic analysis is a "method for identifying, analysing and reporting patterns (themes) within data" (Braun & Clarke, 2006:79). The stages of thematic content analysis include preparing, organizing and reporting the transliterated interviews (Creswell, 2014). In this research, themes are developed by interpreting the data, developing codes, and then grouping the codes into categories which were identified a-priori, based on the theoretical frameworks of Hofstede's cultural dimensions and the Unified- Theory of Acceptance and Use of Technology 2.

Atlas.Ti, is a qualitative data analysis program that facilitates textual analysis and the interpretation of large numbers of texts. This program was used to help analyse the data once the interview guide and the interviews had been transcribed and imported. This software is applicable to analyse how culture influences patients' technology use, as it can be used to extract rich, textual data. After becoming familiarised with the data, the data was analysed using a

deductive approach. An assessment of qualitative validity is discussed in chapter 5. The steps used to analyse the data using Atlas.ti were applied as follows:

Thematic content analysis

- Interviews were transcribed from audio into text. The researcher performed quality checks by listening to the audio more than once.
- Each transcription was analysed by identifying common themes across the transcripts.
- The additional ad hoc probing questions were analysed and placed into common themes.
- After the themes had been identified, codes were assigned to the themes according to the two theoretical frameworks, Hofstede's cultural model and UTAUT2.
- Once codes have been assigned, categories have been developed based. Codes that did not fit within these themes, categories, or formed part of the theoretical model were identified. These findings can be used in additional analysis for future research.
- After patterns have been recognised, relationships were identified between Hofstede's cultural dimensions and the UTAUT2. The empirical findings were then linked and compared with the theories presented in the literature review.

Each step is depicted in the form of screenshots in Appendix F.

Process of conceptualising codes

The act of coding is usually the intuition of the qualitative researcher, drawing on an understanding of the problem domain and the literature. The researcher uses her understanding of the research terrain and assigns appropriate codes or labels to the data. Using the qualitative method, the process used to create codes was as follows:

- The researcher read and understood the definitions of UTAUT2 and Hofstede's cultural dimensions and then applied Hofstede's cultural dimensions in relation to m-health acceptance and diabetes self-management.
- Once the definitions were understood clearly, the researcher mapped the relationship between UTAUT2 and Hofstede's cultural dimensions. Thereafter, definitions were created of the constructs in relation to m-health acceptance in the context of diabetes self-management (see section 3.14 page 76). The mapping of the two theoretical models and its constructs served as the themes in this research.

- The researcher started to code data and once 10 participants were analysed, the researcher looked at the codes and created definitions for them. This formed as a basis to analyse the outstanding transcripts and it assisted the researcher to merge and split codes where necessary.
- Once codes were generated, the researcher used the definitions to create categories for the codes (see section 4.3, table 10 on page 82).

3.14 Preparing for analysis: Mapping the relationship between the Unified- Theory of Acceptance and Use of Technology 2 and Hofstede's cultural dimensions

To prepare for the empirical work, the first stage involved the juxtapositioning of the UTAUT2 against Hofstede's cultural dimensions, Table 7 presents the outcome of this. It maps the seven constructs of the Unified- Theory of Acceptance and Use of Technology 2 (UTAUT2) against Hofstede's cultural dimensions in order to assess which of the theoretical definitions of the Hofstede's cultural dimensions fit against the UTAUT2. The relationships between UTAUT2 and Hofstede's cultural dimensions are discussed after the Table 7.

Table 7: Framework for analytical analysis

Utaut2 / Hofstede	Performance expectancy	Effort expectancy	Social influence	Facilitating Conditions	Hedonic Motivation	Price Value	Habit
Power Distance			X				
Individualism-Collectivism			X		X		
Masculinity-Femininity	X	X					
Uncertainty avoidance		X		X			
Long term orientation – Short term orientation						X	
Indulgence-Restraint							X

The definitions of the relationship between UTAUT2 and Hofstede's cultural dimensions in relation to diabetes self-management are given in Table 8.

Table 8: The relationship between UTAUT2 and Hofstede's Cultural dimensions

Constructs	Definitions in relation to this study
Performance expectance and Masculinity-Femininity	Refers to the way in which gender roles or gender stereotypes influence a diabetic patient's expectation of how an application will lead to their ability to make improvements in relation to self-care behaviour activities.
Effort expectancy and Masculinity-Femininity	Refers to the way in which gender roles or gender stereotypes have an influence on a diabetic patient's expectation of how easy or difficult it would be to use an application for diabetes self-care behaviour activities
Effort expectancy and Uncertainty avoidance	Refers to the way in which the patients' perceptions of ease or difficulty in using an application- influence their decision to adopt/use an application in support of self-care activities
Social influence and Power distance	Refers to when diabetic patients believe that people in high positions and power, e.g., health care professionals believe that they should use an application for self-care behaviour activities.
Social influence and Individualism-Collectivism	Refers to the way in which a diabetic patient makes their own decision and those important others do not have an influence on a diabetic patients' decision of whether to use an application for self-care behaviour activities. Refers to the way in which a diabetic patient makes decisions based on their society, e.g., family and their important people have an influence on whether they should use an application for self-care behaviour activities.
Facilitating conditions and Uncertainty avoidance	Refers to the way in which support exists to reduce uncertainty around the use of an application for diabetes self-care behaviour activities.
Hedonic motivation and Individualism	Refers to the way in which the pleasure from using an application has an influence on a diabetic patients' willingness to use.
Price value and Long-Term Orientation-Short-Term Orientation	Refers to the way in which the perceived benefit and the cost of using an application have an influence on diabetic patients' willingness to persevere and save. It refers to the way in which the perceived benefit and the cost of using an application has an influence on diabetic patients' traditions and values
Habit and Indulgence-Restraint	Refers to when people make the decision automatically because of learning, and that decision is one that satisfies them**.** It refers to the way in which the choices taken by diabetic patients have an influence on self-care activities. Refers to the way in which societal rules have an influence on whether diabetic patients use an application for self-care behaviour activities.

3.15 Ethical considerations

Ethics in research refers "the standards of behaviour that guide your conduct in relation to the rights of those who become the subject of your work, or are affected by it" (Saunders, Lewis & Thornhill, 2016:239). This study was performed professionally as it adhered to specified ethical considerations during the research process.

Ethical approval from the UWC Biomedical Ethics Committee was received before the commencement of the research process and data collection. The participants who wanted to take part in this study had to satisfy certain criteria: they had to be South African citizens who have been diagnosed with type 2 diabetes mellitus and who reside in the Cape Flats area in the

Western Cape, specifically, Mitchells Plain and Strandfontein.

Once ethical approval was received, participants received an information sheet that set out the research objectives, along with a letter of consent requesting their involvement in the study and the terms of participation. The participants were then allowed to ask any questions related to the study. The consent form stated the following:

- I understand that my participation is voluntary and that I am free to withdraw at any time.
- I understand that all my personal data and responses will be kept strictly confidential.
- I understand that there are no risk or harm to myself by participating in this interview guide.
- I understand that participation involves questions related to my diabetes management, culture and technology acceptance.

Moreover, the confidentiality of the participants was maintained as participants' names were not used (Dearden & Klein, 2018). No other personal information such as participants' residential addresses or place of employment were requested during the data collection process. This was to ensure a level of trust with the participants. In addition, clinical information, such as blood glucose readings, was not collected. The data collected was stored on a secure google drive account, and only the supervisors assigned to this study were able to access the information. This was done to ensure the continuous safety of participants' information. There was a low risk in the participation of the study as the interviewer did not ask sensitive questions, but instead focused on respondents' daily routines and their attitudes towards managing such routines with the assistance of a mobile application. Neither was participants' information given to any third parties. The researcher only probed respondents based on their diabetes self-management and whether they would use an m-health application to improve the management of their condition.

3.16 Chapter summary

This chapter reflects the research philosophy and research choice used when collecting data for this study. After examining the different research philosophies, interpretivism was chosen. The researcher also examined the various research choices and based on previous research, decided to employ qualitative research methods to collect data using a semi-structured interview guide. This study followed a case study approach to answer the research question and develop a framework on how culture influences m-health acceptance and use amongst diabetes patients. In addition,

the data analysis was discussed, and the researcher used Atlas.ti – a computer software program to assist with the analysis.

The succeeding chapter presents the research results and findings attained from applying the philosophy, techniques and methods discussed in this chapter.

Chapter 4: Research findings and discussion

4.1 Introduction

The literature review (chapter 2) addressed literature and theoretical works that guided the study. The previous chapter discussed the research methodology used in this study, research design, method and strategy. In this chapter, the researcher presents the themes, categories and concepts that emerged from the data and provides an interpretation of the findings in relation to other studies. The researcher drew on the juxtaposition of the Unified-theory and Acceptance of Technology 2 and Hofstede's cultural dimensions framework to understand the influence of culture on technology adoption.

This chapter presents a synthesis of the qualitative data, which follows the themes according to the juxtaposition. The categories represent Hofstede's cultural dimensions in relation to technology adoption, and the concepts are the codes that emerged from the data.

The research findings and analysis in this section are in response to the following research sub-question:

> *How do the dimensions of Hofstede's framework influence technology adoption amongst diabetic patients in previously disadvantaged communities?*

This chapter commences by providing an overview of the demographics of interviewees in table format followed by an overview of themes in a summary format. The next section presents a discussion of the research findings and concludes with reflections on the findings.

4.2 Demographics of Participants

Demographic data were extracted from the interview guide from the twenty type 2 diabetic patients. As shown in Table 9, the majority of the respondents that took part in this study are females (70%). In terms of age, the majority of the respondents (55%) were aged between 50 and 65 years old, with 25% of the respondents being between 26 and 35 years old, 15% of the respondents being between 26- 35 years old, and the minority (5%) being between 18 and 25 years old. This indicates that many of the participants are digital immigrants who were born prior to 1985.

Table 9: Demographics of participants

		Frequency	Percent
Gender	Female	14	70%
	Male	6	30%
	Total	**20**	**100%**
Age	18-25 years old	1	5%
	26-35 years old	3	15%
	36-49 years old	5	25%
	50-65 years old	11	55%
	Total	**20**	**100%**
Race	Coloured	18	90%
	Indian	2	10%
	Total	**20**	**100%**
Level of educational	High school	13	65%
	Post-school	7	35%
	Total	**20**	**100%**
Marital status	Married	14	70%
	Divorced	5	25%
	Widowed	1	5%
	Total	**20**	**100%**
What are you currently doing?	Employed	11	55%
	Unemployed	9	45%
	Total	**20**	**100%**
Language	English	15	75%
	Afrikaans	5	25%
	Total	**20**	**100%**
Medical aid	Yes	10	50%
	No	10	50%
	Total	**20**	**100%**
Area	Strandfontein	10	50%
	Mitchells Plain	10	50%
	Total	**20**	**100%**
Type of diabetes	Type 2- insulin resistant, using oral diabetes medication, e.g., metformin	12	60%
	Type 2- using oral diabetes, medication and insulin	8	40%
	Total	**20**	**100%**

The majority of Strandfontein and Mitchells Plain communities comprises people of colour. In this study, 90% of the sample population identified as *Coloured* (90%) and the minor percentage of the respondents identified as *Indian* (10%).

A majority of the population's highest educational level is grade 12 (Matric) (25%), grade 10 (25%) and a diploma (25%), with a minority of the sample (5%) having grade 8, 9, 11, degree and honours as their highest educational level. This indicates that many respondents have not completed their education. Despite the low educational level, the findings state that 55% of

participants are employed, while 45% of participants are unemployed, which is not unexpected given the level of education of this population.

Seventy-five percent of the respondents' first additional language is English, and the first additional language of the remaining 25% is Afrikaans. Fifty percent of participants reported having medical aid, whereas the remainder of the population do not have medical aid as a result of high unemployment and affordability. The data shows that half of the respondents reside in Mitchells Plain (50%), whereas the remainder live in Strandfontein (50%).

4.3 Overview of qualitative analysis outcomes

In this section, the themes, categories and concepts which were derived from the qualitative analysis (Table 10) are presented. These findings reflect the results of the interview analysis, which answer the key research question. The key constructs are taken from the UTAUT2 model and were used together with Hofstede's cultural dimensions to probe the data.

Table 10: Summary of research findings in relation to UTAUT2 and Hofstede's cultural dimensions

Themes	Category	Codes derived from the qualitative analysis
Performance expectancy in relation to Masculinity-Femininity	**Masculinity:** • Breadwinner Obligations **Femininity:** • Caregiver Obligations	• Work influences • Time management • Caregiver Influence • Application expectations
Effort expectancy in relation to uncertainty avoidance	• Technological impediments • Technological convenience	• Technology anxiety • Distrust in application • Find alternative application • Compatibility of cell phone
Social influence in relation to power distance	• Medical practitioner influence • Opinions towards medical practitioners	• Preferring doctor • Doctors provide advice • Disagreement with doctors • Comfortable with doctor
Social influence in relation to individualism-collectivism	**Individualism:** • Individual responsibility **Collectivism:** • Social Cohesion	• Accountable for self-management • Negative Attitude • Social support • Support group
Facilitating conditions in relation to uncertainty avoidance	• Pre- disposing factors of avoidance • Social advocacy	• Fear of crime • Lack of skills • Awareness of application • Application assistance

Themes	Category	Concepts derived from the qualitative analysis
		availability
Price value in relation to long-term orientation- Short- term orientation	**Long-term orientation:** • Monetary mindset **Short-term orientation:** • Traditional mindset	• Saving- low priority • Thrift • Willing to persevere • Tradition • Pricing of application
Habit in relation to indulgence	**Indulgence:** • Personal regulation	• Choices • Manage diabetes with application
Hedonic motivation and individualism	**Individualism:** • Perceived enjoyment • Negative drivers of application use	• Application is fun • Application is enjoyable • Age • Application is challenging

The table above illustrates the codes that emerged based on technology adoption and cultural dimensions. The process of creating the codes is discussed in chapter 3 section 3.13 on page 75-76. These codes were used to explore how culture influences technology adoption among diabetic patients. Appendix F presents some of the detailed coding reports from which Table 10 is derived.

The following section discusses each of the themes.

4.4 The role of masculinity and femininity on expectations of users and non-users' performance of mobile applications on adoption and use.

Venkatesh et al. (2003), defines performance expectancy as the "degree to which an individual believes that using the system will help him or her to attain gains in job performance" (2003:447). In addition, Hofstede, Hofstede & Minkov, (2010) state that masculinity refers to a "society in which emotional gender roles are clearly distinct" (2010:519). Following on the latter, in this study, performance expectancy and masculinity refer to the way in which gender roles or gender stereotypes have an influence on a diabetic patient's expectation of how an application will lead to something like an improvement on their self-care behaviour. It should be pointed out that masculinity-femininity is not synonymous with male and female (Cyr, Gefen & Walczuch, 2017). Masculinity- femininity is a degree of psychological gender, and it signifies whether a society adopts masculine values or feminine values (Bem, 1981; Hofstede, 1984). Consequently, both biological sexes (male and female) can exhibit masculine and feminine values to different degrees (Cyr, Gefen & Walczuch, 2017).

The concepts that emerged from the data are those of *breadwinner obligations* and *work influences*.

4.4.1 Breadwinner obligations

In this study, *Breadwinner obligations* are defined as the responsibility of the person who provides the primary financial support to their family.

Masculinity is not only related to gender but is a characteristic of culture. In the last decade, gender roles have changed, particularly the role of a woman. In the current context, women possess more of the traits traditionally considered as masculine (Ebert, Steffens & Kroth, 2014). This indicates that both male and female can possess masculine traits. There is a possibility that women can be more masculine than men in their value orientation and vice versa (Cyr, Gefen & Walczuch, 2017).

The data in this study shows that the stereotyping of males in the household as a breadwinner is not as prevalent as it was decades ago (Nnubia, Ibeanu & Okechukwu, 2020). The data indicate that males are not the dominant household breadwinner as they were decades ago. Similarly, the characteristics of the research population indicate that women have what was previously known as masculine traits such as ambition and earnings. In the 21st century, several women in the research population have shown masculine traits such as ambition and earnings.

Two underlying conceptual issues provide insight into this finding. The first revelation is that both male and females focus their time and energy on breadwinner activities, such as work influences. This, in turn, has resulted in a negative effect on their ability to adopt and use mobile applications. In this regard, what the data indicates, for example, is that everything that is outside of breadwinner obligations is less of a priority for them. For example, participants stated,

> *"I am working all the time so when I get home sometimes, I am too tired to even self-manage my diabetes"(51-year-old female)*

and

> *"It will take a lot of time and I think work is also a concern, it will definitely be something that will influence my work as well"(43-year-old male).*

Likewise, other respondents had similar views that using a mobile application and going the extra mile and making an extra effort to learn to use a mobile application is considered to be a

distraction from the core breadwinner obligations.

The second notion of culture identified in the data is time management which is linked with the concept of *work influence.*

The data indicates that for these diabetic patients working is a means of survival. The results show that participants are generally not doing white-collar jobs. They are doing blue-collar jobs such as delivering goods and working in a factory. This implies that they have job situations that do not allow them time to manage their diabetes via an application. These respondents prioritise their time to make a living rather than to take care of their health effectively. In this regard, what the data indicates is that using an application is perceived to be a time-consuming activity while working. Examples of responses that demonstrate the latter are:

> *"It will take a lot of time and I think work is also a concern, it will definitely be something that will influence my work as well"(43-year-old male)* and

> *"half of me want to tell you that it is an excellent idea and the other half of me want to tell you that when I go back to work I will probably not have the time to do it or to use it"(57-year-old female).*

Time management was not just a work-related issue. Other participants had the same opinion that they do not have time to adopt and use a mobile health application because they either do not have the time to learn how to operate an application or they are limited to a certain period to learn how to use a mobile application. This is due to having more than one job and being a breadwinner and a caregiver. For example, a respondent whose economic circumstances require them to hold down a second job stated that if they did not have to do that, they would most likely manage their diabetes using an application. In addition, another respondent mentioned that they would have been using it if they had free time. This is summarised in the quotations below:

> *"you see the thing is probably I've got a second job. So, that's what takes a lot of my time. Maybe if I never had that then I would've been with the cell phone"(50-year-old male)* and

> *"I would have been on it already, If I had time, I only have time on weekends"(35-year-old female).*

Even though participants had similar views regarding work influences and time management, having a negative impact on the adoption and use of mobile applications, they continued to have a positive view. Zhang, Weng & Zhu (2018) stated that in masculine cultures, the adoption of

new technology would be high when it is for work purposes and lower when it is for personal use. This was found not to be the case in this study population. The findings were dissimilar with literature due to many of the participants doing blue-collar jobs rather than white collar jobs. In addition, these participants perceive technology to be a distracting and a tool that requires effort. Previous research indicated that in high masculine cultures, perceived usefulness plays a role in individuals' decisions when adopting new technology (Lin, 2014). This was found to be the case in this population too. For example, mobile application user revealed that through the use of an application, they could save time, and this indicates that an application is beneficial for them. An example of a respondent that demonstrates the latter is:

> *"I'm a working man so I don't always have time to write down my glucose levels and keep track of everything so I knew having an app on my phone would help me in that regard that is what would keep me trying to use the app because I know the benefit of it"(30-year-old male).*

The findings in this section suggest that a masculine culture prevails in the research population and that this is perpetuated by breadwinner obligations.

The notion of breadwinner obligation as a masculine concept indicates a negative impact on mobile application adoption. As such participants who are breadwinners are less likely to use a mobile health application for diabetes self-management.

The second category, caregiver obligation, is discussed based on what the data reveals regarding Performance expectancy in relation to femininity.

4.4.2 Caregiver Obligation

According to Venkatesh et al. (2003), performance expectancy is defined as the "degree to which an individual believes that using the system will help him or her to attain gains in job performance" (2003:447). Femininity is seen as a "society in which emotional gender roles overlap: both men and women are supposed to be modest, tender, and concerned with the quality of life" (Hofstede, Hofstede & Minkov, 2010: 517), and therefore is seen as a relevant concept. In this study, performance expectancy and masculinity refer to the way in which gender roles influence a diabetic patient's expectation of how an application will lead to their ability to improve activities in relation to care behaviour activities. It should be emphasised that in feminine cultures, individuals are expected to be mindful of the opinion of others as they are

deemed more people-oriented (Thowfeek & Jaafar, 2012). Therefore, it can be noted that others may influence the decision to accepting mobile applications.

The key concept that emerged from the data in relation to femininity are *caregiver influence* and application expectations. This is discussed below in relation to the outcome of what the data reveals.

In examining the research population, it is evident that the stereotyping of females in the household as a primary caregiver is prevalent. In several societies, there are societal and cultural demands on females to adopt the role of family-caregiver. For example, cooking dinner for the household and rearing children. As such many of the stereotypical female expectations have resulted in having a negative effect on their ability to adopt and use mobile applications.

Caregiver obligations are described as the person who focuses on nurturing and considering the needs of others in their society. *Caregiver influences* emerged as a concept from the data. In this regard, females are more focused on making informed health decisions to assist others in leading healthier lifestyles. What the data indicates is that a caregiver is less concerned with activities that lead to successful adoption and use of mobile applications as they consider and see to the needs of others. For example, participants stated that,

"I don't at the moment. It's a big, big battle because I've got a one year old and a two-year-old. Uhm... so, they take up a majority of my day"(35-year-old female)

and

"I'm the chef here in the house. I, I cook and I'm the one that shops so I'm, I'm one hundred percent responsible for my own and for my husband because he doesn't like taking medication so … But I'm the one that's responsible"(44- year-old female).

Likewise, these participants and others had comparable views that using a mobile application is an extra effort. It is considered to be an activity that they are not able to do as it tends to be a distraction from their core caregiver obligations. Literature indicates that individuals in high femininity societies may give extra attention to the readiness of technology as it affects the society wellbeing (Tarhini et al., 2017). In this research population, this is not the case.

Cyr, Gefen & Walczuch (2017) found that both biological sexes (men and women) exhibit masculine and feminine values. This was found to be the case in this study population too. The findings similar to the literature because people in disadvantaged communities cannot afford to

be unemployed due to their economic circumstances. The data in this study indicates that females in this population are both caregivers *and* working women. The outcome of the data reveals that anything outside of these roles (caregiver and earnings) are secondary and less of a priority to the respondents. For example, one participant stated that when they arrive home from work, they have to take care of her family and other household responsibilities. Many other participants shared similar views, and these are summarised in the following quotations:

> *"I work, when I come from work then I must come do this and do that quicker, by the time we done its bedtime again"(35-year-old female),*

> *"I am a working all the time so when I get home sometimes, I am too tired to even self-manage my diabetes. Weekends I have more time so by then I do my wife duties"(51-year-old female)* and

> *"I don't have any more time left because my child needs me more than now which is the case now actually. Just getting a bit hectic with her"(25-year-old female).*

In this research population, participants are either home carers who take care of their family or are both working women and the sole caregiver of their family. This indicates that participants consider relationships between individuals and the quality of life in their society. As such, the notion of caregiver influence as a femininity related concept has resulted in a negative impact on mobile applications for diabetes self-management.

The second notion of culture identified in the data is *application expectation* which was found to be linked with the concept of caregiver obligation. As women take the role of a caregiver and a working woman, before using any mobile application, the perceived benefit has to be clear.

In this research population, females have a role as a caregiver and as a working woman. In the society that they live, due to financial circumstances as well as personal choices, in order to survive, both males and females need to work to sustain their livelihood else they may be living at the poverty level. For women, high expectations arise when making use of mobile applications as they have to believe that a mobile application will be beneficial to them. In this regard, what the data indicates is that an application must be able to track their diabetes and provide feedback. For example, participants stated:

> *"I think it would help me track what my levels are and how uhm… I can bring it down if it is high or you know bring it up if it's low"(42-year-old female),*

"Basically, it will give me feedback and then, by that I will learn if I am doing the right thing or the wrong thing, where I am going wrong"(65-year-old female) and

"So, that's my expectation of an application, just to have an overall look at what you should use, what you're doing over a specific period of time"(35-year-old female).

Likewise, other respondents had similar views that an application should be beneficial to help them achieve gains in their life. Based on findings in this section, it is evident that these participants are a moderate femininity culture which indicates that the quality of life and relationships are most important (Sun, Lee & Law, 2019). Hoque & Sorwar (2017) reported that the more an m-health application is perceived as a benefit to one's health, their intention to use an m-health application is stronger. In this society, it is not quite the case as women value both work obligations and caregiver relationships.

The data therefore suggests that the notion of caregiver obligation as a femininity related concept has a negative impact on mobile application adoption. In this study sample, this, in turn, indicates that women are less likely to use a mobile application for their diabetes self-management.

4.5 The role of uncertainty avoidance on expectations of users and non-users' effort of mobile applications on adoption and use

According to Venkatesh et al. (2003), effort expectancy refers to the "degree of ease associated with the use of the system" (2003:450). As stated by Hofstede, Hofstede & Minkov (2010), uncertainty avoidance is described as "the extent to which the members of a culture feel threatened by ambiguous or unknown situations" (2010:191). In this study, effort expectancy and uncertainty avoidance refer to the way in which the patients' perception of ease or difficulty in using an application - influence their decision to adopt and use an application in support of self-care activities.

The literature indicates that the higher uncertainty avoidance of a certain population, the more likely they will perceive new technology as less useful than individuals in low uncertainty avoidance culture (Lin, 2014). It should be emphasised that if the technology (in this regard an m-health application) reduces uncertainty and ambiguity, then cultures ranking high on this dimension would be at ease in adopting such a mobile application faster than anticipated (Alshare & Mousa, 2014).

The preceding paragraph frames the findings in the following section in which four concepts emerged from the data: technology anxiety, distrust in applications and, finding an alternative application and compatibility of cell phone.

4.5.1 Technological impediments

In examining the research population, the data suggest that various hindrances exist that influence a participants' decision to adopt mobile applications. These impediments have resulted in participants having a negative perception towards adopting an application for self-management.

The first notion that was revealed by data is *technology anxiety*. Technology anxiety refers to the fear people feel when they think of using technology. In this population, many of the participants are elderly and have few technological skills.

Individuals in high uncertainty avoidance cultures are more apprehensive about fraud and privacy (Zhang, Weng & Zhu, 2018). He & Freeman (2019) found that females commonly have higher technology anxiety and lower self- efficacy when using technology. This is the case in this research population too. It has been found that women are more worried by security issues than males, while males are more mindful of the efficiency of technology (Tarhini, Hone & Liu, 2014). This was found to be the case in this study population too. For example, the data reveals that technology anxiety is a result of participants having declining cognitive capabilities, and this results in them experiencing a negative impact on using mobile applications for self-care activities. Participants were asked whether a mobile application for diabetes self-management would stress them out, and the data indicates that amongst older participants, they would find a mobile application to be stressful. This is due to their lack of understanding of mobile health applications. For example, participants stated that,

> *"Yes, I, ek dink nie ek sal die knowledge... ek het nie daai knowledge om daai te doen nie sonder help van iemand nie"(59-year-old female),*
>
> **Translation** *"Yes I, I don't think I will have the knowledge. I dont have the knowledge to do this without the help of some one"(59-year-old female)* and
>
> *"Yes, because I don't know how to use it and what if the app takes money from my account every month"(65-year-old female).*

Low uncertainty avoidance cultures are willing to take risks and have great acceptance towards products, services and technology (Baptista & Oliveira, 2015). In this study sample, respondents

acknowledge uncertainty avoidance, which indicates that they are less likely to adopt new technology if they lack of confidence and trust in it. This suggests that being apprehensive towards using a mobile application can result in participants having a negative effect on the adoption and use of a mobile application.

In examining the data, the results show that younger participants are more positive towards the adoption and use of mobile applications. In this study sample, younger adults are more technologically savvy as compared to elderly participants. They, therefore, have a more positive disposition to the adoption of mobile applications for self-care activities. For example, participants stated that,

"I'm actually very tech savvy so I was going to figure it out anyway"(25-year-old female) and

"I would say I'm good with technology so using the app is easy and convenient"(30-year-old male).

The literature indicates that more mature users have greater technology anxiety than younger users (Hoque and Sorwar, 2017). This may be due to being digital immigrants. Others have shown that older patients are unlikely to adopt and use mobile applications as they perceive them as challenging to use (Petersen, Jacobs & Pather, 2020). Contrary to these findings, the data indicates that the majority of the elderly participants indicated that using a mobile application will not be a stressful situation as it is a tool that they have to get used to. In agreement with these findings, another elderly participant stated that they have the competencies to use an application, and as a result, an application will be beneficial to them. For example, participants stated that,

"No, I will get used to it. It won't stress me out to use the app. If I… It will, how can I put it now? You know, I must get used to it"(65-year-old female).

"No, if you had to come to me maybe 10 years ago or so then it would have stressed me but not anymore"(60-year-old female) and

"I have the competence to do anything, if you set your mind to it you can do it, so it don't stress me at all, I think it would help me, really I do"(60-year-old female).

This respondent and others shared similar views that using an application will not be a stressful situation as they will become more comfortable with using the application over time.

Other studies have shown that the elderly adults put less importance on the effectiveness of m-

health services based on their perceptions relating to their attitude towards m-health service (Deng, Mo & Liu, 2014). However, comparing our findings to those of older studies, it must be pointed out that this is not the instance in this research population. The results indicate that the information an application provides to the user could cause stress and anxiety for the participant. For example, participants stated that:

> *"It won't stress me out. It could be at the stage where maybe you want information and then the information you want it's not …it's like a negative one where a decision how can I say you didn't want that answer you thought it was going to be a positive answer but you got a negative answer on it"(46-year-old male)* and

> *"You know putting it in is fine but you know I hear, I'm thinking you know I can eat this and this is fine for me. And then when I put it, uhm you know when I enter the information and I check my levels and it's not, it's… then I'm going to, you know then I'm going to think, oh God, what next, what do you know then it's… It will definitely stress me out"(57-year-old female).*

These respondents had similar views to one another that the ease or difficulty of using an application is not the core impediment to using an application for self-management. The technological impediment, as an uncertainty avoidance related concept, may have a negative impact on mobile applications as this population forms part of a moderate uncertainty avoidance culture.

The second concept in relation to technological impediment, from a culture perspective, is distrust in an application. This is strongly linked to the concept of technology anxiety. *Distrust in an application* is, therefore, another culture concept that was found to influence diabetic patients' adoption and use of mobile applications.

Although trust plays a key role in the 'doctor-patient relationship', disparities prevail concerning how patients define the term trust. For this research population, trust emanated from their personal experiences and encounters with their doctor or the opinions held concerning their doctors' competency. For other patients in this research population, trust means confidence. The expression 'best interest' was used by individuals in this study, and this can be nearly synonymous to the concept of trust in the doctor-patient relationship. For example, participants stated that,

> *"No, I don't feel uncomfortable if I disagree with them. They have my best interest at*

heart, so I trust them"(65-year-old female),

"I need to discuss it with my doctor because his advice is more important than what I'm doing"(36-year-old female)

and

"I like to talk to my doctor. He knows more than I do. I don't want to do my own thing and then get sick"(65-year-old female).

In examining the research population, the results show that *distrust in application* usage is prevalent. As such, this has resulted in having a negative influence on a participant's ability to adopt and use mobile applications. The data indicates that participants do not trust an application as they perceive that it may not provide accurate information. For example, participants stated that,

"The phone I won't really trust because it is a phone not a human being, anything could go wrong"(65-year-old female),

"Using the app itself doesn't stress me out, it is more of trusting the application to not give out my personal information to others"(51-year-old female) and

"I don't trust it because I don't know enough about it or know anyone that uses a diabetes app"(65-year-old female).

Previous studies (Xin, Techatassanasoontorn & Tan, 2015; Shiu et al., 2015) indicate that the role of trust in the decision-making of adopting technology is paramount in uncertainty avoidance cultures. Likewise, many respondents had similar opinions that they may not adopt an application due to the uncertainty that exists in using a mobile application. As these findings are prevalent amongst elderly participants, this indicates that older patients have a low usage rate towards mobile health applications as they perceive an application to be less accurate than having face-to-face consultations with their doctor.

The literature indicates that if a mobile application has the ability to reduce uncertainty for the user, then users who form part of high uncertainty avoidance cultures would have a strong intention to use it. Thus, reducing the uncertainty would also ease the fear of information security (Alshare & Mousa, 2014).

In addition, individuals will act when a family member or an influential other encourages them to use an application, even though they may not believe in the application (Belkhamza et al., 2014).

Previous studies (Alhirz & Sajeev, 2015; Tarhini et al., 2017) indicate that informational influence from other e.g., family and friends, can present evidence encouraging them to adopt and use new technologies. Until the risk of use has disappeared, people from uncertainty avoidance societies will delay accepting a new technology (Lee, Trimi & Kim, 2013).

Researchers have claimed that a negative relationship exists between uncertainty avoidance dimension and technology adoption (Olasina & Mutula, 2015). Similarly, this is the case in this research population too. The notion of distrust in application usage as an uncertainty avoidance related concept may result in having a negative effect on participants' ability to adopt and use a mobile application.

4.5.2 Technological convenience

A decade ago, mobile applications were not as prevalent as today, and there were not many options available to the user to choose from. Thus, they had to adopt what was freely available. In the current context, thousands of mobile applications exist, and users are free to choose what they prefer. This has resulted in a positive effect on their ability to adopt and use mobile applications as the decision lies with the user as to which application to use.

The outcome of the analysis reveals that using substitute mobile application in this study sample is prevalent. Even though numerous applications exist, many of them are not user friendly to a particular cultural group of people. The data in this study shows that respondents would seek an alternative application when an application is not user friendly and accessible to them. Examples of respondent that demonstrates the latter:

"I'd probably look for something easier if it was too difficult"(35-year-old female)

and

"I would probably look for something easier because they are so many applications when it comes to that diabetes monitoring"(35-year-old female).

Hoehle, Zhang & Venkatesh (2015) found that "espoused cultural values play an important role in affecting the relationship between mobile application usability and individuals' continued intention to use mobile social media applications" (2015:350). Similarly, in a different context, this seems to be the case in this population too. It is evident that cultural backgrounds and values need to be taken into consideration when developing an application.

Likewise, other respondents who are not using any form of mobile health application shared the same view that they would find an application that is free of any effort and is suitable for their needs. This indicates that an application has and will have a positive effect on users. Ozturk et al. (2016) suggests that improving the usability of an application increases the perception of the value of an application, and this, in turn, influences continuance intention to use. This was found to be the case in this study population too. For example, participants acknowledge the perceived benefit of an application as many of them would not abandon an application entirely but rather search for an application that is easier to use. This, in turn, has a positive effect on the adoption and use amongst diabetes patients.

Tan et al., (2018) and Hoehle, Zhang & Venkatesh, (2015) have found that usability is a significant predictor for users' continuous intention to use mobile applications. This was found to be the case in this study population too. The data in this study, therefore, suggests that the notion of technological convenience as an uncertainty avoidance concept has resulted in a positive impact on mobile application adoption. In the study sample, this, in turn, indicates that participants are more likely to use mobile applications for their diabetes self-management.

The second important issue in relation to *Technological convenience* is that of compatibility of a cell phone.

Müller (2016) indicates that it is vital to investigate how the cultural context shapes health behaviour, the interaction with mobile technology, and how user interfaces are perceived (Burns, Montague & Mohr, 2013). What may be ideal in one culture may not be accepted by users in a different culture.

In examining the data, it was found that although all participants have a mobile phone, a few participants stated that an m-health application is not compatible with their mobile device. This finding was evident among elderly adults. What the data indicates, for example, is that participants would use mobile health applications as long as their cell phone is able to access the application. Participants stated that,

"I tried to put on an app for other things but then it doesn't take"(63-year-old female) and

"I need an update, I need an upgrade"(60-year-old female).

This indicates that the notion of compatibility of a cell phone as an uncertainty avoidance related concept has resulted in a negative impact on mobile applications for diabetes self-management. This finding indicates that respondents may perhaps try to avoid adopting a mobile application as their mobile phone is not accessible to the application.

4.6 The role of power distance on the social influence of users and non-users on mobile application adoption and use

According to Venkatesh et al. (2003), social influence refers to "the degree to which an individual perceives that important others believe he or she should use the new system" (2003:451). As stated by Hofstede, Hofstede & Minkov (2010), power distance refers to the "extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally" (2010:61). In this study, social influence and power distance is the extent to which diabetic patients believe that people in high positions and power, for example, healthcare professionals (doctors and nurses) believe that they should use an application for self-care behaviour activities. It is noteworthy to mention that societies from power distance cultures prefer to be told what to do; these people depend on the views of others from others (Daniels & Greguras, 2014). This is especially the case when adopting new technology. Individuals in this culture are very likely to take notice of the thoughts and opinions of others before adopting new technology (Tarhini et al., 2017; Lu et al., 2017).

The foregoing paragraph frames the findings in the following section in which the four concepts that emerged from the data are: preferred doctor, doctor advice, disagreement with a doctor and comfortable with the doctor.

4.6.1 Medical practitioner influence

In examining the research population, the findings demonstrate that participants prefer to consult their doctor rather than using a mobile application for their diabetes self-management. In this regard, what the data indicates is that health care professionals play an essential role in respondents self-management. Examples of this are demonstrated in the responses below:

"I like to talk to my doctor. He knows more than I do"(65-year-old female),

"I don't think the decisions I make will be better than a doctor. A doctor is qualified even though he does not know my body, his advice is always much more better"(30-year-old male) and

"I would choose going to the doctor if something seems off than using an App"(25-year-old female).

These respondents and many others had similar views that they prefer the traditional face to face consultation with their doctor rather than using a mobile health application. This suggests that they are more concerned with the opinions of their doctor as doctors are perceived as being more superior and their decision holds more value. Overall, these findings are in accordance with findings reported by previous scholars that elderly participants would prefer traditional health services (Khatun et al., 2016). However, it must be pointed out that in this research population, the data indicates that younger participants would also prefer visiting the doctor as opposed to solely using an application.

Based on the data, it is evident that this research population forms part of a high-power distance culture. This suggests that people accept and adhere to the hierarchical order, which in this context is healthcare professionals. As a result, respondents are more unwilling to use m-health applications even if they believe that they are able to do so. From these findings, it is clear that respondents are less likely to adopt and use mobile applications if their doctors do not inform them about them or if their doctors disagree with using mobile applications.

The second notion of culture that comes out of the data is that of doctor advice which is strongly related to preferring doctors.

Culture appeared to influence the personal understanding of the relationships between patient and doctor. The results show that respondents prefer consulting their doctors as they provide expert recommendations and advice. In examining the research population, what the data indicates is that that participant gave interpretations of different meanings of their relationships with their doctors. Some of the participants described their relationship with their doctor as equal and open. In addition, there were a few who believed that doctors should show concern for them.

"The doctor would give you... uhm... better advice, only because he's better educated as to what else I should be doing. Uhm... so for example, I that know when I was pregnant, I was having difficulties with my sugar and what he did with my bolus injection"(35-year-old female),

"He is very open, you understand. When he speak to me. Frankly, to me, he is very, very open so I don't have a problem with anybody"(59-year-old male)

and

"somehow the doctor just got through to me, so. I've got to adhere to it, because what do I know about medication, so I've got to adhere to a doctor's instruction and guiding"(53-year-old male).

This finding provides evidence that respondents visit the doctor as they provide patients with guidance and advice. In this regard, what the data indicates, for example, is that the doctor's decision is better than their own, as the doctor is more knowledgeable and thus provides better advice. In addition, the data indicated that respondents look up to doctors for their sound knowledge and proficiency.

4.6.2 Opinions towards medical practitioners

In this study, *Opinions towards medical practitioners* is defined as the thoughts and feelings of a person towards health professionals.

The first concept in relation to opinions towards medical practitioners, from a culture perspective, is disagreement with the doctor. While respondents observe their health care professionals (doctors) to be open to patients' thoughts and opinions. Other respondents view their doctors as an authority figure, and their relationship as one-sided.

The outcomes of the analyses reveal that respondents comply with the opinions of their doctors as they fear disagreeing with them. As such, this may result in having a positive influence on participants' ability to adopt and use mobile applications. The data indicates that because patients feel uncomfortable disagreeing with their doctor, they do not disagree and follow the doctors' orders. For example, one participant stated that,

"I do because I mean I figure that the doctor knows better than what I do but then again I also, I mean I know my body and I know how I feel. So ja, I do feel very … I do feel uncomfortable. It's a bit you know uhm, ja, it's confusing because you know it's the doctor and then it's how I feel"(44-year-old female) and

"Yes because at the end of the day they supposed to be the knowledgeable people…they should direct you the way it should be but at the end of the day they don't know your body and they don't know how you feel"(46-year-old male).

A few participants had a different opinion and mentioned that they do not disagree with their doctor or feel uncomfortable as they trust the doctor will have considered the patients' interests. This is summarised in the quotations below:

"*No, I don't feel uncomfortable if I disagree with them. They have my best interest at*

heart, so I trust them"(65-year-old female)

and

"No, I don't disagree with the doctor because I'm not a doctor and the doctor is the one that knows best"(43-year-old male).

This participant and many others shared the same sentiment that they do not feel uncomfortable when disagreeing with their doctors. This indicates that these respondents form part of a high- power distance culture. This suggests that patients would possibly accept authoritative "expert" advice from the doctor because they perceive that the doctor makes better decisions regarding their health.

In relation to the notion of culture, this study's population sample comprises a high- power distance society. Özbilen, (2017) found that high power distance cultures have a tendency to show lower levels of new technology adoption. In this population, this tends to be the case too. Individuals in high power distance countries would not feel persuaded to act on their attitudes and inclination (Hassan, Shiu & Parry, 2016). Thus, they are likely to resist change. In addition, they are expected to be slow in accepting new products and services. In this study, patients feel more worried about conforming to the opinions of others. This is due to individuals perceiving that the rules governing their actions are more controlled by others than by their own willpower (Hofstede, 1980). This results in a negative effect on adoption and use as this society has a lower rate of technology adoption of diabetes self-care activities.

4.7 The role of individualism and collectivism on the users and non-users' social influence of mobile applications on adoption and use

According to Venkatesh et al. (2003), social influence is defined as "the degree to which an individual perceives that important others believe he or she should use the new system." (2003:451). Hofstede, Hofstede & Minkov (2010) state that individualism "refers to societies in which the ties between individuals are loose: everyone is expected to look after him- or herself and his or her immediate family" (Hofstede, 2010:92). In this study, social influence and individualism refer to the way in which a diabetic patient makes their own decision and those significant others do not have an influence on a diabetic patients' decision of whether or not to use an application for self-care behaviour activities.

The foregoing paragraph frames the findings in the following section in which four concepts emerged from the data: accountable for self-management, negative attitude, social support and support group.

4.7.1 Individual responsibility

In this study, *Individual responsibility* is defined as the idea that a person chooses, prompts and makes their own decisions and deals with the consequences.

In examining the research population, the data indicates that in many households, diabetic patients are responsible for their diabetes self-management. As such, the views of significant others may not have a positive influence on their ability to use a mobile application.

Two underlying conceptual issues provide insight into this finding. The first concept that derived from the notion of culture is *accountable for self-management*. The data indicate that participants are responsible for their diabetes self-management as they prioritise their interest rather than the opinions of important others in their society. For example, participants stated that,

> *"I feel it's my responsibility, to be honest, because my doctor is just there to, sort of, to help manage and, you know, give the medication part of it. Um, but it is my responsibility every day to ensure that I'm doing the right thing for myself to sort of benefit at the end of the day"(36-year-old female)* and
>
> "*I am responsible and it is up to me how I manage it"(51-year-old female).*

Many other respondents shared the same sentiments that managing their diabetes in whichever way they see fit is their responsibility. This is because they are considered to be the most important person in this process. In relation to the notion of culture, this study's population sample comprises a high individualist culture. Participants who have a high individualist culture have a positive attitude towards using application adoption as they perceive that the technology can help them perform tasks effectively (Sun, Lee & Law, 2019). In addition, participants who view the usefulness of an application for self-interest and the notion of accountability for self-management to be related concepts, can result in a positive impact on mobile application adoption.

A second important issue in relation to individual responsibility is that of negative attitude which is linked with the concept of accountable for self-management. Arpaci, (2016) found that in the context of collaborative learning in higher education, collectivistic cultural adoption orientations

would be more strongly related to the attitudes and subjective norms toward collaborative learning than those of individualistic orientations. This is not the case in this study; the results show that having an attitude towards mobile application is prevalent in an individualistic culture.

This research population resides in low-income areas with various socio-economic concerns. The literature indicates that "attitude towards using m-health is affected by sociocultural factors such as participants' disregard for the use of available technologies, the mistrust of technology, and participant preference for face-to-face contact with medical staff" (Petersen et al., 2019:9). In this research population, this is the case too. This study is similar to the literature by (Petersen et al., 2019) because this study is conducted in the same province as well as in the same context. In this regard, what the data indicates is that participants do not see the benefit of using an application. For example, participants stated that,

"To be honest, nothing will make me want to use an app"(65-year-old female).

and

"It doesn't really appeal to me, honestly. I don't even sit on my phone"(50-year-old male).

There are many reasons as to why this respondent will not use a mobile application; for instance, they participant is not part of the working class and thus does not see the benefit of an application. The literature indicates that regarding the impact of masculinity on technology acceptance, societies with high masculinity hold a negative attitude toward technology adoption (Sun, Lee & Law, 2019).

In this study, the notion of individual responsibility as a concept of individualism-collectivism has resulted in a negative impact on mobile application. This has resulted in users having a negative attitude towards adoption and use of mobile applications.

The second concept in relation to social cohesion is discussed based on what the data reveals regarding Social influence in relation to collectivism.

4.7.2 Social Cohesion

Collectivism is also a relevant concept. According to Venkatesh et al. (2003), social influence is defined as "is the degree to which an individual perceives that important others believe he or she should use the new system." (2003:451). Hofstede, Hofstede & Minkov (2010) state that

collectivism "pertains to societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout a person's lifetime continue to protect them in exchange for unquestioning loyalty" (2010:92). Following on the latter, social influence and collectivism refer to the way in which a diabetic patient makes a decision based on their society, e.g. family and their important people have an influence on whether he/she should use an application for self-care behaviour activities. It is noteworthy to mention that behavioural intention is influenced by subjective norms and their espoused cultural values to use technology (Teo & Huang, 2018).

The foregoing paragraph frames the findings in the following section in which two concepts emerged from the data: social support and support group.

In this study, *Social cohesion* is defined as the connectedness and unity between a group of people in a given society.

The data in this study shows that family and friends support is prevalent. As such, the influence of other members in the family and friends may have a positive influence on respondents adopting and using mobile applications for diabetes self-management.

Two underlying conceptual issues provide insight into this finding. The first one is that of social support. *Social support* refers to family, friends and important others having an influence on respondents' diabetes self-management and their decision to adopt mobile applications. The outcome of the analysis reveals that family and friends influence the way patients manage their diabetes and whether or not they would adopt and use applications for their self-management. For example, participants expressed how their doctor, family and colleagues influenced them to adopt an application. Examples of the responses that demonstrate the latter are:

> *"She's [the doctor] actually is the one that we like downloaded it together. She showed me how I should be using it. We set it up together in her office. So, she was really the... I think the instigator in me utilising the application to begin with"(35-year-old female),*

> *"My family and my work colleagues. When I was diagnosed with diabetes my wife would read up on it and send me links to lots of information and that is how we (me and my wife) came across a diabetes app"(30-year-old male)* and

> *"My family encouraged me to use the application so that made it easier"(30-year-old male).*

Although many respondents are not mobile application users, many of the participants stated that if their family were aware of an application, they would support and influence them in adopting and using a mobile application. For example, participants stated that,

> *"If my family knew about a diabetes application, they would have told me about it ages ago. They would probably download it for me also because they can see that I struggle to manage my diabetes because of working so much. So, they would download it for me, show me what is for what and make sure I use it daily"(51-year-old female),*

> *"I have a lot of friends that can and that really also motivate me and tell me about the data app and diet and the physio and the gym"(61-year-old female)* and

> *"I've got kids that is… they are constantly you know on, on they the laptops and their cell phones and stuff like that and especially if… with the help of them, they will remind me you know mommy, your details, you need, you know you have to do that"(44-year-old female).*

The second concept in relation to social cohesion, from a culture perspective, is a support group which is linked with the concept of social support. A support group is therefore another culture concept that was found to influence diabetic patient's adoption and use of mobile applications.

A support group has been identified as an emerging code from the data. In this study, *Support group* is defined as a group of people who have shared experiences and concerns and provide one another advice and support.

The outcome of this study reveals that respondents form part of a support group and their support group has an influence on their diabetes self-management. The data in this study shows that a respondent feels that if their support group were aware that a diabetes application exists, they would inform them and support them in using an application. This is summarised in the quotations below:

> *"The support group don't know about the app either, if they did they would tell me about it and also support me"(65-year old female)*

and

> "*If they [the support group] knew about a diabetes application, they would have told me about it ages ago"(51-year-old female).*

Participants mentioned that even though they use a mobile health application for diabetes self-management, they would consult their online support group to ensure they are on track with their management. This is summarised in the following quotations:

> *"but I also check on the diabetes support group Facebook page if what I am doing is okay or if someone had the same concern as me previously"(30-year old male)*

and

> *"I'm part of a group called…I think it's type one diabetes on Facebook. It's relief and medical information and it's for people from everywhere"(35-year-old female).*

The findings in this section, suggest that a collectivistic culture prevails in this group, and this is perpetuated by social cohesion. Lin, (2014) found that subjective norms have a more significant influence on behavioural intentions to adopt new technology in collectivistic cultures.

The notion of social cohesion as a collectivism concept indicates a positive impact on mobile application adoption. As such participants are more likely to use a mobile application for diabetes self-management.

4.8 The role of uncertainty avoidance on conditions of users and non-users' facilitating mobile applications on adoption and use

According to Venkatesh et al. (2003), facilitating conditions "is the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" (2003:453). Hofstede, Hofstede & Minkov (2010) state that "uncertainty avoidance is defined as the extent to which the members of a culture feel threatened by ambiguous or unknown situations" (2010:191). In this study, facilitating conditions and uncertainty avoidance refer to the way in which support exists to reduce uncertainty around the use of an application for diabetes self-care behaviour activities. It should be noted that even though organisational and technical infrastructure is present to warrant the use of technology, e.g., m-health applications, people in low uncertainty avoidance societies tend to quickly adopt and accept technology (Özbilen, 2017) and in contrast, a high uncertainty avoidance society may still avoid using new technology.

The foregoing frames the findings in this section in which four concepts emerged from the data: fear of crime, lack of skills, awareness of application and application assistance availability.

4.8.1 Predisposing factors of avoidance

In this study, *Predisposing factors of avoidance* is defined as factors that make people vulnerable to undesirable situations.

In examining the research population, the data indicates that crime is prevalent in this population. Of late, the incidents of cyber-crime have increased and changed the way people view the internet. Behl, Pal & Tiwari (2019) have found that perceived risk of cyber-crime negatively influences the usage of applications for transacting online. In addition, cyber-crime inversely impacts the confidence of users and thus their tendency to use mobile applications (Behl, Pal & Tiwari, 2019). For this research population, crime in general is a daily occurrence.

The literature indicates that people residing in low-income areas find it unsafe to walk in their communities due to the occurrence of crime (Booysen & Schlemmer, 2015). In this research population crime is on the rise and respondents fear for their safety.

Two underlying conceptual issues provide insight. The first is that of fear of crime, which reveals that fear of crime has caused respondents to refrain from using mobile applications. The data suggest that the fear of crime influences whether respondents use a mobile health application for diabetes self-management. In this regard, what the data indicates is that respondents are less inclined to use a mobile health application due to the risk associated with using an application. For example, participants stated,

> *"what if someone steals my phone when I go fetch my pension and then they can see all my personal information. Also, I won't have the information anymore and then I can't show my doctor my progress"(65-year-old female)* and

> *"Crime is another thing that would stress me out. My phone getting stolen with all my information on the app is something that would put me off from using a diabetes application"(51-year-old female).*

Likewise, these respondents shared similar opinions that using mobile applications can be a stressful activity due to cyber-crime and unsafe communities where they reside. Likewise, fear of uncertainty may result in resistance to adopting the technology. The data, therefore, suggest that the notion of predisposing factors of avoidance as an uncertainty avoidance related concept has a negative effect on their ability to adopt and use mobile applications.

The second notion of culture identified in the data is a *lack of skills* which was found to be linked

with Predisposing factors of avoidance.

In this research population, many of these participants are over 50 years old and are not from the digital age. This implies that they may not possess the necessary skills to operate a mobile health application. Petersen, Jacobs & Pather (2020) found similar findings. This study is similar to the literature because the research population face the same disparities in technology adoption and health. However, even though participants do not have the skills, what the data indicates is that, if they had the necessary skills, they would adopt and use a mobile health application. The participants stated,

"I don't have the skills. [Laughing], honestly, I will always ask Shakirah them to come help me if I want something"(35-year-old female),

"If I had the skills to do it, I would have been on it already"(35-year-old female)

and

"If I knew, yes, then I would but I must always ask someone to help me"(63-year-old female).

Similarly, a few participants indicated that they do not feel stressed about using a mobile application as they do not know enough about using it. This is demonstrated in the following extracts:

"I don't really know the app yet. So basically, I can't really now"(46-year-old male)
and

"I must first see how difficult the app is"(35-year-old female).

Likewise, these findings indicate that when individuals feel vulnerable to unknown or unpredictable situations, they are inclined to divert away from them. As such, the notion of predisposing factors of avoidance as an uncertainty avoidance related concept has resulted in a negative impact on their adoption and use of mobile applications for diabetes self-management.

4.8.2 Social advocacy

In this study, *social advocacy* is defined as supporting and empowering individuals in using a mobile application.

There are two underlying conceptual issues that provide insight into this finding. The first one is awareness of application.

In examining the research population, the data indicates that lack of awareness was a contributing factor as to why participants are not adopting and using mobile applications. In this study, awareness of an application refers to the knowledge that people have of the existence of an application. In this regard, what the data indicates is that many participants did not know about a mobile application for diabetes self-management before the interview commenced. This, in turn, has resulted in a negative effect on their ability to adopt and use mobile applications. For example, participants stated,

"No, I never knew it existed. This is the first time that I hear about that application"(59-year-old female)

"First time I saw it yesterday when you sent me the screenshots"(42-year-old female),

"I wasn't approached by anybody or, didn't have an app, like you the first person talking to me about an app on my phone"(60-year-old female)

and

"No one told me about a diabetes app. I am hearing about it for the first time from you. If I knew about it, I think I would have checked it out"(51-year-old female).

Likewise, many other respondents shared a similar view that they were clueless about the existence of a mobile health application. The literature indicates that uncertainty avoidance would have a negative influence on technology use (Lai et al., 2016). In this population, this is the case too. The data therefore suggest that social advocacy as an uncertainty avoidance related concept has a negative impact on mobile application adoption.

The second notion of culture identified in the data in this section is application assistance availability.

In examining the research population, the second notion of culture identified in the data is application assistance availability which is linked with the concept of lack of skills. As mentioned previously, participants in this research population are not technologically advanced and thus are not aware of an application. Examples of responses that demonstrate the latter are:

"I was not born in the digital age"(59-year-old male)

and

"I'm fifty-nine and technology is not my strong point"(59-year-old female).

Although participants were not aware of a mobile application, support in application use is available. The evidence reveals that for both male and female participants', support is readily available for respondents should they need it. What the data indicates is that for many participants, immediate family such as children and spouse are available. For example, participants stated,

> *"My kids, around me, is quite savvy where apps and mobile phones and stuff is concerned, so I know they will be able to assist me, should I get to a roadblock or whatever, you understand"(59-year-old male),*

> *"My husband is available. He is more tech savvy than me so he would be able to go through the app and explain to me what I need to do and where I need to go on the app to actually do… get the outcome I need"(42-year-old female)* and

> *"my kids know everything so they will show me how to do it"(46-year-old male).*

Likewise, other respondents had similar views that should they require assistance, their first point of call would be their immediate family as they are always around and are viewed as more technologically advanced than them. The notion of social advocacy as an uncertainty avoidance concept indicates a positive effect on mobile application adoption. As such participants are more likely to use a mobile health application for diabetes self-management.

4.9 The role of long-term orientation and short-term orientation on the value of the price of mobile applications on adoption and use

According to Venkatesh, Thong & Xu (2012), price value is defined as "consumers' cognitive trade-offs between the perceived benefits of the applications and monetary costs for using them" (Venkatesh, Thong & Xu 2012:161). Hofstede, Hofstede & Minkov (2010) state that long-term orientation is "the fostering of virtues oriented toward future rewards—in particular, perseverance and thrift" (2010:239). In this study, price value and long-term orientation refer to the way in which the perceived benefit and the cost of using an application have an influence on diabetic patients' willingness to preserve and save. It should be noted that White South Africans scored low in this dimension, suggesting that they exhibit greater respect for tradition and a moderately insignificant propensity to save for what is to come (Hofstede, 2019). It is also noteworthy to mention that the price value is positive when the value of using an m-health application is observed to be better than the associated financial cost (Huang & Kao, 2015).

The foregoing paragraph frames the findings in the following section in which five concepts

emerged from the data: saving-low priority, thrift, willingness to persevere, tradition and pricing of application.

4.9.1 Monetary Mindset

In this study, *monetary mindset* refers to a persons' beliefs and attitudes about how they make financial decisions daily.

In long-term orientation cultures, individuals have the tendency to centre more on future rewards (Lu et al., 2017). In this population this is not the case. The outcome of the analysis reveals that saving money for future rewards is seen as a low priority to this population, even though working is a means of survival for these respondents. This study is dissimilar to literature because in this population, many people do not have the luxury to save money. Some participants are living off social grants that is used to feed their entire family, while others are working pay check to pay check. In this regard, what the data indicates is that for many, saving money is not an activity they can actively participate in. Participants stated that although saving is important, it is not a priority as there is no money to save for a mobile health application. This is demonstrated in the extracts below:

"Very important but I can't, I cannot because there isn't to save"(60-year-old female),

"If I could save at this point in time. Saving is not an option uhm whatever comes in must go out again"(46-year-old male) and

"So, there's no savings that I can say that I've got savings. I'm gonna take from the savings and buy that and that. I'm living from one month to the next month"(59-year-old female).

These respondents all had similar views that saving money is not attainable for them. This indicates that participants are of a low long-term orientation society. In the context of mobile banking adoption, Baptista & Oliveira (2015) found that low long-term orientation had a strong and negative moderating effect. In line with this research, this is found to be the case too.

The notion of saving as a low long-term orientation category resulted in a negative impact on mobile applications. As such participants may not be able to use mobile applications to self-manage their diabetes in the future due to not being able to save money.

The second notion of culture identified in the data is *thrift* which was found to be linked with the

concept of saving money. Thrift is identified as using money and resources carefully and not carelessly.

In this research population, saving money is not a priority as there is barely enough money to survive. Many respondents mentioned that they do not have money to waste in downloading a mobile application. What the data indicates is that for older respondents, their government grant (pension) is their only means of income. In addition, other respondents indicated that providing for their family financially is more important to them. This indicates that participants would rather spend money on what they perceive to be important. In this case, it is not a mobile health application. This suggests that their circumstances are what urge participants to use their money carefully in order to survive each month. Some participants stated that there is no future to save for. However, they have to use their resources sparingly to uphold a healthy lifestyle. Examples of responses that demonstrate the latter are:

"It's not really important because I'm old already, I don't have a future to save for also, pension is very little. I try to live within my means and spend money on keeping me healthy"(65-year-old female),

"I don't have money to waste. I would rather spend money on food, healthy fruits and vegetables than on that"(65-year-old female)

and

"Look, I am alone, I am a pensioner, so I have to, and the things are very expensive out there, so I have to monitor myself with costs"(65-year-old female).

Likewise, for other participants, spending money and resources carefully were not based on living a healthier lifestyle but more for providing for their family. It was previously mentioned that breadwinner obligations were a significant factor in this research population. For example, what the data shows is that paying for a mobile application is not a priority for participants. Their main concern is seeing to the needs of the family and household. This is summarised in the following quotations:

"No, well I have a family that I have to consider so for me to go pay for something where I can put a bread on a table that it"(46-year-old male),

"Well, very important because I have got a bond to pay and the light needs to burn, food needs to be put on the table"(43-year-old male) and

"It is very important but because of the life I live I have to spend my money I got to see to a household and my children"(51-year-old female).

In relation to the notion of culture, this study's population sample comprises a low long-term orientation culture. Literature indicates that low long-term orientation plays a significant moderating role when studying technology acceptance and use at the individual level (Hoehle, Zhang & Venkatesh, 2015). The notion of monetary mindset as a low long-term orientation concept indicates a negative impact on mobile applications. As such participants are less likely to use a mobile health application for diabetes self-management as saving is, a low priority and thrift is an important factor.

The third concept in relation to monetary mindset, from a culture perspective, is the willingness to persevere. In this study, the *willingness to persevere* is defined as continuing to use a mobile health application even if it may be difficult to use.

The data indicates that many of the participants are not using mobile applications for their diabetes self-management. Although participants are not using mobile applications as yet, respondents perceive that using a mobile application will be beneficial to them. For example, a participant stated that,

"Yes, I wouldn't have leave it, because it's no use going into the diet app, in my concern, and at the end of the day it will help you. So I don't think why will I leave it [the app], even if it's a little bit difficult"(61-year-old female),

"In the beginning I don't think it will be easy but as time goes on it will be easier to use because by then I would have played around with it and figure it out as time went on"(51-year-old female) and

"I think the more I play with it, the more the more I'll know how to use it and use it properly to my advantage"(42-year-old female).

Likewise, other respondents shared similar opinions. This indicates that respondents would continue to use an application even if it is difficult at the beginning as they believe that using an application will provide them with benefits. Literature indicates in the context of learners' voluntary technology adoption that long-term orientation would have a positive influence on technology use and intention to use (Lai et al., 2016). In this research population, this is the case too. The data therefore suggest that the notion of monetary mindset as a long-term orientation concept has a positive impact on mobile application adoption.

4.9.2 Traditional mindset

According to Venkatesh, Thong & Xu (2012), price value is defined as "consumers' cognitive trade-offs between the perceived benefits of the applications and monetary costs for using them" (Venkatesh, Thong and Xu, 2012:161). Hofstede, Hofstede & Minkov (2010) state that short-term orientation is defined as "the fostering of virtues related to the past and present—in particular, respect for tradition, preservation of face, and fulfilling social obligations" (2010:239). In this study, price value and short-term orientation refer to the way in which the perceived benefit and the cost of using an application have an influence on diabetic patients' traditions and values. In individualistic societies, service quality and prices play a significant role in driving consumers' financial decision-making (Zheng et al., 2013).

The foregoing paragraph frames the findings in the following section in which two concepts emerged from the data: tradition and pricing of application.

In this study, *the traditional mindset* refers to behaviour and attitude implemented over a period of time which are shaped by an individuals' culture. This indicates that change occurs; individuals may be resistant to getting on board.

In examining the research population, the data indicates that elderly participants are more traditional in the way that they seek information. As mentioned previously, participants prefer going to the doctor than using an application. For example, participants stated that,

> *"I'm more old school, I like the traditional way of visiting my doctor, where my health is concern"(65-year-old female)* and

> *"I am very old school I just…the only thing I really kept are a record of my blood sugar so that I..if anything could go wrong, I can atleast give that to my doctor and say, this is what the sugars look like over the past two weeks"(57-year-old female).*

These respondents and many others had similar views that they prefer the traditional face to face consultation with their doctor than using a mobile health application. This indicates that this society forms part of a high short-term orientation culture. This is similar to Hofstede' view of culture where White South Africans scored low in long-term orientation (Hofstede, 2019) as they prefer to uphold traditions and are sceptical about change. This indicates that the participants will follow the traditions of their society in terms of managing their condition and in this case, face to face consultations with their doctor.

The second notion of culture identified in the data is the *pricing of application* which was found to be linked with the concept of traditional mindset.

Short-term orientation societies put great importance on attaining rapid results. Consequently, they would give more consideration to the utility and ease of use of new technologies as ways to improve their performance quickly (Lu et al., 2017).

In examining the research population, what the data indicates is that pricing of application emerged as a concept. In this study, the pricing of an application refers to the data service carriers' costs (mobile internet) and service cost associated with using a mobile application. What the data shows is that participants would not necessarily consider downloading mobile applications that they have to pay for. In addition, the data reveals that they feel that there is a variety to choose from, so why should they download mobile applications that have an associated cost when they might be able to download another one at no cost. Examples of responses that demonstrate the latter:

"No, I don't think I've ever downloaded an app that cost me money. I steer clear from those kinds of apps, any app that has a cost involved"(53-year old male),

"There's many apps available that you don't pay for so I don't see the need to download one that I need to pay for"(42-year-old female).

The literature indicates that the price value is positive when the benefits of using mobile applications are perceived to be greater than the associated monetary cost (Baptista & Oliveira, 2015). In this research population, this is the case too. While delving deeper into the data, it was found that other participants would pay for a mobile application. For example, what the data indicates is that when participants find an application that adds value to their life and offers what they need, they will pay the application. For example, participants stated,

"If you've got good reviews on it and if you feel that it would add value to your life then why not"(50-year-old male),

"Not necessarily, I will first check if there are free apps that have the same purpose before spending money unnecessary"(51-year-old female) and

"I don't know hey, depending. I would have to go through the apps and see what it offers for me and if that is the one I want before I decide to pay for it"(57-year-old female).

Likewise, participants shared the same views that if the value is greater than the cost of downloading the mobile application, they will use it. The data therefore suggests that the notion of traditional mindset as a short-term orientation related concept has a positive impact on mobile application adoption.

4.10 The role of indulgence on the habits of users and non-users' mobile applications on adoption and use

According to Venkatesh, Thong & Xu (2012), habit is the "extent to which people tend to perform behaviours automatically because of learning" (Venkatesh, Thong & Xu 2012:161). Hofstede, Hofstede & Minkov (2010) state that indulgence refers to a "society that allows relatively free gratification of basic and natural human desires related to enjoying life and having fun" (2010:519). In this study, habit and indulgence refer to when people make the decision automatically because of learning, and when that decision is one that satisfies them**.** In addition, the way in which the choices are taken by diabetic patients has an influence on self-care activities. The literature indicates that price consciousness is strong in cultures with high masculinity (e.g., White South Africa and Canada), as masculine cultures stress goals such as careers and money (Hofstede, 2001).

The foregoing paragraph frames the findings in the following section in which two concepts emerged from the data: choices and manage diabetes better with applications.

4.10.1 Personal regulations

In examining the research population, the outcome of the analysis reveals that the decision-making process is entirely up to the individual. The literature indicates that this society permits the fulfilment of ones' desire. In this study, choices refer to participants making their own decisions on whether or not they would adopt a mobile application.

The data, in this study, shows that the opinions of others do not have an influence on whether participants adopt and use a mobile health application for self-care activities. In this regard, what the data indicates is that it is their own decision whether they use a mobile application and whichever decision they make, they are free to do so. For example, respondents stated that,

"I make my own choices, my children can't tell me what to do it's my body and my health"(65-year-old female),

"I prefer making it on my own because the doctors already advised me at the beginning. They only need to tell you once. They don't need to repeat themselves"(50-year-old male) and

"Uhm, I will do it on my own. I do … I will, I will speak to my doctor but I basically make it on my own because I take it how I feel. I know my body"(44-year-old female).

Likewise, these respondents and others shared the same view that as it is their body, the decision on whether to use a mobile application is their choice. Even though participants consult their doctor, the decision lies with them.

In relation to the notion of culture, this study's population sample comprises a high indulgence society. The higher the indulgence in the society, the more frequently (willing) participants will use mobile applications for their diabetes self-management. A high indulgent society is more likely to adopt and use a mobile application to gratify their desires and impulses. Based on the data, the notion of the category choices as an indulgence concept indicates a positive impact on mobile application adoption.

The second concept in relation to personal regulations, from a culture perspective, is managing with an application.

In examining the research population, the data indicates that participants are not users of mobile applications for diabetes self-management and thus could not form a routine behaviour that tends to occur subconsciously.

The literature indicates that in order to develop a habit, a certain amount of repetition or practice is required from the individual. Therefore, to explore the role of habit, participants should have experience in using the technology. Thus, we can concur that habit only develops once repetition occurs.

In this study, the impact of habit was only explored amongst current users of mobile applications for diabetes self-management. It should be noted that these are young adults. The evidence indicates that application users found that managing their diabetes with a mobile application is beneficial. Furthermore, it was found that participants felt as if they were in control of their condition and in turn, using a mobile application became second nature to the user. For example, the participants stated:

"I do think that I manage my diabetes better when I use the app because I can take all the things, I do such as my eating habits and medication intake, like you call it self-care activities"(30-year-old male),

"Became like a second nature kind of thing like when I tested my sugar, I would go to the application and then input the data"(35-year-old female) and

"it makes you feel like you're in control of you diabetes... uhm... makes you feel like you've got your shit under control here"(35-year-old female).

Likewise, all these participants shared the same views that using a mobile application is more useful than the traditional way of managing their condition. This, in turn, has resulted in a positive effect on their ability to adopt and use mobile applications.

4.11 The role of individualism on the hedonic motivation of users and non-users' mobile applications on adoption and use

According to Venkatesh, Thong & Xu (2012), hedonic motivation is defined as "the fun or pleasure derived from using a technology." (Venkatesh, Thong & Xu, 2012:161). As stated by Hofstede, Hofstede & Minkov (2010), individualism refers to "societies in which the ties between individuals are loose: everyone is expected to look after him- or herself and his or her immediate family" (Hofstede, Hofstede & Minkov, 2010:92). In this study, individualism and hedonic motivation refer to the way in which the pleasure of using an application has an influence on diabetic patients' willingness to use it. It should be noted that hedonic motivation is linked to an individuals' willingness to adopt a mobile application. The literature indicates that hedonic motivation has been found to influence technology acceptance and use (Venkatesh, Thong & Xu, 2012).

The foregoing paragraph frames the findings in the following section in which four concepts emerged from the data: application is fun, the application is enjoyable, age and application is challenging.

4.11.1 Perceived enjoyment

In this study, *perceived enjoyment* refers to the excitement and happiness derived from using a system (Praveena & Thomas, 2014) and in this case a mobile application. It therefore refers to hedonic motivation experienced when using a mobile health application.

While examining the research population, the outcome of the analysis reveals that mobile

application users found using an application to be fun.

The first notion of culture identified in the data is *application is fun*. The evidence indicates that respondents find mobile application fun to use. In this regard, what the data indicates is that a majority of mobile application users are both intrinsically and extrinsically motivated to use a mobile application. For example, mobile application users stated that an application was enjoyable as they felt as though they accomplished their goal. In addition, others indicated that an application was fun as it provided a step-by-step guide on how to complete exercises correctly. For example, the participant stated,

> *"I think sometimes the area in medical is not really entertaining, but definitely fun. Fun in a sense of... uhm… or more like accomplished. You felt like you had accomplished something when you have filled out all your readings and food units for the day... uhm... and insulin dosage"(35-year-old female),*

> *"It gives you like this unicorn that would jump across the screen if you've finished it, and it also like sends you like points... uhm... if you completed it like for like the last seven days and... uhm... you get an email to say like, "Hey [participants name], you've finished the last fourteen days. This is what your sugar should be looking like," and send you a report of what you've been doing for the last two weeks. So that was really cool. It was like fun"(35-year-old female)* and

> *"It was very fun. Yeh, all the exercises. There's different stuff that I didn't know about that's on the App. Like different kind of exercises and they give you advise as well on how to do it and they show you like different, how you shouldn't be doing certain exercises because you could hurt yourself"(25-year-old female).*

An interesting finding was that although a majority of the mobile application users found an application to be fun, one participant indicated that, using a mobile application for diabetes self-management is not fun due to the fact the participant has to record all their information on an application. This finding could be due to this participant having breadwinner obligations and thus finding it difficult to track their progress and fulfil his breadwinner obligation. For example, a participant stated,

> *"Regarding my sugar app, uhm it wasn't fun because everything I ate I had to record on the app"(30-year-old male).*

From the findings above, the data indicates that for mobile application users, hedonic motivation is a contributing factor to continuous intention to use an application. The literature indicates that

perceived enjoyment had significant positive effects on the perceived usefulness. (Mehra, Paul & Kaurav, 2020). This suggest that before users make the decision to adopt a mobile application, they would evaluate whether the application is better compared to the alternatives of such applications (Mehra, Paul & Kaurav, 2020). As these respondents are from a high individualistic culture, finding mobile applications intrinsically useful is associated with hedonic motivation.

The second notion of culture in the study is application is enjoyable.

In examining the research population, the outcome of the analysis reveals that although the majority of the participants are not using mobile applications, they perceive that it will be enjoyable as they will be learning something new. For example, they will be learning how to use the application and in turn, the more they use it, the more joy they would find in it. This, in turn, has resulted in a positive effect on their ability to adopt and use mobile applications. For example, participants stated that,

"Because the more you use it, the more skilful you will become and the more you will enjoy it and Also, trust in it. It will become you way of life by using the app"(51-year-old female),

"It will be fun using it. It will, maybe, enjoyable too, if I get used to it"(65-year-old female) and

"It will be fun and very interesting to see you know if I was a… if I'm right or you know, if it has a… the effect, if it, if it works for me, if it doesn't work for me. So, that will be very eager … It will probably be more interesting to see what is the results"(44-year-old female).

Likewise, other respondents had similar views that using a mobile application will be fun and enjoyable. In addition, high individualistic cultures will adopt and use mobile applications as they are intrinsically and extrinsically motivated to do so.

4.11.2 Negative drivers of application use

In examining the research population, what the data indicates is that age is a contributing factor that influences the adoption and use amongst elderly participants.

The literature indicates that younger adults are more experienced in using mobile applications as they were raised in the digital era. This finding is prevalent in the research population. Participants mentioned that since they are from a younger generation, using a mobile application

is easier and would not be interesting for someone from an older generation. This is summarised below:

"I'm from the younger generation who knows how to work a cell phone. So, having the skills made it much easier"(30-year-old male),

"I think that yes. Because if I have to show my mother this app. It just wouldn't interest them. It's because I know how to use the app"(25-year-old female),

and

"I am quite tech savvy...so it's easy, but I think the app itself is easy. It's very self-explanatory"(35-year-old female).

In this research population, age was a contributing factor whether participants would adopt and use mobile applications. The data indicate that participants perceive their age to affect their adoption behaviours. Many participants stated that they are pensioners and that using a mobile application would not be an activity they could afford or be interested in. Example of respondents that demonstrate the latter are:

"I think an app will be unnecessary for someone my age"(65-year-old female),

"I'm old and I won't be able to remember everything"(65-year-old female)

and

"I'm fifty-nine and technology is not my strong point. [laugh]"(59-year-old female).

The second notion of culture in the study is application is challenging, which is strongly correlated to age.

In examining the research population, the data indicates that age was not the only issue. Participants felt that using an application would be challenging and thus would not motivate them to use an application. They were not born in the digital age and thus saw no need to use an application. Example of respondents that demonstrate the latter are:

"I think it's more for the younger generation. I would be keen to try uhm like I said, but it's so difficult"(65-year-old female),

"It will be challenging for me to try new technology"(65-year-old female).

If individuals deem the technology to be beneficial and effortless, they are more likely to accept

and use it (Tarhini et al., 2017). The notion of age as an individualistic related category has resulted in a negative impact on mobile application. In this study sample, this indicates that due to age, participants are less willing to use a mobile health application for diabetes self-management.

4.12 Chapter summary

The purpose of this chapter is to provide the results and the discussion of the main findings based on the literature, in relation to the research objectives. Simply put, the findings provided answers to the main research question, the research objective and were linked to the literature.

To study technology and how people use it, cultural differences need to be considered. How culture influences technology acceptance is context-bound and cannot be transferred from one culture to another. Based on Hofstede's cultural dimensions in South Africa, White South Africans scored high in individualism, masculinity and indulgence (Hofstede, 2019) and this is consistent with this study as this research population also forms part of a high individualism, masculine and indulgence society.

Hofstede's cultural dimensions and the UTAUT2 model were central to this study. A juxtaposition of these models answered the objective "to determine which cultural factors affect the acceptance and use of m-health for diabetes self-management". Most of Hofstede's cultural dimensions were identified in this study. However, in terms of Hofstede's cultural dimensions, habit was not significant in these findings as many of the research population in this study are not using m-health applications and thus could not form a habit to use m-health applications. "Habitual behaviour is the best predictor of subsequent technology use of applications used on a daily basis" (Tamilmani, Rana & Dwivedi, 2020:12). However, in this study, a minority of the participants are not using mobile applications for diabetes self-management and thus habit as a construct could not be analysed as it is not prevalent amongst this research population**.**

In addition, these participants may prefer to use traditional means of information seeking as opposed to using a mobile application. Evidence (e.g., Vaportzis, Clausen & Gow, 2017) reported that younger participants are more likely to use technology than older adults as the young form part of the digital age.

The researcher used the theoretical framework to develop a conceptual framework to describe

the findings. The findings provide detailed information to explain culture and technology adoption of diabetic patients. The findings were validated through a qualitative evaluation of research e.g., thick descriptions.

In the final chapter, a summary of the main findings of this research will be presented. Furthermore, Chapter 5 will present the relationships developed between the two models and highlight the research process, potential limitations, contributions of this research and directions for future research.

Chapter 5: Conclusions and recommendations

5.1 Introduction

This chapter concludes by providing an overview of the previous chapters, including the findings of the research. The conclusions were based on the aim, research questions and the findings of this study. Moreover, this chapter describes the contributions of this research. It also undertakes an evaluation of the research. This chapter also examines the implications of the research findings and provides several recommendations for future research. Lastly, the chapter presents a research framework. The framework explains the relationship between the Unified- Theory of Acceptance and Use of Technology 2 and Hofstede's cultural dimension. This framework is the basis upon which the final conclusions of the study are based.

5.2 Reflection on the research process

The study set out to achieve the following objectives:

- To identify which user acceptance models are appropriately aligned to a study of culture
- To derive a framework that defines the concept of culture
- To determine which cultural factors affect acceptance and use of m-health for diabetes self-management.
- To recommend interventions that might lead to improvements in m-health acceptance for diabetic patients.

This study addressed the research questions through a case study research design. The use of a case study was most suitable for this study as it answered that 'what' and 'how' questions and it allowed for the development of context-rich knowledge on the phenomena while it examined the phenomenon in its natural setting. The data collection was accomplished through semi-structured interviews. The data analysis was done using thematic content analysis. Furthermore, validity was achieved following qualitative research validity – credibility, transferability, dependability and confirmability.

5.3 Summary of research findings

In this section, the researcher summarises (Table 11) and reflects on the main findings (Appendix E: example of an interview transcript on page 165).

Table 11: Alignment of technology adoption concept with culture

Theme	Findings
Performance expectancy in relation to masculinity-Femininity	Breadwinner influence, which reflects **masculinity**, has a negative influence on users as a result of work is their main priority. In this population diabetic patients have to work in order to survive which indicates that anything else is simply not a priority and more of a time-consuming task. Caregiver influence, which reflects **femininity**, has a negative influence on users as a result of diabetic patients being responsible for taking care of their family and others are both home carers and providers for their families. This indicates that patients are more concerned with the quality of their life and family than with the adoption mobile applications
Effort expectancy in relation to uncertainty avoidance	Technology impediments, which reflect **uncertainty avoidance**, has a negative influence on users as a result of declining cognitive capabilities. Technology anxiety has been identified amongst older diabetic patients. These elderly patients found mobile application stressful. While younger patients did not. The distrust in application use has also resulted in a negative influence as a result of personal information being easily accessible by others. Technology convenience, which reflects **uncertainty avoidance**, has a positive influence on users and non-users as a result of many mobile applications existing which are freely available to diabetic patients. In addition, diabetic patients who are not using mobile health applications would like to adopt a mobile application that is suitable for their needs. This indicates that diabetic patients would search for an application that is easier to use as opposed to abandoning an application in its entirety.
Social influence in relation to power distance	Medical practitioner influence, which reflects **power distance,** has a negative impact on users and non-users as a result of diabetic patients preferring their doctor. This indicates that diabetic patients are less likely to adopt and use a mobile application if their doctors do not inform them about it or if they perceive that their doctors would not be in favour of them using mobile applications for self-management activities. Opinions towards medical practitioners, which reflects **power distance** has a positive impact on users and non-users. Diabetic patients comply with the opinions of their doctors as they fear disagreeing with them. As such, this may result in having a positive influence on a participant's ability to adopt and use mobile applications. This indicates that if their doctors inform them about a mobile application, they would adopt it.
Social influence in relation to individualism -collectivism	Individual responsibility, which reflects **individualism** has a positive influence on users and non-users as a result of prioritising their own interests rather than the opinions of important others in their society, which indicates that they would adopt and use mobile health applications. Individual responsibility, which reflects **individualism** has a negative influence on users and non-users, as a result of some diabetic patients not seeing the benefit of adopting an application. This indicates a negative attitude towards adoption and use of mobile applications Social cohesion, which reflects **collectivism** has a positive influence on users and non-users as a result of social support and support groups that exists. As such participants are more likely to use a mobile application for diabetes self-management.

Theme	Findings
Facilitating conditions in relation to uncertainty avoidance	Predisposing factors of avoidance, which reflects **uncertainty avoidance** has a negative influence on mobile application adoption. Diabetic patients indicate that using mobile applications can be a stressful activity due to cyber-crime and unsafe communities where they reside. A fear of uncertainty may result in resistance to adopting the technology. Social advocacy, which reflects **uncertainty avoidance** has a negative influence on users and non-users as a result of diabetes patients having a lack of awareness of the existence of mobile applications. This indicates that diabetic patients may not adopt mobile applications. Social advocacy, which reflects **uncertainty avoidance** has resulted in a positive influence on users and non-users as a result of application assistance that is available. Diabetic patients are more likely to adopt mobile applications when organisational and technical infrastructure exists. Diabetic patients indicated that should they require assistance with using an application, family and friends would assist.
Price value in relation to long-term orientation-short- term orientation	Monetary mindset, which reflects **long-term orientation** has resulted in a negative influence on users and non-users as a result of saving being a low priority. Diabetic patients may not be able to adopt mobile applications due to being unable to save money. For some participants, money that is generated needs to be spent on necessities and not carelessly. This indicates that diabetic patients will not waste money downloading an application for use. Elderly diabetic patients survive off their pensions and thus cannot save to download a mobile application for use. Traditional mindset, which reflect **short-term orientation** has resulted in negative influence on users and non-users mobile application adoption. Elderly diabetic patients prefer the traditional way of seeking information as opposed to using a mobile application adoption. In addition, traditional mindset, which reflects **short-term orientation** has resulted in positive influence on users and non-users as a result of the pricing of an application. Diabetic patients would continue to use an application even if it is difficult at the beginning as they perceive that using an application will provide them with benefits.
Habit in relation to indulgence-	Personal regulation, which reflects indulgence has resulted in a **positive influence** on users and non-users as a result of a diabetic patients' decision to act on their own choices and desires. Diabetic patients are able to make their own decisions on whether to adopt mobile applications. This indicates that they are more likely than not to adopt and use a mobile application to gratify their desires and impulses. Mobile application users indicated that they manage diabetes better with an application as they felt in control of their condition, this in turn had a positive influence on mobile application adoption.
Hedonic motivation and Individualism	Perceived enjoyment, which reflects **individualism** has resulted in a positive influence on users and non-users as a result of diabetic patients finding an application enjoyable as they will be learning how to use the application for diabetes self-management. Negative drivers of application use on users and non-users, which reflects **individualism** are as a result of age and a mobile application being challenging. Elderly diabetic patients indicated that being a pensioner they are unable to afford adopting an application nor are they interested in adopting a mobile application as they feel that it would be challenging and perceives these to be for the younger generation.

The findings (Table 11) indicate that although people make their own choices when adopting mobile applications, diabetic patients also respect the hierarchy of the medical practitioners and they would still consult their family and friends. Even though diabetic patients have the choice of whether they are going to use it or not the choice is influenced by what society deemed as normal. These individuals are influenced by the opinion the doctor, family and friends. People are making their own choices', but they are influenced by social construction, the way society is constructed, societal norms, what societal cues and what society thinks is right. So, if using a mobile application is understood as normal to a society they would adopt and use an application. Conversely, if this study had been conducted 10 years ago these responses would have been very different because socially the norm was not to use cell phones, applications, and social media.

A key finding (Table 11) is that the adoption of m-health is affected by culture because of social constructionism. Diabetic patients are free to disagree with their doctor as they are listening to popular discourse. They are socially constructed as a "know all" opinion of their doctor due to popular discourse because doctors are constructed as the "know best"; the person who knows everything about the body better than the patient itself. If the doctor were the one to inform the patient about an m-health application for diabetes self-management, the patient would be more inclined to use it as the opinion and thoughts of a doctor is valued.

Elderly people prefer to visit their doctor than to adopt and use mobile applications to manage their diabetes. What seems normal for one generation is not necessarily normal for another; in the era we are in now, people are caught in the centre because there are people who are born into technology and then there are others who have been around a long time, and although they have been introduced to technology, they are not use to it and the way they are experiencing technology is different. Some find it challenging to adjust while others are simply not interested to make the transition.

Another key finding (Table 11) is that the adoption of m-health is affected by culture because of individuals' monetary mindset. For diabetic patients in this population, saving money regularly for health care is difficult. These individuals often have daily expenses that they have to account for which undermines long-term savings. Saving money for m-health applications is not deemed as a priority for this research population. Many of these participants are elderly patients who live off government grants in order to survive. These individuals do not have money to spend on what they deem as unnecessary as there is barely

enough money for necessities thus making any type of saving not possible. Therefore, using a mobile application to manage their diabetes is not important as they believe that spending money on healthy fruits, vegetables is more beneficial than on m-health applications.

The seven constructs of the UTAUT2 model help to explain m-health adoption among diabetic patients. In this study, the influence of the constructs on m-health adoption varied depending on the cultural values of the diabetic patients.

5.4 A framework for understanding how culture influences m-health acceptance and use by diabetic patients in previously disadvantaged communities.

The framework depicted in Figure 9 is based on the outcome of qualitative data analysis. The relationships between the Unified- Theory of Acceptance and Use of Technology 2 and Hofstede's cultural dimensions derived from the coding process where themes and categories have been developed. The relationships between the constructs have been explained in 3.14 (Table 8). This conceptual framework is the researchers view on the phenomenon investigated which was created through synthesizing the analysis.

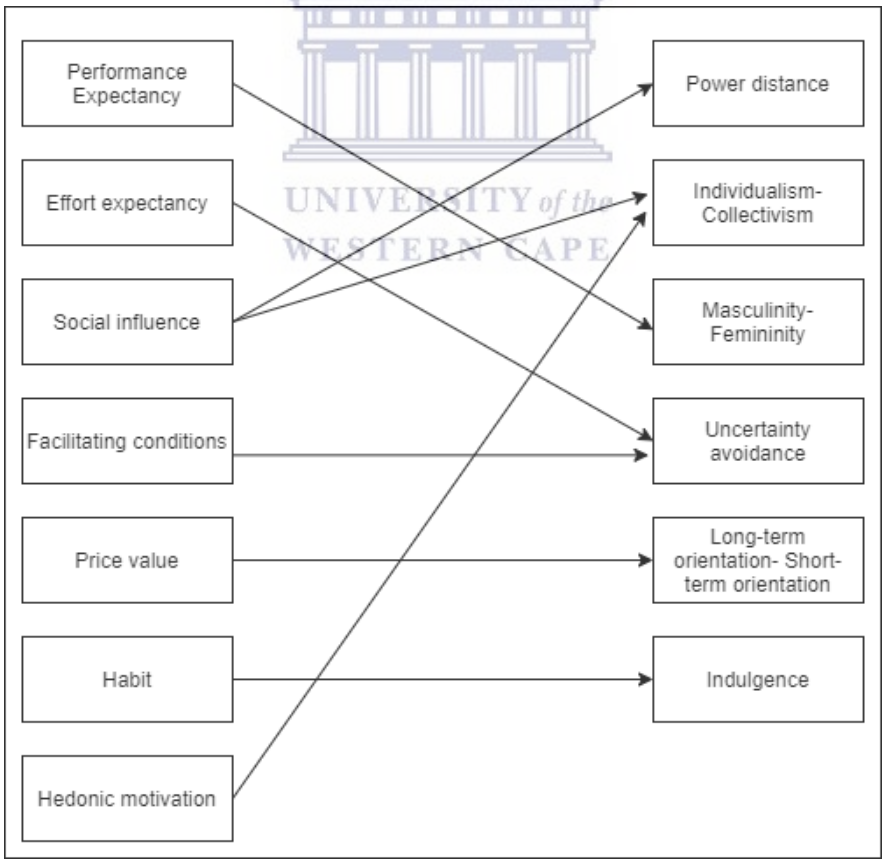

Figure 9: A framework of technology adoption and culture

The researcher merged the UTAUT2 and Hofstede's cultural dimensions to create a conceptual framework (Chapter 2, Figure 7 depicted on page 61) from the extant literature, which was used to examine the research question. This conceptual model provides a retrospective inspection to the theoretical model discussed in the literature review. In addition, the framework depicted above (Figure 9) shows the relationship between technology adoption and culture. The purpose of depicting the relationship between the two is to explain how culture influences technology adoption which is based on the synthesis of analysis in the previous chapter. In addition, the value of this proposed framework would assist application developers as to how cultures influences' m-health adoption for diabetes patients in disadvantaged communities.

5.5 The attainment of the research objective

The research method followed a qualitative approach by first reviewing literature pertaining to technology adoption and culture in relation to diabetes patients. The literature allowed the researcher to develop a deep-rooted understanding of the phenomenon and identify a model and framework to answer the main research question. The section below summarises how the objectives have led to a response to the main research question *"How does culture influence m-health acceptance by diabetic patients in disadvantaged communities?"*. Throughout the research process, each of the sub-questions has been answered. The main research question depicted in Table 1, is answered in objective 3 briefly and objective 4- *to recommend interventions that might lead to improvements in m-health acceptance for diabetic patients*, is discussed in section 5.9 and 5.10 and therefore is not discussed in this section. It can therefore be concluded that all the research objectives have been achieved through the research process.

5.5.1 Objective 1

"To identify which user acceptance models are appropriately aligned to a study of culture"

This sub-question was achieved through reviewing literature. A number of user acceptance models were revealed by investigating deeply into the literature. Several of these user acceptance models have been developed in the last decade and a half. In this study, the models were narrowed down to the pertinent models that related to the research question. The models that were defined and discussed are Theory of Reasoned Action (1975), Technology Acceptance Model (1989), Theory of Planned Behaviour (Ajzen, 1991), Unified-Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and UTAUT2 (Venkatesh, Thong & Xu, 2012). By assessing these models, it was found that the Theory of

Reasoned Action explains less variance in behavioural intention to use technology (Venkatesh et al., 2003). The Technology Acceptance Model can be applied to study m-health acceptance and has been used to study culture (Hoque & Bao, 2015). The Theory of Planned Behaviour has been used to predict self-care behaviours of type 2 diabetic patients (Boudreau & Godin, 2014; Traina et al., 2016), the cultural orientations of individuals (Albar, Anderson & Gallegos, 2015; Arpaci, 2016) and the impact of culture on physical activity (Shukri, Jones & Conner, 2016). The UTAUT model has been used to investigate mobile phone and health application adoption (Cillers, Viljoen & Chinyamurindi, 2017; Hoque & Sorwar, 2017) and espoused culture (Alshare & Mousa, 2014). However, it was found that constructs of this model did not sufficiently explain the low levels of adoption of ICT (Petersen, Pather & Tucker, 2018). Additionally, it has been suggested that focusing on a community, country and culture is a constraint for the UTAUT2 model (Alam et al., 2020). The UTAUT2 has been used in technology adoption and culture studies (Baptista & Oliveria, 2015; Dwivedi et al., 2016). By discussing the prominent models of user acceptance and identifying literature related to the research, the researcher identified that the UTAUT2 is the best model to examine culture and technology adoption by diabetic patients.

5.5.2 Objective 2

"To derive a framework that defines the concept of culture"

To answer this objective the researcher first defined the term culture. Culture is a broad concept and therefore the researcher used definitions of culture given by various authors (Tylor, 1871; Rohner, 1984; Kluckhohn & Strodtbeck, 1961; Hofstede, 1980). By reviewing literature, it was found that culture can be considered at 6 different levels three of which are national, organisational and individual (Hofstede, Hofstede & Minkov, 2010) and culture can influence technology adoption and use. However, there is very little evidence of the influence of culture on technology acceptance at an individual level (Sun, Lee & Law, 2019).

Many cultural models exist however, the researcher discussed the most significant cultural models that are imperative to this research. Trompenaars & Hampden- Turner (1997) and Hofstede's cultural dimensions (1980, 2010) were discussed. Trompenaars and Hofstede's cultural dimensions were critiqued and examined to identify which of these models will be applicable to this study of the dimension of culture for this research population. The researcher identified Hofstede's cultural dimensions as a suitable framework.

5.5.3 Objective 3

"To determine which cultural factors affect the acceptance and use of m-health for diabetes

self-management."

To answer the sub- question, UTAUT2 and Hofstede's cultural dimensions have been utilised as a lens to investigate m-health acceptance and culture amongst diabetic patients. The researcher identified in chapter 4 that Hofstede's cultural dimensions indeed influence technology adoption. Chapter 4, together with a summary in a form of a table (Table 11) discusses and answers this research sub- question and the relationships that emerged from the data are depicted in Figure 9 above.

5.6 Assessment of qualitative research

To ensure that validity and reliability was achieved in this study, the criteria for assessing qualitative research are discussed below.

Qualitative researchers consider credibility, transferability, and dependability and confirmability (Lincoln & Guba, 1985) as the standards by which qualitative studies are assessed. These factors serve as proxies for validity and reliability of qualitative research.

5.6.1 Research Credibility

Credibility is the first criterion in establishing trustworthiness in research. Credibility is comparable to internal validity in quantitative research (Lincoln & Guba, 1985). Credibility refers to the confidence in the accuracy of the research findings. More specifically, credibility ascertains if the research study's findings are a true reflection of the situation from the perspective of the participants (Lincoln & Guba, 1985).

Peer debriefing and member checks were used in this research as strategies to establish trustworthiness. Peer debriefing "provides inquirers with the opportunity to test their growing insights and to expose themselves to searching questions" (Guba, 1981:85). Qualitative researchers are required to request academic assistance from other academics who are prepared to offer scholarly insight. In contrast, member checking is a technique wherein the data collected, data analysis and conclusions are discussed with the participants in the study, rather than academic colleagues. This strategy allows participants to correct any errors, and the option to provide additional information which they deem necessary. In addition, member checks remove researcher bias when interpreting findings (Anney, 2014).

In this research, the following were conducted as part of peer debriefing and member checks.

- The interviews were transcribed, and aspects of the interviews were imported into excel. Moreover, the transcribed interviews were provided given to a writing coaches

for them to provide feedback. This strategy helped enhance the value of the interviews and findings.

- The research results were presented to other researchers and a thesis coach as part of the research progress. The feedback received helped improve the understanding of the research findings, and it also helped with writing up the research findings section of the research.

5.6.2 Research transferability

Transferability is like external validity in quantitative studies (Lincoln & Guba, 1985). The term transferability refers to the degree to which qualitative evidence can be transferred from one study to another that is in a different context or setting (Lincoln & Guba, 1985). More specifically, research transferability is created by affording the reader with confirmation that the research results can be applied to a different research population and situation. Lincoln & Guba (1985) state, "it is, in summary, not the naturalist's task to provide an index of transferability; it is his or her responsibility to provide the database that makes transferability judgements possible on the part of potential appliers" (1985:316). In other words, the researcher's role is to give an indication that the research can be applied in a different study.

Purposive sampling and thick description have been used to address transferability. As stated by Li (2004) thick description "enables judgments about how well the research context fits other contexts, thus thick descriptive data, i.e. a rich and extensive set of details concerning methodology and context, should be included in the research report" (2004:305). When researchers provide detailed descriptions of a setting, the results become more vibrant and realistic (Creswell, 2014). To determine whether this study can be transferred to another study, the research population, research setting, and inclusion is discussed. In this study, cases were chosen that embody culture and technology adoption. The research was carried out in disadvantaged communities Mitchells Plain and Strandfontein, a majority of the participants was *'Coloured'* and a minority was *'Indian'*. These participants are rich in cultural orientations, but technology adoption is low in these areas due to their socio- economical background. Twenty type 2 diabetic patients were purposely sampled, and only type 2 diabetes patients formed part of this study.

5.6.3 Research Dependability

Dependability is similar to reliability in quantitative research (Lincoln & Guba, 1985). Dependability refers to the steadiness of the study's findings over time and the degree to which the research procedure is detailed. This allows a researcher who is not part of the

research team to audit and evaluate the research process (Polit, Beck & Hungler, 2006; Sandelowski, 1986)

In this study, dependability was achieved through an audit trail (Figure 10) and a code-recode strategy. An audit trail refers to defining the research process from the start of the project to the advancement and write up of the research results (Korstjens & Moser, 2018). According to Halpern (1983), the six categories of information that make up an audit trail are "raw data, data reduction and analysis products, data reconstruction and synthesis products, process notes, materials related to intentions and dispositions, and instrument development information". The code-recode strategy refers to coding the data more than once with a gestation period between each coding (Anney, 2014). This strategy provided more in-depth insight into the data patterns, and it aided the researcher to improve the delivery of respondents' narratives. Figure 10 below depicts the audit trail of this research.

5.6.4 Research Confirmability

Confirmability refers to establishing that the findings can be confirmed by others (Lincoln & Guba, 1985). Many strategies exist to establish confirmability. To ensure confirmability, the data collection method and analysis must be clearly described.

Phase 1: Collecting data from type 2 diabetes patients in Mitchells Plain.

Phase 2: Collecting data from type 2 diabetes patients in Strandfontein.

Twenty interviews were conducted, and the textual data were transcribed in English. Participants that responded in Afrikaans were (where necessary) translated into English. Atlas.ti 8 was used to analyse the data and themes emerged from the data using thematic content analysis. The themes generated from the coding process were then used for the development of the merged framework that formed a conceptual framework (Figure 9). In addition, the researcher recorded a physical audit trail to describe the research process, which is depicted in Figure 10.

The physical audit trail below (Figure 10) demonstrates that this research has been carried out using a logical and linear approach.

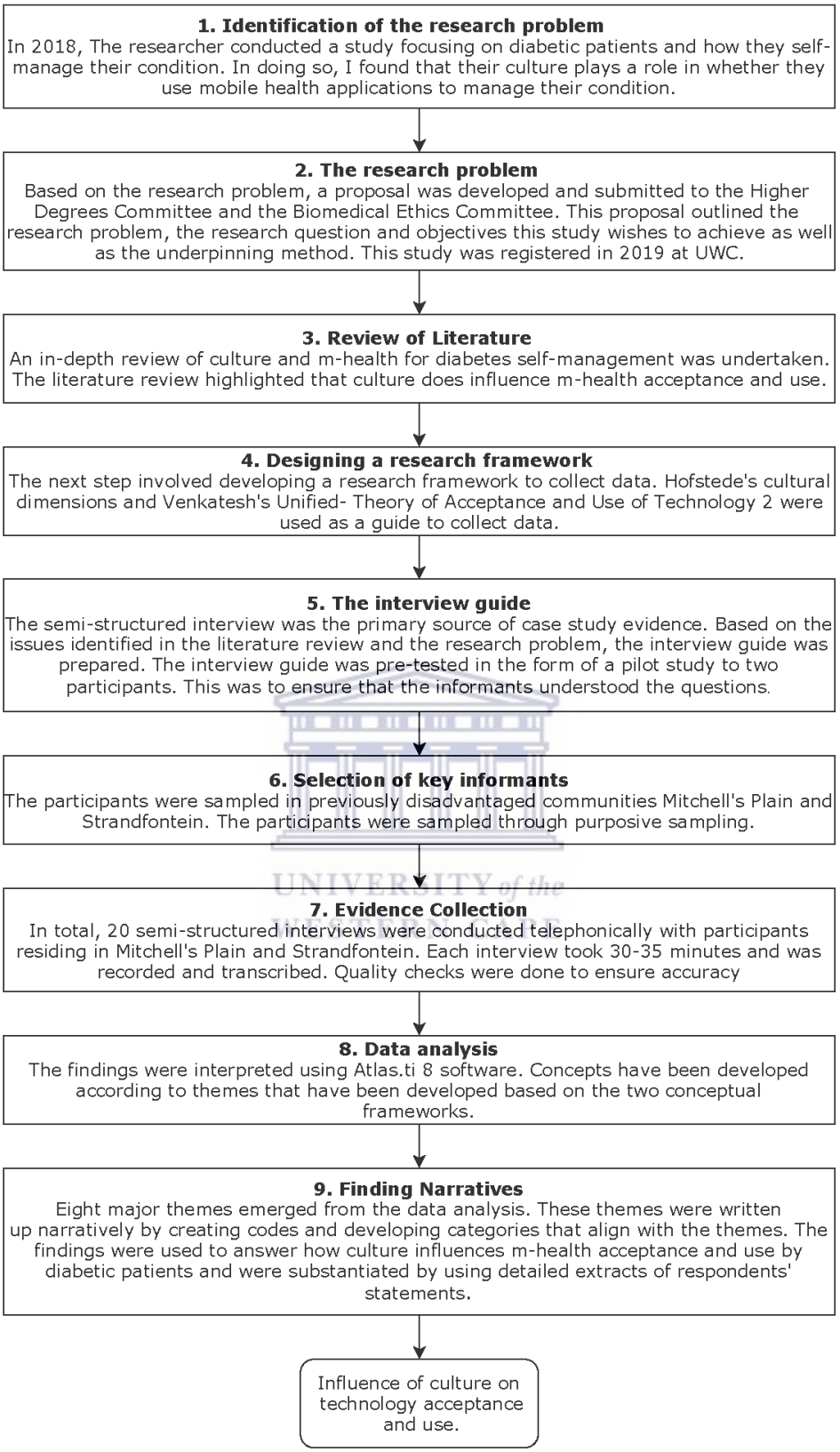

Figure 10: Physical Audit Trail

5.7 Contribution of research

This study draws on the extant frameworks (UTAUT2 and Hofstede's cultural dimensions), subjecting it to empirical investigation in this problem domain and as a result, has determined how the constructs inter-relate in this problem context; and providing evidence of the role of culture in technology adoption amongst diabetic patients in previously disadvantaged communities. The major contribution for the study is an understanding of the application of this conceptual framework in this health context. To date there has been no other study applied in this kind of health context to investigate the role of culture. In essence, this research brought new understanding as to how respondents feel about mobile health applications and how their culture influences their acceptance and use of these applications.

In addition, this study contributes to the academic body of knowledge regarding culture and diabetes self-management in previously disadvantaged communities. This study contributed to a better understanding of culture and technology adoption and how the cultural constructs influence the perceptions of performance and effort expectancy, social influence, facilitating conditions, price value, habit and hedonic motivation, in the context of m-health adoption and diabetes self-management. Long term, this could result in improved disease management, which could contribute to SDG 3 amongst disadvantaged populations.

5.8 Limitations of the study

The research was conducted telephonically rather than face-to-face due to the COVID-19 pandemic. This posed a challenge as additional work had to be done to ensure that participants understood the research objective and what the study entails. As this research was only conducted in previously disadvantaged communities, the findings are only applicable to other populations of similar social and economic status. Another limitation in this study was that many of the respondents were not using a mobile application for diabetes self-management and thus could not form a habit. This indicates that while analysing the data, more than one code could not be developed under the category "continuous discipline", as only a minority of the participants were habitual mobile health application users.

5.9 Recommendations for future research

Given that the study was only done in Mitchells Plain and Strandfontein, it is therefore suggested that future research should be conducted in other areas in the Western Cape, specifically in the Cape flats to see whether the same sorts of results will be achieved in different communities. This could help policymakers and application developers tailor mobile applications for this target population. This research findings could be implemented by

creating a cultural sensitive m-health application for diabetic patients in the low income area within the Western Cape.

The findings in the study indicated that this research population belongs to an uncertainty avoidance culture and that the distrust in using mobile applications is a hindrance to adoption and use by diabetes patients. As uncertainty avoidance is prevalent in technology acceptance (Özbilen, 2017), it is therefore suggested that future research should explore the reasons why diabetic patients lack trust in using a mobile application for diabetes self-management.

As the researcher merged two frameworks to answer the research question, the research framework (Figure 7) can be used as a tool to research technology adoption and culture in a different context, culture and country.

To conclude, the phenomenon of culture and technology adoption is more than a decade old. As the effect of a consumer's intention varies from one culture to another (Alshare & Mousa, 2014), investigating cultural factors provides reasonable justification for more studies in this field, since it is difficult to transfer technology from developed countries into developing countries or from one culture to another (Chung, 2015). It is therefore recommended that another study similar to this one be conducted in another developing country to identify similarities and differences in type 2 diabetic patients' value orientations.

5.10 Implications for policy and practice

This study was conducted as a result of high prevalence of diabetes in the Western Cape. Although opportunities exist in which people can use technologies to improve the way they manage diabetes, they are reluctant to use it due to various reasons as seen through prior research (Petersen et al., 2019; Petersen et al., 2020). Research indicated that there is a very low prevalence of m-health application uptake and use (Petersen, Pather and Tucker, 2018). The study was set out to understand why there is a low prevalence of m-health applications being used in particular low-income communities in the Western Cape. Prior research noted factors that influences technology uptake and use. However, the current study provides evidence of how culture impacts on the use of technology of mobile applications.

As the researcher has obtained a good understanding of culture and how it links to technology adoption in the context of diabetes self-management through the research findings, the knowledge can be shared with stakeholders. This knowledge can be shared as a policy note to the South African Department of Health (DoH) public healthcare system with the intention that they may get into a pro conscientization by creating awareness to the use of promoting

mobile applications for patients to self-manage their diabetes. This is not limited to any organised intervention, but this understanding would help the DoH lead a more successful awareness campaign. If policy makers understand the nature of how technology uptake is negatively influenced by culture, then they can mitigate those in programs by promoting technology use.

The challenges encountered in m-health projects by government have been influenced by numerous factors. These include a lack of alignment and integration of the interventions into health plans, lack of interoperability and use of open-source options and a lack of a single framework to evaluate m-health tools in strengthening the health system (Department of Health, 2015). The DoH strategic goals for m-health (2015-2019) are to prevent disease, reduce its burden, promote health and develop an efficient and effective health management Information Systems for improved decision making (Department of Health, 2015).

The government has implemented several m-health initiatives to support their health programmes. One of the initiatives developed was the MOMConnect programme which proved to be a useful tool in educating and encouraging woman to use services during and after pregnancy. Another initiative implemented by government in clinics and hospitals is the development of a Stock Visibility Systems (SVS). This m-health application is designed to increase "access to accurate, timeous medicine availability information from health facilities" (National Department of Health, 2019:16).

Government should ensure that policies are more reactive to the specific requirements of diabetic patients' culture. Specific attention must be given to improved policies, planning and prioritisation for diabetes, with particular attention to the culture and the uptake and use of technology.

While conducting and analysing the research data, it became clear that the communities trust the role of their healthcare practitioner and therefore a doctor plays a huge role in changing the discourse around mobile application adoption. As the Department of Health, it is their responsibility to train doctors to use an m-health application as the patient trusts their doctor and they will be more willing to use an application when a healthcare professional provides them with this information. In addition, facilitators can promote m-health applications at diabetes support groups to promote technology adoption and mitigate low levels of technology use. It is recommended that the healthcare system should holistically work together to introduce and normalise the use of m-health applications. This will allow more

people to become aware of m-health applications. Another novel intervention could be that the Department of Health uses the findings of this study as a framework to provide their patients with a culturally sensitive, tailor-made m-health application that is zero-rated. This will not only reduce cost as a factor that hinders uptake and use but will serve as a culture specific m-health intervention that will reduce low levels of technology adoption.

5.11 Chapter summary

The purpose of this chapter is to present the summary of the findings based on the results found in the previous chapter. In addition, this chapter followed with the attainment of research objectives, validity and reliability in qualitative research, the contribution and limitation of this study and recommendations for future research. This study indicates that Hofstede's cultural dimensions can be used to study culture and technology adoption in the context of diabetes self-management. The key findings indicate that culture can have both a positive and negative influence on mobile application adoption. In terms of Hofstede's cultural dimensions, masculinity/femininity can have a negative influence on mobile application adoption while indulgence can have a positive influence on mobile application adoption. The findings also indicated that uncertainty avoidance can have a positive and/or negative influence on mobile application adoption. This chapter concludes that all the research objectives were achieved, through an analysis of literature review and an analysis of qualitative data. Validity and reliability were achieved through peer debriefing and member check for research credibility, purposive sampling for research transferability and an audit trail for research dependability. The research contributed to a better understanding of culture and technology adoption in this context of the WC and the researcher recommended that future research on culture and technology adoption can be conducted in other disadvantaged communities as this can assist government and policymakers to create interventions that could assist with the successful adoption of mobile applications for health.

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UNIVERSITY of the WESTERN CAPE

Faculty of Economic and Management Sciences
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Appendix A: Research Project Information Sheet

Project Title:	*The role of culture in mobile application adoption amongst diabetes patients in previously disadvantaged communities in the Western Cape.*

What is this study about?
My name is Mariam Jacobs, a student at the University of the Western Cape (South Africa) pursuing a Masters' Degree in Information Systems. I am conducting a study based on diabetes patients and how they self-manage their condition. This study is solely for academic purposes. The results of this research will also be used to inform policymakers such as the United Nations develop a greater insight into how diabetes patients manage their condition

Is it compulsory to participate in in this research and may I stop participating at any time?
Your participation in this research is completely and entirely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, there is no penalty.

What will I be asked to do if I agree to participate?
If you agree to participate in this research project, you will be asked to complete an interview guide to examine your intention to use mobile health applications for diabetes self-management. This could potentially take up to approximately 30 minutes. If you choose not to answer any question, you do not have to.

Would my participation in this study be kept confidential and is my anonymity protected?
You are not required to provide any personal details, such as your name or clinical information, such as blood glucose readings. All other details such as your age, education, type of diabetes etc is therefore anonymous. This interview guide will be in a form of a semi-structured interview. Data will be stored in a private Google drive account and only the supervisors assigned to this study will have access to the information. Your responses are therefore anonymous. The study will use coding software, Atlas.ti 8 to facilitate the analysis and provide an overall view of the results. This will be presented in themes pertaining to culture and technology acceptance.

What are the risks of this research?
There are zero known risks associated with participating in this research process. This research will not expose you to any harm as a result of your participation.

What are the benefits of this research?
The outcomes of this study will serve to inform policy makers about the influence that culture has on mobile health acceptance and use amongst diabetes patients. The outcome of the study will serve to inform and improve current m-health related intervention which would result in improved or successful adoption and uptake of ICT.

What if I have questions?
If you have any questions feel free to contact Mariam Jacobs, the researcher. My cell-phone number is 084 334 7500 and my e-mail address is 3462668@myuwc.ac.za.
You may also contact study leader: Prof Shaun Pather, University of the Western Cape, Department of Information Systems, Telephone: +27 21 9593248, Email: spather@uwc.ac.za

NOTE: This research project has received ethical approval from the Biomedical Ethics Research Committee of the University of the Western Cape (BM19/8/6), Tel. 021 959 2988, email: research-ethics@uwc.ac.za

UNIVERSITY of the WESTERN CAPE

Faculty of Economic and Management Sciences
Department of Information Systems

Appendix B: Research Participant Consent Form

Project Title:	*The role of culture in mobile application adoption amongst diabetes patients in previously disadvantaged communities in the Western Cape.*

Please tick Yes or No to each of the following

	Yes	No
1. I confirm that I have read and understand the information sheet explaining the above research project and I have had the opportunity to ask questions about the project.		
2. I confirm that I am over the age of 18 years.		
3. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences.		
4. I understand that should I not wish to answer any particular question or questions, I am free to decline.		
5. I understand my responses and personal data will be kept strictly confidential.		
6. I give permission for members of the research team to have access to my anonymised responses.		
7. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result for the research.		
8. I agree for the data collected from me to be used in future research.		
9. I understand that there are no risks or harm to myself by participating in the interview guide.		
10. I agree to take part in the above research project.		

If you have indicated YES to all the above, click on the arrow to continue to the Survey

Proceed to survey

Please direct all queries to:

- Mariam Jacobs, the researcher. My cell-phone number is 084 334 7500 and my e-mail address is 3462668@myuwc.ac.za.
- You may also contact study leader: Prof Shaun Pather, University of the Western Cape, Department of Information Systems, Telephone: +27 21 9593248, Email: spather@uwc.ac.za

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Appendix C: The research instrument - Interview Guide

This interview aims are to improve the self-management of diabetic patients by assessing how diabetic patients in marginalized communities manage their condition. This interview consists of questions of two theoretical frameworks; Hofstede' cultural dimensions and the Unified-Theory-of-Acceptance and Use of Technology 2 (UTAUT2). Furthermore, the AADE7™ Self-Care Behaviors related to diabetes https://www.diabeteseducator.org/living-with-diabetes/aade7-self-care-behaviors were incorporated to understand participants' attitudes towards managing their self-care activities with the assistance of a mobile application. Moreover, the biographical information will be recorded last to ensure validity of the results. The information provided by the participants will be kept confidential and no information will be given to any third parties. This interview guide is for patients with type 2 diabetes mellitus residing in disadvantaged communities. The interview should take between forty-five minutes to an hour to complete.

Introductory comments to interviewee

Good day and thank you for participating in my study which is about diabetes patients and how they self-manage their conditions.

I would like to commence by discussing 7 self-care activities that you may or may not be already aware of.

Diabetes self-management is based on 7 self-care behaviour activities. During our interview, I will be referring to "self-care activities" - This is explained as follows:

1. **Healthy eating –** This is described as understanding the food groups that may or may not have a negative impact on your condition. This will help to maintain your blood glucose levels.
2. **Being active –** May be perceived as any form of exercise such as walking and/or running.
3. **Monitoring –** self-monitoring includes activities to help manage diabetes complications such as foot checks and blood glucose levels**.**
4. **Taking prescribed medication –** consuming medication provided by a registered health professional.
5. **Problem-solving –** is a strategy to attain each of the seven self-care behaviours and includes following a sequence of steps to effectively self-manage diabetes.
6. **Healthy coping –** This is described as participating in activities that help diabetes patients cope with their condition. This includes, faith- based groups, forming part of diabetes support groups and/or taking up hobbies**.**
7. **Reducing risks –** This is described as implementing risk reduction behaviours in your daily life to prevent or slow down the advancement of diabetes complications.

During our interview I will also be referring to mobile health applications. **Therefore, I would also like to explain to you what a mobile health application is and provide you with examples of what an app for diabetes self-management looks like.**

An m-health application is something that you use on your mobile phone and sometimes on tablet computers as well. mHealth applications may be used to self-manage diabetes. It has functionalities that can assist you in doing self-care activities (Healthy eating, exercise etc).

Examples of a diabetes app is provided at the end of this document.

GENERAL:

a. Do you have a mobile phone?

b. Do you use any application on your mobile phone? If yes, which app/s

Prompt: Social media apps (Facebook, Whatsapp), Email, Healthy apps (diabetes app, walking app, diet app)?

c. How do you feel about using an app to help you manage your diabetes?

i. **Probing:** Would you be keen on trying an application for diabetes self-care activities

Question	Source
1. **Current users of a diabetes management app**: When you made the decision to use APP X, what expectation did you have about how it would help you improve the way you did your daily diabetes management? Please explain your answer. 2. **Respondents who are not using an app**: Consider the examples of applications that I showed you. What is your expectation as to how it will help you with your daily diabetes self-management activities? Explain.	UTAUT2 (Performance expectancy)
3. **Current users of a diabetes management app**: When you made the decision to use APP X, how have you benefited from using the app for diabetes self-management. Please explain 4. **Respondents who are not using the app**: What do you think of using an APP for diabetes self-management activities? 5. **Respondents who are not using the app**: What are the reasons for not using an app for diabetes management? 6. **Probing:** How you balance time spent on your diabetes self-management and family time?	UTAUT2 (Performance expectancy)
7. **Current users of a diabetes management app:** When you first started using APP X, did you think that using an application would be difficult? Please explain your answer. 8. **Probing:** Think about the time when you first started using APP X, do you think you would have kept on using the APP even if it might have been a little difficult at the beginning? Explain	UTAUT2 (Effort expectancy)
9. **Respondents who do not use an app:** Do you think it that using an APP for diabetes self-management will be easy?	UTAUT2

Explain? **10. PROBING:** Do you believe that you could in future become skilful at using an APP for diabetes self-management? Explain	(Effort expectancy)
11. Current users of a diabetes management app: Think about the time before you started using APP X. Were there any people (e.g., family, friends, people in the community, work colleagues) who were influential in getting you to start using APP X? Explain why. **12. Probing:** Do you think that the quality of your diabetes related decisions is normally better than that of making decisions with your doctors/nurses at the clinic? Explain	UTAUT2 (Social influence)
13. Respondents who do not use an app: In what ways does/did your family (or close friends / associates) support you in your diabetes self-management? **14. Probing:** Do you prefer making decisions about your diabetes related activities on your own or do you prefer to consult your doctor? Please explain? **15. Probing:** In your opinion, do you feel uncomfortable if you disagree with your doctors/health team regarding diabetes self-management? Explain	UTAUT2 (Social influence)
16. Current users of a diabetes management app: When you first started using your app, what do you think were the factors that made is easy for you to start? **Prompt**: skills, access to a network, affording cost of data **17. Probing:** If any of your circumstances had to change that will prevent you from using the app, what would they be? **18. Respondents who do not use an app:** What are the factors that would make you use an app for diabetes self -care activities. **Prompt:** skills, access to a network, affording cost of data	UTAUT2 (Facilitating conditions)
19. Current user and non- current user: are there anyone available to assist you in using an app, if so, what assistance is available? **Prompt:** Family, help desk, tech supporter **20. Non- User:** Probing: Does the idea of using an APP for diabetes self-management stress you out?	UTAUT2 (Facilitating conditions)
21. Current users of a diabetes management app: Think about a time when you started using APP X, did you find the application is fun, enjoyable, entertaining? Please explain **22. Respondents who do not use an app:** Do you think using an application for diabetes self-care activities will be fun, enjoyable, entertaining? Please explain **23. Probing:** Do you care more about living a healthier lifestyle with diabetes than some people you know? Please explain	UTAUt2 (Hedonic Motivation)
24. Current users of a diabetes management app: Think about a	UTAUT2

time before you started using APP X. Did the issue of the cost of obtaining the app, and the ongoing costs of using it worry you at all? Explain **25. Probing:** Would you keep using the APP even if it's not free? **26. Respondents who do not use an app:** Would you download a diabetes APP that you have to pay for? **27. Probing:** How important is saving money to you?	(Price Value)
28. Current users of a diabetes management app: Think about the time when you started using APP X. Since then would you say you use it regularly? If so, how regularly? Explain **29. Probing:** Do you think that the app became easier to use over time? Please explain	UTAUT2 (Habit)

Demographic Questions:

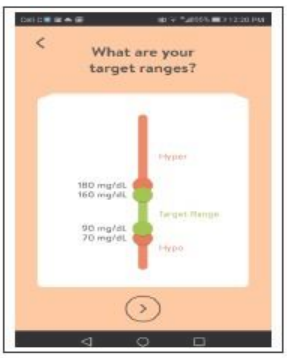
- What is your age? _____
- Male / Female? _____
- What are you currently doing? _____
- What type of diabetes do you have?
    - Type 2- insulin resistant, using oral diabetes medication e.g., metformin or
    - Type 2- using oral diabetes, medication and insulin
- What is your race group? _____
- What is your marital status? _____
- What is your educational level? _____
- Which language do you speak? _____
- Do you have medical aid? _____
- Which area do you currently reside in? _____

Appendix D: Example of a diabetes mobile application - MySugr

Once you download the app and sign in the app will ask you this question.

Once you state the type of diabetes you have the app will ask you this question

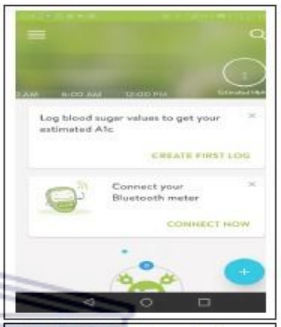
The app will ask you which measurement you use. For eg in SA we use grams



You will put your finger on the target area and press the arrow

Click which meter you use and press on the arrow

If you don't use a glucose sensor, scroll down and click non



Once all information is completed you will come to this screen as you can connect your accu- chek to the app

Press the menu button- three lines in the left corner (previous picture). Once you do this you will see this page above. Press logbook

This is where you insert your readings for the day. If you connected your accu-chek to the app the glucose readings will be automaticallv on here

Once you have your information in you can press on the options below for eg, if you fasting you tap on the option.

You can scroll across the options as well. Eg, if you cleaning you tap on the option. You can also customize the cells

As you can see right on top, you can set reminders as well 😊

You may also insert your information here. Once you click on the calculator next to Insulin (food). The bolus calculator will pop up

The Bolus calculator suggest the right amount of insulin to get in your blood sugar range

As I mentioned earlier, go to the menu option and connect your Accu-check to your phone via Bluetooth. There is a step by step guide

Once all your information is captured the app will look like this but with your information

Appendix E: Example of an interview transcript

INTERVIEWER: Do you have a mobile phone?

INTERVIEWEE: Yes, I do have cell phone

INTERVIEWER: Do you use any application on your mobile phone? For example,
Social media apps like Facebook, WhatsApp or healthy apps like a diabetes app, walking app that track the steps you take per day or a diet app?

INTERVIEWEE: Yes, I do.

INTERVIEWER: Which apps do you use?

INTERVIEWEE: I use all of the social media apps such as Facebook, Instagram, LinkedIn and WhatsApp.

INTERVIEWER: Do you use any apps for diabetes self-management? Such as walking app or apps that have the self-care activities functionalities?

INTERVIEWEE: You know the phone comes with a step tracker, so I use that. I also use an app called Mysugr which tracks your food intake, blood sugar levels and many other things.

INTERVIEWER: How do you feel about using the app to help you manage your diabetes

INTERVIEWEE: I like it uhm. it's interesting

INTERVIEWER: When you made the decision to use MySugr, what expectation did you have about how it would help you improve the way you did your daily diabetes management? Please explain your answer.

INTERVIEWEE: I expected it to be very easy to use, very user friendly not complex with lots of unnecessary functions that serves no purpose and I expected it to track my progress like the step tracker that comes on the phone does**.**

INTERVIEWER: When you made the decision to use MySugr, how have you benefited from using the app for diabetes self-management. Please explain

INTERVIEWEE: The app provided loads of benefits. For example, I was able to keep track of my glucose levels which helped me decide what I could eat on a daily basis [giggles].

INTERVIEWER: When you first started using MySugr, did you think that using an application would be difficult? Please explain your answer.

INTERVIEWEE: I didn't think It would be difficult. For me, it was just something that I had to get used too. I would say I'm good with technology so using the app is easy and very convenient.

INTERVIEWER: Think about the time when you first started using the app, do you think you would have kept on using the APP even if it might have been a little difficult at the beginning? Explain

INTERVIEWEE: Yes, I would have because my family especially my mother and wife want a report of how I manage my diabetes [giggles]. So I show them the app so they can get off my case. I'm a working man so I don't always have time to write down my glucose levels and keep track of everything so I knew having an app on my phone would help me in that regard that is what would kept me trying to use the app because I know the benefit of it.

INTERVIEWER: Think about the time before you started using the app. Were there any people such as family, friends, people in the community or even your work colleagues who were influential in getting you to start using the app?

INTERVIEWEE: My family and my work colleagues. When I was diagnosed with diabetes my wife would read up on it and send me links to lots of information and that is how we (me and my wife) came across a diabetes app. My family supports me in using the app. They remind me to use the app every time and I'm Indian so we eat lots of oily foods so they would always tell me to watch what I eat and do because my kids will follow what I do.

INTERVIEWER: Do you think that the quality of your diabetes related decisions is normally better than that of making decisions with your doctors/nurses at the clinic? Explain

INTERVIEWEE: I don't think the decisions I make will be better than a doctor. A doctor is qualified even though he does not know my body, his advice is always much more better. I do think that I manage my diabetes better when I use the app because I can take all the things, I do such as my eating habits and medication intake, like you call it self-care activities.

INTERVIEWER: Do you prefer making decisions about your diabetes related activities on your own or do you prefer to consult your doctor? Please explain?

INTERVIEWEE: A bit of both. I like to consult my doctor when I visit him but when I am not around him, I will use my own advice and do what I think best. If I am unsure and my doctor is not available, I will just research it by looking on google and see what there is.

INTERVIEWER: Google doesn't always provide accurate information

INTERVIEWEE: Yes, I know, but I also check on the diabetes support group Facebook page if what I am doing is okay or if someone had the same concern as me previously

INTERVIEWER: In your opinion, do you feel uncomfortable if you disagree with your doctors/health team regarding diabetes self-management? Explain

INTERVIEWEE: I don't feel uncomfortable. We are all people. I have nothing to be afraid of.

INTERVIEWER: When you first started using your app, what do you think were the factors that made is easy for you to start? Factors such as skills, access to a network, affording cost of data.

INTERVIEWEE: My family encouraged me to use the application so that made it easier. Also, I have access to the internet so that is a plus. Also, I'm from the younger generation who knows how to work a cell phone. So, having the skills made it much easier.

INTERVIEWER: If any of your circumstances had to change that will prevent you from using the app, what would they be?

INTERVIEWEE: Situations that will make this hard will be, If my family grows any bigger, if the application receives any feature updates and if I no longer have data bundles to use the application I wouldn't bother with it. This is because the application takes up my time and also money for data that I could have rather spent on my children.

INTERVIEWER: are there anyone available to assist you in using an app, if so, what assistance is available for eg; family, help desk, tech supporter.

INTERVIEWEE: yes, my family is available they will always support and help me where they can because they know diabetes is a life-long condition and they always try to encourage me to seek any help I can get if it's via an app, support group or just researching

INTERVIEWEE: Think about a time when you started using APP X, did you find the application fun, enjoyable, entertaining? Please explain

INTERVIEWEE: yes, it was cool, I started watching my phone as I took steps just to see if it works but now it's just part of my daily life. So yes, it was fun and enjoyable at first. Regarding my sugar app, uhm it wasn't fun because everything I ate I had to record on the app.

INTERVIEWER: Think about a time before you started using APP X. Did the issue of the cost of obtaining the app, and the ongoing costs of using it worry you at all?

INTERVIEWEE: nah, the step count app comes with the phone and my sugar app had to be downloaded but it was free on the app store. There is a paid version of the sugar app, but it isn't needed.

INTERVIEWER: Would you keep using the APP even if it's not free?

Interviewee: not at all. The free apps are just convenient and helps me manage my daily diet and blood glucose level.

INTERVIEWER: Think about the time when you started using APP X. Since then would you say you use it regularly? If so, how regularly? Explain

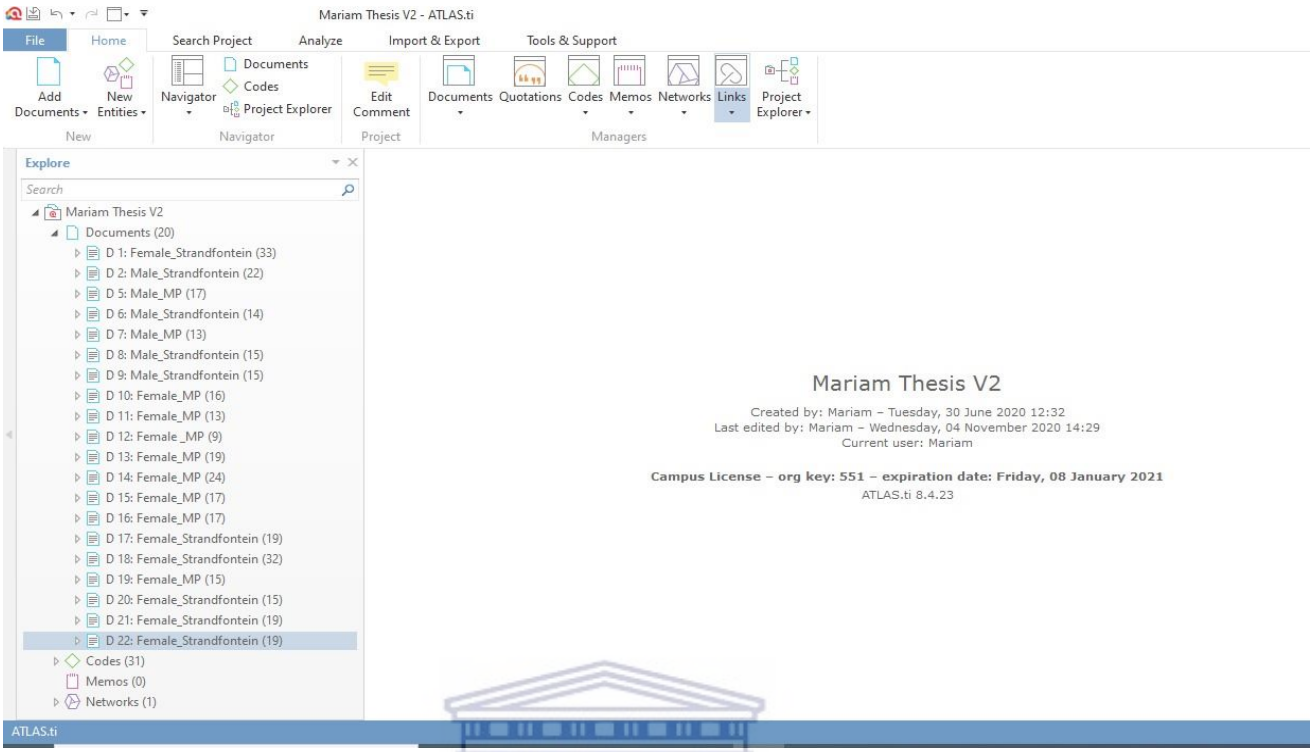
INTERVIEWEE: the day I realised it was on my phone, which was immediately. For the sugar app, I use it every day to record my diet so that when I go to the doctor for anything diabetes related, I will show him my diet and my blood glucose history.

INTERVIEWER: Do you think that the app became easier to use over time? Please explain

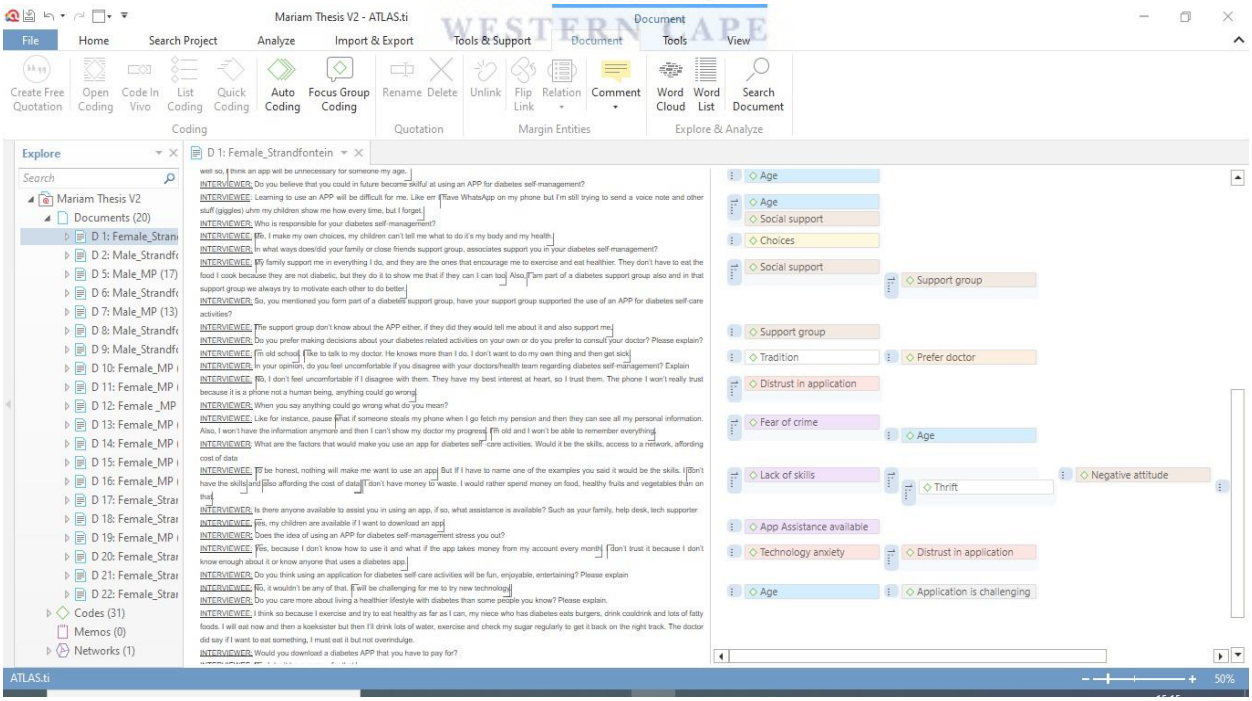
INTERVIEWEE: yes, at first it was a little tough because I was not sure what to expect but now it's very simple because I know what the apps do and how it functions.

Appendix F: Screenshots from Atlas.ti 8

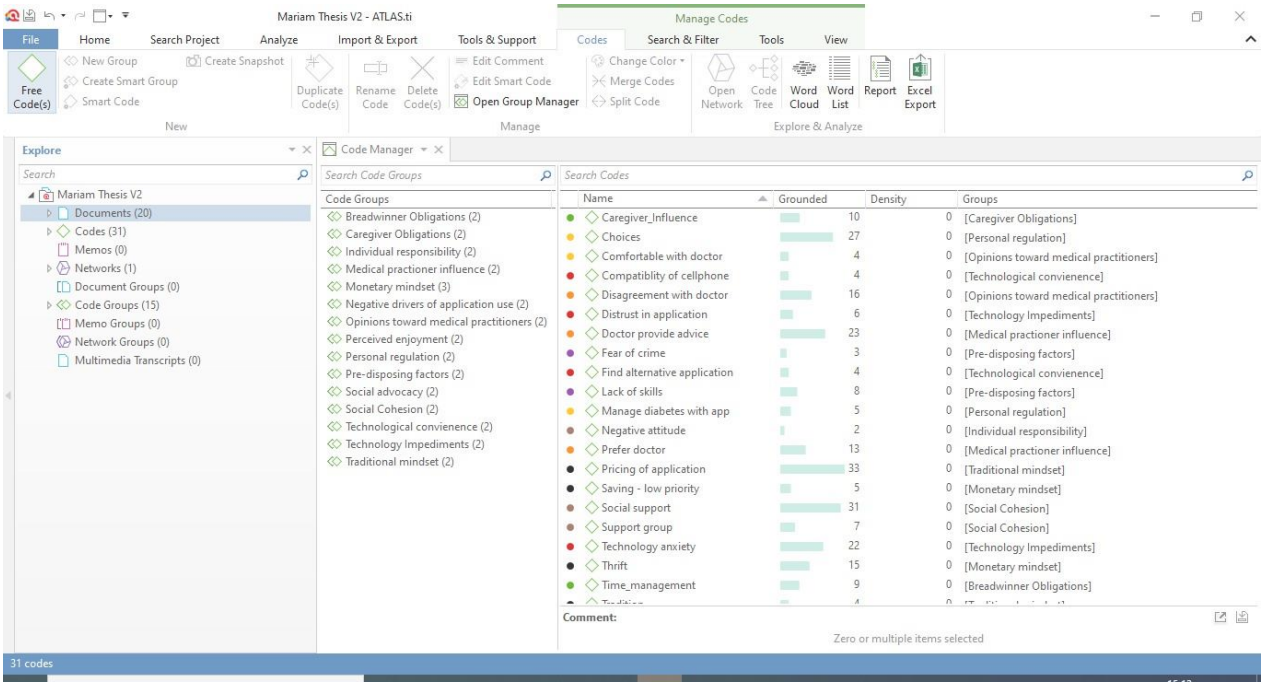
Uploaded documents to Atlas.ti



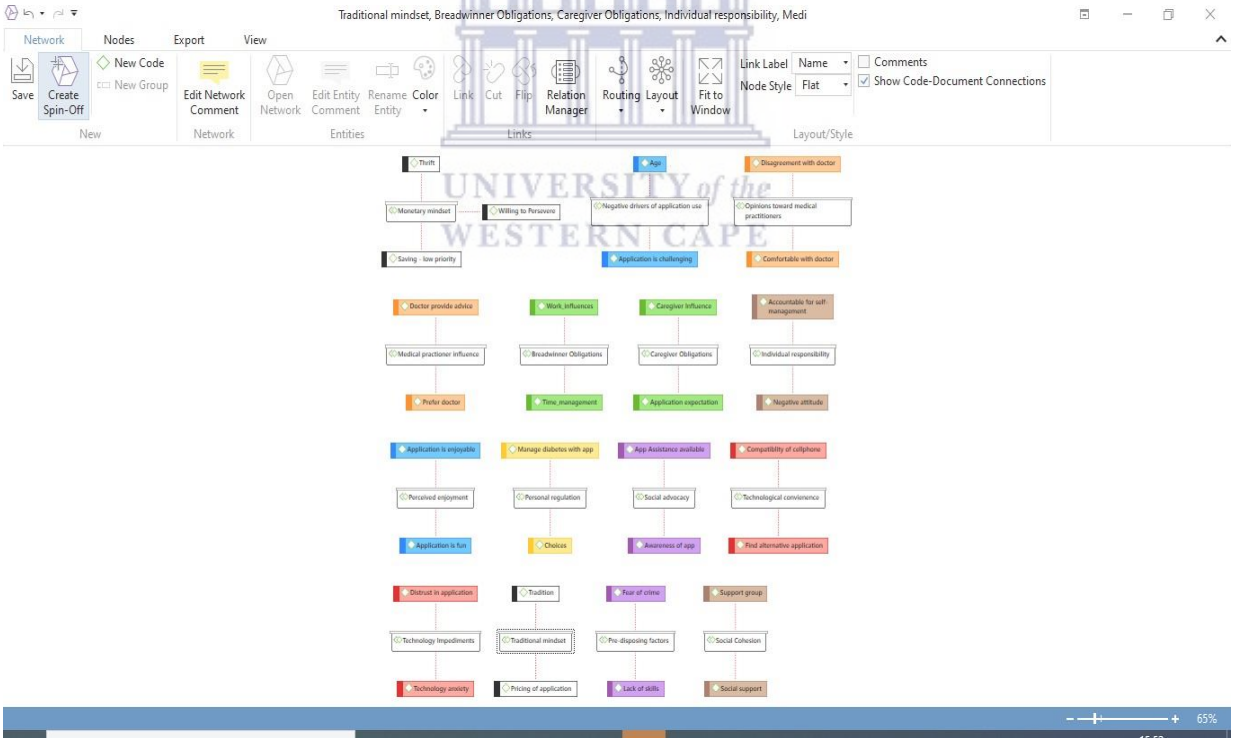
Codes and the associated quotes from interview transcripts



Codes with the associated categories



All codes with the associated categories colour coded



Network diagram of quotations associated with the category breadwinner obligations and caregiver obligations