THE DEVELOPMENT AND IMPLEMENTATION OF COPING STRATEGIES FOR PEOPLE LIVING WITH DIABETES MELLITUS TO ADAPT TO CHANGING TEMPERATURES AT HEALTH CARE CENTRES OF LIMPOPO PROVINCE, SOUTH AFRICA

by

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DECLARATION

I, **Khizamane Joyce Mbombi**, hereby declare that the dissertation, "**The Development and Implementation of Coping Strategies for People Living with Diabetes Mellitus to Adapt to Changing Temperatures at Health Care Centres of Limpopo Province, South Africa**", submitted to the **University of Limpopo**" for the **Doctor of Philosophy (PhD) in Nursing Science** degree, is my own work and that all sources used have been duly cited in the text and the list of references. This thesis has not been submitted previously for a degree at this or any other institution.

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DEDICATION

This thesis is dedicated to the memories of my late parents, William (father) and Merriam Manganyi (mother), mother-and father-in-law, Flora and Wilson Mbombi. I would also like to pay tribute to my husband, Dr Thomas Mbombi, my children, Bhoteke, Thomas and Nyeleti, my nephew, Victor Mbebe, and my supervisors and people living with diabetes mellitus in Limpopo Province.

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ABSTRACT

Introduction: Several parts of South Africa, including Limpopo Province, have been experiencing high temperatures with limited rainfall and desertification. The effects of both cold and hot temperatures have been noticed with higher susceptibility among People Living with Diabetes Mellitus (PLDM). The heat weakens their thermoregulatory and orthostatic responses because they respond to high temperatures. During cold periods the apparent loss of efferent vasomotor control during diabetes neuropathy was particularly evident.

Purpose of the study: The purpose of this study was to develop and implement the coping strategies for PLDM to adapt to changing temperatures at the health care centres of Limpopo Province.

Methods: A mixed method exploratory sequential research design was used, which is collecting and analyzing qualitative data, based on qualitative results. A questionnaire was developed for qualitative data collection. The study population consisted of all PLDM for more than a year who come for treatment at the health care centres of Limpopo Province. Purposive sampling and simple random sampling methods were used to select 185 participants for the research study. Data were analyzed by Tesch's open-coding method and the Statistical Package for the Social Sciences (SPSS Version 25) with the assistance of the university Biostatistician.

Results: PLDM experiences many challenges with regard to the impact of changing temperatures. PLDM have expressed different coping strategies to adopt to changing temperatures, perceived learning needs on coping strategies during changing temperatures, and the description of available services to address challenges related to changing temperatures.

Conclusion: To assist PLDM to adapt to changing temperatures, ongoing implementation of coping strategies should be instituted. The Limpopo Province Department of Health has to offer scheduled continuous in-service training sessions about the impact of changing temperatures on PLDM for all categories of nurses.

Keywords: coping strategies, changing temperatures, people living with diabetes mellitus

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LIST OF ABBREVIATIONS AND ACRONYMS

ADDIE	Analyze, Design, Develop, Implement, and Evaluate
CHC	Community Health Care Centre
DoH	Department of Health
DM	Diabetes Mellitus
IDF	International Diabetes Federation
MMR	Mixed Methods Research
PLDM	People Living with Diabetes Mellitus
SA	South Africa
SPSS	Statistical Package for the Social Sciences
T1DM	Type 1 Diabetes Mellitus
T2DM	Type 2 Diabetes Mellitus
TREC	Turfloop Research and Ethics Committee

DEFINITION OF CONCEPTS

Adaptation	The Oxford Advanced Learner's Dictionary (Deuter & Bradbery, 2015) outlined that adaptation is to make alterations or to change. In this study, adaptation refers to activities that PLDM practice daily to manage their conditions to adapt to changing temperatures.
Coping	According to the Cambridge Dictionary (2019), coping is to deal with a difficult situation successfully. In this study, coping refers to how PLDM employ coping strategies to manage themselves to adapt to the changing temperatures.
Diabetes Mellitus	Lewis, Bucher, Heitkemper, Harding, Knowing & Roberts (2017) defined diabetes mellitus as a chronic multisystem disease characterized by hyperglycemia related to abnormal insulin levels or utilization, or both. In this study, diabetes mellitus refers to the high and low level of blood glucose in the bloodstream that people consulting at Health Care Centres in Limpopo Province have.
Health Care Centre	Health Care Centre is the basic structural and functional unit of the public health services in developing countries, to provide accessible, affordable, and available primary health care to people (World Health Organization, 2016). In this study, Health Care Centre is a facility that normally provides primary health care services, twenty-four maternity services, accident and emergency services and beds where health care users (PLDM) can be observed and collect their monthly treatment.
People Living with Diabetes Mellitus	PLDM are those who have been diagnosed with diabetes by a medical doctor or health professionals. In this study, PLDM refer to people who have been diagnosed with diabetes mellitus who come for treatment at health care centres of Limpopo Province.
Strategies	Strategies are plans designed to achieve long-term aim or goals (DeRobertis, 2006; Horney, 1950; Jackson, 2022). In this study, strategies refer to the series of activities that will help in improving the knowledge of PLDM to employ coping strategies to manage themselves to adapt to the changing temperatures.
Temperature	Temperature is the hotness and coldness as measured with a thermometer (DeRobertis, 2006; Horney, 1950). This study refers to heat and cold environmental conditions experienced by PLDM and is consulting at Health Care Centres in Limpopo Province.

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 Introduction and Background

Globally, diabetes mellitus (DM) is an epidemic that is affecting the lives of several individuals daily (Mandal, 2015). Currently, 422 million people are estimated to be living with DM worldwide and it is a major concern because the number of diabetic cases is expected to double the number by the year 2030 (IJAR, 2017). According to Seposo, Dang & Honda (2017), worldwide DM has been on the rise and affects not just high-income countries, but also has increased among middle-income countries and the following multiple factors might be contributing to the increase in diabetes mellitus prevalence: sedentary lifestyle, variety of food consumption, and even climate change (Kaur & Kochar, 2017; Rudolph *et al.*, 2018). Extreme temperature events are observed to be increasing in their frequency, duration, and magnitude since 2016 and the number of people exposed to heatwaves increased by around 125 million.

Extended periods of day- and night-time high temperatures create cumulative physiological stress on the human body which exacerbates the top causes of death, including respiratory, cardiovascular, diabetes mellitus and renal disease (Méndez-Lázaro *et al.*, 2018). Diabetes Mellitus will be the 7th leading cause of death globally by 2030 (World Health Organization, 2016). It is commonly recognized that temperature extremes raise the risk of mortality and morbidity from cardiorespiratory conditions (World Health Organization, 2018). People Living with Diabetes Mellitus (PLDM) are also at increased risk, for example, in the United States of America, PLDM were reported to have a 17% higher risk of dying during hot days compared to other subjects, which was greater than for any other disease considered (Kenny *et al.*, 2016).

This is probably due to compromised heat dissipation among diabetics which increases the risk of heat related illness. Furthermore, the condition can lead to an impaired vascular response similar to that commonly observed among the elderly during cold temperature (Hajat *et al.*, 2017). The International Diabetes Federation (IDF) (2015) documented that the effect of high-temperature causes dehydration and heatstroke with increased morbidity and mortality in PLDM, and further suggested that there is an urgent need for climate change mitigation and the development of coping strategies that those who are already affected could use to adapt (Kaur & Kochar, 2017).

The Intergovernmental Panel on Climate Change (IPCC) anticipates an increase in the frequency of extreme heat and heat waves as global-temperatures rise, and PLDM in regions such as the Middle East, sub-Saharan Africa, and India, will be much affected (Core Writing Team of the IPCC *et al.*, 2007). Sub-Saharan African countries have been identified to be at risk of an increase in diabetes with the possibility of expanding by 2030 and reaching 34.2 million by 2040. The occurrence of diabetes amongst adults in South Africa (SA) nearly doubled from 5.5% to 9% between 2000 and 2009 (Bertram *et al.*, 2013; Bradshaw *et al.*, 2007). Furthermore, it is projected that an additional 5 million SA individuals have pre-diabetes which is a chronic illness where insulin resistance affects the blood glucose levels to increase above normal (Bertram *et al.*, 2013; Bradshaw *et al.*, 2007).

Health 24 (Ottermann, 2012) documented that approximately 3.5 million South Africans are suffering from diabetes, and there are many more that are undiagnosed (Grundlingh *et al.*, 2022). This is a great concern which warrants pro-active action from health care professionals to develop preventative and coping strategies for diabetes mellitus (Pheiffer *et al.*, 2018). Recently, SA has experienced high temperatures with limited rainfall and desertification in several parts of the country (Nembambula, 2018). Recently the effects of temperature on diabetes mellitus have been noticed with higher susceptibility to both cold and hot temperatures. The heat weakens the thermoregulatory and orthostatic responses because they respond at high

temperatures, whilst during cold periods the apparent loss of efferent vasomotor control during diabetes neuropathy was noted (Yang *et al.*, 2016). The impact that high temperatures will have on the health of people living in Southern Africa is not yet clear. This is particularly worrying since the increases are projected to continue because of climate change (Garland, 2015; McGeehin & Mirabelli, 2001).

Extreme heat with diabetes can be dangerous because heat affects bloods glucose levels. Heat and moderate to high activity can make a person to sweat profusely and PLDM may become dehydrated, leading to a rise in blood glucose levels. PLDM feel the heat more than people who don't have DM because certain DM complications such as damage to the nerves affect the sweat glands which makes the body not cool effectively and lead to heat exhaustion and heat stroke, which are medical emergencies (Dain & Hadley, 2012).

Bega (2019) indicated that Limpopo Province's higher indoor and outdoor apparent temperatures present a greater risk of adverse health impacts, including heat cramps, heat exhaustion and heat stroke. Increase in temperature may exacerbate existing chronic conditions such as cardiovascular diseases, respiratory disease, and diabetes-related complications. It was against this background that the study is aimed at the development and implementation of strategies for PLDM to adapt to changing temperatures at the health care centres of Limpopo Province.

1.2 Research Problem

Polit & Hungler (2013) defined the problem statement as an expressed dilemma or troubling situation that needs intensive investigation and provide for new inquiry. Therefore, in this section, the researcher has outlined the problem statement for this study by indicating what could be the problem in the context of this study. According to Bega (2019), the African region will be subjected to more intense heat extremes over a shorter time period with projections predicting increases of 4-6°C in annual average maximum temperatures for Southern Africa between 2071 and 2100. Higher temperatures in Limpopo Province will increase by 4-7°C for the period 2080-2100,

which will exacerbate existing chronic health conditions such respiratory disease, cardiovascular diseases, cerebrovascular disease, and diabetes-related conditions (SA medical research council's environment health research unit, 2019). Furthermore, exposure to extreme temperatures has been associated with a high mortality rate (Méndez-Lázaro *et al.*, 2018; World Health Organization, 2018; Yardley *et al.*, 2013). PLDM are susceptible to seasonal changes in temperature. PLDM can have serious complications from both the exposure to high and low temperatures (Kapwata *et al.*, 2018; Lam *et al.*, 2018; Rene, 2022; Seposo *et al.*, 2017).

More often individuals look forward to changes of the season, but the changes in temperatures can be uncomfortable for PLDM. Heat and cold temperatures can be a very dangerous health risk which can also affect the metabolism and release of hormones resulting in many complications (Hajat *et al.*, 2017; Kapwata *et al.*, 2018; Labban, 2017; Tien *et al.*, 2016). It has been reported that a rise in temperature can contribute to hypoglycaemia in PLDM as they are unable to adjust to increased temperatures (Blauw *et al.*, 2017). The study further indicated that the following are the clinical manifestations that those who are extremely affected might present with: frequent urination, blurred vision, and weight loss.

News 24 (2012) reported that a study conducted at Phiphidi village in Vhembe District of Limpopo Province assessed the effects of changing temperatures on type 2 diabetes mellitus (T2DM) management and found that PLDM lack coping strategies during extremely hot conditions. The study conducted by Nembambula (2018) emphasized the need for national and provincial comprehensive heat response and education awareness for people living with chronic conditions. Those with pre-exciting health conditions such as DM, respiratory conditions, cardiovascular conditions, and the economically disadvantaged communities are particularly vulnerable to heat-related illnesses, and the majority of homes in rural areas of Limpopo are exposed to high temperatures that could affect their health due to lack of resources. Therefore, this study aimed at developing and implementing coping strategies for PLDM to adapt to changing temperatures in Limpopo Province, whereby health care centres of Limpopo

Province were used to access the targeted population of this study from the communities.

1.3 Paradigmatic Perspective

The research paradigm concerns the research's source, nature, and knowledge development (Bilau *et al.*, 2018). The use of a paradigm guided the researcher to select the relevant methods in positioning and reporting the study. The following perspectives of the research paradigm were applied: pragmatism, dialectics, epistemology, and ontology. The research paradigm will be discussed in detail in Chapter 3. In the context of health care research, researchers paradigmatic positioning relates to their understanding of the nature of knowledge (their epistemological standpoint) and of reality (their ontological standpoint).

1.4 Theoretical Framework

The theoretical framework is the conceptual starting point and the frame of a research study that incorporates a specific crew of beliefs and ideas that relate to the phenomena of inquiry (Anderson-Meger, 2016; Anderson-Meger, 2017; Bezuidenhout *et al.*, 2014). The theoretical framework in this study focuses on the theory of Sr Calista Roy's philosophical assumptions and adaptation model of nursing (George, 2011; Whittemore & Roy, 2002). The theory was used to guide the study and served as a basis for the development of coping strategies for PLDM (Tappen, 2023). The detailed framework from this study is elucidated in Chapter 2 of this study.

1.5 Purpose of the Study

The purpose of the study was to develop and implement coping strategies for PLDM to adapt to changing temperatures at the health care centres of Limpopo Province, South Africa.

1.6 Objectives of the Study

The objectives of the study were achieved according to the phases outlined below:

▲ **Phase 1: Empirical Phase**

This phase covered the first two objectives of this study:

Objective 1: Explore and describe the impact of changing temperatures on PLDM at the health care centres of Limpopo Province.

Objective 2: Describe the knowledge and practices of PLDM about the changing temperatures at the health care centres of Limpopo Province.

▲ **Phase 2: The Development of Coping Strategies**

This phase covered objective 3 of this study:

Objective 3: Develop the strategies for PLDM to adapt to changing temperatures at the health care centres of Limpopo Province.

▲ **Phase 3: Implementation of the Strategies**

This phase encompassed objective 4 of this study:

Objective 4: Implement the coping strategies for PLDM to adapt to changing temperatures at health care centres of Limpopo Province.

1.7 Research Questions

The following research questions guided the study according to three phases:

▲ **Phase 1**

- What is the impact of changing temperatures on PLDM at health care centres of Limpopo Province?
- What are the knowledge and practices of PLDM about the changing temperatures at the health care centres of Limpopo Province?

▲ **Phase 2**

- How can coping strategies for PLDM to adapt to changing temperatures at health care centres of Limpopo Province be developed?

▲ **Phase 3**

- How can coping strategies for PLDM to adapt to changing temperatures at health care centres of Limpopo Province be implemented?

1.8 Overview of the Research Methodology

The study was conducted in 3 Phases.

▲ **Phase 1**

A mixed method research (MMR) approach was followed to gain an understanding of the impact of changing temperatures on PLDM. The approach also assisted the researcher in achieving complementary results by using the strengths of the qualitative method to enhance the quantitative method. The sequential exploratory design, which involved a two-strand project, was applied wherein the researcher collected qualitative data in the first strand and analyzed the results. Thereafter, the results were used to build on the second quantitative strand. The results of both strands guided the development of coping strategies for PLDM to adapt to changing temperatures.

1.8.1 The Qualitative Strand

The qualitative strand consisted of 30 participants. Purposive sampling was used to select 30 participants. The pilot study was conducted among 5 participants. The pilot study assisted the researcher to refine the sampling strategy and the final data collection tool. Data were collected by the researcher through semi-structured one-on-one interviews using an interview guide. Thirty in-depth interviews were conducted until data saturation was reached.

Tesch's method of data analysis (Tesch, 1990), which comprises of eight integrated steps, was used to analyze the data (Creswell, 2014; de Vos, Strydom, Fouche & Delport, 2014). The eight steps are discussed in detail in Chapter 3 of this study. Six themes and twenty sub-themes emerged from this phase which informed the development of the quantitative data collection tool for the second phase of this study. To ensure trustworthiness, credibility, confirmability, dependability, and transferability were adopted in the study. The qualitative strand will be discussed in detail in Chapter 3.

1.8.2 The Quantitative Strand

In the quantitative phase of this study, the researcher utilized simple random sampling to select the 185 participants who participated in the quantitative phase of the study. SPSS version 26.0 was us for data analysis and descriptive statistics was used to assess the categorical variables. Validity and reliability were ensured by using various methods to collect data to obtain true information, such as questionnaires and one-on-one interviews. Validity and reliability will be discussed in detail in Chapter 3.

1.8.3 Integration of the Qualitative and Quantitative Results

Integration and interpretation of data were made by connecting the quantitative data to draw insights into information gained from the qualitative results (Berman, 2017; Fetters *et al.*, 2013). The following integrated results emerged:

- Participant's expression of their reactions to changing temperatures
- Challenges experienced by PLDM during changing temperatures
- Measures employed by PLDM to adapt to hot temperatures
- Measures employed by PLDM to adapt to cold temperatures
- Poor knowledge with regard to changing temperatures
- Recommendations suggested by PLDM

▲ **Phase 2**

1.8.4 Development of Strategies

In Phase 2 of this study, coping strategies for PLDM to adapt to changing temperatures were developed. The development of the strategies was based on the findings from both qualitative and quantitative results. The ADDIE model guided the development of strategies (Hsu *et al.*, 2014; Nichols Hess & Greer, 2016). More details of Phase 3 will be discussed in Chapter 3 (Research Methodology).

1.8.5 Implementation of the Strategies

This phase covered Objective 4 where coping strategies for PLDM were implemented. The implementation part of the ADDIE model was followed after the strategies were validated.

1.9 Ethical Considerations

Health science research depends on ethical standards that advance and guarantee respect for every human subject and secure their wellbeing and freedom (Masic *et al.*, 2014). More importantly, the bill of rights protects the rights of all people in South Africa and upholds the autonomous values of freedom, human dignity, and equality (Constitution of the Republic of South Africa, 1996). This study adhered to the following ethical standards and principles: ethical clearance, permission to conduct the study, informed consent, confidentiality and anonymity, right to privacy, principle of justice/non-discrimination, and the principle of beneficence. More details will be provided in Chapter 3.

1.10 Significance of the Study

The researcher hopes that the findings of the study may benefit the following:

▲ **People Living with Diabetes Mellitus**

PLDM may receive needed coping strategies that will assist them to adapt to climatic

changes.

▲ Nursing Profession

The outcome of the study may assist nurses in giving adequate support to PLDM.

▲ Research

The findings of the study may be useful in formulating the basis for further research and may also prompt other researchers to explore more on the developed strategies.

▲ Nursing Education

The findings of this study may also serve to increase the body of knowledge to nursing education on how to support PLDM and nurses who provide care toPLDM to adapt to changing temperatures at the health care centres of Limpopo Province.

▲ Nursing Administration and Policy

The findings of this study may be of benefit to the nursing management of health care centres to provide support to nurses in the form of training the nurses who provide ongoing care of PLDM to adapt to changing temperatures at the health care centres of Limpopo Province.

1.11 Arrangement of the Thesis Chapters

Table 1.1 summarizes the outline of the thesis.

Table 1.1: Arrangement of the thesis chapters

Chapter	Description
Chapter 1	**Overview of the Study** This chapter provided the introduction and backround to this study, including the research problem, paradigmatic perspective, theoretical framework, purpose of the study, phases and objectives of the study, research questions that guided the study, brief overview of the research methodology, ethical considerations, significance of the study and an outline of the thesis chapters.

Chapter 2	**Literature Review and Theoretical Framework** This chapter encompasses the reviewed literature related to the study. The theoretical framework which guided this study, namely, Calista Roy's adaptation model of nursing formed the basis of this study (George, 2011; Whittemore & Roy, 2002).
Chapter 3	**Research Methodology** This chapter presents a detailed overview of qualitative and quantitative research methodologies used in this study, focusing on the research design, study site, population and sampling, pilot study, data collection and analysis methods, and ethical considerations.
Chapter 4	**Presentation and Interpretation of the Findings** This chapter covers the presentation and interpretation of the findings for both the qualitative and quantitative strands and the application of Roy's theory.
Chapter 5	**Interpretation, Intergration and Discussion of the Findings** This chapter focuses on the interpretation, integration and discussion of both the results of the qualitative and quantitative phases of the study in relation to Roy's Adapation Model.
Chapter 6	**Development and Implementation of Strategies** In this chapter, the development of the strategies was based on the results of both quantitative and qualitative phases and guided by the ADDIE model.
Chapter 7	**Summary, Limitations, Recommendations and Conclusions** In this chapter, the summary of the research findings, the proposed recommendations, limitations and conclusions based on the study results are provided.

1.12 Summary

This chapter introduced the backround to this study, focusing on the the research problem, paradigmatic perspective, theoretical framework, purpose of the study, phases and objectives of the study, research questions that guided the study, brief overview of the research methodology, ethical considerations, significance of the study and an outline of the thesis chapters. The next chapter covers the literature review and theoretical framework that guided the study.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter provides an in-depth review of literature related to coping strategies for patients living with diabetes mellitus (PLDM) to adapt to changing temperatures. A literature review is defined as a written document that presents a reasonably contended incident established of knowledge about a topic of study (Machi & McEvoy, 2016). Literature was reviewed thematically as outlined in Bezuidenhout, Davis & Du Plooy-Cilliers (2014) using a narrative review method. The methodology, data sources, the research terms, the literature parameters, the research findings, the themes derived from the literature, and conclusion and recommendations of the findings are described extensively in this chapter.

2.2 Literature Sources and Methodology

The purpose of the literature review was to evaluate the discoveries of other researchers related to the research problem. The keywords used in the literature search were, but not limited to: Multiple combinations of: Effects of climate change diabetes mellitus patients; Adaptation strategies of people living with diabetes; Coping mechanisms of people living with diabetes to changing temperatures; Effects of hot temperature on people living with diabetes; Effects of cold temperature on patients living with diabetes mellitus; Coping strategies of people living with diabetes during extreme temperatures. The sources used included: Electronic databases, books, journal articles, Google Scholar, PubMed, ScienceDirect, BMC, BIOMED, Portal Journals and more.

Only sources written in English were included and sources were limited to the past 10 years so as to use recent literature, however, older sources were used in the absence of recent publications. The literature review method applied in this study was the Comprehensive Literature Review (CLR) (Onwuegbuzie & Frels, 2016; Onwuegbuzie *et al.*, 2016), which gave credibility to the research. The data were thoroughly assessed as it were, and furthermore in a moral and culturally progressive way. The following steps were followed:

Step 1: Investigating convictions and themes

Step 2: Starting the search

Step 3: Putting away and arranging data

Step 4: Choosing/deselecting information

Step 5: Growing the pursuit media, perceptions, archives, experts and auxiliary information

Step 6: Examining and synthesizing data

Step 7: Displaying the CLR report in a composed shape

2.2.1 Parameters

The findings of the literature search are summarized as follows:

- A total of 65 studies, both quantitative and qualitative, and 16 books were reviewed. Studies that did not meet the inclusion criteria were eliminated and only the studies which met the pre-determined inclusion criteria were included in the literature review.

2.2.2 Themes

The themes of the literature are as follows:

- The effect of hot temperature on PLDM
- The effect of cold temperature on PLDM
- Challenges experienced by PLDM during changing temperatures
- Practices employed by PLDM to cope during changing temperatures

2.2.3 The Effects of Cold Temperature on People Living with Diabetes

Gupta (2021) stated that seasonal changes have effects on diabetic patients because when the temperature drops, the blood sugar levels increase, therefore, the management of diabetes is a prime concern. It has been noted that low temperature can result in excessive cold stresses that strains the body of diabetic patients. Due to stress, the body can release hormones such as adrenaline and cortisol turning the body into a flight-or-fight mode. Furthermore, the liver can release more glucose for energy increasing blood sugar levels. Exposure to extreme cold weather can thicken the blood, making the affected individual more prone to blood clotting and posing further danger of high blood pressure (Orenstein & Welch, 2022).

HbA1c levels amongst PLDM tend to increase during winter months compared to summer months (Higgins *et al.*, 2009). The study by Tien *et al*. (2016) also concluded that cold weather may adversely affect HbA1c level in people with T2DM, especially those under 65 years old this is further supported by an article by Gupta (2021; Gupta *et al.*, 2017) who indicated that whatever the type of diabetes, an individual who has cold temperature can increase the level of HbA1c, this is most likely because of decrease in physical activity. More importantly, slight physical activity is recommended to reduce the blood glucose level. Chow *et al*. (2022) stated that PLDM must bear in mind that activity can affect blood glucose up to 48 hours a little bit of exercise helps to keep you warm. Keeping active is important even if the amount of physical exercise decrease, that is okay as long as the blood glucose level is under control and keep warm in the process.

In England, Neil, Dawson & Baker (1986) identified an increase in hospital emergency room visits amongst diabetic elderly women due to hypothermia. People with diabetes are the most hospitalized due to hypothermia when compared to the general population (Knowlton *et al.*, 2009). The findings are further supported by the study by Kenny, Sigal, & McGinn (2016) who indicated that individuals with both type 1 (T1DM) and type 2 diabetes mellitus (T2DM) are reported to be particularly vulnerable during extreme temperature events and account for a disproportionate number of hospitalizations and deaths.

2.2.4 The Effects of Hot Temperature on People Living with Diabetes

High temperatures can change how the body uses insulin (Zilbermint, 2020), and PLDM may need to test blood glucose levels more often and adjust insulin dosed and eat what they eat (Labban, 2017; Yardley *et al.*, 2013). According to a study by Kaur & Kochar (2017), people with underlying medical conditions such as diabetes are more vulnerable to the adverse health impacts of climate change. In hotter temperatures, dehydration and heatstroke increase morbidity and mortality (Association, 2021). PLDM are predisposed to cardiovascular events during heat waves and higher mortality from a heart attack on days of extreme temperature. Whether you are hot or shivering it is always necessary to take precautions to avoid temperature relating to blood sugar spikes (Orenstein & Welch, 2022).

A study conducted by Hajat *et al*. (2017) indicated that PLDM are at increased odds of medical consultation during days of temperature extremes. Public health information measures should, therefore, provide advice to PLDM about dealing with heat exposure. When the ambient temperature is hot, more people with diabetes end up in the emergency room and are hospitalized because of heat-related illness and further indicated that number of deaths in diabetes patients due to heat-related illness also increases in summer (Zilbermint, 2020). Patients with diabetes may have increased susceptibility to the heat because of impairment of thermoregulatory mechanisms and impaired orthostatic responses at elevated temperatures (Westphal *et al.*, 2010). According to a study conducted by Gill (2000), insulin kinetics and stability can be

altered by prolonged exposure to high temperatures.

The storage of diabetic treatment in the correct temperatures is also of high importance. The recommended temperature for all unopened vials cartridges and prefilled insulin delivery systems is 2-8 degrees and opened at ≤30 degrees for 28 days. Dain & Hadley's (2012) study has revealed that in most African countries refrigerator availability can be a challenge.

2.2.5 Challenges Faced by People Living with Diabetes During Changing Temperatures

During winter months individuals tend to eat more, therefore, individuals with diabetes must adopt healthy eating habits and keep watch over sugar levels for any rising trends in sugar levels (Chow *et al.*, 2022; Novo Nordisk South Africa, 2018). Thus, PLDM should keep an eye on their diet, cold weather can affect your diet, people tent to eat more during cold temperature as they like to eat "comfort food'. This concur with an article by Novo Nordisk South Africa (2018) which stated that winter food can be thought of as 'comfort food' because our bodies may require extra intakes to defend itself against the cold. So, PLDM should stick to their meal plans.

According to Gupta (2021) cold weather makes it difficult for most people to go out, for those with diabetes a little activity each day can help with insulin decrease and help the body to regulate sugar level. The study by Kenny *et al*. (2016) further indicated that physical activity recommendations for individuals with diabetes highlight their susceptibility to adverse heat-related events they should be caution against heat exertion in the heat.

In PLDM increased temperatures can be life-threatening (Méndez-Lázaro *et al.*, 2018; World Health Organization, 2018; Yardley *et al.*, 2013; Zilbermint, 2020). The following explains the reasons why PLDM experience hotness more than normal individuals who don't have diabetes. Here are the causes:

- Sweat glands that cause the body to cool can be affected by other diabetes problems, such as impairment of blood vessels and nerves. Consequently, heat exhaustion and heat stroke, follows, which is life-threatening.

- Dehydration with more frequent urination is likely to occur due to increased levels of blood glucose. Drinking plenty of water is recommended.

It should also be noted that the mixture of humidity and hotness (moisture in the air) can endanger the lives of PLDM. The evaporation (dries) of the skin eliminates heat and cools the body. It's harder to stay cool in high humidity because sweat can't evaporate as well. Diabetes tends to place individuals at greater risk for heat- and cold-related illness during extreme changing environmental temperature (Gupta, 2021; Méndez-Lázaro *et al.*, 2018; Orenstein & Welch, 2022; Sloane, 2021; World Health Organization, 2018; Yardley *et al.*, 2013). Recently, SA has experienced a tendency to increasing temperatures and reduced rainfall and desertification in many areas, which may impact the health of PLDM (Méndez-Lázaro *et al.*, 2018; World Health Organization, 2018).

2.2.6 Practices Employed by People Living with Diabetes to Cope During Changing Temperatures

Collins, Bradley, O'Sullivan & Perry (2009) identified the following coping strategies for PLDM during extreme temperatures: different self-care coping strategies that are influenced by their health care values which might and subsequently affect their diet and workout choices. High temperature tends to affect more PLDM than people in the general population. Therefore, it is recommended that they must wear loose-fitting light-coloured clothing. Frequent blood glucose testing is also recommended because increased temperatures and heat can change how the body uses insulin. Dehydration amongst this vulnerable group can also be prevented by drinking a lot of water even in the absence of thirst. This supported by an article by Hamaty (2020) stated that

extreme heat of summer affects blood sugar level, activity level, makes one to sweat and urinate frequently which may lead to dehydration.

Additionally, they are encouraged to engage in a good healthy lifestyle talks with colleagues, friends, and family, this will assist in lifting the mood. The study by Weller, Baer, Nash & Perez (2017) indicated that 60% of diabetics who are in control of their diabetes they have support from family. The study by Haupt, Berg, Paschen, Dreyer *et al*. (2005) found that PLDM showed that immersion of the fingers and forearms into cold water can affect the accuracy of glucometer, with the measurement taken from cold extremities causing underestimation of glucose level. The study by Dain & Hadley (2012) has revealed that to keep the insulin cool patients have developed unique adaptive strategies such as storing their medication in clay pots which contain sand and water and it hypothesized that cooling occurs by water evaporating through the porous clay.

However, the efficacy of the method of keeping insulin cool has not been critically assessed. It has been recommend that during winter months PLDM must warm their hands first before the blood testing is conducted because the cold weather affects the hands which could make the testing to be more difficult (Novo Nordisk South Africa, 2018; Sloane, 2021; St. Mary's Medical Center, 2018). Sloane (2021) recommended the following measures to be followed for medication storage and supplies for diabetic patients during the cold weather: The equipment for testing should always be protected from exposure to cold and kept indoors; to always remember to warm the monitor under their arms before testing; hot fluids in a non-insulated container can protect the equipment from freezing. Orenstein & Welch (2022) stated that PLDM should keep supplies out of cold because coldness affects insulin and causes the glucose monitor to stop working. They should take clear fluids such as water to replace lost fluids during sweating. The lives of PLDM can be endangered if regular blood checks are not done leading to diabetic ketoacidosis and dehydration and resulting in confusion.

According to the study by Kapwata, Gebreslasie, Mathee & Wright (2018) in rural areas

of Limpopo Province, people with pre -existing health conditions are more vulnerable to heat-related illness than others. in contrast, the study by Kenny *et al*. (2016) stated that individuals with diabetes are potentially more susceptible to the consequences cold stress. The aim of the study was to consider the relationship between the indoor and outdoor environmental temperature in rural settings and the study recommended that evidence of current and future adverse health effects will indicate priorities for planned adaptive strategies and strengthen the case for pre-emptive policies. Such observations can be used to inform the development and implementation of policies and practices around changing temperatures and health, especially in rural areas of SA.

2.3 Theoretical Framework: Roy's Adaptation Model

A theoretical framework is the conceptual starting point and the frame of a research study that incorporates a specific crew of beliefs and ideas that relate to the phenomena of inquiry (Bezuidenhout *et al.*, 2014). The theoretical framework will guide and direct this study so that it does not move away from its purpose. Sr Calista Roy's philosophical assumptions and adaptation model of nursing will form the theoretical framework of this study (George, 2011; Whittemore & Roy, 2002). Roy's adaptation model encompasses the four elements of person, environment, health and nursing. Figure 2.1 is a schematic representation of Roy's adaptation theory.

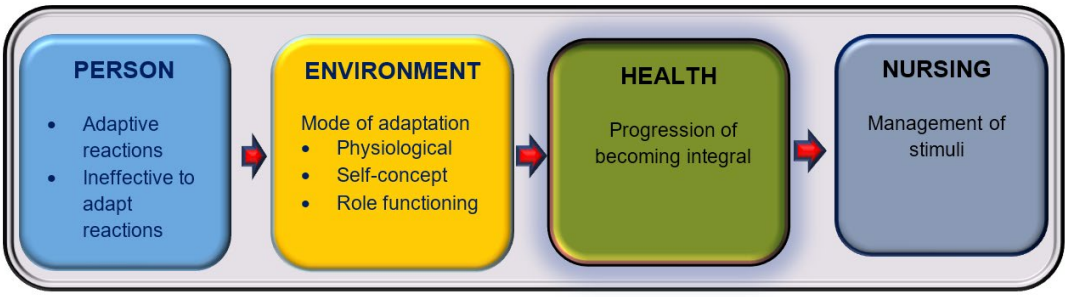

Figure 2.1: Schematic representation of Roy's adaptation theory (Whittemore & Roy, 2002)

2.3.1 Person

According to Roy's theory, a person is a highly adaptive system that receives input of external or environmental stimuli, is able to process or adapt to such stimuli internally, and produce output stimuli that affect the external environment (Polit & Hungler, 2013). In this study, a person refers to PLDM who have to face the impact of changing temperatures on a daily basis at the health care centres of Limpopo Province. The contextual stimuli are internal and external stimuli that may have a positive or negative influence on the situation. In this study, the context was the PLDM, health care providers, and challenges posed by changing temperatures and coping mechanisms with regard to changing temperatures. All these variables influence the adaptation of PLDM with regard to changing temperatures. The range of responses to stimuli or challenges is unique to the individual. The individual's experience also influences the adaptation level.

2.3.2 Environment

The model outlined the following four adaptive modes: physiological, self-concept, role function, and interdependence in which assessment of behaviour can be done. An individual internal or external stimulus determines the environment. In the context of this study, an environment refers to both the impact of hot and cold temperatures on PLDM.

2.3.3 Health

Health is a progression of becoming integrated and able to meet the goal of survival, growth, reproduction, and mastery. In this study, health refers to the daily practices which PLDM have employed in order to adapt to the changing temperatures.

2.3.4 Nursing

Nursing aims at promoting adaptive reactions in the four adaptive modes, using information about the person's adaptation level and focal, contextual, and residual

stimuli. Nursing activities involve the management of these stimuli to stimulate adaptive responses (George, 2011). The nursing process facilitates assessment of behaviours and stimuli, nursing diagnosis, goal setting, intervention, and evaluation. Behavioural assessment deals with the four adaptive modes, whereas the assessment of stimuli focuses on focal, contextual, and residual stimuli. Nursing diagnosis consists of stating the problem. Goals are set concerning the problem and are written in behavioural terms. In this study, interventions refer to planned activities employed by PLDM to manipulate the stimuli (impact of changing temperatures), and evaluate the person's output responses with desired behaviours established to develop and implement coping strategies PLDM to adapt to changing temperatures at health care centres of Limpopo Province and, for this study, DM patients (George, 2011).

2.4 Recommendations of the Literature Review

Few research studies have been done regarding to the impact of changing temperatures on PLDM. Therefore, it is crucial to know the impact of changing temperatures on PLDM. This study seeks to generate more evidence about the impact of changing temperatures on PLDM. More literature is therefore needed with regard to the impact of changing temperatures on PLDM.

2.5 Summary

This chapter encompasses the reviewed literature related to the study. The theoretical framework which guided this study, namely, Calista Roy's adaptation model of nursing formed the bedrock of this study (George, 2011; Whittemore & Roy, 2002). The next chapter presents the research methodology used in this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The purpose of this chapter was to describe and explain the research methodology that the researcher used in this study, which was organized as follows: the description of the research method and design, the study site, population, sampling procedures, sample size, data collection methods, data analysis and pilot study. The procedures to ensure validity, reliability, the trustworthiness of the research findings, and observance of ethical standards throughout the study are presented.

3.2 Research Method

The researcher adopted a mixed method research (MMR) approach which was appropriate when both qualitative and quantitative methods are merged to accomplish the purpose of this study. The use of MMR assisted the researcher to get a comprehensive understanding of the phenomenon. Creswell (2018) defined MMR as a method of investigation, which encompasses the collection of both qualitative and quantitative data, and thereafter the results of qualitative and quantitative are integrated.

Creswell & Plano-Clark (2018) further defined MMR as a process as a process of integrating quantitative and qualitative methods of collecting and analyzing data for a better understanding of a research purpose. For this study, the use of MMR was appropriate which involved collecting, analyzing, and integrating qualitative and quantitative data on coping strategies for PLDM to adapt to changing temperatures were developed.

The benefit of MMR is that it provides more evidence for explaining a research problem that both qualitative and quantitative research alone cannot produce (Creswell & Plano-Clark, 2018). The researcher wanted to obtain a dense description and quality of the study without deficiencies. The researcher chose the MMR approach to gather as much information as possible to assist in the development of the coping strategies for PLDM to adapt to changing temperatures.

3.2.1 Research Design

Research design is the framework of research methods and techniques chosen by a researcher to conduct a study (Bowling, 2014). The design allows researchers to sharpen the research methods suitable for the subject matter and set up their studies for success (Creswell, 2018). According to Botma, Greeff, Mulaudzi & Wright (2010), a research design is a proverbial backbone of the research study, which provides the structure for the research methods and design decisions that should take place to plan the study.

The study applied the exploratory sequential design which comprised of the following three phases. In the first phase, the researcher collected and analyzed qualitative data. Based on the qualitative results, the researcher developed a questionnaire that was used in the quantitative strand, for collection of quantitative data. In the third stage, the researcher integrated the entire results (Creswell, 2018). Figure 3.1 represents a schematic view of exploratory sequential designs outlined by (Creswell, 2018).

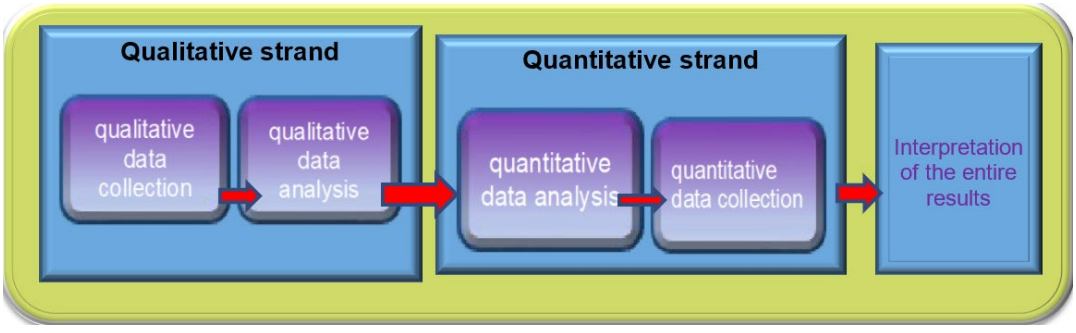

Figure 3.1: Schematic representation of an exploratory sequential design

3.2.2 Study Site

The Limpopo Province is one of the nine Provinces of South Africa situated in the north-eastern corner of South Africa and shares borders with Botswana, Zimbabwe, and Mozambique. The province is divided into five municipal districts, namely Capricorn, Sekhukhune, Mopani, Vhembe, and Waterberg with the tertiary hospital with two campuses in Capricorn District (Figure 3.2).

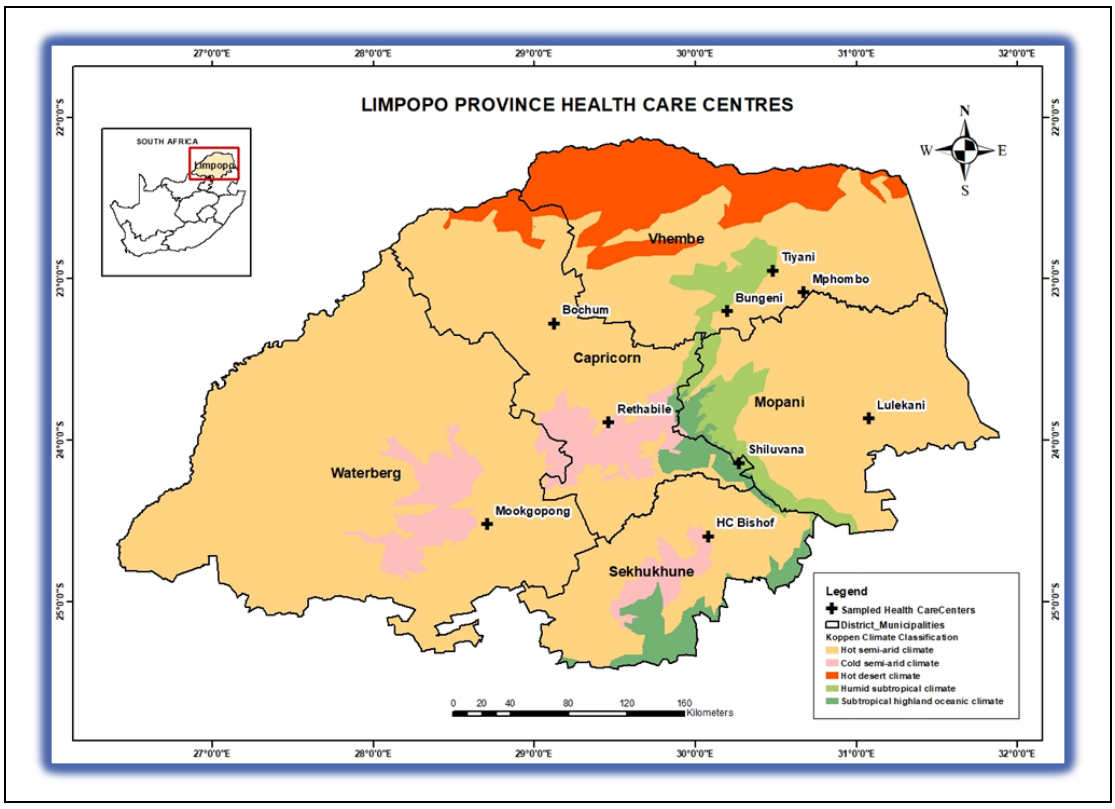

Figure 3.2: Map of Limpopo Province sampled health centres

The Limpopo Province Department of Health facilities consist of the following: 30 District Hospitals, 5 Regional Hospitals, 25 Health Care Centres, and 452 Clinics. In each Municipal District there are Health Care Centres, namely: Capricorn District—4 Health Care Centres, Mopani District—8 Health Care Centres, Sekhukhune District—3 Health Care Centre, Waterberg District—2 Health Care Centres and Vhembe District—8 Health Care Centres. Figure 3.3 is a schematic of the Limpopo Province health care structure.

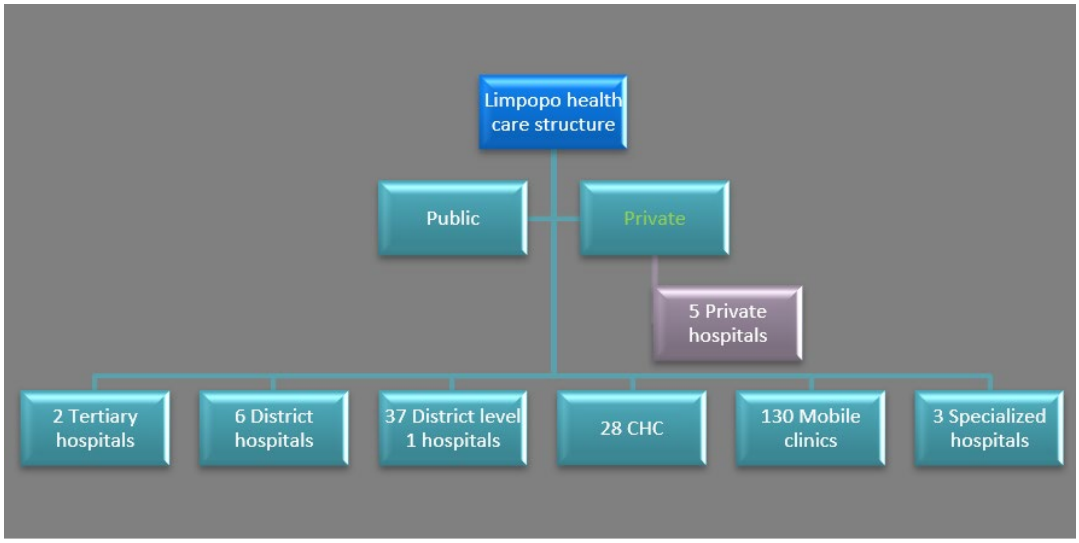

Figure 3.3: Schema of the Limpopo Province health care structure

The study was conducted at the Health Care Centres of each Municipal District of Limpopo Province. A Health Care Centre is the basic structural and functional unit of the public health services in developing countries, to provide accessible, affordable, and available primary health care to people (https://bphc.hrsa.gov/about-health-centers/what-health-center). Such a facility normally provides primary health care services, 24-hour maternity services, accident and emergency services and beds where health care users can be observed and which have a procedure room, but not an operative theatre. Table 3.1 summarizes the Limpopo Province Health Care Centres (LHCC) per District showing climate type and their annual minimum and maximum temperatures.

3.2.3 Population

A population is a complete set of participants that have the characteristics that are of interest to the researcher (De Vos *et al.*, 2011). In this study, the population was all PLDM who come for treatment at health care centres of Limpopo Province. An average of 397 diabetes mellitus patients are seen monthly in all selected health care centres. Therefore, the population for diabetes patients was 397. Population is also described according to participants per phase.

Table 3.1: Limpopo Province Health Care Centres (LHCC) per district: climate type and annual minimum and maximum temperatures

Health Care Centres	Type of climate	Annual-minimum temperature (ºC)	Annual-maximum temperature (ºC)	Municipal District
Bochum Health Centre	Hot semi-arid	20	31	Capricorn
Rethabile Health Centre	Cold semi-arid	17	31	Capricorn
HC Boshoff Health Centre	Hot semi-arid	18.1	29ºc	Sekhukhune
Giyani Health Centre	Hot semi-arid	22	33	Mopani
Shiluvane Health Centre	Humid subtropical	23	20.9	Mopani
Lulekani Health Centre	Hot semi-arid	23	34	Mopani
Tiyani Health Centre	Humid subtropical	19	22	Vhembe
Bugeni Health Centre	Humid subtropical	19	30	Vhembe
Mphambo Health Centre	Hot semi-arid	19	29	Vhembe
Mookgopong Health Centre	Hot semi-arid	18	29	Waterberg

3.2.4 Qualitative Strand of the Study

The first part of the study was qualitative. This is because all the qualitative facts lead to the quantitative part of the study and, based on the results, a questionnaire was developed for data collection in quantitative phase (Creswell, 2018). A qualitative approach was followed in this study to explore the knowledge and practices (Parahoo, 2014) of PLDM at the health care centres of Limpopo Province.

3.2.4.1 Sampling Method

Sampling is the process of choosing a portion of the population to represent the entire population. A sample comprises elements or subset of a population for actual inclusion in the study (De Vos *et al.*, 2011). Non-probability purposive sampling was used to

select participants who participated in the qualitative research study. Babbie (2020) defined purposive sampling as a type of non-probability sampling in which the participants to be observed are selected based on the researcher's decision about which ones will be the most useful. In this study, the researcher requested all PLDM because they were able to provide information on how they live with DM on changing temperatures.

▲ Inclusion Criteria

Inclusion criteria are characteristics that the prospective subjects must have if they are to be included in a study (Polit & Hungler, 2013). Inclusion criteria in this study were based on the following:

⌖ *Qualitative Phase*

All PLDM for more than a year, who collected their treatment at the sampled health care centres of Limpopo Province with the following characteristics:

- The participants were free from hearing problems so that they were able to follow verbal instructions.
- They were psychologically fit and provided sound information.
- They were PLDM for more than a year so they provided information with better experience.
- PLDM above 16 years of age.

▲ Exclusion Criteria

Exclusion criteria are the characteristics that disqualify prospective subjects from inclusion in the study (Polit & Hungler, 2013). Exclusion criteria were based on the following:

- All PLDM and were not willing to participate in the study.

- PLDM who have been diagnosed in less than a year.
- People who needed consent from guardians (are diabetic under-age and mental health care users).

3.2.4.2 Pilot Study

A pilot study is a mini-study conducted to test a small portion of the study before the main study is undertaken (Joubert *et al.*, 2007). For this study, a pilot study was conducted before the main study at Giyani Health Centre, the researcher purposively selected five PLDM to participate, and the five people did not form part of the main study. One-on-one interviews were conducted to pre-test the interview guide, to identify and rectify the flaws and weaknesses of the interview questions or interview skills for improvement. The pilot study also assisted the researcher to verify whether the questions in the interview guide answer the objectives of the study.

The researcher made prior arrangements with Giyani Health Centre Manager. The researcher went to Giyani Health Centre to select participants who meet the sampling criteria, to be included in the semi-structured, one-on-one interview sessions. The results of the pilot testing were positive. However, some amendments were done on the interview guide which include the rephrasing of the main question from “What are the coping strategies you using during changing temperatures?” into “Can you kindly explore and describe the experiences with regard to changing temperatures?”. The researcher made the implemented the changes on the interview guide.

3.2.4.3 Data Collection Method

Data collection is the gathering of information needed to address a research problem (Polit & Hungler, 2013). Data were collected using a one-to-one semi-structured interview. A one-to-one semi-structured interview was erected around central standard questions that allowed the participants to provide comprehensive information about their knowledge on study phenomena as guided by Botma *et al*. (2010). Data were collected from PLDM using a semi-structured one-on-one interview with an interview

guide at the selected 10 Health Care Centres. The central question that the researcher asked was as follows: “Can you kindly describe the strategies you are using to cope with regard to changing temperatures on daily basis?” The researcher asked follow-up questions supplementary to the standard questions based on the answer provided and the interview guide (Appendixes 4A-4D) (Mitchell & Jolley, 2014). A voice recorder was used to record the interview sessions provided and its use was clarified to the participants before starting with the sessions. A room free of interruptions was prepared in each Health Care Centre for the interviews to ensure that privacy was maintained. Participants were kept informed about the purpose and objectives of the study. The researcher sought a signed consent form from the participants for permission to conduct the interview (Appendixes 3A-3C).

- ***Information Session***

The information session was conducted two weeks before and on the day with participants during the one-to-one semi-structured interviews, the researcher outlined issues related to what is expected of the participants during the interviews. The researcher also explained the aim, objectives, and significance of the study together with the central question to be asked as well as the questions in the interview guide (Appendixes 4A-4D), during the information session. The researcher confirmed the period interviews were going to take place to the Health Care Centres Managers.

3.2.4.3.1 Interview Phase

- ***Conducting Semi-Structured Interview***

At the beginning of each interview session, the researcher welcomed the participants with warm greetings. The researcher started with introduction, to the participant and assured them that the permission to conduct the interview session had been granted by the involved personnel, and presented them with all the letters that were granted as proof. Thus, the aim, objectives, and significance of the study were explained again. The participant’s anonymity was ensured, as names were not used, but numbers

instead and recording process were elaborated. The confidentiality of the information was also reinforced. The interview sessions commenced after the participants had signed informed consent forms. The research environment was conducive for interviews; quiet, relaxed, and well-ventilated venues and had no disruptions (De Vos *et al.*, 2011). The interview setting should provide privacy, comfort, and is a non-threatening environment that is easily accessible. No barriers were encountered during the interviews; the participants were able to explain the impact of changing temperatures. The researcher avoided personal questions that would have made the participants feel uncomfortable and therefore hindering the yielding of more data (Hennink, 2013).

The researcher was able to gather more information from the semi-structured interviews. All the interview sessions were recorded with the voice recorder that accumulated a lot of information. The researcher also took field notes to complement the voice recorder since the device could not record the non-verbal communication cues. The interview sessions highlighted the central question to participants, therefore, the follow-up questions followed as outlined by the interview guide (Appendixes 4A-4D). It took the researcher a period of three months in the field with a minimum of 30 minutes for one interview session with each participant for data collection.

- ***Voice Recorder***

Voice recording of the semi-structured, one-on-one interview was done to capture the whole interview process without missing important information and to support the subsequent analysis. The researcher was able to concentrate on the conversation of the interview by making use of a voice recorder. The participants gave consent for audio recording of the interview proceedings at the start of the interviews. It was followed by transcribing the recordings verbatim in preparation for data analysis (Creswell, 2018).

The following communication strategies were used during the interviews:

- ***Probing for Responses***

According to Zikmund & Babin (2015), probing is an interview technique that tries to draw deeper to elaborate more explanations from discussions. Probing was done depending on the participants' responses to obtain a greater depth of information as the participants were persuaded to give more information about their experiences.

- ***Minimal Verbal Responding***

This is a verbal response that correlates with occasional nodding, which assures the participants that the researcher is still listening (De Vos *et al.*, 2011). In this study, the researcher nodded to answer yes to a question, or to show agreement, understanding, or approval, and used the following verbal expressions "mmm", "continue", "oh", in response to what the participants were saying, to allow free flow of information and to encourage the participants to talk.

- ***Encouragement***

According to De Vos *et al*. (2011), participants were encouraged to follow a specific line of thought and encouraged to elaborate about the aspects related to their experiences with regard to changing temperatures.

- ***Paraphrasing***

Paraphrasing is a verbal response where the researcher tries to rephrase what the participant has said differently, while the meaning remains the same to seek more information (De Vos *et al.*, 2011). The researcher repeated some of the participants' words in another arrangement but with the same meaning to verify whether she understood what the participants said.

- ***Reflection***

This is a process of reflecting on something important that the participants have said to get them to expand on that idea (De Vos *et al.*, 2011). Munden (2018) also defined

reflection as repeating a statement that the participant has just said to obtain more information that is specific. The researcher repeated some information as given by the participants, to expand /elaborate on what they meant about their statement.

- ***Validation***

The researcher observed the participants and interpreted their non-verbal communication such as yawning, facial expressions, bodily gestures, and transcribed them for analysis. The researcher also asked for clarity on the observations made to analyzes them correctly (De Vos *et al.*, 2011). All non-verbal communications observed during interviews were captured for inclusion during transcribing and analysis to generate relevant meaning.

3.2.4.3.2 Data Analysis

Data analysis is the process of making sense of text or image data (Botma *et al.*, 2010). Botma *et al*. (2010) further explained that the process involves preparing data for analysis, moving deeper into understanding the data, representing the data, and making an interpretation of the greater sense of the data. The collected data were transcribed verbatim and converted to English before being analyzed. The researcher adopted Tesch's eight steps (Tesch, 1990) as shown below to analyze the qualitative data provided by Creswell (2018).

- Firstly, the researcher listened to the recorded interviews and transcribed the information verbatim. The entire transcripts were then read carefully to obtain a sense of the whole and some ideas were written down.

- One interview was selected and read to get the information, writing down thoughts that came to mind. A table was drawn up with all the topics and sub-topics that emerged, but they were not grouped. The researcher took another transcript, read it trying to relate it with the first one. Other sub-topics emerged and were added to previous ones.

- The researcher then made a list of all the topics. Similar topics were grouped to form themes and sub-themes. The themes and the sub-themes were then named using words that best described all the grouped topics. Where necessary, the themes were changed into sub-themes and the sub-themes also were rearranged as themes.

- The themes were abbreviated as codes, which were written next to the appropriate segments of the transcripts. The researcher prepared this preliminary by organizing schemes to see whether new themes and codes emerged. Whenever a new sub-theme emerged, it was added to the appropriate theme.

- The researcher came up with the most descriptive wording for the themes and sub- themes and the relationship between the themes and sub-themes were outlined.

- The researcher made a final decision on the naming for each theme and separated the themes and the sub-themes in that manner. The themes were arranged in a manner that outlined the information from their experiences of PLDM to adaptation strategies.

- The data materials that belonged to each theme were assembled and a preliminary analysis was made. These data materials were further supported by literature controls of previous studies related to changing temperatures.

- The researcher re-coded the existing material. The researcher came up with a summary of the themes and sub-themes, and the data were sent to the independent coder. The researcher and the independent coder’s common themes and sub-themes were summarized and are discussed in detail in Chapter 4.

3.2.4.4 Measures to Ensure Trustworthiness

Fenton & Mazulewicz (2008) expounded trustworthiness as supporting the argument that the study's results are worth paying attention to. Bless, Higson-Smith & Kagee (2006) explained that trustworthiness is the determination of how much trust could be given to the research process and the findings. The researcher has proved that the information provided was true and had not been manipulated through adhering to the following criteria were Credibility, Confirmability, Transferability, and Dependability.

3.2.4.4.1 Credibility

Credibility determines the extent to which the researcher has recognized the true reflection of the results (Goodman & Moule, 2013). In the study, credibility was ensured through prolonged engagement for a period of three months in the field with a minimum of 30 minutes for one interview session with each participant. The researcher done triangulation during data collection where one-to-one semi structured interviews and questionnaire were utilized (Goodman & Moule, 2013). The researcher presented the data at conferences and workshops for peer and academic scrutiny (Shenton, 2004). Lastly, the participants were informed that they could withdraw from participating in the study, so, that they can willingly participate and give honest information (Shenton, 2004).

3.2.4.4.2 Confirmability

Confirmability is defined as a measure of how well the study's findings are supported by the data collected, regarding the objectivity or neutrality of the data and interpretations (Fenton & Mazulewicz, 2008; Polit & Hungler, 2013). In this study, confirmability was ensured by involving an independent coder. Written field notes and use of voice recording were also produced to confirm the data.

3.2.4.4.3 Transferability

Transferability refers to the extent to which the findings from the data can be

transferred to other groups (Babbie, 2020). Tappen (2023) defined transferability as the degree to which the results can be applied to different settings and other individuals. The sampling and the data collection method used in this study permits the decision of the extent of the findings could be transferred to other individuals and other situations (Tappen, 2023). The study was limited to 10 health care centres, involving DM patients on treatment. However, the researcher exclusively took part in data collection, and it involved 30 participants (Shenton, 2004), and also by dense description of the research methodology as measure to ensure transferability.

3.2.4.4.4 Dependability

Botma, Greeff, Mulaudzi & Wright (2010), described dependability as the considerations of whether the study results will be consistent if the inquest was repeated with similar participants and in a related context. In the study, dependability was ensured by compiling the raw data, data collection and analysis products, process notes, and the reflection of the researcher for examination by the supervisors of the study. The sampling method used also determined the extent to which the data could be dependable.

3.2.4.4.5 Bias

Polit & Beck (2008) described bias as is any tendency that ensures that the study does not threaten the ability of the participants to reveal the truth. More importantly, it also ensures that the researcher do not influence the results thus producing distortion or error in the study results. In this study, the researcher prevented bias by using a purposive sampling method which was to select participants who meet the inclusion criteria in the qualitative phase of the study. The researcher also used the language spoken and understood by the patients. Bias was further prevented by not bringing along preconceived ideas and knowledge on the phenomenon into the study which could interfere with the interviews, the results or the participants in any influential manner.

3.2.5 Quantitative Strand of the Study

The quantitative research method was employed to emphasis the collection of the numerical data. Quantitative research generates statistics by large scale survey research using method such as questionnaires (Showkat & Parveen, 2017). The quantitative phase of the study is the second part of the study. In this strand, data collection was guided by the qualitative results which were used to formulate the data collection tool.

3.2.5.1 Sampling Method

Simple random sampling is defined as a random sampling method where a sample is chosen through a technique in which every member of the population has an equal chance of taking part in the study (Johnson & Christensen, 2014). In this study, the researcher utilized simple random sampling to select the participants who participated in the quantitative phase of the study. Based on provided estimated population on monthly statistics for selected health care centres provided and the objectives of the study, an Epi-Info 7 calculator was used for the minimum sample size for each health facility. The calculated minimum sample size at 95% confidence interval=195 (Table 3.2).

▲ **Assumptions**

- Expected Frequency=50%, we do not know what percentage of patients with diabetes mellitus will be impacted by the changes in temperature; we also don't know what percentage is knowledgeable on adaptation to temperature changes.

- Accepted Margin of Error=5% (the expected maximum deviation from the population value).

- 95% Confidence Interval selected.

Table 3.2: Minimum sample size of PLDM people per health care centre

Name of Health Centre	Estimated population based on the facility monthly statistics	Minimum sample size (split by proportion of overall total calculated above)
Bochum Health Care Centre	45	22
Rethabile Health Care Centre	30	15
Hc Bissoff Health Care Centre	40	20
Giyani Health Care Centre	30	15
Shiluvane Health Care Centre	51	25
Lulekani Health Care Centre	35	16
Tiyani Health Care Centre	45	22
Bungeni Health Care Centre	40	20
Mphambo Health Care Centre	51	25
Mookgopong Health Care Centre	30	15
Total	**397**	**195**

3.2.5.2 Pilot Study

The pilot study was conducted on PLDM to pre-test the questionnaire at Mphambo Health Care Centre of Limpopo Province. The piloting of the questionnaire was to check the feasibility of the study and determine the average time it would take the respondents to complete the questionnaire and to ensure that any ambiguous questions were rectified before the collection of data for the main study. The participants who participated in the pilot study were excluded from the main study to avoid bias. The findings of the pilot study were as follows: most of the vague questions required more than one answer, some questions were not significant for this study. Hence, they were removed from the reconstructed questionnaire.

3.2.5.3 Data Collection Method

In this phase, data were collected using a structured questionnaire developed based on the results of the qualitative phase. Quantitative data collection encompasses

gathering of numeric data with the use of questionnaires to obtain primary data from individuals (Babbie, 2020). In this study, a formal structured questionnaire, which contained questions, designed to obtain information from PLDM was used. In this study, data were collected by the researcher and two field workers who were trained how to use the data collection tool. A self-administered questionnaire (Appendix 5A) which was distributed to the respondents to complete on their own, but the researcher and two field workers were available to clarify any questions that might be asked by participants and assist those who cannot write or read.

The questionnaire comprised five sections: Section A which is about the Demographic data comprising 9 questions, Section B which is about participants expression about the impact of changing temperatures comprised 14 questions, Section C which is about the participants different ways of dealing with the effect of changing temperatures comprised of 17 questions, Section D which covered 4 questions related to health information/learning needs, and Section E which involved 2 questions on recommendations. The self-administered questionnaires were translated into the languages understood by the respondents, namely: Xitsonga (Appendix 5B) and Sepedi (Appendix 5C). The questionnaire took about 20 to 30 minutes to complete.

3.2.5.4 Data Analysis

Quantitative data analysis is a process whereby the statistical presentation and manipulation of observations to describe and explain the phenomena that those observations reflect (Babbie, 2013; Babbie, 2020). In this study, descriptive statistics were used by the researcher to describe and analyze raw data from questionnaires.

To organize the collected data, the researcher captured the data on a Microsoft software Excel sheet and then analyzed the data by using the Statistical Package for the Social Sciences (SPSS Version 26.0) with the assistance of the university Biostatistician. Data were organized, summarized, and presented in the form of tables showing frequencies and percentages.

3.2.5.5 Validity and Reliability

Validity and reliability were adhered to in this study to ensure the quality of the quantitative data collected through the questionnaire. The measures to ensure validity and reliability are explained below:

3.2.5.5.1 Validity

Goodman & Moule (2013) described validity as a measure of whether a data collection tool accurately measures what it is supposed to measure. In this study, the researcher constructed the questionnaire in a way that addressed the objectives and answer the questions of the study. Validity was ensured through face validity and content validity.

- **Face Validity**

According to Babbie (2012), face validity is the quality of an indicator that makes it easy to measure a variable. In this study, face validity was ensured by giving the questionnaire to supervisors, peers, and biostatisticians to review before piloting with the instrument. This exercise has assisted the researcher to determine the readability and simplicity of the content, and mainly to ensure that the questionnaire measures what it is supposed to measure.

- **Content Validity**

Content validity looks at whether the instrument adequately covers all the content that it should with respect to the variable. In other words, does the instrument cover the entire domain related to the variable or construct it was designed to measure? A panel of experts is used to evaluate the content validity of new questionnaires (Polit & Beck, 2008). In this study, the researcher ensured content validity through the literature review and by giving the questionnaire to the supervisor and biostatistician to check if the instrument covered all aspects under study.

3.2.5.5.2 Reliability

Babbie (2020) defined reliability as quality of measurement technique that proposes

the collection of similar data in repeated observations of the identified problem. In this study, reliability was ensured through conducting a pilot study to pre-test the questionnaires aiming to revise and restructure the questions where necessary and by translating the questionnaires into the languages spoken and understood by the participants.

3.2.5.6 Bias

Brink, Van der Walt & Van Rensburg (2014) explained bias as an influence that produces an error or a distortion that can affect the quality of evidence both in qualitative and quantitative research studies. Bias can occur in any step of the research process. Bias is defined as a procedure where researchers conducting research influence the results in order to depict a particular outcome (Creswell, 2013; Shuttleworth, 2009a; Shuttleworth, 2009b; StudyCorgi, 2020). Simple random sampling in the quantitative phase of the study was used to select the participants from the target population to ensure that everyone had an opportunity to take part in the study to avoid selection bias.

3.3 Phases of the Study

The following phases highlight how the study was conducted with the methodologies that were followed.

3.3.1 Phase 1: Empirical Phase

The first three objectives were covered in this phase of the study. A mixed method exploratory design was employed to accomplish these objectives. The mixed methods allowed the researcher to syndicate both quantitative and qualitative procedures, approaches, also study concepts (Creswell, 2018). The data were collected using both the qualitative and quantitative approaches sequentially. For qualitative data, the researcher conducted a semi-structured interview with a guide. Thus, also a self-administered questionnaire was used to gather quantitative data. Therefore, the researcher adopted Tesch's eight steps for data analysis to analyze qualitative data,

and SPSS version 25 was used for quantitative data analysis (Creswell, 2013). Integration was done where the quantitative and qualitative results were brought together to determine the extent to which the two data confirm, contradict, or expand. Comparing and relating the two data sets allowed the researcher to come with a summary of the whole study results to achieve the purpose of the study.

3.3.2 Phase 2: Development of Coping Strategies

Objective number 3 was covered in this phase of the study, where coping strategies for PLDM were developed together, dependent on the empirical phase analysis results. The development process was guided by Roy's Adaptation Theory (Whittemore & Roy, 2002) and the ADDIE Model of Nursing (Mustafa *et al.*, 2010).

3.3.3 Phase 3: Implementation of Coping Strategies

Objective number 4 was covered in this phase of this study were the developed strategies were implemented. The researcher as the facilitator drew a schedule with dates for implementation of the coping strategies. The schedule was made available to the participants and to the respective health care centre mangers. Figure 3.4 presents the phases of the study.

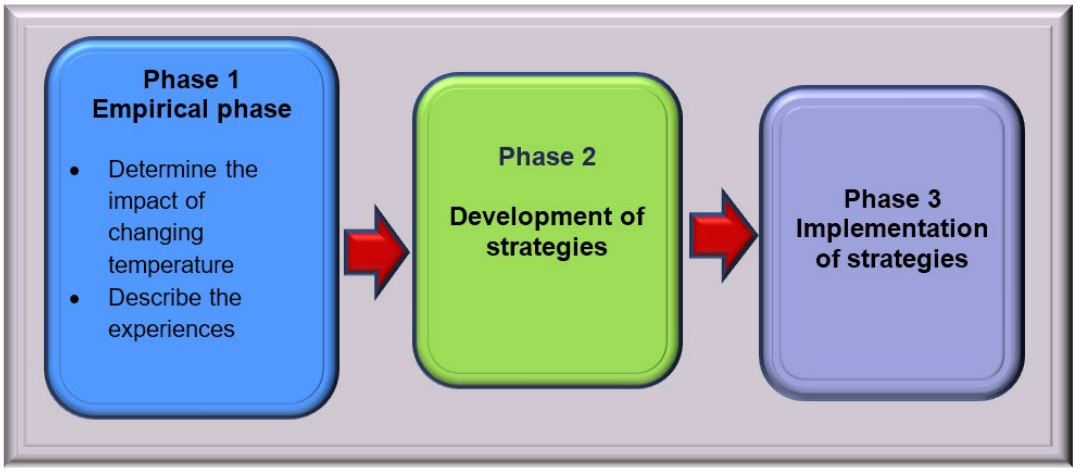

Figure 3.4: Schematic representation of phases of the development of strategies

3.4 Ethical Considerations

Ethics is the study of norms and values within a group that direct and provide judgments of what is right or wrong in human behaviour (Mellish *et al.*, 2009). Polit & Beck (2008) also described ethics as a system of moral values concerning the degree at which the research procedures observe, follow professional, legal, and social obligations of the participants. Ethical principles were considered and adhered to in both the quantitative and qualitative strands

3.4.1 Ethical Clearance

To ensure ethical approval the research proposal was presented at the following:

- Research Committee, Department of Nursing Science, School of Health Care Sciences Research Ethics Committee and the Faculty Higher Degrees Committee. The proposal was then submitted to the Turfloop Research Ethics Committee (TREC) for ethical clearance which was granted (TREC/72/2021; Appendix 1).

3.4.2 Permission to Conduct the Study

The researcher submitted the document online to apply for permission from the Limpopo Province Department of Health Research Committee (Appendix 2A), District Executive Manager. Permission to collect data was be obtained from the respective Health Care Centres Managers (Appendixes 2B-2G).

3.4.3 Informed Consent

The researcher informed the participants first about the purpose and the objectives of the study in their language. Thereafter, each participant was provided with an opportunity to ask questions for clarity. Furthermore, during recruitment, the researcher respected the participant's cultural beliefs, habits, and lifestyle. Those who verbally and voluntarily agreed to participate were given a written consent form to sign (Appendixes 3A-3C). The researcher further explained that each participant has the

freedom to withdraw from participating in the study without fear of discrimination or being mistreated by the researcher or anyone (De Vos *et al.*, 2011). The use of a voice recorder and its purpose were also outlined. The participants were assured of their privacy and the confidentiality of their information hence participants gave verbal consent.

3.4.4 Privacy

Privacy implies that participants' information whether be it the spoken, written or electronic that could be identified with the participants, must be kept private (Rickard, 2014). In this study, privacy was ensured by interviewing the participants in private consulting rooms of the selected health care facilities. Additionally, the participants were informed that the information would be kept under lock and key and also password protected in the system were only the researcher and the supervisor have access.

3.4.5 Anonymity

Anonymity was ensured through guaranteeing that the participants were not identified with their names, but rather the researcher used numbers as participants' identifications so that the participants' responses would not be identified with them thus protecting the participants' identity (Babbie, 2020). In this study, during the presentation and publication of the results, the names of the participants were protected by allocating numbers.

3.4.6 Confidentiality

Confidentiality was maintained by assuring that the information provided by participants was not be shared with anyone who is not participating in research. Additionally, the participants were assured that the voice recorder files would be allocated codes that would be known only to the researcher, the supervisor, and the appointed independent coder.

3.4.7 Protection from Harm

To protect the participants from harm, the researcher worked on maximizing the possible benefits while decreasing possible harm. The researcher requested PLDM who were willing to participate in the study, irrespective of age. The participants were requested to fill in the consent form to participate in the study. Participants who were not well or not comfortable in taking part were excused.

3.4.8 Principle of Non-Maleficence

The principle of non-maleficence states that the researcher must act in a specific way that will elude unnecessary harm or injury (Carter & Lubinsky, 2016). In this study, the principle of non-maleficence was ensured through making sure that the participants were settled down in a safe environment and participants who have to take medications or to eat food before the data collection sessions start were allowed to do so and water for drinking was available in the room.

3.5 Summary

This chapter has focused on the research design and methodology that underpinned this study. Detailed information regarding the mixed methods design, its origins, its relevance to this study and its general characteristics, were explored in this chapter. The following chapters build on from the methodological propositions made in this chapter by employing the proposed data presentation and analysis approaches to analyze the quantitative and qualitative data.

CHAPTER 4

PRESENTATION AND INTERPRETATION OF THE FINDINGS

4.1 Introduction

The previous chapter discussed the research methodology for the study. This chapter presents detailed findings of both the qualitative and quantitative strands, interpretations, and discussion of the findings of the one-to-one semi-structured in-depth interviews conducted and the self-administered questionnaires.The qualitative and quantitative data analysis took place separately, followed by data integration, interpretation, and discussion of the combined findings.

4.2 Data Analysis and Management

The data from both qualitative and quantitative strands were analyzed separately. The qualitative data were analyzed using the 8 steps of Tesch's open-coding method (Tesch, 1990) as previously described (Creswell, 2018). Data were also submitted to an independent coder who also used the 8 steps of Tesch's open-coding method of qualitative data analysis to analyze data independently as described by Creswell (2018).

A telephonic meeting was set up between the researcher and the independent coder to discuss and agree on final themes and sub-themes. The quantitative data from questionnaires were analyzed using the SPSS version 26.0. The researcher firstly checked for the completeness of the questionnaires and assigned identification numbers to them, entered data into the SPSS software for analysis. Descriptive statistics was used to calculate the categorical variables.

4.3 Presentation and Interpretation of the Qualitative Strand

The results were analyzed to provide the background on the impact of changing temperatures on PLDM through analyzing their characteristics from the interviews first, followed by the themes and sub-themes.

4.3.1 Characteristics of the Participants

The aim of presenting characteristics of the participants is to describe the influence they might have on the results of the study.

The characteristics of the participants are presented in Table 4.1.

Table 4.1: Characteristics of the participants

Name of facilities	Number of participants	Gender	
		Male	Female
Bochum CHC	4	2	2
Rethabile CHC	3	0	3
HC Bissoff CHC	3	0	3
Gyaini CHC	2	0	2
Lulekani CHC	2	0	2
Shiluvane CHC	3	0	3
Tiyani CHC	3	1	2
Bungeni CHC	4	1	3
Mphambo CHC	3	0	3
Mookgopong CHC	3	1	2
Total	**30**	**5**	**25**

Table 4.1 also shows that 30 participants consented to participate in the main study. Females dominated the study with a participation rate of 83.3% and the males formed the minority with 16.6%.

4.3.2 Themes and Sub-Themes

Six themes and their respective sub-themes (Table 4.2) emerged from the data analysis using Tech's open-coding method. The themes and sub-themes of this study are supported through direct quotations from the participants. The direct quotations of the participants are written in italic in this study's findings. The results were further supported by the relevant literature controls. Table 4.2 summarizes the themes and sub-themes reflecting the impact of changing temperatures on PLDM.

4.3.2.1 Theme 1: Paradoxical Experiences Related to the Impact of Changing Temperatures

The increase in global temperatures may aggravate various health issues, including DM. The study findings revealed that PLDM have paradoxical experiences related to the impact of changing temperatures. The following sub-themes emerged from this theme: Experiences of PLDM related to body reaction during exposure to hot temperature, Experiences of PLDM related to body reaction during exposure to cold temperature and Ailments experienced related to changing temperatures.

4.3.2.1.1 Sub-Theme 1.1: Experiences of PLDM Related to Body Reaction During Exposure to Hot Temperature

The findings of this study revealed that the participants raised a concern that during exposure to hot temperature they experience excessive sweating and dizziness, as described in the following extracts:

> *Mmm, when it is hot the sweat just drip from my face, since I reached menopause it has become worse it has been long. It has never stopped. [Participant 10]*

> *When it is hot, I would sweat a lot and the sweat just drip because of feeling too hot. [Participant 18]*

> *Sweating a lot is my problem. Sometimes when I do my laundry, when I left my neck up, I feel a little dizzy. [Participant 15]:*

Table 4.2: Themes and sub-themes on the impact of changing temperatures on PLDM

Theme	Sub-Themes	
1. Paradoxical experiences related to the impact of changing temperatures	1.1.	Experiences of PLDM related to body reaction during exposure to hot temperature
	1.2.	Experiences of PLDM related to body reaction during exposure to cold temperature
	1.3.	Ailments experienced related to changing temperatures
2. Challenges of PLDM during changing temperatures	2.1.	PLDM find it difficult to maintain regular exercise required
	2.2.	Progress of diabetes mellitus not easily monitored due to changing temperatures
	2.3.	Challenges related to intimidation by nurses on uncontrolled blood glucose level
	2.4.	Disturbance of daily routine due to changing temperatures
3. Knowledge on changing temperatures for PLDM	3.1.	Knowledge on the importance of dietary lifestyle
	3.2.	Knowledge on the importance of regular exercise
	3.3.	Knowledge on proper storage of medication
	3.4.	Knowledge on the importance of adherence to treatment
4. Description of coping strategies adopted by PLDM on changing temperatures	4.1.	Drinking warm and cold fluids during changing temperatures commendable
	4.2.	Wearing of proper clothing during changing temperatures favoured
5. Perceived learning needs on coping strategies during changing temperatures suggested	5.1.	Provision of regular or continuous training on coping with changing temperatures suggested and encouraged
	5.2.	Education on healthy living for PLDM during changing temperatures
	5.3.	Education on stress management suggested for PLDM
	5.4.	Provision of information on proper storage of medication during changing temperatures suggested for PLDM
6. Description of available services to address the changes related to changing temperatures	6.1.	Provision of information by the hospitals and clinics commended
	6.2.	Services on provision of food parcels suggested by PLDM

Additionally, participants also described that during exposure to hot temperatures they also experience the feeling of dizziness and weakness:

> *Eish. Sister ... I don't want to lie am only using treatment I don't even miss one I drink it in the morning and evening both high blood and diabetes in the morning and evening. Nowadays when is very hot I started to become dizzy. One day I fell down and got bruises on my knee due to this dizziness when is very hot. [Participant 2]*

I feel dizzy and sweat a lot when it's hot though it does not happen more often, I experience it more when I'm feeling hot. Even when my hands become stiff, when I have problems, I feel like something is moving my back to the top of my head…laughter, that's when I'm angry. [Participant 20]

On those days I become too dizzy and weak start to realise that is because of the very hot temperature it does not allow me to move around it makes me to just sit down and do nothing I cannot even pick up something or just to sweep due to that I will be feeling tired. [Participant 5]

The findings of this study revealed that changing temperatures has a negative impact on the bodies of PLDM. In support of the study findings, Wright *et al*. (2015) found that negative health effects of exposure to raised temperatures during heatwaves and on hot days include cramps, fainting, heat exhaustion, heatstroke, and dehydration. The findings are further supported by Snouffer (2018) who indicated that extreme heat and moderate to high activity can make PLDM to sweat profusely and become dehydrated leading to rise in glucose levels.

4.3.2.1.2 Sub-Theme 1.2: Experiences of PLDM Related to Body Reaction During Exposure to Cold Temperature

Data from the interviews show that cold temperature has a negative impact on their bodies. PLDM have shared their experiences related to how their body react during exposure to cold temperature. They described that when it is cold they experience body pains and cramps. This was supported by the following extracts:

Like today is very cold and cloudy, the joint of my legs am feeling pains and muscle cramps, like now am sitting before I can walk, I must limp first so that I can walk properly. [Participant 2]

Eish … but when it is cold my legs are painful like there is no blood circulation now when am sitting is becoming swollen I must sit down

on the floor and put them straight. [Participant 7]

I don't know if it due to the condition or the accident I had because when it is cold I usually feeling pains my bones aches. So due to that this condition is not curable I do counsel myself to take things positive so that I can able to live normal life. [Participant 11]

The findings of this study concur with a report by Stöppler (2016) which indicate that cold sensations to the feet of PLDM can come from poor blood circulation and it is due to abnormal elevated blood and glucose in the urine. Stöppler (2016) further indicated that these symptoms cause narrowing of arteries and capillaries that impaired blood supply to tissue leading to cold feet symptoms like pain, numbness, pins and needles tingling sensations (Avillion, n.d.). In addition, an article by St Mary's Medical Centre (2018) stated that complications of diabetes peripheral neuropathy can be complicated by cold weather, which is the result of nerve damage that causes numbness and pain in the hands and feet of diabetics as well as in other areas of the body.

4.3.2.1.3 Sub-Theme 1.3: Ailments Experienced Related to Changing Temperatures

The findings of this study indicate that PLDM experience ailments related to changing temperatures including painful legs and eye problems. The following statements captured during the interview verifies this:

Mmm.. my legs especially the heels sometimes are painful, when am sleeping in certain position I will feel like am having a sore and I will take blanket off them so that to have little bit of air on them and feel right. [Participant 3]

The coldness will get into my bones and will make me get flu and cough. Most of the time I just make warm water to fill up the jar and drink it when am feeling cold. [Participant 6]

In addition, the participants experienced eye problems:

> *Another thing that is bothering me my eyes cannot see clearly… Sister… if I can get medication to put some drops, now people know that I cannot see clearly, even when a person I know can pass I won't recognise her/him … my eyes. [Participant 2]*

Another participant added by saying that:

> *I stared having a terrible headache and vein just move from here (pointing on the forehead) something just dropped into my eye (right eye). What was it I did not know, next morning woke up my eyes went blind both of them. [Participant 17]*

The findings of this study revealed that participants experienced many physical and physiological problems with regard to changing temperatures. Similarly, the study by Yasmin, Ali, Banu, Rasul, Sauerborn & Souares (2020) indicates that both T1DM and T2DM are associated with reduced ability to maintain core temperature during thermal stress. This study further indicated that due to the impairments in the body's ability to dissipate heat mediated via increases in skin blood flow and sweating during heat stress. In support of the study findings indicates that, Labban (2017) indicated that during hot temperatures PLDM experience double vision (Kovacova & Shotliff, 2022), aching behind the one or both eyes and changes in the way the eyes adjust from light to dark. Cold temperatures place physiological stresses on the body, one symptom diabetic nephropathy where the kidney damage resulting from diabetes is a feeling of being cold all the time (Gupta, 2021; Sloane, 2021).

4.3.2.2 Theme 2: Challenges of PLDM During Changing Temperatures

Living with diabetes brings along health challenges related to maintenance of quality of life and challenges related to self-care practices which influence diabetes outcomes. The study findings revealed that PLDM are faced with challenges due to changing temperatures. The following sub-themes emerged: PLDM find it difficult to maintain regular exercise required, Progress of diabetes mellitus not easily monitored due to changing temperatures, Challenges related to intimidation by nurses on uncontrolled

blood glucose level, Disturbance of daily routine due to changing temperatures.

4.3.2.2.1 Sub-Theme 2.1: PLDM Find It Difficult to Maintain Regular Exercise Required

The findings of this study demonstrate that participants find it difficult to maintain regular exercises due to changes in temperatures and they become tired quickly because of hot temperatures. This is confirmed by the following quotations from the participants:

> *I am a person who like to run but now due to the changes of temperature am not able to do that. [Participant 9]*

> *Eish nowadays the temperature in the morning is not good for me to do exercises like I use to do. [Participant 3]*

> *I used to do exercise, but nowadays when is very hot I get tired quickly and I drink a lot of water to make me feels better. [Participant 11]*

The findings of this study are supported by a report by American Diabetes Association (2019) which stated that it can be a problem for PLDM who are not into regular exercise to put together an exercise plan even though regular physical exercise is an important part of managing diabetes or dealing with prediabetes (Westphal *et al.*, 2010). Collins & Bradley (2009) indicated that health-related behaviour like engaging in regular excises by diabetic patient need to be encouraged in promoting healthy lifestyle. However, a report by Centers for Disease Control and Prevention (2022) indicated that PLDM feel more heat than people who don't have diabetes resulting in dehydration. Literature indicates that a heat-protection advice to avoid exposure to both high and low temperatures should be provided to PLDM by primary care physicians and endocrinologists (Lam *et al.*, 2018; Westphal *et al.*, 2010).

4.3.2.2.2 Sub-Theme 2.2: Progress of Diabetes Mellitus Not Easily Monitored Due to Changing Temperatures

Participants also shared that they were unable to check their blood glucose regularly when it is hot because of the following reasons: staying far from the clinic and not having a machine (device) to check their blood glucose. This is what participants said:

> *I have no problem with my blood pressure going high or low. My blood sugar is not controlled, and I struggle to be checked here by doctor I inject too much it drops too low, when it drops too low, I put a little more in the injection and it becomes normal. When it is too high, I drop the injection amount a little. [Participant 23]*

> *My problem is that I don't have the machine to check myself at home when is hot my sugar is not stable it just goes up and down and it makes me feel weak sister. [Participant 14]*

> *When is hot my blood sugar is always high and cannot check it am staying far from the clinic, I will drink more water as the sister said but I will be feeling weak. [Participant 7]*

The findings of this study revealed that there is a gap in monitoring the progress of their PLDM monitoring. The Mayo Clinic advocates that self-testing blood sugar (blood glucose) can be an important tool in managing your diabetes and preventing complications and provides useful information for diabetes management which is monitor the effect of diabetes medications on blood sugar levels. In addition, the study by Cameron (2018) stated that guidelines inform health professionals to educate patients on how they should monitor themselves, but very little is known about how patients self-monitor in the real world is done. This is concerning because it is clear that educating a person about self-management strategies does not guarantee that they will follow the strategies to manage their conditions (American Diabetes Association, 2019; Avillion, n.d.; Weller *et al.*, 2017).

4.3.2.2.3 Sub-Theme 2.3: Challenges Related to Intimidation by Nurses on Uncontrolled Blood Glucose Level

The findings of the study revealded that PLDM feels intimidated by the nurses at the health care centres. They are concerned about the negative attitudes of nurses when their blood glucose level is not controlled indicating that nurses should make them feel strong and not shout at them. This was indicated in the following extracts:

> *Another thing is that when we have come here at the clinic do not intimidate us when blood glucose is high by saying that "you will die" I don't mean here they are doing that I mean that must not do that. Your messages must make us to be strong always. [Participant 11]*

> *Nurses shout at us when blood glucose is high because we do not know anything about the sickness, but not all nurses shout. [Participant 3]*

The findings of the study are supported by the study by Munshi *et al*. (2013) which stated that one of the biggest challenges for health care providers today is how to address the continued needs and demands of individuals with chronic illnesses like diabetes. The study is supprted by the notion that nurses are struggling in overcrowded hospitals and do not have sufficient time to provide support to patients, this can result in nurses experiencing burnout and, consequently, lack of compassionate care (Babaei & Taleghani, 2019; Valizadeh *et al.*, 2018). The literature further demonstrated that nurses and other health care professionals encounter many barriers to providing optimal diabetes care. The most important findings regarding the barriers are nurses' lack of knowledge about diabetes, lack of resources, and lack of time which makes them have frustrations at work (Williams *et al.*, 2019).

4.3.2.2.4 Sub-Theme 2.4: Disturbance of Daily Routine Due to Changing Temperatures

The finding of this study revealed that participants are unable to perform their daily chores due to the effect of changing temperatures. This was supported by participants

who said:

> *On those day those days I become too weak and start to realise that is because of the very hot temperature it does not allow me to move around it makes me to just sit down and do nothing I cannot even pick up something or just to sweep due to that I will be feeling tired. [Participant 8]*

> *What I do am forcing myself to do house chores, I sit next to the fire bring everything I need to use and cook, the children am staying with end up saying I must stop but I said am training myself. [Participant 11]*

> *When is hot as you know that nowadays when is hot it becomes very hot I don't do any house chores because I get tired and so I drink a lot of water to make myself feel better. [Participant 17]*

In support of the findings of this study, Kenny *et al*. (2016) indicated that when PLDM must perform physical work in the heat, the occurrence of heat-related morbidity and mortality is likely to be more frequent. Furthermore, it has been recommended that PLDM or anyone with autonomic neuropathy, cardiovascular complications, or pulmonary disease should avoid exercising outdoors on very hot and/or humid days to prevent heat-related illnesses (Colberg, 2017).

4.3.2.3 Theme 3: Knowledge on Changing Temperatures for PLDM

The Endocrinology Society has indicated that PLDM who are exposed to hot temperature have important gaps in their "heat awareness," or knowledge about proper diabetes self-care in hot weather (Fisher, 2014), even though diabetes increases the chance for them to suffer from heat illness. In this, study participants indicated that they lack knowledge on how to cope with the changing temperatures. The following sub-themes emerged: Knowledge on the importance of dietary lifestyle, knowledge on the importance of regular exercise, knowledge on proper storage of medication and

Knowledge on the importance of adherence to treatment.

4.3.2.3.1 Sub-Theme 3.1: Knowledge on the Importance of Dietary Life Style

The findings of this study revealed there is lack knowledge of participants regarding the importance of dietary lifestyle including to be taught what to do about diet. This was confirmed by the following quotations:

> *I would like to me taught about how to eat the problem is that I just eat what is available I don't have a choice because of am not working and I don't have money to buy what they said I have to eat frequent small amount of food. Fruits I don't have those they said I have to eat. [Participant 6]*

> *I would really like to be taught about my diet. Since I'm an older person, I am always busy with chores for longer periods and I eat only when I'm finished, laughter…I never rest until I finish what I am doing so I do not eat as well as I am supposed to eat for a person with my condition. [Participant 15]*

> *Eish, Sister they scare us when the say diabetes mellitus kills and indeed it kills, another time … Eish my muscles. We want to be taught what we should do especially about diet, thing to eat not to eat sister. [Participant 2]*

> *Sometimes when am hungry not knowing what to eat I just end up taking only sour tea just to eat two slices of bread at least I ate something it will be better Participant: 4]*

The aspect that stands out from above extracts is that there is a need for health education with regard to diet (Soep & Agussalim, 2020). Patient educational materials should be developed relating to self-management skills in the heat, and the topic should be included in standard diabetes education programmes when applicable.

Breland (2013) indicated that extreme environmental conditions limited people with diabetes access to healthy food, understanding and communication with clinicians about healthy eating. Healthy eating and its adherence are crucial to better diabetes outcomes, minimizing the complications and also improving the quality of life of patients (American Diabetes Association, 2019).

4.3.2.3.2 Sub-Theme 3.2: Knowledge on the Importance of Regular Exercise

The findings of the study revealded that some participant have knowledge on the importance of exercise. This was supported by the extracts below:

> *I am a person who like excises, I eat normal every three hours in small frequent amount, when I eat two slices bread will use canderal in tea and during the day eat small portion of pap. I drink a lot of water not because of thirst is for controlling my condition. [Participant 11]*

> *It can be hard to get motivated to exercise in the winter. But exercise is an important part of keeping blood sugar normal. [Participant 13]*

The findings are supported by the American Diabetes Association (ADA) (2019) which indicates that physical activity is vital for using up spare glucose in the body and making the muscles more sensitive to insulin. Exercise can help reverse diabetes in its early stages and prevent heart-related complications in more severe presentations. The ADA recommends that PLDM should also get 30 minutes of moderate-to-vigorous exercise on at least 5 days of the week.

Welch (2022) state that PLDM should check the forecast before heading outside. Temperature, wind and moisture, along with the length of time that you'll be outside, are key factors in planning a safe cold-weather workout. The IDF (2015) indicated that nutrition, exercise, and medication are extremely important in diabetes care and improves the quality of life (Vas *et al.*, 2017).

4.3.2.3.3 Sub-Theme 3.3: Knowledge on Proper Storage of Medication

The aspect that stands out from the extracts below is that most of the participants have the knowledge on how to store their medication. Although more emphasis is needed because both hot and cold weather extremes can affect testing equipment and medications. The participants said:

> *Yes, treatment must be stored where is cool not where is warm am storing mine inside the fridge not in the deep freezer just where is cool on top. Just to make it cool. [Participant: 19]*

> *Yes sister. Before I had a fridge, I was told to put the injection inside a stainless-steel plate. Now that I have a fridge I put it in the fridge, not the freezer. [Participant 23]*

> *Previously, I was just leaving the medication inside the bag so one day a while ago the sister ask someone to bring the medication from the fridge is that day I knew that medication must be stored in the fridge.so asked that the medication can be stored in the fridge not the deep freezer. Since then now am doing like that putting medication in the fridge after using. [Participant 7]*

The finding of this study revealed that participants have the knowledge on how to store medications. In support of the study findings, Hamaty (2020) posited that extreme temperature can also damage your medications and testing equipment. Furthermore, he said that patients need to always be reminded to take precautions to protect their medications during both winter and summer.

Development of effective patient education on supplies storage and improve patients' diabetic control and own complications; educational strategies need to consider patients' health literacy levels and self-care skills (International Diabetes Federation, 2015; Tang *et al.*, 2008).

4.3.2.3.4 Sub-Theme 3.4: Knowledge on the Importance of Adherence to Treatment

The findings of this study revealed that participants displayed lack of knowledge related to adherence to their treatment.

Below are extracts from what the participants said:

> *When you see me like this I was taking the 850 mg tablets (Glucophage), as was taking them, they put me the other one which they said I have to take it once in day I stopped taking them. And they gave me 500 mg so I started losing weight. I went to see the doctor when he checked my blood glucose it was too high the machine was not able to show the numbers so he injected me and gave me the 850 mg now am becoming much better so now I want to be put back to the 850 mg as the doctor has indicated. [Participant 10]*

> *The tablets are good. Is just the blood pressure one, the Aspen, it makes me cough and the other one I divide it makes me lose weight, so I complaint about them to doctor, so the change, but sometimes the other ones they give the same treatment that gives me problems. I sometimes skip taking them. [Participant 23]*

Patients lack knowledge about the kind of treatment they are getting at health care centres. The study findings indicate that patients are not receiving continuous health education about medication that they receive at the different health centres. This is concerning because it will affect the adherence level of PLDM. The study by Polonsky, Hessler, Ruedy & Beck (2017) revealed that patients with diabetes mellitus are more likely to be adherent to medication regimens when they have some tangible sense that the prescribed medication is contributing to some positive and relatively immediate outcomes. The study by Nikitara *et al*. (2020) has reported that health care professionals provided conflicting information that might cause patients with diabetes to become confused and to be uncertain about the care they receive.

4.3.2.4 Theme 4: Description of Coping Strategies Adopted by PLDM on Changing Temperatures

The study findings indicate that PLDM have different self-care coping strategies which are influenced by their self-care health values. This may consequently affect their diet and exercise choices, frequency of blood glucose monitoring, and compliance with prescribed medication regimens. The following sub-themes emerged: Drinking warm and cold fluids during changing temperatures commendable and Wearing of proper clothing during changing temperatures favoured.

4.3.2.4.1 Sub-Theme 4.1: Drinking Warm and Cold Fluids During Changing Temperatures Commendable

The participants indicated that they drink warm fluids when they feel cold and also drink cold fluids when they feel cold to adapt to changing temperatures. This is supported by the following extracts from the participants:

> *Thirst yes I will be just drinking water and I drink lots of it. As am drinking too much water I will be frequently going to the bathroom to urinate. [Participant 9]*

> *Is true the days are not the same I drink lots of water and am always having water with me. You know there are this big jar that I have always finish one and continue drinking so that am must have enough water in my body. Am always drinking water. [Participant 22]*

> *When is very hot I sit under the shade and drink lot of water, but I don't drink water from the fridge I cannot tolerate it. [Participant 2]*

The above findings revealed that PLDM have practices that they employ in order to deal with the effects of changing temperatures. These findings are supported by recommendations to stay hydrated, even if you don't feel thirsty, keep out of the heat of the day and wear loose and light clothing and protect your skin with sunscreen (Fisher, 2014; Hamaty, 2020; Kenny *et al.*, 2016; Labban, 2017; Loughnan, 2013;

World Health Organization, 2018). A report by Orenstein & Welch (2022) indicated that people with diabetes must take these steps to keep their DM in control when temperature soars, drink plenty of water, stay out of heat the day, store medication properly and know signs of low blood sugar.

4.3.2.4.2 Sub-Theme 4.2: Wearing of Proper Clothing During Changing Temperatures Favoured

The findings of the study revealed that during changing temperatures PLDM wear clothes which are loose or light when it is hot and warm cotton clothes when it is cold. In this study, participants described how they keep up with the changing temperatures this what they said:

> *Is it now due to the cloth that am wearing when is very hot I wear light clothes. [Participant 9]*

> *I wear light clothes even at night am not wearing blankets because I will feel very hot so just use light duvet to cover myself now am not wearing a jersey because I will feel hot. [Participant 15]*

> *When is very hot especially on those months where is hot am using the fan through the night until morning, but now still little bit cold am not using it. [Participant 25]*

Participants also described that during exposure to cold temperature they wear warm clothes this what participants said:

> *Am just wearing warm clothes and drink warm water to warm my body and start to do my house chores due to that am staying alone. [Participant 5]*

> *During cold temperature, I wear warm clothes to keep myself warm so that I don't catch colds and be indoors. [Participant 11]*

The findings of this study revealed that PLDM wear proper clothing during extreme temperatures and this is corroborated by several reports (Fisher, 2014; Hamaty, 2020; Kaur & Kochar, 2017; Kenny *et al.*, 2016; Labban, 2017; Novo Nordisk South Africa, 2018; Westphal *et al.*, 2010; World Health Organization, 2018; Yang *et al.*, 2016; Yardley *et al.*, 2013). The Mayo Clinic further advocates that when it is cold, PLDM should always protect their head, hands and feet from cold due to that are vulnerable to frostbite by wearing cotton hat and gloves. A study conducted by Méndez-Lázaro *et al*. (2018) showed that the hottest ever recorded season in San Juan, Puerto Rico, was associated with most deaths resulting from cardiovascular diseases (45.1%), hypertension (14.4%), and stroke (11.2%), while the rest of the deaths were attributable to respiratory diseases (7.8%), diabetes mellitus (4.5%), pneumonia (8.6%), and renal disease (8.2%).

4.3.2.5 Theme 5: Perceived Learning Needs on Coping Strategies During Changing Temperatures Suggested

The findings of the study revealded the perceived learning needs of PLDM on coping strategies during changing temperatures as suggested during interviews. Extreme heat events are becoming permanent features of summer seasons, therefore, appropriate heat action plans involving behavioural strategies are much needed. The following sub-themes emerged: Provision of regular/continuous training on coping with changing temperatures, Education on healthy living for PLDM during changing temperatures, Education on stress management suggested for PLDM and Provision of information on proper storage of medication during changing temperatures suggested suggested for PLDM.

4.3.2.5.1 Sub-Theme 5.1: Provision of Regular or Continuous Training on Coping with Changing Temperatures Suggested and Encouraged

The findings of the study revealed that there is a need for continuous education for PLDM with regard to changing temperatures this what the said:

Anything that we can be taught about it will be good because I was only taught on the day that I started using the tablets due to that am old easily forget things it can be helpful if the can keep on reminding me on what to eat and not to eat and how to live on daily basis. [Participant 4]

They must teach us about how to manage and to control our condition. It is a problem to me because they need to tell us what to do or not to do so that we are able to control and manage my condition. [Participant 5]

Since as people living with diabetes we don't have any information about the future I would like to be helped by you who are educated to help us you have to continue teaching and advise us so that we must able to live longer. [Participant 8]

The extracts from participants indicate that participants need more continuous health education on how to cope during changing temperatures. Both extremely cold and hot temperatures increase diabetes mortality in different manners (Song *et al.*, 2021). Therefore, diabetes education programmes should include information on either managing or combating the effects of extreme hot and cold weather (Fisher, 2014).

4.3.2.5.2 Sub-Theme 5.2: Education on Healthy Living for PLDM During Changing Temperatures

The findings of the study revealed that education on healthy living including diet need to emphasise by health care professionals at all times. The participants' quotations below support the study findings:

As you are educated and having the knowledge about the condition you can advise us on things to do to or not do in order for me to live healthy, because I don't have the knowledge about the condition but you can able to see at what stage is my condition and able to change treatment when is no longer effective. [Participant 9]

To be honest is that as an individual is good to be told about things that you doing wrong and try to reframe the wrong and to your best to live a healthy lifestyle. [Participant 10]

Eish Sister they scare us when the say diabetes mellitus kills and, indeed, it kills, another time … Eish, my muscles. We want to be taught what we should do especially about diet, thing to eat not to eat sister. [Participant 2]

I would like to me taught about how to eat the problem is that I just eat what is available I don't have a choice because of am not working and I don't have money to buy they said I have to eat frequent small amount of food. Fruits I don't have those they said I have to eat. [Participant 6]

The findings of this study are supported by Sami (2017) who stated that the review of various studies suggests that T2DM patients require reinforcement of DM education. Dietary management education by health-care providers at the health care facilities will encourage PLDM to understand the disease management better and for more appropriate self-care and better quality of life during extreme weather conditions. The study by Asif (2011) indicated that the amount and type of food consumed mainly serve as determinant of human health. This study is in line with a study by Jager *et al*. (2019), which reported knowledge of preparation of diabetic food or meals is very much important.

4.3.2.5.3 Sub-Theme 5.3: Education on Stress Management Suggested for PLDM

The findings of this study revealed that participant indicated that they experience stress regarding changing temperatures. Literature revealed that stress can cause some people to become ill and when you have diabetes, stress can significantly affect your ability to control the disease. If you are under stress, you may skip meals or forget to take your medication which will affect your blood sugar level (Falco *et al.*, 2015). The

sub-theme revealed that participants need education on how to manage stress:

> *I am a human, I have stress. I would like to be educated on how to manage the stress at home and at work. Especially at work and my siblings. I need to be educated on how to cope with the everyday life because there are people who need me, and I also need them. [Participant 24]*

This is supported by a study which indicates that stress might affect the behaviour of PLDM with emotional mood disturbances (Turin & Radobuljac, 2021). There is a negative correlation found between stress and treatment adherence level among T2DM patients because of lack of awareness and carelessness, Diabetes Self-Management Education (DSME) is an important program for patients in managing their sugar level on regular basis and has proved as an effective approach Sami (2017). This coping strategy is essential for effective self-care in diabetes.

4.3.2.5.4 Sub-Theme 5.4: Provision of Information on Proper Storage of Medication During Changing Temperatures Suggested for PLDM

The findings of the study revealed lack of knowledge on proper storage of medication during changing temperatures. On the other hands some participants have indicated that they lack knowledge on how to store their medications. Participants were asked to explain how they store their medication at home with regard to changing temperatures. This is what they said:

> *They have never told me where to put my medication mine I just leave it in the bag. When I finish eating I just take my bag and drink my tablets and put it back. [Participant 20]*

> *How to store my tablets am putting them in the kitchen cabinet Participant 30]*

Am putting my tablets in the drawer of the dressing table in my room is in a good place. [Participant 05]

This is supported by the study of Altebainawi *et al*. (2020) which concluded that knowledge on optimal storage of antidiabetic medication is poor among DM at public hospitals and clinics during extreme temperature changes. Keeping medications stored properly helps to ensure the safety, purity, potency and overall effectiveness of medicines. Improper storage at home or while traveling may cause accidental poisoning and can subject medications to unfavourable conditions such as high temperature, light, and humidity. Thus, medication handling and storage (particularly, those sensitive to high temperature by patients are becoming an issue of concern (Altebainawi *et al.*, 2020).

4.3.2.6 Theme 6: Description of Available Services to Address the Changes Related to Changing Temperatures

Provision of services by the government is very much crucial because people in rural areas depend more on those available services. The study findings gave a clear description of services that are available to address the challenges related to changing temperatures. The following sub-themes emerged: Provision of information giving by the hospital and clinics commended, Services on provision of food parcel suggested by PLDM.

4.3.2.6.1 Sub-Theme 6.1: Provision of Information by the Hospitals and Clinics Commended

The study findings revealed that health education sessions take place daily at clinics. They further indicated that participants accept and follow the related health advice given by nurses. This is confirmed by the following extracts from the participants' responses:

They gave me a file information showing what must I eat, drink and what not to eat or drink how to handle the situations and is not a

really a big problem on what to do or not to do. At the hospital they gave me all the information that I have to use at home and am happy to use it. For all these years, I can control it. [Participant 1]

Here at the clinic they have taught us that my condition is not curable so I must manage myself and follow the instructions. What bothers me is that my blood glucose is not controllable it is always high. It is always fluctuating goes up and down. [Participant 8]

I was given a form at the clinic, I eat movate porridge, low fat milk, 100% milk and weet bix. I also eat meat, but I remove the skin first. I was also told to avoid food with a lot of oil. [Participant 26]

The findings of this study revealed that there is a need to strengthen continuous education on services available and on how to access them with regard to changing temperatures. A report by Zilbermint (2020) concurred with the findings, indicating that patients with diabetes and cardiovascular complications should be considered high risk and may require an individualized treatment management plan. In primary health care facilities, health education is common and the cornerstone. The provision of health education to patients helps improve knowledge, compliance to treatment and self-care of the disease (Eckman *et al.*, 2012; Parahoo, 2014) (Jahan et al., 2014).

4.3.2.6.2 Sub-Theme 6.2: Services on Provision of Food Parcels Suggested by PLDM

The findings of this study revealed that participants further suggested that they need assisted with food parcels. The available literature indicates that social support is important in helping patients with diabetes to cope with the disease and to improve adherence to treatment (Ramkisson *et al.*, 2017). The findings of this study are confirmed by the following extracts from participants:

Yes, we need help food, we don't eat proper food because of we don't have things to buy with (meaning money) to buy proper food even apples we don't eat them. [Participant 3]

I went to hospital they said I have to get grant due to that my blood glucose is always high but at the hospital indicated that I cannot received grant because my condition is curable. I was selling tomatoes since I was experiencing this dizziness I stopped selling cause was exposing myself to danger of being hurt my tomato cases. [Participant 18]

Eish as I have indicated that if we can receive supplements because pap, bread have lot of starch so if we take supplements and we will be more strong. [Participant]

The extracts above suggest that there is need for food supply for people with chronic conditions in order to cope well during changing temperatures. The study by Low Wang, Hess, Hiatt & Goldfine (2016) indicated that healthy eating is the primary method to treat DM. Black and Latino individuals with DM, especially poor, insufficient or undereducated are more likely to have a diet in fat and low in fibre, fruit and vegetables.

This is further supported by the observation that PLDM in vulnerable or minority communities have poor access to healthy food, and they are more likely to experience food insecurity which is associated with DM (Berkowitz *et al.*, 2018).

4.4 Presentation and Interpretation of the Quantitative Strand

The mixed method exploratory sequential design was adopted in this study. The study commenced with the qualitative strand, and thereafter the results from the themes and sub-themes which emerged during thematic analysis were discussed. According to Creswell (2018), one of the limitations of a qualitative research approach is a bias where the researcher might influence the results, and more importantly, qualitative results cannot be generalized because of the sample size. In this study, the use of the quantitative approach enabled the researcher to generalize the qualitative results to a larger population of PLDM in the Limpopo Province.

4.4.1 Response Rate

To ensure that the findings of the study are representative of the whole population, a total of 195 questionnaires were distributed, and 185 were returned and the returned questionnaires were considered for data analysis as they were fully completed.

4.4.2 Data Analysis

Data were analyzed using SPSS version 26.0 with the assistance of the University statisticians. Tables are used to present data which is divided into different sections (Appendix 5A). The respondents had to state whether they Agree, Disagree, Uncertain and/or others.

4.4.3 Section A: Demographic Data

The demographic data are presented in Table 4.3.

▲ **Age**

The ages of the participants in this study ranged as follows: (n=2)=1.1% participants were between 81-90 years old, (n=27)=14.6% participants were between 71-80 years old, (n=52)=28.1% participants were between 61-70 years old, (n=57)=30.8% participants were between 51-60 years old, (n=37)=20% were between 41-50 years old, (n=8)=4.3% were between 31-40 years old and (n=2)=1.1% were between 20-30 years old.

▲ **Gender**

The study consisted of 117 (63%) females and 68 (36%) males. Females were considerably more than males. These results mean that women are mostly suffering from diabetes mellitus than men.

▲ **Ethnicity**

The study revealed that most participants were African (n=179; 96.8%), followed by Whites (n=4; 2.2%) and Coloureds (n=2; 1.1%). These results imply that more Africans

in the study population were suffering from diabetes mellitus.

Table 4.3: Demographic characteristic of the repondents

Demographic	Category	Frequency(n) (%)		
		Female	Male	Total
Age	20-30	(0.0%)	2 (1.1%)	2 (1.1%)
	31-40	5 (2.7%)	3 (1.6%)	8 (4.3%)
	41-50	27 (14.6%)	10 (5.4%)	37 (20.0%)
	51-60	36 (19.5%)	21 (11.4%)	57 (30.8%)
	61-70	29 (15.7%)	23 (12.4%)	52 (28.1%)
	71-80	18 (9.7%)	9 (4.9%)	27 (14.6%)
	81-90	2 (1.1%)	(0.0%)	2 (1.1%)
Ethnicity	African	113 (61.1%)	66 (35.7%)	179 (96.8%)
	Coloured	2 (1.1%)	(0.0%)	2 (1.1%)
	White	2 (1.1%)	2 (1.1%)	4 (2.2%)
Marital status	Divorced	3 (1.6%)	4 (2.2%)	7 (3.8%)
	Married	58 (31.4%)	46 (24.9%)	104 (56.2%)
	Single	38 (20.5%)	12 (6.5%)	50 (27.0%)
	Widowed	18 (9.7%)	6 (3.2%)	24 (13.0%)
Highest level of education	Never went to school	12 (6.5%)	2 (1.1%)	14 (7.6%)
	Primary school	32 (17.3%)	18 (9.7%)	50 (27.0%)
	Secondary	57 (30.8%)	35 (18.9%)	92 (49.7%)
	Tertiary	16 (8.6%)	13 (7.0%)	29 (15.7%)
Employment status	Employed	14 (7.6%)	13 (7.0%)	27 (14.6%)
	Pensioner	42 (22.7%)	25 (13.5%)	67 (36.2%)
	Self-employed	7 (3.8%)	14 (7.6%)	21 (11.4%)
	Unemployed	54 (29.2%)	16 (8.6%)	70 (37.8%)
Residence type	Rural	95 (51.4%)	51 (27.6%)	146 (78.9%)
	Semi-rural	17 (9.2%)	12 (6.5%)	29 (15.7%)
	Urban	5 (2.7%)	5 (2.7%)	10 (5.4%)
Treatment	Tablets		168 (90.81%)	
	Injection		9 ((4.86%)	
	Both tablets and injection		8 (4.32%)	
Years being diagosed with diabetes	1 year		15 (8.11%)	
	2 years		15 (8.11%)	
	3 years		37 (20.0%)	
	4 years		33 (17.84%)	
	5 years		39 (21.08%)	
	5 years and above		46 (24.66%)	
Total		**117 (63.2%)**	**68 (36.8%)**	**185 (100%)**

▲ Marital Status

The marital status of the study participants was as follows: Married (n=104; 56.2%); Single (n=50; 27%); Divorced (n=7; 3.8%); and Widowed (n=24; 13%).

▲ Highest Level of Education

The participants had varying levels of education. The educational levels of the study respondents were as follows: Secondary school (n=92; 49.7%); Primary school (n=50; 27%); Tertiary education (n=29; 15.7%); and those respondents who Never attended school (n=14; 7%).

▲ Employment Status

The employment status of the study respondents was as follows: Employed (n=27; 14.6%); Pensioners (n=67; 36.2%); Self-employed (n=21; 11.4%).

▲ Residence Type

The participants were also expected to indicate the type of residential area where they lived. The residential areas of the respondents were as follows: Rural area (n=146; 78.9%); Semi-rural (n= 29; 15.7%); and Urban (n=10; 5.4%).

▲ Treatment

The participants were also expected to indicate the type of treatment that they are taking. The findings show that most PLDM are taking Tablets (n=168; 90.81%); Injection (n=9; 4.86%) Both tablets and injection (n=8; 4.32%).

▲ Years Being Diagosed with Diabetes

The participants indicated the years of being diagnosed with diabetes as follows: Five years and above (n=46; 24.66%); Five years (n=39; 21.08%); Four years (n=33; 17.84%); Three years (n=37;20%); Two years (n=15; 8.11%); and One year (n=15; 8.11%).

4.4.4 Section B: Participants' Expression of Their Reactions to Changing Temperatures

In this section, the respondents were supposed to indicate whether they Agree, Disagree, or are Uncertain or Other on the statements provided.

4.4.4.1 Participants' Experiences of Symptoms During Hot Temperature

Table 4.4 summarizes the participants' experiences of symptoms during hot temperature.

Table 4.4: Participants' experiences of symptoms due to hot temperatures

Symptoms due to the effects of hot temperature	Agree n (%)	Disagree n (%)	Uncertain n (%)
I experience excessive sweating during hot days.	96 (51.9%)	85 (45.9%)	4 (2.2%)
I experience dizziness when is hot.	104 (56.2%)	79 (42.7%)	2 (1.1%)
I suffer itchiness of vulva during hot days.	41 (22.2%)	92 (49.7%)	(0%)
My legs are painful when is hot.	93 (50.3%)	89 (48.1%)	3 (1.6%)
I am feeling hungry more often.	92 (49.7%)	89 (48.1%)	4 (2.2%)
I am experience loss of energy.	88 (47.6%)	96 (51.9%)	1 (0.5%)

▲ **Excessive Sweating**

The study findings indicate that 51.9% (n=96) of the participants Agreed that they were experiencing excessive sweating during hot temperature whereas 45.9% (n=85) Disagreed and 1.1% (n=4) were Uncertain about experiencing excessive sweating during hot temperatures.

▲ **Dizziness**

The study findings indicate that 56.2% (n=104) of the participants Agreed that they were experiencing dizziness during hot temperatures, whereas 42.7% (n=79) Disagreed and 1.1% (n=2) were Uncertain.

▲ **Itchiness of Vulva**

The study findings indicate that 49.7% (n=92) of the participants Disagreed that they sufferred from itchiness of the vulva during hot temperatures, whereas 22.2% (n=41) Disagreed.

▲ **Painful Legs**

The study findings indicate that 50.3% (n=93) of the participants Agreed that their legs were painful during hot temperatures, whereas 48.1% (n=89) participants Disagreed and 1.6% (n=3) were Uncertain.

▲ **Feeling Hungry More Often**

The study findings show that 49.7% (n=92) of the participants Agreed to feeling hungry more often when it is hot, whereas 48.1% (n=89) Disagreed and 2.2% (n=4) were Uncertain.

▲ **Loss of Energy**

The study findings show that 51.9% (n=96) of the respondents Disagreed that they experienced loss of energy when it is hot, whereas 47.6% (n=88) Agreed and 0.5% (n=1) were Uncertain.

4.4.4.2 Participants' Experiences of Symptoms During Cold Temperature

Table 4.5 summarizes the participants' symptoms during cold temperature.

▲ **Legs and Heels Are Painful**

The study findings reflect that 63.8% (n=118) of the participants Disagreed that when it is cold their legs and heels were painful and 36.2% (n=67) Agreed.

▲ **Painful Joints**

The study findings reflect that 57.8% (n=107) of the participants Agreed to that during

cold temperatures they experienced painful joints, and 42.2% (n=78) Disagreed.

Table 4.5: Participants' experiences of symptoms due to cold temperatures

Symptoms due to the effects of cold temperature	Agree n (%)	Disagree n (%)	Uncertain n (%)
When it is cold my legs and heels are painful	67 (36.2%)	118 (63.8%)	(0%)
During cold days I experience painful joints.	107 (57.8%)	78 (42.2%)	(0%)
When it is cold my feet are too cold leading to inability to sleep.	48 (25.9%)	136 (73.5%)	1 (0.5%)
When it is cold my whole body feels too cold	92 (49.7%)	92 (49.7%)	1 (0.5%)

▲ **Feet Are Too Cold Leading to Inability to Sleep**

The study findings show that 73.5% (n=136) of the participants Disagreed that when it is cold their feet are too cold leading to inability to sleep, whereas 25.9% (n=48) Agreed and 0.5% (n=1) were Uncertain.

▲ **Whole Body Feels Too Cold**

The study findings show that equal proportions of the participants (n=92; 49.7%) Agreed and Disagreed that during cold temperatures their whole body feels too cold, whereas 0.5% (n=1) were Uncertain.

4.4.4.3 Challenges Experienced by Participants

Table 4.6 summarizes the challenges experienced by the participants.

▲ **Reduced Eyesight**

The study findings show that 56.8% (n=105) participants Agreed that they sufferred from reduced eye sight, whereas 42.2% (n=78) Disagreed and 1.1% (n=2) were Uncertain.

Table 4.6: Challenges experienced by participants

Symptoms	Agree n (%)	Disagree n (%)	Uncertain n (%)
Am suffering from reduced eyesight.	105 (56.8%)	78 (42.2%)	2 (1.1%)
Am not able to work due to my condition.	78 (42.2%)	107 (57.8%)	(0%)
I am able to check my blood glucose regularly.	48 (25.9%)	136 (73.5%)	1 (0.5%)
I am not able to do my daily chores with no difficulty.	127 (68.6%)	56 (30.3%)	2 (1.1%)

▲ **Not Able to Work**

The study findings reflect that 57.8% (n=107) of the participants Disagreed that they were not able to work due to their condition, whereas 42.2% (n=78) Agreed and 0.5% (n=1) were Uncertain.

▲ **Able to Check Blood Glucose Regularly**

The study findings reflect that 73.5% (n=136) of the participants Disagreed that they were able to check their blood glucose regularly, whereas 25.9% (n=48) and 1.1% (n=2) were Uncertain.

▲ **Not Able to do Daily Chores with No Difficulty**

The study findings reflect that 68.6% (n=127) of the participants Agreed to that they were not able to do their daily chores without difficulty, whereas 30.3% (n=56) Disagreed and 1.1% (n=2) were Uncertain.

4.4.5 Section C: Participants' Ways of Dealing with the Effects of Changing Temperatures

In this section, the participants were supposed to indicate whether they Agree, Disagree, are Uncertain or Other on the statements provided.

4.4.5.1 Coping with Hot Temperature

Table 4.7 summarizes the participants' different ways of dealing with hot temperature.

Table 4.7: Participants' different ways of dealing with hot temperatures

Coping with hot temperature	Agree n (%)	Disagree n (%)	Uncertain n (%)	Other, Specify n (%)
When it is hot I apply cold cloth/tap sponge on my body to cool down.	111 (60%)	73 (39.5%)	1 (0.5%)	-
I drink lot of water from the tap when it is hot.	175 (94.5%)	10 (5.4%)	-	-
I drink cold water from the fridge when it is hot.	74 (40%)	110 (59.5%)	1 (0.5%)	-
When feeling hot I take a bath to cool myself down.	134 (72.4%)	50 (27%)	1 (0.5%)	-
I am using a fan when am feeling hot.	102 (55.1%)	82 (44.3%)	1 (0.5%)	-
I wear loose light clothes when it is hot.	167 (90.3%)	18 (9.7%)	-	-
When it is hot I sleep on the floor to cool the body.	55 (29.7%)	129 (69.7%)	1 (0.5%)	-
When it is hot sit outside under the shade when experiencing hotness.	152 (82.2%)	31 (16.8%)	1 (0.5%	1 (0.5%)
I am always indoors for protection from heat	66 (35.7%)	117 (63.2%	1 (0.5%)	1 (0.5%)
I do house chores in the morning.	154 (83.2%)	29 (15.7%)	1 (0.5%)	1 (0.5%)

▲ Apply Cold Cloth\Tap Sponge on Body to Cool Down

The study findings reflect that 60% (n=111) Agreed that when it is hot they apply cold cloth\tap sponge to cool down their bodies, whereas 39.5% (n=73) Disagreed and 0.5% (n=1) were Uncertain.

▲ Drink Lots of Water from Tap

The findings of the study revealed that 94.5% (n=175) of the participants Agreed that they drink lots of water from the tap when it is hot, whereas 5.4% (n=10) Disagreed and 0.5% (n=1) were Uncertain.

▲ Drink Cold Water from the Fridge

The findings of the study revealed that 59.5% (n=110) of the participants Disagreed

that they drink cold water from the fridge when it is hot, whereas 40% (n=74) Agreed and 0.5% (n=1) were Uncertain.

▲ Take a Bath to Cool Down

The findings of the study revealed that 72.4% (n=134) of the participants Agreed that they take a bath to cool down, whereas 27% (n=50) Disagreed and 0.5% (n=1) were Uncertain.

▲ Use a Fan

The findings of the study revealed that 55.1% (n=102) of the participants Agreed that they use a fan when the they are feeling hot, whereas 44.3% (n=82) Disagreed and 0.5% (n=1) were Uncertain.

▲ Wear Loose Light Clothes

The findings of the study revealed that 90.3% (n=167) of the participants Agreed that they wear loose light clothes when it is hot, whereas 9.7% (n=18) Disagreed.

▲ Sleep on the Floor to Cool Body

The findings of the study revealed that 69.7% (n=129) of the participants Disagreed that they sleep on the floor to cool their bodies when they feel hot, whereas 29.7% (n=55) Agreed and 0.5% (n=1) were Uncertain.

▲ Sit Outside Under the Shade

This study reveals that 82.2% (n=152) of the participants Agreed that when it is hot they sit outside under the shade, whereas 16.8% (n=31) Disagreed while equal proportions of the participants 0.5% (n=1) cited they were either Uncertain or specied Other.

▲ Always Indoors for Protection from Heat

The findings of the study revealed that 63.2% (n=117) of the participants Disagreed

that they are always indoors for protection from the sun, whereas 35.7% (n=66) Agreed, while 0.5% (n=1) were equally Uncertain or specified Other.

▲ **Do House Chores in the Morning**

The findings of the study revealed that 83.2% (n=154) of the participants Agreed that they do house chores in the morning, whereas 15.7% (n=29) Disagreed, while 0.5% (n=1) of participants in equal proportions were either Uncertain or specified Other.

4.4.5.2 Coping with Cold Temperature

Table 4.8 summarizes the participants' different ways of dealing with cold temperatures.

Table 4.8: Participants' different ways of dealing with cold temperatures

Coping with cold temperature	Agree n (%)	Disagree n (%)	Uncertain n (%)	Other, Specify n (%)
When it is cold I stay indoors to be warm.	156 (84.3%	26 (14.1%)	2 (1.1%)	1 (0.5%)
I sit around the fire when it is cold to keep warm.	74 (40%)	111 (60%)	-	-
When it is cold I sit at the sun to keep warm.	99 (53.5%)	84 (45.4%)	1 (0.5%)	1 (0.5%)
I wear warm clothes when it is cold.	184 (99.5%)	I (0.5%)	-	-
When am feeling cold I drink tea/warm fluids.	143 (77.3%)	40 (21.6%)	2 (1.1%)	
When I feel cold I take a warm bath	165 (89.2%)	20 (10.8%)	-	-

▲ **Stay Indoors**

The findings of the study revealed that 84.3% (n=156) of the participants Agreed that when it is cold they stay indoors to be warm, whereas 14.1% (n=26) Disagreed, while 0.5% (n=1) were Uncertain and 1.1% (n=2) indicated Other.

▲ **Sit Around the Fire**

The findings of the study revealed that 60% (n=111) of the participants Disagreed that they sit around the fire when it is cold to keep warm, whereas 40% (n=74) Agreed to the statement.

▲ **Sit in the Sun**

The findings of the study revealed that 53.5% (n=99) of the participants Agreed that when it is cold they sit in the sun to keep warm, whereas 45.4% (n=84) Disagreed, while the remainder of the participants in equal proportions (n=1; 0.5%1) were Uncertain or specified Other.

▲ **Wear Warm Clothes**

The findings of the study revealed that 99.5% (n=184) of the participants Agreed that they wear warm clothes when its is cold, whereas 0.5% (n=1) Disagreed.

▲ **Drink Tea/Warm Fluids**

The findings of the study revealeds that 77.3% (n=143) of the participants Agreed that when they feel cold they drink tea/warm fluids, whereas 21.6% (n=40) Disagreed and 1.1% (n=2) were Uncertain.

▲ **Take a Warm Bath**

This study reveals that 89.2% (n=165) of the respondents Agreed that when they feel cold they take a warm bath, whereas 10.8% (n=20) Disagreed.

4.4.6 Section D: Participants' Health Information/Learning Needs

Table 4.9 summarizes the participants' health information/learning needs.

▲ **Nurses Provide Dietary Information**

The responses to nurses providing information with regard to the diet to follow revealed that 78.9% (n=146) of the participants Agreed, whereas 21.1% (n=39) Disagreed.

Table 4.9: Participants' health information/learning needs

Health information/learning needs	Agree n (%)	Disagree n (%)	Uncertain n (%)	Other, Specify n (%)
Nurses provide information with regard to the diet to follow.	146 (78.9%)	39 (21.1%)	-	-
I receive useful information about what to do on hot/cold days.	117 (63.2%)	68 (36.8%)	-	-
Nurses provide me with continuous information on how to keep medication.	143 (77.3%)	42 (22.7%)	-	-
I need support on planning my daily activities.	111 (60%)	74 (40%)	-	-

▲ **Receive Useful Information About What to Do on Hot/Cold Days**

The participants' responses to "I receive useful information about what to do on hot/cold days" revealed that the majority Agreed that they received useful information (n-117; 63.2%) wheres 36.8% (n=68) Disagreed to the statement.

▲ **Nurses Provide Continuous Information on How to Keep Medication**

The findings of the study revealed that 77% (n=143) of the participants Agreed that nurses provided them with continuous information on how to keep medication, whereas 22.7% (n=42) Disagreed.

▲ **Need Support on Planning Daily Activities**

The participants' responses to "I need support on planning my daily activities" revealed that 60% (n=111) Agreed, whereas 40% (n=74) Disagreed to the statement.

4.4.7 Section E: Participants' Recommendations

Table 4.10 summarizes the participants' recommendations.

▲ **Provision Should be Made for Food Parcels**

The participants' responses to "I would recommend that the government provide food

parcels," revealed that 60% (n=111) Agreed, whereas 40% (n=74) Disagreed.

Table 4.10: Participants' recommendations

Recommendations	Agree n (%)	Disagree n (%)	Uncertain n (%)	Other, Specify n (%)
I would recommend that the government provide food parcels	111 (60%)	74 (40%)	-	-
I suggest that I should be provided with machine to test at home.	158 (85.4%)	27 (14.6%)	-	-

▲ **Provision Should be Made for Glucometer**

The participants' responses to "I suggest that I should be provided with machine to test at home," revealed that of 85.4% (n=158) Agreed to that they should be provided with a glucometer, whereas 14.6% (n=27) Disagreed.

4.5 Summary

This chapter has outlined an in-depth analysis, presentation, and interpretation of the results. Both the qualitative and quantitative data were presented and expounded. Chapter 5 presents the merging and the discussion of the findings.

CHAPTER 5

INTERPRETATION, INTERGRATION AND DISCUSSION OF THE FINDINGS

5.1 Introduction

This chapter will focus on the integration and discussion of the qualitative and quantitative results. The study adopted a mixed-method exploratory sequential design where qualitative data were collected and analyzed and the findings informed the development of a quantitative data collection instrument (Onwuegbuzie *et al.*, 2010). The integration of results from qualitative and quantitative data is done to bring a clearer understanding and to fully address the objectives of the study. The qualitative data were connected with the quantitative data to draw insight into the information gained from the results of both phases of the study (Berman, 2017; Wetcher-Hendricks, 2011).

5.2 Integration and Interpretation

In this study, integration was done at the reporting level through the adoption of the mixed method exploratory sequential design, which best enhances the achievement of the purpose of this study which was the development and implementation of coping strategies for PLDM to adapt to changing temperatures. The methodological integration occurred through building the results that emerged from qualitative data collected which informed the development of the quantitative data collection instrument (Wetcher-Hendricks, 2011). The reporting and the interpreting level was done through narrative interference from qualitative and quantitative data were contiguously described (Fetters *et al.*, 2013). Additionally, through a narrative approach, the researcher was able to connect the qualitative and quantitative data.

Thereafter, meta-inferences (narratives and theoretical statements) were developed to provide the connection between the qualitative and quantitative phases of the study (Creamer, 2018; McCrudden & McTigue, 2019). Figure 5.1 illustrates the different levels and approaches adopted during integration of the qualitative and quantitative results.

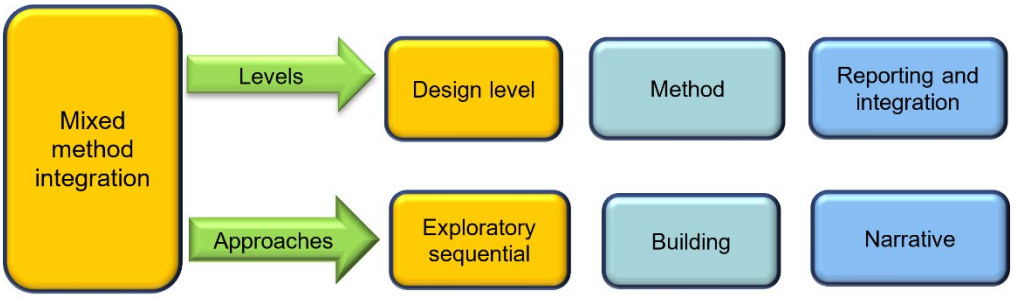

Figure 5.1: The different levels and approaches adopted during integration of the qualitative and quantitative results

5.2.1 Demographic Data

5.2.1.1 Gender

The study included both males and females. The females dominated both phases at 83.3% in qualitative and 63% females were considerably more than males. These results mean that more women are suffering from diabetes mellitus than men. This finding cooroborates that of Zhang, Ni, Yu, Wu *et al*. (2019) who reported in their study that women had a higher prevalence than men. However, Nordström, Hadrévi, Olsson, Franks & Nordström (2016) have found a higher prevalence of T2DM in older men than in older women.

5.2.1.2 Age

The respondents of the study were mainly 50 years and above. The total number of respondents was 185; 138 (75%) were 50 years and above. The participants' age prevalence is supported by Kalyani, Golden & Cefalu (2017) postulated that older

participants have a higher prevalence rate of diabetes mellitus compared to the younger age groups in the United States. This is because the risk for T2DM is mainly associated with age.

5.2.1.3 Marital Status

The majority of the study's participants were married. Fifty-six (56%) per cent of the indicated that they are married. This concurs with a study by Ramezankhani, Azizi & Hadaegh (2019), who have found that widowed women had a lower risk of T2DM. However, a study by Cornelis, Chiuve, Glymour *et al*. (2014) has pointed out that not being married, especially widowhood, was associated with an increased risk for T2DM in men. This study's results have shown that marital status did not influence the T2DM status of the participants.

5.2.1.4 Employment Status

The majority of the patients (37.8%) were unemployed, 36.2% pensioners and 14.6% employed. Unemployment can have an impact on their diabetes management. In their study, Naser *et al*. (2019) have found that patients' employment status can be linked to their behaviour. This is due to the negative association of unemployment and patients' health outcomes (Naser *et al.*, 2019).

5.2.1.5 Residential Areas

The majority of participants of this study (78.9%) were from rural areas while 5.4% were living in urban areas. This finding is supported by Rural Health Information (https://www.ruralhealthinfo.org/) which stated that diabetes is an increased concern for rural communities compared to urban communities because of risk factors that are prevalent in rural communities. The findings are further supported by a study which stated that in the United States rural areas have a higher burden of T2DM compared to urban areas (Dugani *et al.*, 2021).

5.2.2 Integration of the Major Findings of this Study

To achieve Objective 1, which was to explore and describe the impact of changing temperatures on PLDM to adapt, in Phase 1 (qualitative) of the study, participants were asked to describe their experiences with regard to the impact of changing temperatures on their daily living. Six themes and their respective sub-themes emerged. The following sub-theme outlined the experiences of PLDM regarding the impact of changing temperatures: Experiences of PLDM related to body reaction during exposure to hot temperature, Experiences of PLDM related to body reaction during exposure to cold temperature, Ailments experienced related to changing temperatures, Challenges of PLDM during changing temperatures and Knowledge and practices on changing temperatures for PLDM.

The themes and sub- themes were used in the development of the questionnaire for quantitative phase, which included various sections of the questionnaire (Appendix 5A). Table 5.1 indicates the findings that led to the integration of the results. In order to more fully address the research questions, interpretation-level integration occurred, connecting the qualitative data from Phase 1 of the study with the quantitative data from Phase 2 of the study using a joint display (Table 5.1). A joint display allows data to be visually brought together to “draw out new insights beyond the information gained from the separate quantitative and qualitative results” (Fetters *et al.*, 2013).

5.3 Interpretation and Discussion of Integration Findings

The correspondence between the results of the two phases refers to the similarities, which were identified during the integration stage of qualitative, and quantitative results. This section, thus, presents the interpretation and discussion of the integrated results from qualitative themes, quantitative constructs and literature control narratively. During the integration of the qualitative and quantitative results, the following findings were identified as illustrated in Table 5.1. Roy’s adaptation theory was used in support of the findings of this study (Whittemore & Roy, 2002).

Table 5.1: The integration of the qualitative themes and quantitative constructs

Objective	Sub-themes and quotations from participants in qualitative results	Corresponding items from questionnaire quantitative results	Results from interpretation
Objective 1: **To explore and describe the impact of changing temperatures on PLDM**	**Body's rection during exposure to hot and cold temperature:** • Experience excessive sweating • Feeling of dizziness • Painful legs • Feeling hungry more often	**Effects of hot temperature:** • 51% of participants experienced excessive sweating. • 56% of participants experienced dizziness. • 50% of participants agreed that their legs are painful when is hot temperature. • 50% of participants agreed to feeling hungry more often during hot temperature.	**Participant's expression of their bodily rection to changing temperatures**
	• Experience painful joints • Whole body feeling cold • Suffer from reduced eyesight • Unable to check blood glucose • Unable to do their daily activities	• 57% of participants indicated that during cold temperature the experience painful joints. • 50% of participants agreed that during cold temperature their whole bodies feel cold. • 56% of participants agreed to that they suffer from reduced eyesight. • 68.5% of participants agreed to that they are unable to check their blood glucose. • 67% of participants agreed that they are not able to do their daily activity.	**Challenges experienced during changing temperatures**

Objective 2: **Describe the knowledge and practices of PLDM to adapt to changing temperatures**	**Knowledge and practices adapt to cope with changing temperatures:** **Sub-theme** **Practices to adapt to hot temperature** • Some participants indicated that they use a wet cloth/tap sponge to cool themselves	• 94% of participants agreed that they drink water from the tap to cool their bodies. • 90% of participants agreed that they wear light loose clothes when feeling hot. • 72% participants agreed that they take a bath to cool their body down. • 82% of participants agreed that they sit under the shade when is hot. • 99% of participants agreed that during cold temperature they wear warm clothes. • 77% of participants agreed that they drink warm fluids/tea. • 84.3% of participants agreed that they stay indoors to keep warm when feeling too cold. • 89% of participants agreed that they take a warm bath when experiencing coldness. • 53% participants agreed that they sit in the sun to keep warm during cold temperature. • 78% of participants in quantitative phase indicated that they received health information with regard to the diet to follow.	**Measures employed by PLDM to adapt to changing temperatures**

	Sub-theme **Knowledge on adapting to changing temperatures** • Most participants in qualitative phase indicates that need to be taught about which diet they should follow. • Participant indicated that they need support on planning activities.	• 60% of participants indicated that the need support on how to plan their daily activities	**Poor knowledge with regard to changing temperatures**
	Suggestions from participants • Participants suggested that they should be provided with food parcels • Participants suggested that they should be supplied with glucometers.	• 85.4% of participant agreed that they should be provided with food parcels. • 98.3% of participants agreed that they should be provided with glucometer to check themselves at home.	**Recommended services proposed by PLDM**

5.3.1 Participants' Reactions to Changing Temperatures

The findings of this study indicate that participants expressed diverse experiences on how the impact of changing temperatures affected their body. Participants further outlined that they suffered from bodily reactions during exposure to hot temperature. In the quantitative study, 96% of PLDM experienced excessive sweating during hot temperature, 56% PLDM experienced dizziness, 50% suffered from painful legs and 50% experienced painful legs. The qualitative results further indicated that participants experienced itchiness of vulva, feeling of hunger more often during hot temperature. The results of this study revealed that the impact of hot temperature on PLDM was severe. PLDM are at high risk for heat exhaustion which occurs when it is very hot and losing of water and salts from the body which lead to the following symptoms: sweating more than usual, dizziness and cramping muscles (American Diabetes Association, 2019).

The findings demonstrate that there is a need for development of coping strategies for PLDM to adapt to changing temperatures. Experiences of PLDM related to body reactions during exposure to cold temperature. The findings of this study revealed that 50% of participants indicated that their whole body felt too cold and 58% experienced painful joints. An article by Rene (2022) confirmed that patients with vascular problems often do not have proper blood flow, especially to their extremities, and cold temperature may exacerbate slow blood flow. The findings are further supported by an article by Gupta (2021) that indicated that most PLDM were unaware of their nerve functions, and are unable to feel the difference between the cold and hot weather, which can lead to burn injury. Also, during the winter season, most diabetic patients tend to lose feeling in their toes and feet due to vascular changes.

5.3.2 Challenges Experienced by PLDM During Changing Temperatures

The qualitative results revealed that participants experienced challenges with regard to their condition. The findings of this study showed that 56.8% of the participants

agreed that they suffered from reduced eyesight. The findings of this study also revealed that participants agreed that they were not able to do their daily chores with no difficulty and furthermore had challenges with regard to monitoring their condition. The findings of the quantitative phase revealed that 73.5% of participants indicated they were unable to check their blood glucose regularly. The findings of this study conclude that PLDM experiences challenges during changing temperatures.

The finding of this study revealed that the participants lacked knowledge on how to store their medication. The study by Hajat *et al*. (2017) indicated that public health protection measures should provide advice to patients with T2DM and their health care providers about dealing with heat exposure, and the contribution that GPs could make in helping identify and manage such patients should be enhanced. Some medication are sensitive to heat and may lose thedir effectiveness or cause harmful side effects when exposed to heat, other medications alter individual tolerance to extreme heat and increase the risk of illness (Altebainawi *et al.*, 2020).

5.3.3 Measures Employed by PLDM to Adapt to Hot Temperature

The study findings provide a snapshot of measures employed by PLDM to adapt to hot temperatures. PLDM revealed during interviews that they drink lots of water from the tap during hot temperatures, thus indicating that most PLDM were familiar with taking appropriate measures to respond to the effect of hot temperature. These findings concur with statements by WHO that during extreme hot temperature people must keep their bodies cool and hydrated (World Health Organization, 2016; World Health Organization, 2018). Furthermore, they should use light and loose-fitting clothing and bed linen, take cool showers or baths, and drink regularly while avoiding alcohol, caffeine and sugary drinks. It was also indicated that they should try to spend 2–3 hours of the day in a cool place, if necessary and possible.

The finding of the study revealed that when they feel hot, PLDM take a bath to cool their bodies which concur with an article by Loughnan (2013) that stated during extreme hot temperature, PLDM should place damp towels around their necks and

shoulders to cool themselves, place their feet in basin or bucket of cool water. Cool water is better than icy cold water, which causes blood vessels to constrict and slow down the body's ability to radiate heat.The study also revealed that during hot temperature participants wore light loose clothes and the quantitative phase results indicate that 90% of participants agreed. This supported by article by Better Health (2022) which stated that when you're diabetic during hot temperature wear light-coloured, loose-fitting clothing made from natural fibres like cotton and linen (https://www.nhs.uk/better-health/). According to the Centers for Disease for Control and Prevention (2022) diabetics should drink plenty of water—even if they're not thirsty—so they don't get dehydrated, avoid alcohol and drinks with caffeine, like coffee and energy or sports drinks. These can lead to water loss and spike blood sugar levels, so check blood sugar before, during, and after activity, wear loose-fitting, lightweight, light-coloured clothing.

The findings of this study revealed that participants sit in the shade during hot temperature to cool themselves. The quantitative phase indicated that 82% of participants agreed that they sit under the shade when they feel hotness. This is supported by a study that indicates that patients used multiple methods to protect themselves from the heat (Nassar *et al.*, 2010; Westphal *et al.*, 2010). The findings of this study revealed that participants do their house chores in the morning. The quantitative phase results score of 83% support the finding of the qualitative phase that most PLDM were familiar with the need to keep exposure time in the heat short.

Additionally, patients were taking appropriate protective measures during hot weather. The findings is supported by Centre for Chronic Disease and Prevention Control (2022) which stated that PLDM schedule outdoor activities carefully and pace themselves when doing exercise, get plenty of rest and also be sure to know the signs of heat stress. In addition, the article by Better Health (2020) state that during hot temperature PLDM need to plan ahead, schedule activities during the coolest part of the day and avoid exercising in the heat. If tjey must go out, they should wear a hat and sunscreen and take a bottle of water with them (https://www.nhs.uk/better-health/).

5.3.4 Measures Employed by PLDM to Adapt to Cold Temperature

The study findings revealed that during cold temperature 84% of participants stayed indoors to keep themselves warm. The findings of this study also revealed that participants sit in the sun during cold temperature to keep warm. The study further indicated that 53.5% agreed that they sit in the sun to keep warm when it is cold. The findings this study revealed that participants have employed measures to deal with changing temperatures in order to adapt. This finding is supported by an article by Orenstein & Welch (2022) If your hands are cold, you may have to warm them up to get a good blood sugar reading and wash them in warm water before testing.

5.3.5 Poor Knowledge with Regard to Changing Temperatures

The finding of this study revealed that PLDM lacked knowledge on how store their medication and also need taught on how to plan their diet. According to IDF (2015), nutrition and diabetes medication play important part in diabetes management and its outcomes leading to stabilization of glucose levels. Asif (2014), in support of these results, accentuated that diet and medication is an integral part of PLDM management; therefore, the health care provider and the patient should understand the basic dietary needs of the patient. Ouyang (2017) also asserted that nurses should inspire patients to understand the importance of diet and medication storage to aid in diabetes management, for a better quality of life.

5.3.6 Recommendations Suggested by Participants

The findings of this study revealed that PLDM suggested that they should be provided with food parcels, 85.4% participant agreed to that. Participants further suggested that they should be supplied with HGT machines to monitor their blood glucose while at home, 98% agreed to that in quantitative phase. This finding is supported by the study by Wrigh, Adeniyi, Yogeswaran & Longo-Mbenza (2015) which indicated that the majority of PLDM reported that lack of money to buy machines for testing blood glucose affected their control of diabetes and some of the participants reported that the nearest clinics have shortage of machines to check blood glucose; hence, they are

compelled to travel long distances to see doctors. The findings are further supported by Werfalli (2019) and Nooseisai *et al*. (2021) who stated that some family members may need education about how to undertake diabetes self-management care tasks such as self-monitoring of blood glucose and administering insulin to enable them to support the person with diabetes.

5.3.7 Integration of Roy's Adaptation Model to the Findings of This Study

The findings of this study are further supported by Roy's adaptation theory (Whittemore & Roy, 2002) which was used as a theoretical frame work for this study, wherein, PLDM expressed their bodily reactions regarding the impact of changing temperatures, challenges experienced by PLDM with regard to changing temperatures, measures employed by PLDM in order to adapt to changing temperatures and PLDM poor knowledge with regard to changing temperatures. This study explored the measures used by PLDM and found that there is a need to develop coping strategies for PLDM to adapt to changing temperatures.

5.3.7.1 Roy's Adaptation Theory

Roy's adaptation theory focuses on changes experienced by human beings as the response to environmental stimuli to maintain the integrity, identified and described the major concepts and sub-concepts that are relevant to this study. Roy's theory comprises several major health sciences meta-paradigm concepts and sub-concepts (Whittemore & Roy, 2002). Regarding the concepts, this study concentrated on human beings, the environment, health and nursing (Brink *et al.*, 2014). Below is an explanation of those concepts as related to this study which is person, environment, health and nursing.

5.3.7.2 Major Concepts of Roy's Adaptation Theory in This Study

- **Person**

The researcher developed the strategies for PLDM based on Roy's adapation theory.

Discussion of the findings should include literature to support the study findings. Roy's adaptation theory views a person in a holistic way, the core concept in her model is adaptation which assumes that a person is an open system who responds to stimuli from both internal and external sources (Whittemore & Roy, 2002). The human is constantly changing, moving toward a dynamic state of system stability or coping of varying degrees (Ahmadi & Sadeghi, 2017). This study was concerned with PLDM reactions to the impact of changing temperatures, assisting PLDM to respond positively and to cope with the stress associated with the impact of changing temperatures. In addition, the researcher used Roy's theory because it concentrates on the human being's response to actual or potential environmental stressors (Whittemore & Roy, 2002). Hence, in this study, the stressors are explained based on the effect of hot and cold temperatures below:

▲ Environment

The environment is a vital arena that is suitable to the system and its functions. The environment may be viewed as all factors that affect and are affected by the system. Roy's adaptation model identifies relevant environments that are the internal, external, and created environments (Whittemore & Roy, 2002). In this study, the environment is the hot and cold temperatures that people are facing on a daily basis. All the effect of cold and hot temperatures and interactive influences that are solely within the PLDM's boundaries make up this environment. In this study, body reactions (physiological reactions) of PLDM regarding their external environment which signifies the cold and hot temperatures.

The effect of hotness and coldness which create bodily reactions (physical reactions) of PLDM, the signs and symptoms that PLDM must manage on a daily basis, e.g., painful body. Painful legs and heels, and the created measures are consciously developed and used by the PLDM to support protective adaptation, which are the measures employed by PLDM about changing temperatures. Wearing of loose-fitting clothing during hot temperature, drinking lots of water, scheduling of house chores, doing them in the morning, sitting under the shade and during cold temperature they

have employed the following measures: wearing of warm clothing, taking of warm showers to warm their bodies, staying indoors to keep warm, wrapping themselves in blankets to keep warm.

- **Health**

In Roy's adaptation theory, health is defined as the condition or degree of system stability and is viewed as a continuum from wellness to illness (Whittemore & Roy, 2002). When the system needs of PLDM are met, optimal wellness exists. When the PLDM are not equip with knowledge regarding changing temperatures, they will fail to cope with the challenges of the impact of changing temperatures. When the assistance to adapt to changing temperatures is not consistent, PLDM will suffer a lot of the challenges regarding the impact of changing temperatures (Ahmadi & Sadeghi, 2017).

- **Nursing**

According to Roy's adaptation theory, a nurse's role while providing care for a PLDM involves facilitation of adaptation, they assess PLDM's behaviours for adaptation and assist in manipulating the stimuli that come from the environment (impact of both hot and cold temperatures) so that they fall within the PLDM's field of positive coping resulting in adaptation (Whittemore & Roy, 2002). Nursing education and practice have a significant impact on the knowledge and competencies of nursing personnel and other health professionals. The competencies of health professionals enable them to meet the various needs of PLDM. The primary concern is to develop coping strategies that are appropriate to assist PLDM to adapt to changing temperatures. Nursing interventions aim to help the PLDM adaptor adjust and retain, restore, or maintain some degree of stability between PLDM system variables and environmental stressors, focusing on conserving energy (Fawaz *et al.*, 2018).

5.4 Summary

The integration of changing temperatures adaptation into current public health practice is needed to ensure the adaptation strategies increase future resilience.

CHAPTER 6

DEVELOPMENT AND IMPLEMENTATION OF STRATEGIES

6.1 Introduction

This chapter outlines how the coping strategies for PLDM to adapt to changing temperatures were developed and implemented. Strategies are defined as plans designed to achieve particular long-term aims. Strategies are clusters of decisions about goals to pursue, the actions to take and how resources will be used to achieve these goals (Hornby, 2015; Nesengani *et al.*, 2021). In this study, strategies refer to proposed actions, behaviours, approaches and procedures that would assist PLDM in order to adapt to changing temperatures. The development of strategies were guided by the ADDIE model (Hsu *et al.*, 2014).

6.2 Objectives of the Study Which Guided the Development of Coping Strategies for PLDM

Objectives 1 and 2 in Phase 1 of the study at the situational were to:

- Explore and describe the impact of changing temperatures on PLDM at the health care centres of Limpopo Province.
- Describe the knowledge and practices of PLDM about the changing the temperature at the health care centres of Limpopo Province.

Objective 3 in Phase 2 of the study was to:

- Develop the strategies needed for PLDM to adapt to changing temperatures at the health care centres of Limpopo Province.

The findings of Phase 1 of the study guided the development of coping strategies for PLDM.

Objective 4 in Phase 3 of the study was to:

- Implement the coping strategies PLDM to adapt to changing temperatures at health care centres of Limpopo Province.

The research findings on the impact of changing temperatures, knowledge, and practices of PLDM, with regard to changing temperatures the practices guided the development of coping strategies for PLDM at the health care centres of Limpopo Province.

6.3 Methodology for the Development of Strategies

The findings of this study indicated that PLDM have poor knowledge with regard to adapting to changing temperatures at the health care centres of Limpopo Province. Coping strategies are formulated based on the major findings of the integration of the results of this study. The findings were as follows: participants' reactions to changing temperatures, challenges experienced by PLDM during changing temperatures, measures/practices employed by PLDM to adapt to changing temperatures, lack/poor knowledge with regard to changing temperatures, including recommendation of services by PLDM. The subjective information that was received from the PLDM, the objective data found by the researcher during the study and the assessments made were used in the development and implementation of the developed strategies. The methodology which was followed is the ADDIE model (Mustafa *et al.*, 2010), as decribed below:

6.3.1 The ADDIE Model

The ADDIE model was the model of choice used in the development of the coping strategies for PLDM (Figure 6.1). ADDIE is an acronym for Analyze, Design, Develop, Implement and Evaluate (https://www.uwb.edu/it/service-catalog/teaching-learning/

hybrid-and-online-learning/instructional-design/addie). The ADDIE model (Bouchrika, 2022; Nichols Hess & Greer, 2016; Spatioti *et al.*, 2022) is a systematic instructional design model consisting of five phases: Analysis, Design, Development, Implementation, and Evaluation. During this study the researcher assessed the various measures employed by PLDM with regard to the impact of changing temperatures, in turn, PLDM described the challenges and learning needs. This model assisted the researcher in the development of the coping strategies needed for PLDM to adapt to changing temperatures.

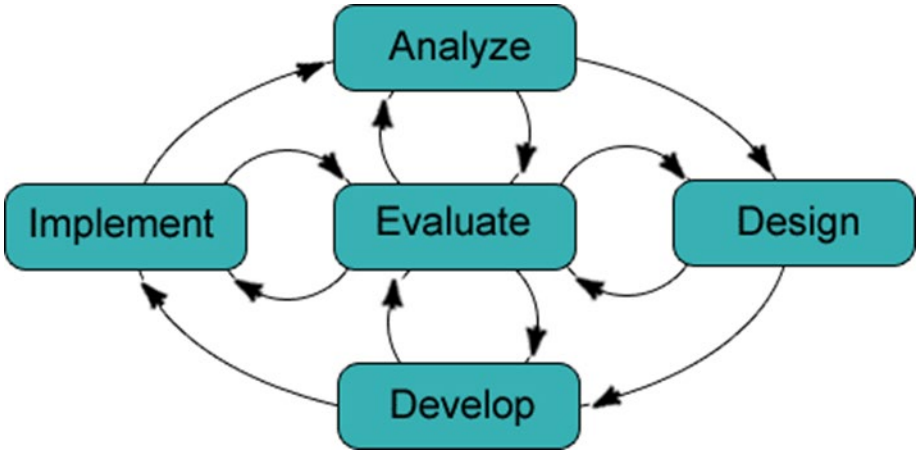

Figure 6.1: Schematic representation of the ADDIE model (Mustafa *et al.*, 2010)

6.3.1.1 Step 1: Analysis

The analysis is the first step of ADDIE's model which was considered as the goal setting stage in this study. The goal was to develop the coping strategies for PLDM to adapt to changing temperatures at the health care centres of Limpopo. This step provided the background of the PLDM in order to determine the impact of changing temperatures, their prior knowledge, prerequisites for learning their demographic information such as age, educational level, gender, residential area, employment status (South Africa Demographic and Health Survey (2016), 2017). These details assisted in determining the PLDM's needs. The major findings of the study were used to develop the coping strategies for PLDM.

6.3.1.2 Step 2: Design

The design phase includes the mapping out of the plan for the development of the coping strategies. The plan gives the details of who, where, what, when and how details of the coping strategies for use by the researcher and other health professionals who were part of developing and implementing the strategies (Shaikh *et al.*, 2004). This was done because of the integration of findings of the qualitative and quantitative strands that informed the design of the strategies. The gaps between what the PLDM know and what they need to know, including their support needs as indicated during empirical phase assisted the development of the coping strategies. Needs assessment results helped to determine the content necessary for the development, implementation and evaluation of the strategies.

6.3.1.3 Step 3: Development of the Coping Strategies

According to the ADDIE model (Hsu *et al.*, 2014), the development step is where the researcher creates and assembles the information needed for the development of the coping strategies. The aim of this study was the development of the coping strategies is to enhance PLDM's coping skills to adapt to changing temperatures. The purpose of the strategies is to provide educational suport and to equip PLDM with the knowledge to adapt to changing temperatures. The researcher developed the strategies that matched the learning needs identified in the design step.

6.3.2 Developed Strategies Based on the Challenges of the Participants

6.3.2.1 Theme 1: Participants Bodily Reactions to Changing Temperatures

STRATEGY 1

Self-Care Management of Symptoms During Changing Temperatures

The strategy was developed based on the participants' bodily reactions during changing temperatures both hot and cold temperatures.

Objective: To have the knowledge on how to cope with symptoms during changing temperatures.

Application:

- Use of proactive measures, including fan, cold showers, staying indoors or under the shade to keep your body cool.
- Wearing of loose light clothes during hot temperatures to keep your body cool.
- Drink lots of water during hot temperature to stay hydrated.
- Avoidance of strenuous activities during hot days.
- Drinking of warm fluids during cold temperature to keep your body warm.
- Be in warm place during cold temperature to keep warm.
- Wear warm clothes during cold temperature to keep your body warm.

6.3.2.2 Theme 2: Challenges Faced by PLDM During Changing Temperatures

STRATEGY 2

Awareness Regarding the Impact of Changing Temperatures

Objective: Knowledge of PLDM about complications of diabetes mellitus related to the impact of changing temperatures.

Application:

- Regular visit to health care centre for periodic check-up.
- Test your blood sugar levels frequently so that you can take

appropriate actions to keep levels stable.

- Monitor yourself for possible development of heat exhaustion, as well as hypoglycemia and hyperglycemia.

6.3.2.3 Theme 3: Poor Knowledge on Treatment/Medication Storage

STRATEGY 3

Proper Medication and Supplies Storage

The strategy was developed based on the challenges of poor knowledge about storage of medication and supplies.

Objective: To strengthen the knowledge about proper storage of medication and supplies.

Application:

- Take proactive measures to protect your medication and supplies from changing temperatures.
- Don't leave medication and glucose meter outside in direct sunlight.
- All refrigerated medicines should be always kept in the fridge.
- Request available home-based carers to monitor the proper storage of medication and supplies.
- Request both verbal and written instructions from the health-care professionals regarding the correct storage of medication and supplies.

6.3.2.4 Theme 4: Measures Employed by PLDM During Changing Temperatures

STRATEGY 4

Safety Measures During Changing Temperatures

This strategy was developed in relation to the practices that PLDM are engaged with during changing temperatures.

Objective: To encourage PLDM to maintain safety measures during temperature changes

Application:

- Know your normal blood glucose levels to prevent complications.
- Check your blood glucose level before and after exercise.
- Do not start exercise or strenuous physical activity during extreme temperatures.
- Always carry some snacks to prevent hypoglycaemia.
- Maintain hydration by taking fluids regularly.

6.3.2.5 Theme 5: Perceived Learning Needs

STRATEGY 5

Suggested Self-Care Coping Strategy

The above strategy was developed to address the perceived learning needs by participants.

Objective: Know the importance of self-care during temperature changes.

Application:

- Know the importance of scheduling activities properly.
- Participate in available diabetic support groups at your health care centre.

- Attend public health campaigns by health care workers to gain knowledge about the impact of changing temperatures.
- Request for available diabetic pamphlets, e.g., posters with pictures of food that should be consumed.

6.4 Validation of the Developed Strategies

Validation refers to the process of collecting validity evidence to evaluate the appropriateness of the interpretentions, uses, and decisions based on assessment results (Cook & Hatala, 2016). This study adopted the Delphi technique where the researcher consulted health care professionals who are considered experts in caring for PLDM at primary health care centres. The Delphi technique explains that experts in the field share their insights that stimulate thoughts and help bring consensus to an issue (Ogbeifun *et al.*, 2016). The developed strategies were validated for feasibility and to make sure that the strategies are well understood by PLDM.

In this study, the researcher subjected the developed strategies to the professional nurses at the health care centres who are experts in diabetes. The strategies were checked for practicality and possibility which means capable of being done or carried out successfully, Strategies were validated for being clear and free from ambiguity. Strategies were also checked for transparency and quality of being understood. The professionals stated that the strategies were well written and very much simple to be implemented. The developed strategies would be available at the health care centres where the study was conducted and will be accessible to all PLDM and the health care professionals who are responsible for the continuous implementation of the strategies as they render care. The developed strategies are important because PLDM will be supported and will be assisted to adapt to changing temperatures.

6.5 Implementation of the Developed Strategies

Implementation is a process of operationalization of the developed coping strategies. The implementation of the strategies was intended to confirm if the results of the study

were still the same as what the participants explained during the situational analysis phase in Chapter 3 of the study. The participants again have to confirm as to whether the strategies address their learning needs. The plan was to implement the coping strategies in all sampled health care centres in Limpopo Province where data were collected, but due to time frame constraints the plan was adjusted. Before the implementation, telephonic arrangements were made with the professional nurse who work at chronic section in the health care centre, the process was explained to all the health care workers involved in providing care to PLDM. A verbal permission was granted, and an appointment was secured for the diabetic support group day.

▲ The Implementation Processes

The health education talk session were delivered in the language of preference of the PLDM. The sessions lasted from 2 hours. The PLDM were allowed to ask questions during and also at the end the session when they did not understand. The PLDM were also asked to give the facilitator feedback about the session and how they feel.

⌖ *Methodology*

The researcher followed Gagne's Nine Levels of Learning or instructional events (Gagne, 1985). The instructional events assisted the PLDM to learn smoothly and retain information. The researcher was able to identify the learning problem where participants were not following. Nine instructional events were used as follows:

1. **Gain attention:** the researcher (facilitator) briefed PLDM about the need for the teaching at the beginning of the session to gain their attention and cooperation.

2. **Identify objectives:** the objectives of the learning were outlined at the beginning of the session and the PLDM were also reminded about them during the lessons.

3. **Recall prior learning:** the PLDM were asked to share what they know about

the impact of changing temperatures to minimise lack of interest.

4. **Present stimulus:** the researcher provided information based on individual needs.

5. **Guide learning:** PLDM were asked to share personal information related to the changing temperatures.

6. **Elicit performance:** the facilitator allowed PLDM to demonstrate the information learned and were ready to move to the next topic.

7. **Provide feedback:** the facilitator always gave the PLDM feedback about how they were answering.

8. **Assess performance:** PLDM were continually assessed through being asked to repeat what was said.

9. **Enhance retention/transfer:** (Generalization)—the facilitator used a summary of important facts to assist PLDM in retaining the information.

- ***A poster***

The researcher designed a poster for facilitation of learning, It is a tool that enables visualization in the classroom to promote learning (Manarin, 2016; Rosanti & Seman, 2019). The poster was used during the implementation period. The benefits of using a poster is that it promotes learning as follows:

1. It affords learners a chance on visual learning with a lecture (Rowe & Ilic, 2009)

2. It encourages and inspires learners to learn,

3. It stimulates learners' interest in the topic under study,

4. It illustrates a concept effectively since it uses a combination of text and images, with different styles,

5. It guides the teacher on how to use the poster since it is designed as a flow-chart,

6. It gives directions for hands-on instructions, and

7. Provides suggestions for additional instructional activities (Rosanti & Seman, 2019).

- ***A pamphlet***

A pamphlet is described as a small leaflet or booklet containing information on a single subject (Wiley, 2019). The facilitator used pamphlets as take- home packages for the attendees to serve as a reminder and referral document in managing DM (Appendix 8). The pamphlets were further translated into the patients' vernacular, being Xitsonga. The benefits of the pamphlets are outlined below as follows:

1. A pamphlet provides less information and is more focused – limited to a single topic (Gupta, 2021)

2. It informs readers of a specific subject effectively,

3. Pamphlets are mostly used to spread awareness than selling to the reader directly (Wiley, 2019).

4. Pamphlets inform and educate PLDM by transferring proper scientific knowledge into lay terms,

5. They assist patients to find solutions to their problems, to cope and modify health-related risks and behaviours, to conform to recommendations of health care professionals (Gupta, 2021).

6.6 Evaluation of the Developed Strategies

The evaluation of the coping strategies was incorporated at the end of each session with the PLDM who were asked to share their feelings about the health education

session after being taught. The PLDM were also asked to rate the facilitator's performance in their teaching. The Kirkpatrick Evaluation Model was used to evaluate the session with the PLDM (Kirkpatrick *et al.*, 2013).

The model defines the four levels of evaluation as follows:

- **Level 1 – Reaction**

This level measures the degree to which the teaching sessions experienced was satisfactory. The researcher as a facilitator asked the PLDM to share how they felt about the whole teaching session. The PLDM's reactions were positive and they felt that the teaching was relevant and very much important. One participant's response was: "I have gained a lot of information about the things I was not aware of that the medications can be stored in a fridge as am using injections for my diabetes. Hey! now I know." When asked to rate the session out of 10 the participant said, "Mm eish I have learned a lot today. [am I] allowed to give you 10? You have taught me a lot of things. [Researcher] The facilitator said that you can give any number. Okay, let me give you nine (9)."

- **Level 2 – Learning**

This level measures the degree to which the PLDM attained the desired knowledge, skills and attitudes as a result of teaching. It determines whether the objectives were achieved. This was indicated in what one participant said, "We thank you for the information, maybe the reason the blood sugar was always elevated is [that] we were not taking proper food and medication need to take at the correct time. I thank you for the information". Another participant said, "Now there is much information that I did not know about this diabetes, even about which diet to follow and the importance of storing medication in a cool environment not to keep it in a bag." When asked to rate the learning, one participant said, "it is the first time I get a well-presented information. Thank you very much, it was very good: out of 10, I will give 8, is it important."

- **Level 3 – Behaviour**

It measures the degree to which PLDM's behaviours have changed as a result of the strategies provided. That means the PLDMs apply the knowledge and skills learned from the sessions to their lives. This is evident in on participant saying, "Now I feel empowered to face all the impact of changing temperatures on my body." Another participant also said, "We are happy, we will also share the information with other people in the community."

- **Level 4 – Results**

Level 4 pursues to establish if the actual outcomes of the teaching session such as improved quality of life, improved knowledge about the changing temperatures and the ability to manage complications during changing temperatures. These tangible outcomes of the strategies implementation may not be determined at this stage because the participants will be given time to put the knowledge and skills gained into practice (Parahoo, 2014).

6.7 Summary

In this chapter, the researcher showed that the aim and the objectives of the study were achieved, which were the development and implementation of the coping strategies for PLDM to adapt to changing temperatures. The strategies implementation evaluation results provided positive feedback for conducting the whole study.

CHAPTER 7

SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSIONS

7.1 Introduction

This chapter presents the summary of the study, the limitations, and the recommendations. The background of the study and its intended purpose are summarized in this chapter. The limitations of the study are also outlined as the challenges faced when conducting the study. The study recommendations were generated based on the study findings.

7.2 Summary

The summary details the sequence in conducting the whole study from the beginning to its final stage as outlined below:

The main purpose of this study was the development and implementation of coping strategies for PLDM to adapt to changing temperatures at the health care centres of Limpopo Province, South Africa. This purpose was achieved through determining the impact of changing temperatures on PLDM, describing the knowledge and practices of PLDM during changing temperatures using a mixed method research approach.

▲ Completion of the Phases of the Study

An exploratory sequential design was used wherein the researcher conducted a one-no-one semi-structured interview using an interview guide with closed-ended questionnaires to collect data from PLDM at the health care centres in the Limpopo Province.

The interviews were audio-recorded to capture all information and field notes were written to capture non-verbal cues. All information was transcribed verbatim into English and analyzed using Tesch's open-coding method for qualitative data analysis where PLDM described their lived experiences and challenges regarding changing temperatures. The main findings of qualitative strand were: Experiences related to the impact of changing temperatures, Challenges of PLDM during changing temperatures, Knowledge on changing temperatures, Description of coping strategies adopted by PLDM on changing temperatures, Perceived learning needs on coping strategies during changing temperatures suggested, and the Description of available services to address challenges related to changing temperatures. To further explore and describe the experiences and challenges, the results from the interviews were used to develop a data collection instrument in the quantitative phase.

The quantitative strand followed whereby a structured close-ended questionnaire was used to collect data. The description of the conceptual framework for coping strategies was grounded on the integration findings of the study. The findings revealed that PLDM experienced many challenges related to the impact of changing temperatures, they have different coping strategies to adapt to changing temperatures, perceived learning needs on coping strategies during changing temperatures suggested, and the description of available services to address challenges. Trustworthiness was ensured through credibility, confirmability, dependability, transferability. Validity and reliability were also ensured in the quantitative phase of the study. The conceptual framework for the development and implementation of the coping strategies was carried out during Phase 2 of the study. Phase 3 followed in which coping strategies were developed, and then implementation of the strategies.

7.3 Limitations of the Study

The study was conducted in the selected health care centres of Limpopo Province. Thus, the findings were only limited to select health care centres of Limpopo Province and therefore the findings of this study cannot be generalized to all health care centres in Limpopo Province and other provinces in South Africa. However, the original plan

(time frames) for fulfilling all the phases of this study were adjusted due to the COVID-19 pandemic mandatory restrictions and limitations which were enforced by the government to ensure the safety of all citizens in the province, and in South Africa. Therefore, the implementation phase was done only at one health care centre.

7.4 Recommendations

The study recommends the following based on the findings that emerged:

7.4.1 Health Care

- **Paradoxical experiences related to the impact of temperature**. Its three sub-themes indicated the bodily reactions during changing temperatures. PLDM experienced many symptoms with regard to the impact of changing temperatures. This study recommends that continuous health talks about the management should be provided to PLDW by health care professionals, including nurses.

- **Challenges PLDM related to changing temperatures.** PLDM are having difficulty in maintaining their blood glucose, and engage in physical activity during changing temperatures. The study recommends that health care professional must provide information to PLDW in scheduling time for doing their physical activities and provide health talks about the importance of checking their blood glucose.

- **Knowledge on changing temperatures.** PLDM acknowledge that with regard to medications/supplies storage that they are not able to follow proper diet with regard to changing temperatures. The study recommends the availability of Diabetes pamphlets which should be distributed to PLDM. They could be like posters with drawings of food that should be consumed, as many diabetic patients are not literate. A further recommendation is that continuous individual health talks about medication storage should be emphasized.

- **Measures employed by PLDM to deal with changing temperatures.** The study recommends that continuous monthly teachings and workshops should be conducted to teach diabetes patients about their disease and management at a primary health care level with regard to changing temperatures.

7.4.2 Nursing Education

- In the existing curriculum, student nurses should be developed to include home visits in assisting PLDM to cope and help themselves to maintain a good quality of life.

- Short courses for professional nurses might be developed to enhance the health care providers in delivering health education to PLDM with regard to changing temperatures.

7.4.3 Nursing Practice

- A family member or a guardian needs to be present to support the patient. Frequent visits to the health care centres with the patient should be considered by the guardian, at least quarterly.

- Diabetes pamphlets should be distributed to PLDM. They could be like posters with drawings of food that should be consumed, as many diabetic patients are not literate. The pamphlets could include any other ‘to do’ activities.

- Home-based carers need to be trained about the symptoms of diabetes mellitus and how to monitor blood glucose, so they can do home visits regularly and effectively. Their information may include the nature of the disease, the various diabetes self-management behaviours and positive and negative consequences of not adopting health recommendations. This education may take place individually or in a

group setting.

7.4.4 Nursing Research

- The Department of Health needs to fund researchers for more robust research to be done at all levels, in order to find a way to deal with the impact of changing temperatures on diabetes burden.
- The Department of Health could appoint people to assess the efficacy of existing projects that supply food parcels to PLDM in need and to develop food banks.

7.5 Contribution According to Knowledge Development

The contribution to the body of knowledge is aligned to the South African Qualifications Authority (SAQA) NQF level 10 (2012).

7.5.1 Criterion 1: Conceptualization of New Research Initiatives and Building of New Knowledge and Practice

The research results demonstrated the expertise and critical knowledge during the implementation of the research by identifying that PLDM lack knowledge and skills in planning activities to adapt to changing temperatures. Then, from the findings of qualitative and quantitative, were used to develop strategies and implemented to assist PLDM to adapt to changing temperatures.

7.5.2 Criterion 2: Demonstration of Scholarly Debates Around Theories of Knowledge Production and Practice

After data collection and analysis of the qualitative and quantitative results together guided by Roy's adaptation theory and the ADDIE model were used to develop the coping and implementation phase of activities for self-management to be used by the PLDM. This was done according to Objective 4 and the implementation phase in Chapter 6 of the study.

7.5.3 Criterion 3: Development of New Methods, Techniques, Processes, Systems or Technologies In Original, Creative, and Innovative Ways Appropriate to Specialized and Complex Contexts

Strategies activities were developed with the aid of Roy's adaptation model of nursing (Whittemore & Roy, 2002), research findings, health promotion manual, and the participants were trained in specific strategies to implement those activities during the implementation process. PLDM were asked questions throughout the session to evaluate their understanding of the information provide. Finally, the Inter Heart Tool was used to screen those at risk and can be useful to the Department of Health, especially in primary health care settings to screen all patients for cardiovascular disease (CVD) development.

7.5.4 Criterion 4: Application of the Specialist Knowledge and Theory to Address Complex Practical and Theoretical Problems

The researcher as lecturer with the background knowledge in primary health care has developed interest in research. The researcher decided to explore the impact of changing temperatures on PLDM and observed their experiences in relation to a rise in temperature.

7.6 Conclusions

In this chapter, the study process and events were summarized, and recommendations were made according to the study findings. The study explored and described the impact of changing temperatures on PLDM, the knowledge and practices of PLDM about changing temperatures at the health care centres of Limpopo Province. A conceptual framework was modelled which guided the development and implementation of the coping strategies for PLDM. The coping strategies were implemented successfully. The recommendations that were made would contribute toward a profound impact on the lives of PLDM, if instituted. The whole process of conducting the study was a success although the study has its limitations.

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APPENDIX 1

ETHICS CLEARANCE CERTIFICATE

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email:anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: **11 May 2021**

PROJECT NUMBER: **TREC/72/2021: PG**

PROJECT:

Title:	The development and implementation of coping strategies for people living with diabetes mellitus to adapt to changing temperature at health care centers of Limpopo Province, South Africa
Researcher:	KJ Mbombi
Supervisor:	Prof TM Mothiba
Co-Supervisor/s:	Prof KK Ayisi
	Dr MA Bopape
School:	Health Care Sciences
Degree:	PhD in Nursing Sciences

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE
The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:
i) This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.
ii) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.
iii) PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

APPENDIX 2A

REQUEST TO LIMPOPO DEPARTMENT OF HEALTH TO CONDUCT THE RESEARCH

P.O. Box 1286

Giyani

0826

Limpopo Department of Health

Private Bag X908

Polokwane

0700

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT THE FOLLOWING HEALTH CARE CENTRES OF LIMPOPO PROVINCE, SOUTH AFRICA: RETHABILE, BUCHUM, LULEKANE, SHILUVANE, HC BISHOFF, BUNGENI, MPHAMBO, TIYANI, AND MOOKGOPONG

Dear Sir/Madam

I, Khizamane Joyce Mbombi, a PhD student in the Department of Nursing Science at the University of Limpopo, hereby request permission to conduct a study at the above-mentioned Health Care Centres of Limpopo Province. The title of the study: “Develop and implement coping strategies for people living with diabetes mellitus to adapt to changing temperatures in Limpopo Province South Africa”.

This project will be conducted under the supervision of Prof T.M. Mothiba of the University of Limpopo. All information received from the respondents will be treated confidentially and will be used solely for purposes of the research. Attached receive a copy of my thesis proposal, which includes a copy of the consent to be used in the research process. If you require any further information, please do not hesitate to contact me on cell 082 499 213, email: kjmbombi@gmail.com.

Thanking you in advance for your cooperation.

Yours sincerely

Mbombi K.J.

APPENDIX 2B

PERMISSION FROM THE LIMPOPO DEPARTMENT OF HEALTH TO CONDUCT THE RESEARCH

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Department of Health

Ref : LP_2021-06-003
Enquires : Ms PF Mahlokwane
Tel : 015-293 6028
Email : Phoebe.Mahlokwane@dhsd.limpopo.gov.za

Khizamane Mbombi

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

The development and implementation of coping strategies for people living with diabetes mellitus to adapt to changing temperature at Health Care Centre of Limpopo province, South Africa

1. Permission to conduct research study as per your research proposal is hereby Granted.
2. Kindly note the following:
   a. Present this letter of permission to the institution supervisor/s a week before the study is conducted.
   b. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
   c. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   d. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   e. The approval is only valid for a 1-year period.
   f. If the proposal has been amended, a new approval should be sought from the Department of Health
   g. Kindly note that, the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated

_____ 15/07/2021_____

PP **Head of Department** **Date**

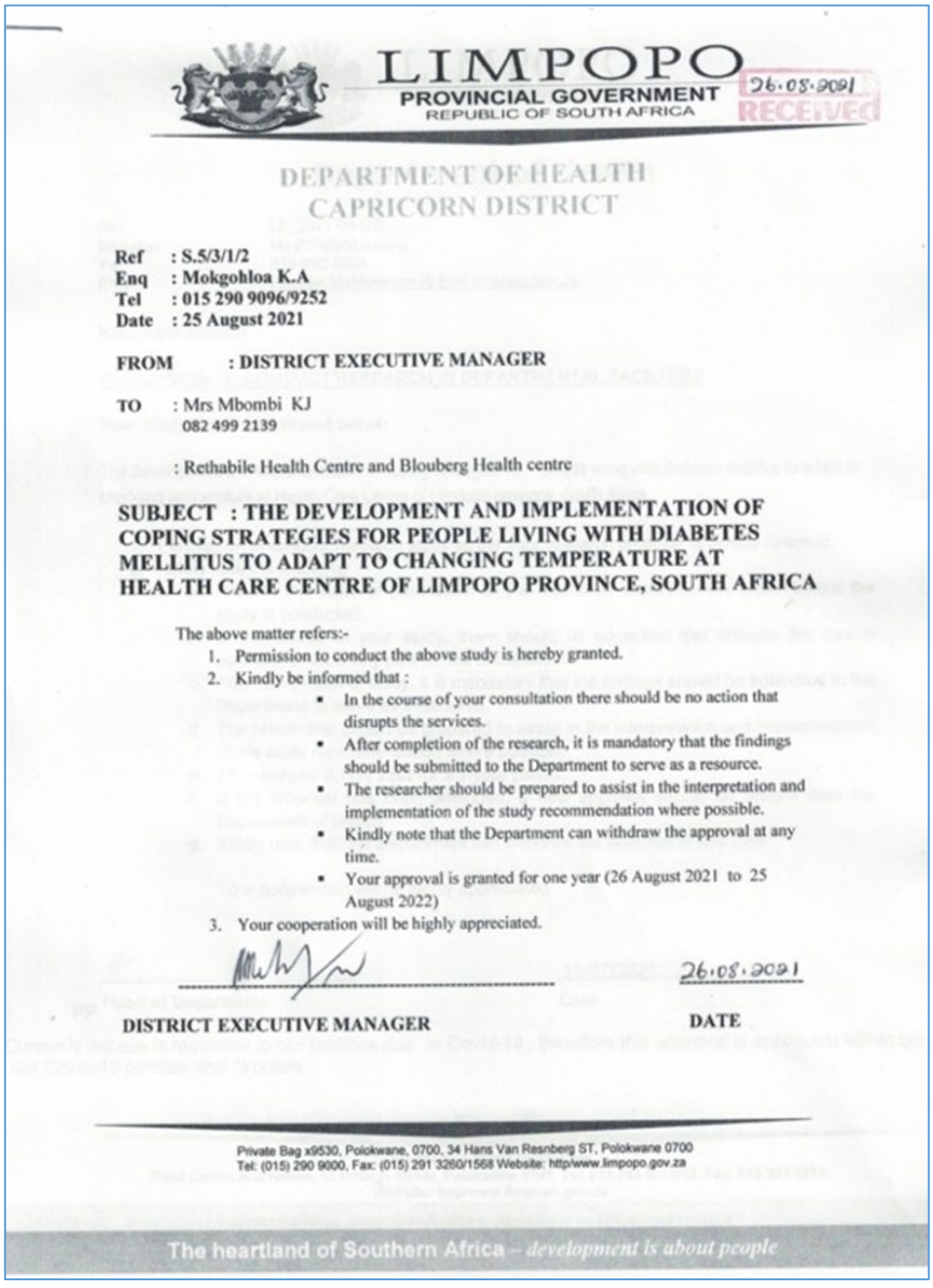
Currently access is restricted to our facilities due to Covid-19 , therefore this approval is applicable within ou our Covid-19 policies and circulars

Private Bag X9302 Polokwane
Fidel Castro Ruz House, 18 College Street. Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.
Website: http/www.limpopo.gov.za

The heartland of Southern Africa – Development is about people!

APPENDIX 2C

PERMISSION FROM THE DEPARTMENT OF HEALTH CAPRICORN DISTRICT TO CONDUCT THE RESEARCH PROJECT



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

26.08.2021
RECEIVED

DEPARTMENT OF HEALTH
CAPRICORN DISTRICT

Ref : S.5/3/1/2
Enq : Mokgohloa K.A
Tel : 015 290 9096/9252
Date : 25 August 2021

FROM : DISTRICT EXECUTIVE MANAGER

TO : Mrs Mbombi KJ
082 499 2139

: Rethabile Health Centre and Blouberg Health centre

SUBJECT : THE DEVELOPMENT AND IMPLEMENTATION OF COPING STRATEGIES FOR PEOPLE LIVING WITH DIABETES MELLITUS TO ADAPT TO CHANGING TEMPERATURE AT HEALTH CARE CENTRE OF LIMPOPO PROVINCE, SOUTH AFRICA

The above matter refers:-

1. Permission to conduct the above study is hereby granted.
2. Kindly be informed that :
   - In the course of your consultation there should be no action that disrupts the services.
   - After completion of the research, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   - Kindly note that the Department can withdraw the approval at any time.
   - Your approval is granted for one year (26 August 2021 to 25 August 2022)
3. Your cooperation will be highly appreciated.

26.08.2021

DISTRICT EXECUTIVE MANAGER **DATE**

Private Bag x9530, Polokwane, 0700, 34 Hans Van Resnberg ST, Polokwane 0700
Tel: (015) 290 9000, Fax: (015) 291 3260/1568 Website: http/www.limpopo.gov.za

The heartland of Southern Africa – *development is about people*

APPENDIX 2D

PERMISSION FROM THE DEPARTMENT OF HEALTH WATERBERG DISTRICT TO CONDUCT THE RESEARCH PROJECT

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
HEALTH
WATERBERG DISTRICT

REF: 4/3/3.
ENQ: NKGODI D.R (PA TO THE DISTRICT EXECUTIVE MANAGER)

TEL NO: 014. 718 0623 / 082 344 0227.
E-MAIL: David.Nkgodi@dhsd.limpopo.gov.za

TO: KHIZAMANE MBOMBI

RE: PERMISSION TO CONDUCT RESEARCH: YOURSELF.

The above bear's reference: -

1. The office of the District Executive Manager, hereby confirms receipt of your request to conduct research on a the development and implementation of coping strategies for people living with diabetes mellitus to adapt to changing temperature at health care centre of Limpopo Province, South Africa
2. Permission is hereby granted as per approval by the HOD.
3. You are further requested to notify this office on when you are going to start with the research and make sure that there is no action that disturbs service delivery.

Your support and cooperation in terms of the above will be highly appreciated.

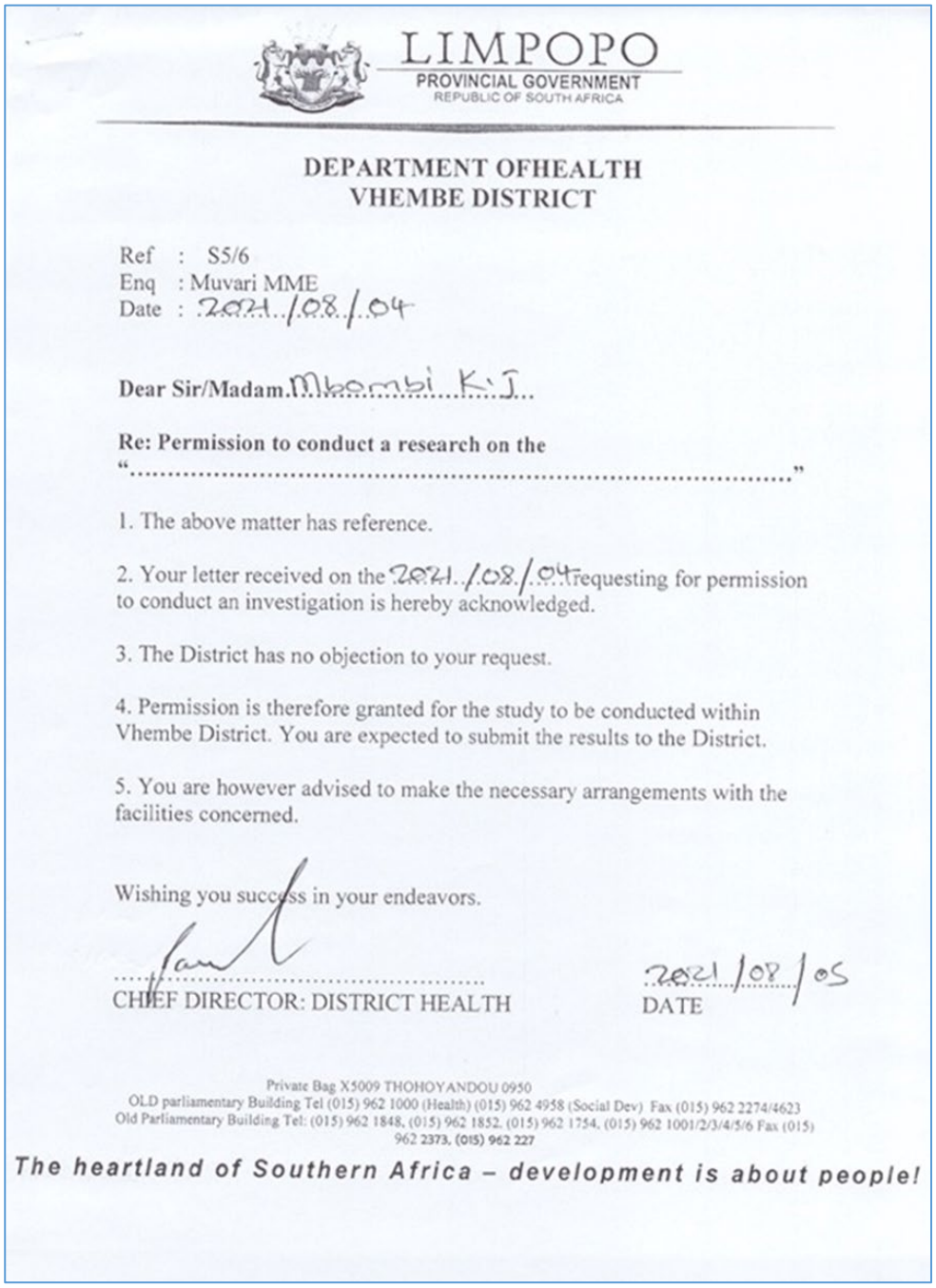
BULANNGA N.G.
DISTRICT EXECUTIVE MANAGER

14/09/2021
DATE

Waterberg District Office Private Bag X 1026 Modimolle,
0510 Tel (014) 718 0600 Fax (014) 718 0675

APPENDIX 2E

PERMISSION FROM THE DEPARTMENT OF HEALTH VHEMBE DISTRICT TO CONDUCT THE RESEARCH PROJECT



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OFHEALTH
VHEMBE DISTRICT

Ref : S5/6
Enq : Muvari MME
Date : 2021/08/04

Dear Sir/Madam. Mbambi K.J

Re: Permission to conduct a research on the
"....."

1. The above matter has reference.

2. Your letter received on the 2021/08/04 requesting for permission to conduct an investigation is hereby acknowledged.

3. The District has no objection to your request.

4. Permission is therefore granted for the study to be conducted within Vhembe District. You are expected to submit the results to the District.

5. You are however advised to make the necessary arrangements with the facilities concerned.

Wishing you success in your endeavors.

.....
CHIEF DIRECTOR: DISTRICT HEALTH

2021/08/05
DATE

Private Bag X5009 THOHOYANDOU 0950
OLD parliamentary Building Tel (015) 962 1000 (Health) (015) 962 4958 (Social Dev) Fax (015) 962 2274/4623
Old Parliamentary Building Tel: (015) 962 1848, (015) 962 1852, (015) 962 1754, (015) 962 1001/2/3/4/5/6 Fax (015) 962 2373, (015) 962 227

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APPENDIX 2F

PERMISSION FROM THE DEPARTMENT OF HEALTH MOPANI DISTRICT TO CONDUCT THE RESEARCH PROJECT

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
MOPANI DISTRICT

Ref No: S4/2/2
Enquiries: S Chuma
Tel Direct: 015 811 6633
Email address: Shadrack.Chuma@dhsd.limpopo.gov.za

To: **Ms. Mbhombi K.J**
P.O Box 1286
GIYANI
0826

PERMISSION TO CONDUICT RESEARCH IN THE DEPARTMENT HEALTH FACILITIES OF MOPANI DISTRICT: YOURSELF

1. Your letter from the Provincial office dated the 15 July 2021 has reference.
2. This serves to inform you that permission is granted to your request to conduct research on "**The development and implementation of coping strategies for people living with diabetes mellitus to adapt to changing temperature at Health Care Centres of Limpopo Province", South Africa".**
3. Note that the aforementioned permission is valid for only one year.
4. You will be required to furnish the Managers of the following Health Care Centres with this letter for the purposes of access and assistance: **Giyani, Shiluvane and Lulekani**.
5. You are further expected to abide by all prescripts governing public service during the course of your research.
6. Thanking you.

S. h — a
.....
DIRECTOR: CORPORATE SERVICES

2021/07/22
.....
DATE

Private Bag X628, GIYANI, 0826
Tel: 015 811 6500 Fax: (015) 812 3162 Website: http://www.limpopo.gov.za

APPENDIX 2G

PERMISSION FROM THE DEPARTMENT OF HEALTH SEKHUKHUNE DISTRICT TO CONDUCT THE RESEARCH PROJECT

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
HEALTH
SEKHUKHUNE DISTRICT

DEPARTMENT OF HEALTH
SEKHUKHUNE DISTRICT
DATE:.....
RECEIVED BY:.....
DISTRICT EXECUTIVE MANAGER

Ref : S2/2/3
Enq : MOGANO K.N.M
Tel : 015 633 2412/ 076 399 8428
Date : 15 September 2021
Email:Norman.Mogano@dhsd.limpopo.gov.za

Khizamane Joyce Mbombi

DEVELOPMENT AND IMPLEMENTATION OF COPING STRATEGIES FOR PEOPLE LIVING WITH DIABETES MELLITUS TO ADAPT TO CHANGING TEMPERATURE AT THE HEALTH CARE CENTERS OF LIMPOPO PROVINCE, SOUTH AFRICA.

Background

The above student is furthering studies with University of Limpopo for PhD in Nursing Sciences, student number: 200201791
Her research topic is DEVELOPMENT AND IMPLEMENTATION OF COPING STRATEGIES FOR PEOPLE LIVING WITH DIABETES MELLITUS TO ADAPT TO CHANGING TEMPERATURE AT THE HEALTH CARE CENTERS OF LIMPOPO PROVINCE, SOUTH AFRICA. It's a quantitative research which does not need access of any clinical records by the student. (It is a Questionnaire interview method with subjects of study)

The Provincial department of health HOD has granted her permission to conduct this research and to observe and adhere to all principles of research

Motivation

The district HRD request that permission be further granted to Khizamane Joyce Mbombi to conduct this research at the Health care centres, as already been granted this permission by the provincial office as outlined on the attached letter.

Approved /~~not approved~~

Mathabe.....
ACTING DISTRICT EXECUTIVE MANAGER

2021.09.15.....
Date

Private Bag X04, Chuenespoort 0745
Tel: (015) 633 2300, Fax: (015) 633 7927
Website: http://www.limpopo.gov.za

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APPENDIX 3A

UNIVERSITY OF LIMPOPO ENGLISH CONSENT FORM

UNIVERSITY OF LIMPOPO CONSENT FORM

Statement concerning participation in a clinical research project.

Name of project/study

Development and implementation coping strategies for people living with diabetes mellitus to adapt to changing temperatures at health care centres of Limpopo Province, South Africa

Information box:

Thank you for approving to participate in this study. My name is Khizamane Joyce Mbombi, I am a researcher from the university of Limpopo. The aim of this study is to:

Develop and implement coping strategies for people living with diabetes mellitus to adapt to changing temperatures at health care centres of Limpopo Province, South Africa

The study is non-invasive, and do not involve any manner of harm anticipated. The objectives are to explore and describe the knowledge and practices of people living with diabetes mellitus. Participation in this study is completely voluntary and that you may withdraw from it at any time and without victimisation.

Should you have any queries, kindly contact:

K.J. Mbombi (082 499 2139)

I have read the information and heard the aims and the objectives of the proposed study and was provided the opportunity to ask questions and given adequate time to rethink the issue. The aim and the objectives of the study are clear to me. I have not been pressurized to participate in any way.

I understand that participation in this clinical trial/study/project is completely voluntary and that I may withdraw from it at any time and without supplying reasons. I know that this study/project has been approved by the Research and Ethics Committee, University of Limpopo and the Limpopo Department of Health. I am fully aware that the results of this study/project will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

I hereby give consent to participate in this study/project.

…… ……

Name of participant Signature

…… …… ……

Place Date Witness

……

Statement by the researcher

I provided verbal and/or written information regarding this study/project. I agree to answer any future questions regarding the study/project to the best of my ability.

I will adhere to the approved protocol.

…… …… ……

Name of researcher Signature Date

APPENDIX 3B

DEPARTMENT OF NURSING SCIENCE XITSONGA CONSENT FORM

Department of Nursing Science Xitsonga Consent Form

Xiletelo mayelana na ku nghenelela eka ndzavisiso

Vito ra ndzavisiso:

Ndzi nyikiwile xikongomelo na maendlelo ya ndzavisiso, ndzi thlela ndzi nyikiwa nkarhi wo vutisa swivutiso na ku nyikiwa nkarhi lowu eneleke ku ehleketisisa hi mhaka leyi. Xikongomelo na maendlelo ya ndzavisiso swi basisiwile eka mina. Andzi sindzisiwanga ku nghenelela hi ndlela yihi kumbe yihi. Ndza swi twisisa leswaku ku nghenela eka ndzavisiso lowu i ku tsakela ka mina naswona ndzi nga tihumesa eka swona nkarhi wun'wana na wun'wana handle ko hlamusela ku hikwalaho ka yini.

Ndza swi tiva leswaku ndzavisiso lowu wu pfumeleriwile hi komiti ya swa vulavisisi leyi vuriwaka Turfloop Research Ethics Committee (TREC) na ndzawulo ya rihanyo xifundzha-nkulu xa Limpopo na va rangeri va xipedhlele. Ndza swi tiva hi ku hetiseka leswaku mbuyelo wa ndzavisiso wu ta tirhisiwa eka swikongomelo swa tisayense nakona swi nga hangalasiwa. Ndza pfumela eka leswi, ntsena loko ndzi tiyisisiwa leswaku ndzi nga ka ndzi nga humelerisiwi kumbe ku tivisiwa eka van'wana.

Ndzi nika mpfumelelo wo nghenelela eka ndzavisiso lowu.

……... ….……..……

Vito ra Mungheneleri Nsayino wa mungheneleri/ muhlayisi

……. …….. ……...

Mbhoni Ndhawu Siku

Xiletelo hi mulavisisi

Ndzi nyikile vuxokoxoko hi ku vulavula na hi leswi tsariweke mayelana na ndzavisiso lowu.

Ndza pfumela Ku hlamula swivutiso hi vuswikoti bya mina eka nkarhi lowu taka mayelana na ndzavisiso.

Ndzi ta landzelerisa eka maendlelo lawa ya pfumeleriweke.

…….. …… ……

Vito ra mulavisisi Nsayino Siku

APPENDIX 3C

DEPARTMENT OF NURSING SCIENCE SEPEDI CONSENT FORM

Department of Nursing Science Sepedi Consent Form

"Setatamente mabapi le go tšea karolo ka go Protšeke ya Dinyakišišo tša Teko ya Klinikhale *." ("APPLICATION FORM FOR PROPOSED RESEARCH PROJECT AT THE UNIVERSITY OF LIMPOPO")

Leina la Protšeke / Dinyakišišo / Teko*

Ke badile/ke kwele ka ga tshedimošo mabapi le maikemišetšo le morero wa dinyakišišo tšeo di šišintšwego gomme ka fiwa nako yeo e lekanego gore ke naganišiše ka ga taba ye. Ke tloga ke kwešiša maikemišetšo le morero wa dinyakišišo tše gabotse. Ga se ka gapeletšwa go kgatha tema ka tsela efe goba efe. Ke a kwešiša gore go kgatha tema Protšekeng/Dinyakišišong tše ke ga boithaopo gomme nka tlogela go kgatha tema nakong efe goba efe ntle le gore ke fiwe tshwaro empe.

Se se ka se be le khuetšo efe goba efe go kalafo yaka ya ka mehla ya maemo a ka. Ke a tseba gore Teko/Protšeke/Dinyakišišo tše di dumeletšwe ke Turfloop Research and Ethics Committee (TREC), Kgoro ya tša maphelo ya Limpopo, moetapele wa kgoro ya maphelo tikologong ya kheprikone. Ke tseba gabotse gore dipoelo tša Teko/Dinyakišišo/ Protšeke tše di tla dirišetšwa merero ya saense gomme di ka phatlalatšwa. Ke dumelelana le se, ge fela bosephiri bja ka bo ka tiišetšwa.

Mo ke fa tumelelo ya go kgatha tema Tekong/Dinyakišišong/ Protšekeng

..... ……..

Leina la molwetši/ moithaopi Mosaeno wa molwetši goba mohlokomedi

....

Lefelo Letšatšikgwedi. Tlhatse

……Setatamente ka Monyakišiši

Ke fana ka tshedimošo ka molomo le/goba yeo e ngwadilwego mabapi le Teko/Dinyakišišo/ Protšeke ye.

Ke dumela go araba dipotšišo dife goba dife tša ka moso mabapi le Teko/Dinyakišišo/ / Protšeke ka bokgoni ka moo nka kgonago ka gona.

Ke tla latela melao yeo e dumeletšwego. .... …….

……..…… Leina la Monyakišiši Mosaeno Letšatšikgwedi

Lefelo……

APPENDIX 4A

INTERVIEW GUIDE

Central question:

"Can you kindly describe the coping strategies you are using to adapt to changing temperatures?"

Probing questions:

1. How does changing temperatures affect your daily activities?
2. How long have been you diagnosed with diabetes?
3. Describe your coping skills concerning adapt to changing temperatures?
4. What are challenges do you face in adapting to changing temperatures?
5. What is the effect of changing temperatures on your medication?
6. What is the effect of changing temperatures on your blood glucose level?
7. Can you please indicate the learning needs about adapting to changing temperatures?
8. What kind of help would you like to receive in coping and adapting to changing temperatures?
9. Describe other kinds of support you may need to cope and adapt to changing temperatures?

APPENDIX 4B

XIKOMBISO XA XIVUTISI XA NKAMBELO

Xivutiso xa le xikarhi:

Hi ku titsongahata ni kombela mi hlamusela tindlela leti miti tirhisaka ku tiyisela macincelo ya maxele?”

Swivutiso leswi swi lavaka tinhlamulo hi xitalo:

1. Macincelo ya maxelo ya miendla yini mayelana ni mahanyelo ya n’wina ya siku na siku?
2. Swini nkarhi wo fika kwihi mpfhuka loko va mi byele leswaku mini vuvabyi bya Diabetes?
3. Hlamuselani tindlela leti ti mi pfunaka loko mi ti tirhisa ku tiyisela macincelo ya maxele?
4. Hi swihi swiphiqo leswi swi misivelaka ku tiyisela macincelo ya maxele?
5. Ku humelela yini loko ku vani macincelo ya maxele mayelana na mirhi leyi miyi n’waka?
6. Hi swihi leswi humelelaka eka n’wina mayelana na macincelo ya maxele leswi swi nga ka mpimo wa chukele leri nga engatini ya nwina?
7. Ndzi kimbela mi kombisa leswi mitsakelaka ku dyondziswa hi swona leswaku mi ta kota ku tiyisela no tolovela macincelo ya maxele?
8. Hi wihi pfuneto lowu mi wu lavaka leswaku mi ta kota ku tiyisela no tolovela macincelo ya maxele?
9. Hlamuselani tindlela to hambana ta nseketelo lowu miwu lavaka leswaku mi ta kota ku tiyisela no tolovela macincelo ya maxele?

APPENDIX 4C

TSHUMBEDZO YA KHASELEDZO

Mbudziso ya vhukate:

"Vhanga kona u talusa ndil dzine vha nga dzishumisa u kona u tshila na dzi tshanduko dza mufhiso"

Mbudziso dzo no toda u talutshedza u tshi ya phanda (u gwa mafhungo)

1. Kushandukele kwa mutsho ku khou kwama/tutuwedza hani mishumo/ku tshilelo kwavho kwa duvha na duvha?
2. Zwo wanala u bva lini zwa uri vha na vhulwadze ha zwigiri?
3. Kha vha talutshedze u ri vha khou zwi kona hani u kona u tshila na kushandukele kwa mutsho?
4. Ndi vhukondi/khaedu ifhio ine vha khou tangana nayo musi vha tshi khou lingedza u tshila na ku shandukelo kwa mutsho?
5. Ndi a fhio masiandaitwa a ne a bveledziwa nga ku shandukelo kwa mutsho kha mishonga ya vho?
6. Ndi a fhio masiandaitwa ane a bvelediwa nga ku shandukelo kwa mutsho kha mishonga yavho?
7. Ndi khou humbela uri vha ambe ngudo dzi no todea khau kona u tshila na ku shandukelo kwa mutsho?
8. Ndi I fhio thuso ine vanga I fhiwa kana / u newa ine ya nga ita uri vha kone u tshila na u tanganedza ku shandukeloe kwa mutsho?
9. Kha vha ambe dzinwe tshaka dza thikhedzo dzine vha nga dzi toda u kona u tshila na u tanganedza ku shandukelo kwa mutsho?

APPENDIX 4D

SEPEDI INTERVIEW GUIDE

Potšišo kgolo:

"O ka nhlalosetša gore o somiša ditsela dife gore o kgone go phela le phetogo ya phišo"

Dipotšišo tša go fatolla:

1. Naa phetogo ya phišo e ama bjang mešomo ya gago ya tšatši ka tšatši?
2. Ke nako e kakaang go utulutšwe gore o swerwe ke bolwetši bja swikiri?
3. Tlhalosa gore ke ditsela dife tše o di šomišago go phela le phetogo ya phišo
4. Ke dihlotlo dife tše o lebanego le tšona go itlwaetša phetogo ya phišo
5. Naa phetogo ya phišo e ama bjang dihlare tšago
6. Naa phetogo ya phišo e ama bjang kelo ya gago ya swikiri mo madding
7. O ka mpotša gore o hloka tsebo efe go go thuša go kgona go tlwaela gophela le phetogo ya phišo
8. Ke thušo efe ye o nyakago go e fiwa mabapi le go phela le go itlwaetša phetogo ya phišo
9. Hlaloša mekgwa e mengwe ya thego ye o e hlokago gore o kgone go phela ka gare ga seemo se sa phetogo ya phišo

APPENDIX 5A

ENGLISH QUESTIONNAIRE

Instructions: Read carefully and answer ALL questions. Please tick the appropriate answer with a tick **(√) or** a cross **(×)** where applicable

SECTION A

DEMOGRAPHIC DATA OF THE PARTICIPANT

A1. Age

20-30	
31-40	
41-50	
51-60	
61-70	

A2. Gender

Female	
Male	

A3. Ethinicity

African	
White	
Indian	
Coloured	

A4. Marital status

Single	
Married	
Widowed	
Divorced	

A5. Highest level of education

Primary school	
Secondary school	
Tertiary	
Never went to school	

A6. Employment

Employed	
Self employed	
Unemployed	
Pensioner	

A7. Residence

Rural	
Semi-rural	
Urban	

A8. Are you currently taking chronic medication?

1. Injection	
2. Tablets	

A9. How long have you been diagnosed diabetes mellitus?

1. One year	
2. Two years	
3. Three years	
4. Four years	
5. Five years and above	

SECTION B

TICK ONE BOX AGAINST EACH STATEMENT ACCORDING TO THE SCALE BELOW.

Scale: 1=Agree, 2=Disagree, 3=Uncertain 4=Other: Specify

PARTICIPANT EXPRESSION OF THEIR REACTION TO CHANGING TEMPERATURES

Effect hot temperature	Agree	Disagree	Uncertain	Other specify
1. I experience excessive sweating during hot days	1	2	3	4
2. I experience dizziness when is hot.	1	2	3	4
3. Suffer itchiness of vulva during hot days.	1	2	3	4
4. My Legs are painful when is hot.	1	2	3	4
5. I am feeling hungry more often.	1	2	3	4
6. I am experience loss of energy.	1	2	3	4

Effect cold temperature	Agree	Disagree	Uncertain	Other specify
7. When is cold my legs and heels are painful.	1	2	3	4
8. During cold day I experience painful joints.	1	2	3	4
9. When is cold my feet are too cold leading to inability to sleep	1	2	3	4
10. When is cold my whole body feels too cold.	1	2	3	4

Challenges related to condition	Agree	Disagree	Uncertain	Other specify
11. I am suffering from reduced eye sight	1	2	3	4
12. Am not able to work due to my condition	1	2	3	4
13. I am able to check my blood glucose regularly.	1	2	3	4
14. I am able to do my daily chores with no difficulty.	1	2	3	4

SECTION C: PARTICIPANT DIFFERENT WAYS OF DEALING WITH THE EFFECT OF CHANGING TEMPERATURES.

Coping with hot temperature	Agree	Disagree	Uncertain	Other specify
15. When is hot I apply cold cloth/tap sponge on my body to cool down	1	2	3	4
16. I drink lot of water from when is hot.	1	2	3	4
17. I drink cold water from the fridge when is hot.	1	2	3	4

18. When I am feeling hot I take a bath to cool myself down.	1	2	3	4
19. I am using fan when am feeling hot.	1	2	3	4
20. I wear loose light clothes when is hot.	1	2	3	4
21. When is hot I sleeping on the floor to cool the body.	1	2	3	4
22. When is hot sit outside under the shade when experiencing heat.	1	2	3	4
23. I am always indoors for protection from heat.	1	2	3	4
24. I do house chores in the morning.	1	2	3	4

Coping with cold temperature	**Agree**	**Disagree**	**Uncertain**	**Other specify**
25. When is cold I stay indoors to be warm.	1	2	3	4
26. I sit around the fire when is cold to keep warm.	1	2	3	4
27. When is cold I sit at the sun to keep warm.	1	2	3	4
28. I wear warm clothes when is cold.	1	2	3	4
29. When am feeling cold I drink tea/fluids.	1	2	3	4
30. When feel cold I take a warm bath	1	2	3	4

Section D

HEALTH INFORMATION/LEARNING NEEDS

Health Information/Learning Needs	**Agree**	**Disagree**	**Uncertain**	**Other specify**
31. Nurses provide information with regard to the diet to follow.	1	2	3	4
32. I receive useful information about what do on hot/cold days.	1	2	3	4
33. Nurses provide me with continuous information on how to keep medication.	1	2	3	4
34. I need support on planning my daily activities.	1	2	3	4

Section E

RECOMMENDATIONS

Recommendations	Agree	Disagree	Uncertain	Other specify
35. I would recommend that the government provide food parcels	1	2	3	4
36. I suggest that I should be provided with machine to test at home.	1	2	3	4

APPENDIX 5B

XITSONGA QUESTIONNAIRE

Nongonoko wa swivutiso

Xitsonga

Swiletelo: Hlaya hi ku twisisa kutani u hlamula swivutiso leswi landzelaka. Hi kombela leswaku u fungha nhlamula leyi nga fanela hi ku tirhisa mfungho wa xidzadza **(√) kumbe** xihambano **(×)** eka ndhawu leyi nga fanela.

XIPHEMU XA A

VUXOKOXOKO BYA VUTSHAMO BYA VANGHENELERI

A1. Malembe

20-30	
31-40	
41-50	
51-60	
61-70	

A2. Rimbewu

Wa Xisati	
Wa Xinuna	

A3. Nhlonghe

Nhlonghe ya ntima	
Nhlonghe yo basa	
Mu-indiya	
Mu-khaladi	

A4. Xiyimo xa vukati

Tekiwanga	
Tekiwile	

Muferiwa	
La nga herisa vukati	

A5. Xiyimo xa tidyondzo leti u nga dyondza tona

Dyondzo ya masungulo	
Dyondzo ya le xikarhi	
Dyondzo ya le henhla	
A ndzi ya ngi exikolweni	

A6. Xiyimo xa ntirho

Ndzi thoriwile	
Ndza ti tirha	
A ndzi thoriwanga	
Ndzi hola mudende wa vadyuhari	

A7. Vutshamo

E Makaya	
Doroba ra le xikarhi	
Dorobankulu	

A.8 U phaka maphilisi ya vutshunguri bya mavabyi yo ka ya nga holi xana?

1. Ntlhavelo	
2. Maphilisi	

A.9 Xana i malembe ya ngani u kambeliwini u kumeka u ri na nhlengelo wa vuvabyi bya chukele ke?

1. Lembe rin'we	
2. Malembe ya mbirhi	
3. Malembe ya nharhu	
4. Malembe ya mune	
5. Malembe ya ntlanu na ku tlula	

FUNGHA XIBOKISANA XIN'WE EKUSUHI NA XITATIMENDE XIN'WANA NA XIN'WANA EKUSUHI NA XIKALU LEXI NGA LAHA HANSI.

Xikalu: 1=Pfumela, 2=Ala, 3=ku kanakana, 4=Swin'wanyana: Kongomisa

XIYENGE XA B

MAVULAVULELO YA VANGHENELERI LOKO VA TI KOMBISA MATITWELO YA VONA EKA KU CINCA KA MAHISELO.

Swi ta ndhaku swa mahiselo yo hunda mpimo	**Pfumela**	**Ala**	**Ku kanakana**	**Swin'wanyana: Kongomisa**
1. Masiku lawa ri hisaka swinene ndzi badla ku hunda mpimo.	1	2	3	4
2. Loko ku hisa ndzi biwa hi nsululwani.	1	2	3	4
3. Eka masiku lawa rihisaka ngopfu ndza xaniseka hi ku hlohlonyiwa ehandle ka xirho xa le xihundleni.	1	2	3	4
4. Milenge ya mina ya vava loko ku hisa.	1	2	3	4
5. Mikarhi yo tala ndzi twa ndlala swinene.	1	2	3	4
6. Ndzi ni ku heleriwa hi matimba.	1	2	3	4

Switandhaku swa maxelo yo titimela	**Pfumela**	**Ala**	**Ku kanakana**	**Swin'wanyana: Kongomisa**
7. Loko ku titimela milenge na swirhendze swa mina swa vava.	1	2	3	4
8. Mahlangano ya mina ya vava siku leri ku titimelaku.	1	2	3	4
9. Loko ku titimela mikondzo ya mina yi twa xirhami swinene leswi endlaka ni va ni xiphiqo xo khudzahela.	1	2	3	4
10. Loko ku titimela miri wa mina wu twa ngopfu xirhami.	1	2	3	4

Swiphiqo leswi fambelanaka na xiyimo lexi	**Pfumela**	**Ala**	**Ku kanakana**	**Swin'wanyana: Kongomisa**
11. Ndza xaniseka hi mahlo ya mina hikuva ya vona kusuhi	1	2	3	4
12. A ndzi koti ku va ndzi tirha hikokwalaho ka xiyimo lexi.	1	2	3	4

13. Ndza swi kota ku ti kambela chukele leri nga kona emirini siku na siku.	1	2	3	4
14. Ndza swikota ku tirha mitirho ya le ndlwini ya siku na siku ndzi nga vi ni ku tikeriwa.	1	2	3	4

Xiyenge xa C Tindlela to tirhana na mintlhotlho ya ku cinca cinca ka mahiselo.

Ku kota ku hanya eka mahiselo ya le henhla.	**Pfumela**	**Ala**	**Ku kanakana**	**Swin'wan yana: Kongomi sa**
15. Loko ku hisa ndzi ti vekela lapi ro titimela/ xiponci lexi tsakamaka emirini wa mina leswaku ndzi ti timula.	1	2	3	4
16. . Ndzi nwa mati yo tala loko ku hisa.	1	2	3	4
17. Loko ku hisa ndzi nwa mati yo titimela yo huma eka xigwitsirisi.	1	2	3	4
18. Ndzi ti timula hikuva ndzi hlamba loko ndzi twa ku hisa ku hundza mpimo.	1	2	3	4
19. Ndzi tirhisa xiphyuphyisi ku tibela moya loko ndzi twa ku hisa.	1	2	3	4
20. Ndzi ambala swiambalo swo vevuka swo ka swi nga ndzi manyi loko ku hisa.	1	2	3	4
21. Loko ku hisa ndzi etlela ehansi ku va ndzi timuleka miri.	1	2	3	4
22. Ndzi tshama ehansi ka ndzhuti loko ndzi hlangana na ku hisa ka xiyimo xa le henhla.	1	2	3	4
23. Ndzi tshama endeni ka yindlu ku va ndzi ti sirhelela eka mumu.	1	2	3	4
24. Ndzi tirha mitirho ya le ndlwini ni mixo.	1	2	3	4

Ku hanya eka maxelo yo titimela	**Pfumela**	**Ala**	**Ku kanakana**	**Swin'wan yana: Kongomi sa**
25. Loko ku titimela ndzi tshama endzeni ka yindlu leswaku ndzi ko ta ku kufumela.	1	2	3	4
26. Ndzi tshama endilweni loko ku titimela leswaku ndzi ta ko ta ku kufumela.	1	2	3	4
27. Loko ku titimela ndzi tshama edyambyini leswaku ndzi ta kufumela.	1	2	3	4

28. Ndzi amabala swiambalo swo kufumela loko ku ri karhi ku titimela.	1	2	3	4
29. Loko ndzi twa ku titimela ndzi nwa tiya/swi halaki.	1	2	3	4
30. Loko ndzi twa xirhami ndzi hlamba hi mati yo kufumela.	1	2	3	4

Xiyenge xa c

Vuxokoxoko bya swa rihanyo/ swi dingo swa ku dyondza	**Pfumela**	**Ala**	**Ku kanakana**	**Swin'wan yana: Kongomi sa**
31. Vatirhisi va xaxameta vuxokoxoko mayelana na madyelo lawa ya fanelaka ku landeleriwa.	1	2	3	4
32. Ndzi kume vuxokoxoko hi vuenti leswaku ndzi fanele ku swi endlisa ku yini eka masiku lawa ku hisaku/ ku titimelaku.	1	2	3	4
33. Vaongori va ya emahlweni va ndzi nyika vuxokoxoko bya leswaku ndzi yi khomisa xinjhani mi mirhi ya mina.	1	2	3	4
34. Ndzi dinga nseketelo wa ku kunguhata migingiriko ya mina ya siku na siku.	1	2	3	4

Swiringanyeto

Swiringanyeto	**Pfumela**	**Ala**	**Ku kanakana**	**Swin'wan yana: Kongomi sa**
35. Ndzi nga ringanyeta leswaku mfumo wu nyikela hi maphasele ya swakudya.	1	2	3	4
36. Ndzi ringanyeta leswaku na mina ndzi nga nyikeriwa hi muchini wo ti kambela loko ndzi ri laha kaya.	1	2	3	4

APPENDIX 5C

SEPEDI QUESTIONNAIRE

LETHATHAMOLO LA DIPOTŠIŠO

Taelo: Bala ka hlokomelo o arabe dipotšišo ka moka. Ka kgopelo kgetha Karabo ya maleba ka letswao (√) goba sefapano (X) mo go kgonegago.

KAROLO A

Dipotšišo tša nyakišišo

A1. Mengwaga

20-30	
31-40	
41-50	
51-60	
61-70	

A2. Bong

Mosadi	
Monna	

A3. Semerafe

Mo-Africa	
Tšhweu	
Ma-India	
Ma-caladi	

A4. Boemo bja Lenyalo

Go se be lenyalong	
Nyetšwe/Nyetse	
Mohlologadi	

Hlalanego	

A5. Kgato ya godimo ya thuto

Sekolo sa tlase	
Sekolo sa secondary	
Thuto e phagamego	
Ga se a tsena sekolo	

A6. Mošomo

Go se šome	
Bereka	
Go itšhoma	
Phenšene	

A7. Madulo

Magaeng	
Metse-magae	
Ditoropong	

A8. Na gona bjale o dirisa/tšea dihlare tsa bolwetsi bosa alafegego?

Tshwana	
Diphilisi	

A9. Ke lebaka le le kae le hlahloba bolwetši bja swikiri?

1. Ngwaga	
2. Mengwaga e mebedi	
3. Mengwaga e meraro	
4. Mengwaga e mene	
5. Mengwaga e mehlano	

KAROLO B: MAIKUTLO A BARALOKI GE THEMPHARETŠHA I TONYA

Taetšo: Swaya goba o marake lepokisana le tee kgahlanong le setatamente go ya le ka mo ongwadilego ka mapokisaneng ao a latelago

Lepokisana 1= Go dumela, 2 = Go gana, 3 = Go s tsebe

B1. Maitemogelo a baraloki mabapi le ditlamorago tša go fetoga ga thempharetšha ya go fiša)

	Go dumela	Go gana	Go setsebe
1. Ke lemoga kudumela ye ntši kudu mo matšatši a go fiša.	1	2	3
2. Ke lemoga go dikologa ge go fiša kudu	1	2	3
3. Ge go fiša ke ba le di hot flushes	1	2	3
4. Ge go fiša ke kwa golapa kudu	1	2	3

B2. MAITEMOGELO A BARALOKI MABAPI LE DITLAMORAGO TŠA GO FETOGA GA THEMPHARETŠHA (THEMPHARETŠHA YA GO TONYA)

	Go dumela	Go gana	Go setsebe
5. Maoto a ba bohloko le mešifa mo matšatši a go tonya	1	2	3
6. Mmele waka o bohloko le marapo ge go tonya	1	2	3
7. Go tonya go tlo tsena marapong ka tsena ke mokgohlane le gohlola	1	2	3
8. Ke lemoga mathata a go bona le Mahlo ga bone gabotse ga thempharetšha e fetoga.	1	2	3

B3. DITLHOHLO TŠA PLWD GE THEMPHARETŠHA E FETOGA

	Go dumela	Go gana	Go setsebe
9. Ke humana go le boima go tšwela pele ka go itšhidulla ka mokgwa wa tshwanelo Kgafetša Kgafetša.	1	2	3
10. Ke humana go le boima go latela dijo tša bophelo botle ka sehla ka selemo	1	2	3
11. Ditlamorago tša dihlare di feteletša ka sehla sa selemo	1	2	3
12. Ke nyaka go rutwa ka dijo tša go phelega ga ka. Sa go ja le go se jewe ka nako ya go fetoga ga thempharetšha .	1	2	3

13. Ke itšhidulla ka mehla go kaonafatsa seemo sa ka.	1	2	3
14. I want to be taught on how to properly store my medication	1	2	3
15. Ke nyaka go rutwa ka mekgwa wa go boloka dihlare tsa ka, ka mokgwa wa maleba.	1	2	3
16. Ke tseba bohlokwa ba go latela dihlare go laola seemo sa ka.	1	2	3
17. Go boima go hlokomelo tšwelopepe ya bolwetsi tja swikiri ka lebaka la go fetoga ga tempheretsha.	1	2	3

D. TSEBO KA GO FETOGA GA THEMPHARETŠHA BAKENG SA PLWD

	Go dumela	**Go gana**	**Go setsebe**
18. Ge swikiri e le godimo baoki dikliniking ba re tshosha.	1	2	3
19. Ka dinako tše dingwe ke lemoga mathata a go fela ga dihlare kliniking.	1	2	3
20. Ke palelwa ke go dira mešomo ya ka ya letšatsi ka lebaka la ditlamorago tša go fetoga ga thempharetšha.	1	2	3

E. HLALOSO YA MAANO A GO SOMA KA KATLEGO YA BOEMO GO TŠWA GO PLDM MO GO FETOGENG GA TEMPHARETŠHA.

	Go dumela	**Go gana**	**Go setsebe**
21. Ke nwa meetse a go tonya ebile ke nwa a ma ntšhi ge go fiša.	1	2	3
22. Ge go fiša kedula ka fase ga morithi ka ba ka nwa meetse a ma ntšhi.	1	2	3
23. Ke apara diaparo tše bohefo ge go fiša.	1	2	3
24. Ke apara dikobo tša go ruthela kaba ka ba ka nwa meets a go ruthela, go ruthetsa Mmele	1	2	3

F. THATO YA THUTO MABAPI LEGO PHELA GABOTSE KA GO FETOGENG GA TEMPHARETŠHA

	Go dumela	**Go gana**	**Go setsebe**
25. Go amogela Thuto Tswelopele go Katlego le boemo go fetogeng ga themperatšha gotlo nthusa go somna le boemo	1	2	3
26. Go humana thuto y a ka mehla go pheleng ga botse go PLDM ka go feyoga ga thempheratšha	1	2	3

27. Thuto ya go tlwaela go phelenga ga PLDM ge thempharatšha e fetoga e tlo nthusa go ba le boemo.	1	2	3

G. HLALOSO YA DI DITSHEBELETSO TŠA GO BA GONA GO AHLOLA MATHATA MABAPI LE GO FETOGA GA THEMPHERETŠHA

	Go dumela	**Go gana**	**Go setsebe**
28. Ke humana thuto ya ka mehla go tsamoiso dikliniking ge ke eya go tseba dihlare.	1	2	3
29. Tokišetso ya diphuthelwana tša dijo go PLID go tlo thusa go laola seemo sa ka.	1	2	3

APPENDIX 6

VERBATIM TRANSCRIPT

VERBATIM TRANSCRIPT

Age: 53 years

Gender: Female

Duration: 21 min 01 sec.

Researcher: Good morning

Participant: Good morning sister

Researcher: I am a PhD student at university north (Limpopo) now am doing my research on diabetes regarding changing temperatures how does these changes affect you as you leave with diabetes mellitus.

Participant: Oh right.

Researcher: Am working at nursing college. Am a lecturer there.

Participant: Oh ….my god

Researcher: How old are you?

Participant: 53yrs

Researcher: Laughter … 53yrs old … do you have any qualifications ?.... highest standard of educations passed.

Participant: They say is grade 10.

Researcher: Oh…ok.

Researcher: So what I want to know … how long have you been diagnosed with diabetes mellitus.

Participant: Since 2010…yeap

Researcher: Since 2010?

Researcher: I hope you have read the consent and understood everything .. because we have to give the consent to you to read and understand what is going to happen with the information that you are sharing with me.

Participant: Oh

Researcher: So it is between me, you and my supervisor and no other person to will share the information with.

Participant: Oh …jaa …ok.

Researcher: So how does changing temperatures affect you ? …. Like when the day is hot….. what are the things that you find it difficult to live as you live with condition?

Participants: Nodding her head.

Researcher: So what are the effect of hotness affect you?

Participant: Yah.. ok ..em.. what I have realised is when my sugar is high like….under par..neh ..I get like hot flushes.. I can see even that I start to sweat .. like … I can stand at the sun.. like I feel very hot .. if I take my temperature is normal is just that am feeling very hot and sweaty…. I know that ….even I have machine at home to check my sugar the readings is 10 or 14 depending on did I take medication at the right time.. depend on what am eating or when am taking my treatment but most of the time am on chronic treatment … so every six months am going to see the doctor then they take blood for last three months.. and then

what happens every time for the last two years they said my sugar is fine… is stays between 4,5,and 6 does not fall too much high according to treatment just like that.

Researcher: Okay …mm..okay

Participant: But previously they started me on with low dose it was just going up and up .. so . I saw the Gp here in town so.. he put me on another treatment added on what I was using. I was using 500mg and now am using 1000mg.. so what happens.

Researcher: mm.. mm

Participant: Now am taking Glucophage 500mg in the morning and 500mg in the evening And . I have to eat after taking my treatment otherwise sugar drops to 2 and when sugar drops to 2m I start to shiver and feeling very , very bad when is high.. I know exactly when it is high since it has been many years, when is high I know by the way am feeling I know now I can test I can see is too high or maybe I had a piece of cake or something cold drinks or whatever…. ….With too much sugar or…. I have put too much sugar in my porridge or whatever the case might be it goes too high but according to my diet I can control……..I have realised that in the morning I have to take treatment I have to eat proper breakfast treatment….. let's say I take treatment at 07 o'clock then if I did not eat by 08'oclock or 08hr30 will go to the sugar that is goes too low.

Researcher: Mmm….so…….

Participant: After that maybe I will take cookies or something, cooldrink or something just to make me feel better but after this attack I fee I very very tired with the low sugar… with the high sugar I feel the temperature and I know its very high.. with low sugar I start to shake.. after sugar come to 4,5,6,. depend on between 6&7 then I know am fine.

Researcher: So… when it is cold… … mm….sometimes in the problem the thing you feel when you sweat too much it will be during hot temperature?

Participant: Yah….. yah…..because am on … I had hysterectomy 2017 in am on even that one treatment am taking it every day.. I know that one am used to when I feel

Researcher: Even if environmental temperature is normal?

Participant: Yah… is cold very hot when I check temperature and it is normal and I feel very hot

Researcher: Mmm…. So what are things you do to feel calm or cool especially when it is hot… things you're doing?

Participant: I check my sugar when is too high I take treatment even if it is an hour or two before the time am used to take my treatment….so for that one am just wash on my face with cold water so that my body could cool off a little bit and then after am fine.

Researcher: Your only use cold water?

Participant: Yes …. am just sponging myself using only cold water.

Researcher: You don't use any fan ?.....for…..

Participant: No…I just tap sponge myself and sometimes I use the water that was in the fridge to drink that water to cool me down.

Researcher: But during that hot weather you always er…. I mean that you always when is hot when you feel that you take lot of water that was from the fridge and then you use that for tap sponge?

Participant: Yes taking lot of water it makes me feel much better and like refreshing from hot flushes I called it's like hormone problems is just when the sugar is going too high then I start to feel this sweaty hot body the temperature when I take it is normal.

Researcher: Ok ..because of the temperature is normal is that some of your coping skills you use to at least when you feel that hotness, you drink water, you tap sponge and you wash your face so that you feel refreshed.

Participant: Yes nodding. Just to cool down.

Researcher: Does this changing temperatures affect your medications?

Participant: No it does not

Researcher: Does not affect your medication storage? .. do you have… only using tablets?

Participant: I don't use insulin I only use two tablets.

Researcher: Mmm.. or usually the changing in glucose or blood sugar problems it happens more during winter or summer?

Participant: I think during summer I have more problems than in winter is only during December, January when is very.. very hot problems comes more often.

Researcher: Oh….er.. is during hot weather….. what about your clothing, dressing you dress heavy weight clothing ?

Participant: No…no is just in winter I will put on my jersey or jacket, but for now am just dressing like this(light clothes) am just dressing cool.

Researcher: Mm….

Participant: When am seated I have the fan just to keep my body cool, am not using jackets or trousers and all this things.

Researcher: You only use light clothes so that you feel free ..ok.

Participant: Nodding head ..yes….yes.

Researcher: Can you indicate the learning needs about adapting or anything you need to learn about adapting to temperature as you live with this condition?

Participant: No.. I don't think so because it has been a long time living with this because I know what my body is telling me and I know when is the problem.

Researcher: Mmm.

Participant: So then I know what to do I have to anytime to see the doctor and I can control the situation.

Researcher: By doing thing you're supposed to do.

Participant: Yes..yes (nodding of head).

Researcher: Ok so what kind of help would you like to receive especially as you live with this condition?

Participant: Er...er.

Researcher: Especially when coming to education, health talks and everything.

Participant: Ok.. what was happening because of diabetes since 2014 I went for foot operation I had problems with my feet since 2014 until now I have six operation on my right and left feet. They say the bones are crumbed because of the sugar they have to put on the screws and whatever they have put it inside even the right foot I cannot bend it. So last year the body started rejecting some of the screws the Doctor had to take some of them out.

Researcher: Oh…. Er.

Participant: So I had a problem the wound was not healing that properly, it was taking a lot of time to heal so the doctor put me on lot of antibiotics but when I was in hospital by that time I had a severe infection, Dr Grobler an orthopaedic saw what happened and then sent a dietician and counsellor… er …psychiatrist

Researcher: A psychologist?

Participant: Yes, yes they gave me a file information showing what must I eat, drink and what not to eat or drink how to handle the situations and is not a really a big problem on what to do or not to do. At the hospital they gave me all the information that I have to use at home and am happy to use it. For all this years I can control it.

Researcher: Mmm..

Participant: So even am living with my husband and my daughter is 25years old so at home am having all the support.

Researcher: Mmm.

Participant: f say I have maybe low sugar I tell them that now am tired I have to go and lie down and they live me just to rest until I feel better so even at home have all the support.

Researcher: Mmm.. and then what about here at work or government ?

Participant: You know I have qualified as an enrolled assistant nurse in 2002 then I came from Phalaborwa to Mookgopong with a transfer. I started to work here in 2005 at the health Centre.

Researcher: Mmm.

Participant: So I was nursing here since 2013 my foot was struggling giving me problems so in 2016 because of the operations I was absent due to that I have to be on feet with POP and whatever duties. So I was given medical ill-health retirement and then they say NO and they can see am having problems the report of the specialist shows, so what they cannot give me medical ill heath retirement but what can they do is to put me on an administrative post so that I cannot walk around and pick up patients and do all the nurses are used to do that is why am on administrative post.

Researcher: Mmm

Participant: That is what they have done Mr Kekana from Polokwane has done, am still paid as a nurse but on an administrative post and handling all the HR so this is my office, answering calls, doing capturing and assisting the managers, stock taking and control. They support me in whatever am doing, I don't have to walk too much because of my feet problems. Sometimes am not feeling well or sugar is not okay I tell them they say I must go home and rest or when I have to see the doctor they very much supportive they say I can go and they must know what is the problem. Managers are supportive and other staff members I call them to come an collect things from my office. Am able to cope

Researcher: Mmm

Researcher: So during cold weather how do you manage your sugar or do you have anything that troubles you?

Participant: Er…. With sugar I can control it with the way am eating.

Researcher: With diet?

Participant: Yes with the way am eating having breakfast, apple or something at 10oclock, at 12 o'clock a sandwich and at 3 o'clock tea or coffee whatever at 17 o'clock or 18 o'clock when I arrive home have supper.

Researcher: And then have you ever engaged in walking exercises?

Participant: The problem exercise is a challenge for me because of my feet , so am walking with crush.

Researcher: Oh

Participant: I have to support with crush even at home am using wheelchair sometimes. So I have support in using crush and wheelchair for walking and here at work they come to collect and they say I must not walk too much.

Researcher: Mm thank you so much.

Participant: Exercise are very difficult for me I have to go for knee replacement I have a problems with my knees, the other day I went to see the Doctor said the discs are falling of the bones crushing each other. I told Doctor Nell because of it need a lot of money and operation is major is better to postponed it to next year or a year after. At the moment am ok.

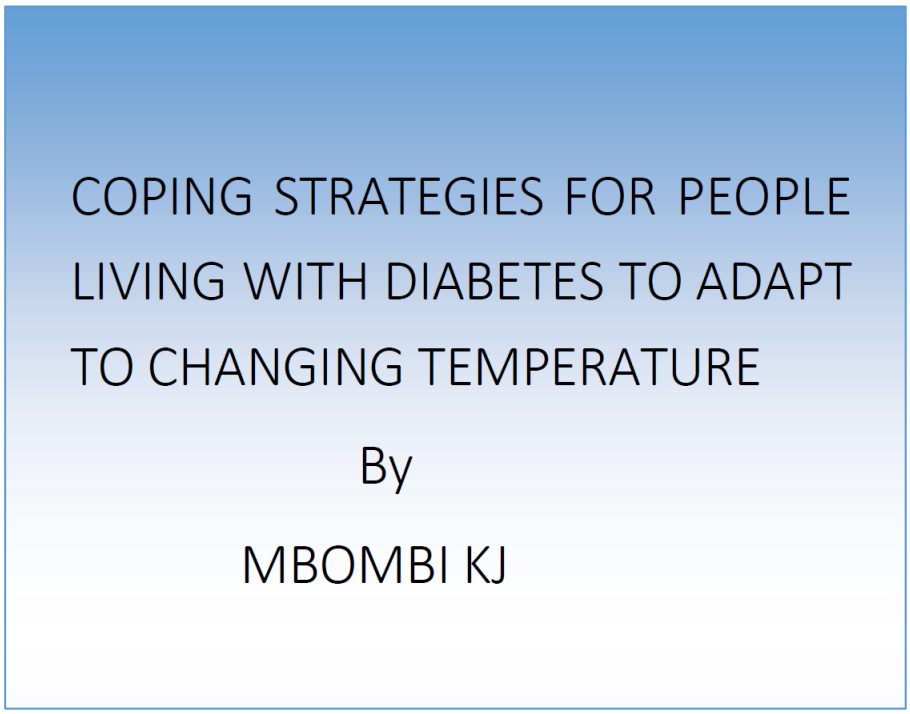
Researcher: Ok thank you so much for giving us information so will have to come in the near future. So we have come to the end of our interview. I think the information will be helpful for us and I hope maybe will in the near future come again , so that we do continuation of what we spoke about.

Participant: Yah is really good to see that they are some people out there who cares for us.

Researcher: Thank you so much.

APPENDIX 7

HEALTH EDUCATION DURING IMPLEMENTATION



STRATEGY 1

Health education on diabetes symptoms management during changing temperature strategy

⇒ Provide health education to PLDM about the management of symptoms such excessive sweating, dizziness, feeling of weakness and excessive hunger during changing temperatures.

⇒ Encourage the use of proactive measures, including fans, cold showers, taped sponging use of damp cloth and staying indoors or under the shade during hot temperatures to keep cool.

⇒ Wearing of loose light clothes during hot temperatures.

⇒ Emphasise the importance of drinking water during hot temperatures.

⇒ Educate PLDM about the importance of avoidance of strenuous activities such exercise or doing house chores during hot days.

⇒ Drinking warm fluids during cold temperatures.

⇒ Encourage PLDM to be in a warm place during cold temperatures

⇒ Encourage wearing warm clothes during cold temperatures.

⇒ Educate about the complications that can develop due to exposure to hot and cold temperature

STRATEGY 2

Conduct health awareness campaigns about the impact of changing temperature

⇒ Continuous health education on the complications suc heatstroke , dehydration of DM during hot/cold temperature .

⇒ Encourage PLDM on the importance of regular visits to health facilities during changing temperatures whenever not feeling fine.

⇒ Provide information about the importance of checking blood glucose.

⇒ In-service training of health professionals about the management complications that PLDM experience during changing temperature on PLDM.

STRATEGY 3

Health education material on proper medication storage readily available

⇒ Diabetic pamphlets should be distributed to people living with diabetes mellitus, they could be like posters with medication cabinet / fridge and food that should be consumed, as many PLDM are not literate. The pamphlets could include any other 'to do' activities.

⇒ Provide continuous health information about proper medication storage.

⇒ Provision of Individualized health talks about the impact of changing temperature.

⇒ Both verbal and written instructions on how to plan activities , diet to follow should be given to people living with diabetes in addition to correct and complete

STRATEGY 4

Health promotion and prevention regarding the effects of changing temperature.

⇒ Availability of educational programs about changing temperature at health care facilities and communities could assist PLDM .

⇒ Effective dietary education should include activities promoting a more positive attitude towards the DM during changing temperature.

⇒ PLDM education and empowerment in the prevention of hypoglycaemic/ hyperglycaemic emergencies during changing temperature.

STRATEGY 5

Health training programs for health care workers that address the challenges of people living with diabetes

⇒ Quarterly public health campaigns by health care workers in different areas in the communities must include information about the impact of changing temperatures.

⇒ For PLDM who reported they could not afford to buy the proper diet for their condition, it should be the duty of a health care professional to encourage them that they should grow their own vegetables in their gardens.

⇒ Training of community health care workers, and support structures be developed in the community so that people living with diabetes can attend these in the community facilities

⇒ Inclusion of other co-existing chronic conditions with diabetes in health education during community outreach about the impact of changing temperature.

⇒ For people living with diabetes is the responsibility of health care providers to explain the relationship of those conditions to help PLDM to able to cope with changing temperatures.

STRATEGY 6

Self-care management strategy related to maintaining quality life during changing temperatures

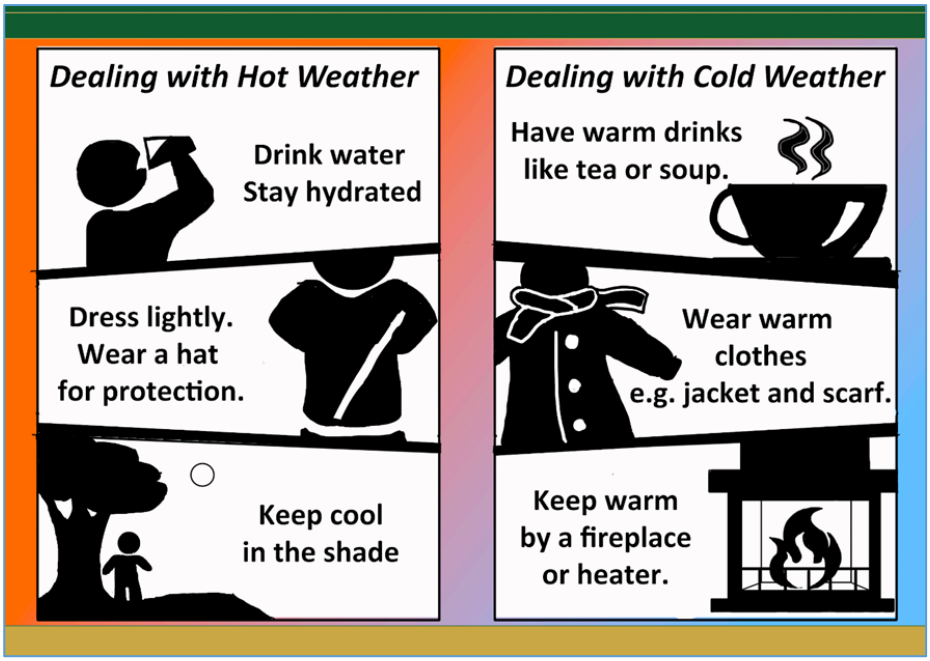
⇒ Provision of Hgt machine to people living with diabetes so that they can be able to check their blood glucose while at home. Available home-based carers could be trained to monitor the progress of diabetic people.

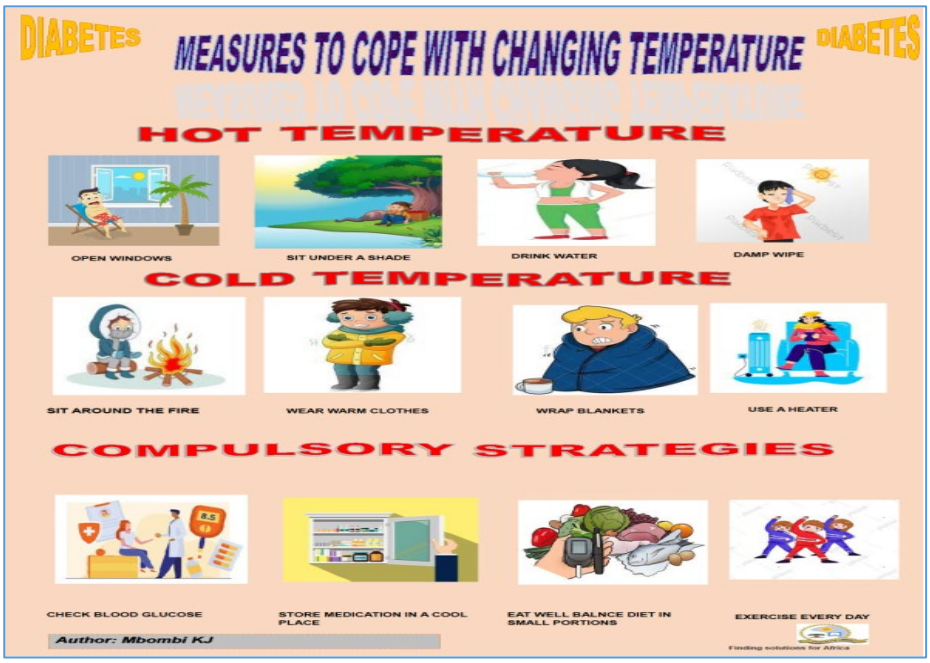
⇒ Education, based on exercise, blood glucose monitoring and self

-management, which could include family members should be emphasized.

⇒ People living with diabetes mellitus need to be advised to be- long to support groups and to follow the instructions and the health talks provided by health care providers

⇒ Health care professionals should always encourage people living with diabetes to visit clinics with their families or guardians at least quarterly,


Dealing with Hot Weather
Drink water
Stay hydrated
Dress lightly.
Wear a hat
for protection.
Keep cool
in the shade
Dealing with Cold Weather
Have warm drinks
like tea or soup.
Wear warm
clothes
e.g. jacket and scarf.
Keep warm
by a fireplace
or heater.


DIABETES
MEASURES TO COPE WITH CHANGING TEMPERATURE
DIABETES
HOT TEMPERATURE
OPEN WINDOWS
SIT UNDER A SHADE
DRINK WATER
DAMP WIPE
COLD TEMPERATURE
SIT AROUND THE FIRE
WEAR WARM CLOTHES
WRAP BLANKETS
USE A HEATER
COMPULSORY STRATEGIES
CHECK BLOOD GLUCOSE
STORE MEDICATION IN A COOL PLACE
EAT WELL BALNCE DIET IN SMALL PORTIONS
EXERCISE EVERY DAY
Author: Mbombi KJ

APPENDIX 8

CONFIRMATION BY LANGUAGE EDITOR

CONFIRMATION BY LANGUAGE EDITOR

Prof Donavon C. Hiss

Cell: 072 200 1086 | E-mail: hissdc@gmail.com or | dhiss@outlook.com

25 January 2023

To Whom It May Concern

This serves to confirm that I have edited the language, spelling, grammar and style of the **Doctor of Philosophy (PhD) in Nursing Science** dissertation by **Khizamane Joyce Mbombi**, titled: "**The Development and Implementation of Coping Strategies for People Living with Diabetes Mellitus to Adapt to Changing Temperatures at Health Care Centres of Limpopo Province, South Africa", submitted to the University of Limpopo**" The manuscript was also professionally typeset by me.

Sincerely Yours

Cert. Freelance Journalism, Dip. Creative Writing, MSc (Medicine), PhD