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Attitudes, knowledge, and physical activity among patients with type 2 diabetes in Dihlabeng, South Africa

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2024

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Vermaak, Cornel . (2024). Attitudes, knowledge, and physical activity among patients with type 2 diabetes in Dihlabeng, South Africa [Master`s dissertation, University of the Witwatersrand, Johannesburg]. WIReDSpace. https://hdl.handle.net/10539/46885

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ATTITUDES, KNOWLEDGE, AND PHYSICAL ACTIVITY AMONG PATIENTS WITH TYPE 2 DIABETES IN DIHLABENG, SOUTH AFRICA

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A dissertation submitted to the Faculty of Health Sciences, School of Therapeutic Sciences, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science in Medicine, Sports and Exercise Science.

Johannesburg, 2024

DECLARATION

I, Cornel Vermaak, declare that this dissertation is my work. The dissertation is submitted for the Degree Master of Science in Medicine, Sports and Exercise Science. University of the Witwatersrand, Johannesburg. The dissertation has not been submitted before any other university for any purpose.

Signed at Johannesburg on this the 3 day of September, 20 24.



Cornel Vermaak

ABSTRACT

Background: The benefits of physical activity for the treatment of type 2 diabetes mellitus are well recognised but underutilised in rural areas. Physical activity is included in the stepwise management of patients with type 2 diabetes mellitus in the South African Essential Medicine and Standard Treatment Guidelines. **Aims:** This study aimed to describe the knowledge, attitudes, and level of physical activity among type 2 diabetic patients in the rural area of Dihlabeng Regional Hospital, Dihlabeng South Africa. Furthermore, the study aimed to develop a community-tailored physical exercise programme for the study population. **Methods:** Data were gathered from 150 consenting adult patients at the Diabetic Clinic at Dihlabeng Regional Hospital, Bethlehem, Free State. This was done through the anonymous completion of a researcher-developed questionnaire that included the International Physical Activity Questionnaire. Additionally, 64 participants took part in researcher-led focus groups. Knowledge was assessed using the results of the researcher-developed questionnaire based on the physical activity recommendations in the South African Essential Medicine List and Standard Treatment Guidelines. **Results:** Results indicated that participants had moderate to good knowledge regarding physical activity as a treatment method for type 2 diabetes mellitus. The overall attitude of participants was positive, generally participants exhibited a low to moderate level of physical activity, with a lack of facilities identified as the primary barrier to performing physical activity. Emanating from the findings, a community-tailored exercise programme was developed. **Conclusion:** This study highlights the need to bridge the knowledge-behaviour gap and address barriers to physical activity in managing type 2 diabetes mellitus in rural South Africa. Tailored interventions and community engagement are essential for promoting physical activity and enhancing health outcomes in rural type 2 diabetes mellitus patients.

ACKNOWLEDGEMENTS

A word of thanks to the following people:

My supervisors, Prof. P Gradidge, Prof. D Constantinou and Dr. M Lichaba for guidance.

Medical staff at Dilhabeng Regional Hospital, especially the Physiotherapy Department for assistance in designing a physical activity programme.

My family for support.

Lastly the participants of the study.

Soli Deo Gloria

TABLE OF CONTENTS

CHAPTER 1: OVERVIEW 1

1.1 Introduction 1

1.2 Background 1

1.3 Problem statement 2

1.4 Research question 3

1.5 Aim of the study 3

1.6 Objectives of the study 3

1.6 Demarcation of the study field 3

1.7 Significance of the study 3

1.8 Outline of the dissertation 4

1.9 Summary 4

CHAPTER 2: LITERATURE REVIEW 5

2.1 Epidemiology of type 2 diabetes in South Africa 5

2.2 Predisposing lifestyle factors 6

2.3 Management of type 2 diabetes mellitus 8

2.4 Physical activity interventions to manage type 2 diabetes mellitus 9

2.5 Mechanism of exercise improving insulin resistance. 10

2.6 Effects of poorly managed type 2 diabetes mellitus 10

2.7 The rationale for optimising type 2 diabetes treatment. 10

2.8 Qualitative studies to design community-driven physical activity programmes and barriers 11

2.9 Use of the International Physical Activity Questionnaire (IPAQ) 11

2.10 Summary 12

CHAPTER 3: RESEARCH METHODOLOGY 13

3.1 Study design 13

3.2 Study field demarcation 13

3.2 Study population 13

3.3 Study sample 13

3.4 Data collection 16

3.5 Data analysis 21

3.6 Validity and reliability 22

3.7 Budget 23

3.8 Project Timeline 24

3.9 Ethical Considerations 25

3.11 Summary 25

CHAPTER 4: RESULTS 26

4.1 Introduction 26

4.2.1 Quantitative data 26

4.2.1.1 Gender 26

4.2.1.2 Age 26

4.2.1.3 Level of education 26

4.2.1.4 Employment status 27

4.2.1.5 Source of income 27

4.2.1.6 Dwelling 28

4.2.1.7 Comorbidities 28

4.2.1.8 Access to gym, sports and exercise facilities 29

4.2.1.9 Diabetic diet adherence 29

4.2.1.10 Diabetic medication use 29

4.2.1.11 Body mass index 30

4.2.1.12 HbA1c% results 30

4.2.1.13 Level of physical activity according to the International Physical Activity Questionnaire (IPAQ) 31

4.2.1.14 Level of knowledge regarding physical activity and type 2 diabetes mellitus 31

4.2.1.15 Level of physical activity compared to participant characteristics. 33

4.2.2 Qualitative data: Focus Groups 34
4.2.2.1 Participants 34
4.2.2.2 Duration 34
4.2.2.3 Attitudes towards physical exercise as a treatment for type 2 diabetes mellitus 34
4.2.2.4 Health Benefits 35
4.2.2.5 Characteristics of a physical activity programme for the community 35
4.3.2.6 Barriers that prevent physical activity in the community. 38
CHAPTER 5: DISCUSSION 41
5.1 Introduction 41
5.2 Discussion 41
5.3 Summary 52
CHAPTER 6: CONCLUSION 53
6.1 Introduction 53
6.2 Limitations of the study 54
6.3 Implications of the study 55
6.4 Recommendations 56
6.5 Conclusion 57
REFERENCES 58
APPENDICES 65
Appendix 1: Human Research Ethics Committee (Medical) Clearance Certificate 65
Appendix 2: Post Graduate Committee Approval 66
Appendix 3: Approval from Free State Department of Health 67
Appendix 4: Approval from Dihlabeng Regional Hospital 68
Appendix 5: Participant Information Sheet 69
Appendix 6: Questionnaire 70
Appendix 7: Consent Form Data Collection 76
Appendix 8: Consent form Focus Group Discussions 77

Appendix 9: Consent form Audio Recordings..... 78
Appendix 10: Focus Group Discussion Framework 79
Appendix 11: Framework for the development of a physical activity programme.. 82
Appendix 12: Example of physical activity programme handout. 83

LIST OF FIGURES

CHAPTER 4

Figure 4.1: Level of education of participants 26
Figure 4.2: Employment status 27
Figure 4.3: Source of income of participants 27
Figure 4.4: Comorbidities of the participants. 28
Figure 4.5 Access to gym, sports and exercise facilities. 29
Figure 4.6: Body Mass Index of participants 30
Figure 4.7: Box and Whisker Plot HbA1c% of participants 30
Figure 4.8: Level of Physical Activity Categories 31
Figure 4.9: Level of knowledge of physical activity as treatment modality for type 2 diabetes mellitus 31

LIST OF TABLES

CHAPTER 2

Table 2.1: Physical Activity Categories 12

CHAPTER 3

Table 3.1: Framework for the development of a community-tailored physical activity programme……18

CHAPTER 4

Table 4.1: Knowledge Questions and Participants Results. 32
Table 4.2: Level of physical activity of participants compared to characteristics. 33
Table 4.3: Focus Group Characteristics 34

CHAPTER 5

Table 5.1: Physical Activity Programme..... 49

LIST OF ABBREVIATIONS

HbA1c% - Glycated hemoglobin percentage

IPAQ - International Physical Activity Questionnaire

METS - Metabolic Equivalents

SASSA - South African Social Security Agency

RESEARCH DEFINITIONS

HBA1c%: refers to glycated haemoglobin, which identifies average plasma glucose concentration over 3 months.

Physical Activity: defined as all voluntary bodily movement produced by skeletal muscles that requires energy expenditure.

Light physical activity: Less than 3 METS expenditure

Moderate physical activity: 3 to 6 METS expenditure

Vigorous physical activity: More than 6 METS expenditure

CHAPTER 1: OVERVIEW

1.1 Introduction

This chapter will provide an overview of the study. The background, aims, objectives, research assumptions, study field demarcation, ethical considerations, research methodology and the significance of this study will be discussed.

1.2 Background

Diabetes mellitus can be classified into four broad categories. Type 1 diabetes mellitus, type 2 diabetes mellitus, gestational diabetes, and other specified causes of diabetes (American Diabetes Association, 2020).

Type 2 diabetes mellitus is defined as a disorder of insulin action and secretion leading to persistent hyperglycaemia (Alberti & Zimmet, 1998). This chronic disease is treated with a multimodal approach, including physical activity, diet – referred to as lifestyle modification, and pharmaceutics.

The diagnostic criteria for type 2 diabetes mellitus as per the World Health Organization (2019) is: “People with fasting plasma glucose values of ≥ 7.0 mmol/L; 2-h post-load plasma glucose ≥ 11.1 mmol/L; glycosylated haemoglobin (HbA1c ≥ 6.5%); or random blood glucose ≥ 11.1 mmol/L) in the presence of signs and symptoms of diabetes”. Signs and symptoms of type 2 diabetes mellitus include increased thirst, frequent urination, hunger, poor wound healing, and fatigue. Some patients also present with recurrent urinary tract infections – especially males.

The Centres for Disease Control and Prevention (2022) notes that diabetes is a global problem with over a billion people diagnosed with diabetes. Nine out of ten patients diagnosed with type 2 diabetes mellitus are diagnosed at various stages of the disease. This is important to note as type 2 diabetes mellitus is a lifestyle disease that can be prevented. The disease needs to be prevented as morbidity and mortality due to diabetes mellitus type 2 have a significant health and socio-economic impact on society.

The treatment of type 2 diabetes mellitus is multimodal and consists of lifestyle changes and medication. Lifestyle changes include physical activity and a healthy diet and are considered preventative at a primary and secondary level, for the development

and worsening of diabetes mellitus type 2. Once lifestyle modifications fail medication is added as the next step in the treatment of the disease. Characteristics of a programme to prevent type 2 diabetes are well defined by the Centres for Disease Control and Prevention. Such a programme needs to be affordable, relevant to implement, and evidence-based. The programme should focus on healthy eating and physical activity (Centres for Disease Control and Prevention, 2022).

Duclos et. al. (2022) determined that in multiple randomised controlled trials, physical activity reduced the incidence of type 2 diabetes by 50% in the population with impaired glucose tolerance. In their meta-analysis of various studies, Dulcos et al., (2022) determined that physical activity reduced the HBA1c by a mean decrease of 0.6% over 12 weeks. To note, some of the studies showed decreases of the HBA1c up to 0.8% over 12 weeks. This is close to that of Metformin monotherapy which decreases HbA1c% on average by 1.1% over 12 weeks (Hirst, et al., 2012).

The Da Qing Diabetes Prevention Outcome Study (Gong, et al., 2019) found that after a 30-year follow-up, patients that lifestyle interventions lead to a delay in the onset of type 2 diabetes mellitus and decreased morbidity due to micro- and macrovascular complications. Therefore, it is justified to design and implement a physical activity programme for communities to curb lifestyle diseases such as type 2 diabetes mellitus. Lifestyle interventions need to be practical utilising intensive lifestyle intervention like supervised physical exercise. Pi-Sunyer (2014) also concluded that the intensive lifestyle intervention group developed fewer complications related to diabetes resulting in a decreased cost of healthcare for diabetes type 2 compared to the group that only received diabetic medication and education.

1.3 Problem statement

In a narrative review of physical activity as a prescription for the treatment of type 2 diabetes mellitus, Mendes et al. (2016) postulate that non-compliance to prescribed physical activity may be a lack of understanding of the importance of physical activity as a treatment modality. No previous research has been done to establish the above in the rural community of Dihalbeng, Free State, South Africa.

1.4 Research question

What is the knowledge, attitude and physical activity behaviour of type 2 diabetics in Dihlabeng?

1.5 Aim of the study

The study aimed to determine the attitudes, knowledge, and level of physical activity of patients with type 2 diabetes at Dihlabeng Regional Hospital, South Africa and subsequently to develop a physical activity programme.

1.6 Objectives of the study

Objectives include:

- To determine the physical activity patterns of type 2 diabetic individuals in Dihlabeng.
- To determine the attitude that these persons have towards physical activity as a treatment modality.
- To determine the knowledge that these persons have towards physical activity as a treatment modality.
- To design a community-tailored physical activity programme for the treatment of type 2 diabetes mellitus in a rural setting.
- To identify barriers that prevent patients from performing physical activity.
- To identify the comorbidities of the type 2 diabetic patients at the clinic.
- To determine the HbA1c% to current level of physical activity, employment status, knowledge of physical activity and attitude towards physical activity.

1.6 Demarcation of the study field

This study was conducted at Dihlabeng Regional Hospital in Bethlehem, Free State at the Diabetic Medical Outpatients Department. The population of the Dihlabeng area is estimated to be around 150,000 (Stats SA, 2021) with a mix of ethnic groups and languages spoken.

1.7 Significance of the study

The community members are the protectors of their health. However, the expertise of healthcare providers is needed to help the community achieve a healthy lifestyle. The knowledge and attitude towards physical activity as a treatment for type 2 diabetes

mellitus as well as the possible challenges the members may face in the implementation of a physical activity programme was unknown. This is especially true in a rural setting with limited resources. In a review article by Fine et al. (2022) findings were made that there is limited understanding of the characteristics as well as the effectiveness of physical activity programmes based in rural communities. Across the world, only 12 studies to date have been done in rural settings. Involving the community members in the treatment plan for their type 2 diabetes mellitus will ensure ownership of the programme which in return will contribute to the sustainability of such a programme. This may result in long-term behavioural change, which has been evident in a study by Leach et al. (2014).

The purpose of the study was to understand the attitude, knowledge, and physical activity in the rural area of Dihlabeng, as part of the treatment for type 2 diabetes mellitus. This may form the basis to help formulate healthcare policies and programmes for the treatment of type 2 diabetes mellitus in a rural setting.

1.8 Outline of the dissertation

Chapter 1: Overview
Chapter 2: Literature Review
Chapter 3: Research Methodology
Chapter 4: Results
Chapter 5: Discussion
Chapter 6: Conclusion

1.9 Summary

In this chapter the background to this study was given. This was followed by the aims and objectives, study field demarcation, ethical considerations, methodology and the significance of the study. The literature review will be presented in the next chapter.

CHAPTER 2: LITERATURE REVIEW

Diabetic education alone is not sufficient to ensure a healthy lifestyle (Pi-Sunyer, 2014). During the Look AHEAD trial, patients were followed up over a mean period of 9.6 years. Two groups were established, one group was given intensive lifestyle intervention, including unsupervised physical activity. The other group was only given education regarding the disease and lifestyle changes, but no intervention was done (Look AHEAD Research Group et al., 2013). The trial concluded that participants that had intensive lifestyle intervention had raised the quality of life and there was an improvement in the risk factors and a decrease in diabetic-related complications. This resulted in decreased healthcare costs. Pi-Sunyer (2014) also concluded that participants in an intensive lifestyle intervention group develop fewer complications related to diabetes resulting in a reduced cost of healthcare for diabetes type 2 compared to the group that only received diabetic education. Mlangeni et al. (2018) found that out of 26339 South African individuals, 57.4 % (CI: 55.9-59) were not physically active. Gradidge et al. (2014) found in a cross-sectional study of 977 women in Soweto, South Africa, that only 45% (n=977) of women in this urban area participate in physical activity for leisure. The prevalence of metabolic syndrome in this group was 40% (n=977). In this population, 67% were classified as active with walking as a means of travel accounting for most of the physical activity (Gradidge, et al., 2014).

2.1 Epidemiology of type 2 diabetes in South Africa

The prevalence of type 2 diabetes mellitus in South Africa is increasing rapidly resulting in increased morbidity. Diabetes was the second most common underlying cause of death in South Africa in 2016 (Stats SA, 2017). It is estimated that in 2009 about 9.0% of adult South Africans over the age of 30 were diagnosed with type 2 diabetes mellitus. This contributed to 78,900 years lost to morbidity in 2009 (Bertram, et al., 2009). In 2021 the International Diabetes Federation estimated that there are 4,234 million people in South Africa living with diabetes. No distinction was made regarding the type of diabetes. Considering that the prevalence of type 2 diabetes mellitus almost doubled between 2005, 5.5% to 9.0% in 2009, The International Diabetes Federation (2021) predicts that the prevalence of type 2 diabetes mellitus in South Africa will increase if the upward trajectory continues. Bradshaw et al. (2007) identified diabetes as one of the major contributing diseases to the quadruple disease

burden, which includes communicable diseases (HIV and Tuberculosis), maternal and child mortality, trauma and non-communicable diseases such as hypertension, type 2 diabetes mellitus, cancer and mental illness South Africa face.

South Africa has the second highest number of people living with type 2 diabetes in Sub-Saharan Africa (World Health Organization, 2016) and was the leading cause of natural causes of death of women in the country (Statistics South Africa, 2017).

According to the International Diabetes Federation (2021), diabetes costs South Africa USD 1700.7 per person per year on average. At the average exchange rate of R14.79/USD in 2021 that is R25155.39. Although this expenditure does not differentiate between the type of diabetes, it can be assumed that most of the spending will be towards patients with type 2 diabetes mellitus, as the prevalence of type 2 diabetes mellitus is estimated to be higher than other types of diabetes (International Diabetes Federation, 2021).

The increase in the prevalence of type 2 diabetes mellitus can be attributed to an epidemiological transition in the population, known as Omran's Theory (Omran, 1971). Omran described the influence of modernisation on a society that leads to a change in the disease profile of the society. The change is from primarily communicable diseases to non-communicable diseases. Cardiovascular disease, obesity and type 2 diabetes are examples of non-communicable diseases (Omran, 1971). South Africa is following this epidemiological transition as the data above suggests.

2.2 Predisposing lifestyle factors

Lack of physical activity

One of the most significant risk factors for the development of type 2 diabetes mellitus is a sedentary lifestyle defined as ≤ 1.5 metabolic equivalents (METs) while sitting or lying (Sawada, et al., 2010). One MET is defined as 1 kcal per kg of body weight per hour (Duclos, et al., 2011). Television time, a common sedentary activity can be directly linked to the development and worsening of type 2 diabetes mellitus (Hu, et al., 2001). In a study by Kohl et al. (2012) up to 31% of people do not meet the minimum physical activity they require (Kohl, et al., 2012).

There is a positive correlation between the development of type 2 diabetes and a lack of physical activity. The American College of Sports Medicine takes the position that

at least 150 minutes of exercise in the moderate to vigorous range (in conjunction with a healthy diet) is required to delay or prevent the development of type 2 diabetes mellitus (Colberg, et al., 2010).

Although lack of physical activity plays an important role in the development of type 2 diabetes mellitus, the increase in sedentary behaviour independently contributes to the increased risk of developing type 2 diabetes mellitus (Helmerhorst, et al., 2009). Helmerhorst et al. (2009) defines sedentary behaviour as behaviour that results in less than 1.5 METS energy expenditure. This includes working at a desk, reading and watching television.

Urbanisation

Factors that contribute to the increase in patients with type 2 diabetes in South Africa are multifactorial. The urbanisation of rural areas and an increase in income lead to a change in diet and a decreased level of physical activity. The effect is an increased incidence of lifestyle diseases like type 2 diabetes mellitus (South Africa Demographic and Health Survey, 2016). This is a common trend in Sub-Saharan Africa where there is a rapid change in socio-economic status (Kangmennaang, et al., 2023). Furthermore, urbanisation results in a decrease in physical activity like walking, cycling and physical activity at work such as manual labour (Ezzati & Riboli, 2014).

Diet and Habits

Other lifestyle risk factors include unhealthy eating habits. For example, a diet with low fibre and a high glycaemic index is associated with a higher risk of developing type 2 diabetes mellitus. A diet that comprises of high refined carbohydrates and fats that lead to a high caloric intake will also increase the risk for type 2 diabetes mellitus (Narayan, et al., 2006).

Smoking and alcohol consumption also increase the risk of developing type 2 diabetes mellitus (Wu, et al., 2014). Smoking leads to increased levels of nicotine in the body which leads to the development of insulin resistance – the underlying pathophysiology of type 2 diabetes mellitus (Bajaj, 2012). In the study, Bajaj (2012) gives a detailed the effects of nicotine on skeletal muscle – in particular how nicotine decreases the uptake of glucose by skeletal muscles resulting in increased blood glucose levels.

Obesity

Some studies claim that obesity is the most important predisposing factor for the development of type 2 diabetes. This is because obesity, central and visceral obesity, is a major contributor to multiple other conditions that also lead to an increased risk of developing diabetes mellitus type 2 (Kyrou, et al., 2018). This has led to the term “diabesity” being used to refer to both diseases as one. Interdependent, obesity and type 2 diabetes mellitus commonly exist together (Sims, et al., 1973).The risk of developing type 2 diabetes mellitus increases as body mass index and waist circumference increase (Hu, 2008). The pathophysiology is complex but involves multiple mechanisms resulting in beta-cell dysfunction and an increase in peripheral resistance to insulin (Klein, et al., 2022).

Sleep

Lack of sleep can contribute to the development of type 2 diabetes. This is the result of an increased sympathetic outflow resulting in catecholamine release that increases blood glucose levels. Chronic fatigue leads to an increase in baseline sympathetic outflow and results in permanently raised blood glucose levels. In addition, irregular sleep patterns also result in increased sympathetic outflow, further increasing the risk of developing type 2 diabetes mellitus (Zizi, et al., 2010).

The quantity and quality of sleep is therefore important. One factor that significantly affects sleep and is associated with the development of diabesity is obstructive sleep apnoea with a similar pathophysiology as above that eventually leads to an increase in sympathetic outflow (Punjabi, et al., 2004).

Socioeconomic stressors contribute to decreased duration and worsening of the quality of sleep (Zizi, et al., 2010). In one study by Bonnet and Arand (1995) it is noted that we currently sleep one hour less than we used to 100 years ago and that people are currently sleeping 6.8 hours per day (Bonnet & Arand, 1995). A strong association exists between lack of sleep duration and poor sleep quality and the development of type 2 diabetes mellitus according to the literature reviewed in this section.

2.3 Management of type 2 diabetes mellitus

The South African Department of Health has very clear step-by-step guidelines on how to manage type 2 diabetes mellitus. The first step involves lifestyle modifications and

starting the patient diagnosed with type 2 diabetes mellitus on metformin thereafter. Follow-up should occur after 3 months and HbA1c% should be tested. The target HbA1c% for adequate control used in the community clinics, as per the above guidelines, is less than or equal to 7%. This equates to an average blood glucose level of 8.6mmol/l over 3 months. If this is achieved the patient will be continued on current treatment. Once the HbA1c% is above 7% then the next step is to add a sulfonylurea drug. After 3 months the HbA1c% is measured again - targeting 7% or less. Failure of steps 1 and 2 will result in the addition of basal insulin to the treatment plan (South African National Department of Health, 2020).

Lifestyle modification includes counselling on physical activity by the healthcare professional and a dietician consultation.

2.4 Physical activity interventions to manage type 2 diabetes mellitus

It was found that type 2 diabetes mellitus needs to be prevented through primary prevention by improving primary health care management (Preat & van Loon, 2009). It is well known that physical activity is effective in the treatment of type 2 diabetes mellitus and has been described as the cornerstone to achieving glycaemic control (Preat & van Loon, 2009) This is inexpensive and low risk compared to pharmacological agents and can be done at any level of health care. In a meta-analysis of studies regarding the effect of exercise on glycaemic control by Shah, et al. (2020), all the studies that met the inclusion criteria (26 studies), found that physical activity significantly lowers HbA1c%. Physical activity in diabetic patients improves overall health, including mental health and general well-being (Wycherley, et al., 2013).

The South African Primary Healthcare Standard Treatment Guidelines and Essential Medicine List (2020) recommendation for physical activity in the management of type 2 diabetes mellitus, along with dietary advice, is 30 minutes of moderate to vigorous physical activity five days a week. In simple terms, moderate physical activity translates to brisk walking on a level surface, whereas walking up an incline or jogging is classified as vigorous physical activity. Data from the Ellisrass longitudinal study (2017) suggest that most people residing in rural areas met this goal of 30 minutes a day at the time of the study (Mabweazara, et al., 2017).

Multiple other guidelines from different societies including the American College of Sports Medicine, The International Diabetes Foundation and the European Society of Cardiology agree that the prescribed minimum physical activity should be no less than 150 minutes per week of moderate to vigorous aerobic physical activity. Moderate to vigorous aerobic physical activity is defined as a physical activity with a heart rate of 50 to 70% of the maximum heart rate as per the American College of Sports and Exercise Medicine (Colberg et al., 2010). The frequency should be at least five days per week with no more than two consecutive days without physical activity (Mendes et al., 2016). Physical activity, in particular aerobic activity may decrease visceral fat even without leading to a notable loss in weight (De Feo, et al., 2006).

2.5 Mechanism of exercise improving insulin resistance.

Glycogen phosphorylation in skeletal muscle doubles (Perseghin, et al., 1996) during exercise. This is important as the reduction of the activity of glucose phosphorylation by hexokinase enzymes has been linked to the development of insulin resistance in patients with type 2 diabetes mellitus (Rothman, et al., 1995). Therefore, whole-body glucose homeostasis is improved as exercise increases the uptake of glucose, especially by skeletal muscle via the GLUT-4 transporter (Muñoz, et al., 2023).

Physical activity can be used to predict the development of insulin resistance (Sawada, et al., 2010). In the study by Sawanda et al. (2010) Japanese men were subjected to exercise testing and found that long-term cardiorespiratory fitness has been linked to a lower incidence of developing insulin resistance.

2.6 Effects of poorly managed type 2 diabetes mellitus

Poorly managed diabetes leads to an increased risk of complications and death. Using the targets as per the South African Essential Medicine List and Standard Treatment Guidelines 7%, for every 1% increase in HbA1c% is associated with an increased risk of microvascular (35%) and macrovascular events (38%). This leads to an increased risk of death by 38% (Zoungas, et al., 2012).

2.7 The rationale for optimising type 2 diabetes treatment.

The public sector cost to manage type 2 diabetic mellitus patients in 2018 was R2.7 billion. This only includes diagnosed cases, but if undiagnosed cases are also added to this, the cost dramatically increases to R21.8 billion. It is estimated that in 2030 this

will increase to R35.1 billion (Erzse, et al., 2019). It is therefore essential that patients are optimally managed to try and decrease these costs.

2.8 Qualitative studies to design community-driven physical activity programmes and barriers

Multiple studies have found that when a healthcare worker counsels diabetic patients on physical activity, it leads to increased physical activity and better glycaemic control (Norris S.L. et. al., 2005). If patients have good knowledge about physical activity, it will impact their real-life practice (Roberts, 2010). Roberts' findings confirm that patients with knowledge about healthy lifestyle habits will directly translate into the pursuit of a healthy lifestyle. This can be applied to diabetic patients as well, in terms of physical activity. This is further confirmed by Hui et al., (2014), that knowledge regarding physical activity has a positive effect on people exercising.

In a similar study by Palaniswamy et al. (2020) barriers that prevent physical activity in Salem India were identified. These included poor road conditions, lack of facilities for physical activity and fear of hypoglycaemia. Crime is a barrier in the urban South African province of Gauteng (He, et al., 2020). He et al. (2020) found that there is an inverse association between low perceived neighbourhood safety and physical activity. Women felt more unsafe in the neighbourhood and were less likely to exercise compared to male individuals (He, et al., 2020). In summary, some barriers to physical activity include a lack of facilities, crime and fear of hypoglycaemia

2.9 Use of the International Physical Activity Questionnaire (IPAQ)

The questionnaire provides the researcher with information on the level of physical activity of participants and divides it into 3 categories – low, moderate, and high (International Physical Activity Questionnaire , 2005).

The questionnaire has been used in multiple settings and extensively used to determine the level of physical activity of participants in different countries and population groups (Craig, et al., 2003).

Table 2.1: Physical Activity Categories

Category	Criteria
Low	Participants did not meet the criteria for moderate or high physical activity.
Moderate	At least one of the following: 3 or more days of vigorous-intensity activity of at least 20 minutes per day, OR 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day, OR 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 600 MET-minutes/week.
High	At least one of the following: Vigorous-intensity activity on at least 3 days achieving a minimum Total physical activity of at least 1500 MET-minutes/week, OR 7 or days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3000 MET-minutes/week.

2.10 Summary

Chapter 2 provided a literature review. The following chapter will discuss the research methodology.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Study design

A mixed-method study design with a sample of convenience was used.

The quantitative method used a cross-sectional design to determine the physical activity pattern of individuals in the Dihlabeng area as well as to determine the knowledge that these people have about physical activity as a treatment modality. The second part of the study, focus groups (qualitative study design), was used to determine the attitude of these patients towards physical activity and to identify factors for the successful implementation of a physical activity programme in the community.

3.2 Study field demarcation

This study was conducted at Dihlabeng Regional Hospital in Bethlehem, Free State at the Diabetic Medical Outpatients Department. The is expected to be predominantly agricultural, with many residents working in farming or related industries. The population of the Dihlabeng area is estimated to be around 150 000, (Stats SA, 2021) with a mix of ethnic groups and languages spoken.

3.2 Study population

Type 2 Diabetic patients, who attend the Diabetic Clinic at Dihlabeng Regional Hospital formed part of the study population. Male and female type 2 diabetic patients, 18 years and older, were part of the study. All the patients were from the Dihlabeng rural area. Unfortunately, there is no data available to determine the number of diabetics in this specific population

3.3 Study sample

3.3.1 Study Participants

Participants were sourced from the Diabetic Clinic at Dihlabeng Regional Hospital in Bethlehem, Free State, South Africa. This provided a low-cost, easily accessible sample for the study.

All patients present at the clinic were invited to participate in the study. Most of the patients attending the clinic are patients with poorly controlled diabetes mellitus type

2 that failed management at the district health level and therefore referred to Dihlabeng Regional Hospital for further management. Male and female patients are seen at the clinic and most of the patients are middle-aged or above with an age range of 45 to 60.

The patients were booked for the clinic in advance. The patients were invited to participate in the study after they arrived at the clinic at 07:00. From 07:00 until 10:00 patients had their blood taken for HbA1c percentages, weight and height. After this, they waited for the results before being attended to by a doctor. This waiting time was used to complete the questionnaire and focus groups.

3.3.2 Sample Size

Quantitative study

Based on the knowledge that at least 40 patients attend the clinic per week (unpublished data from the clinic), the number of patients required for the study was an estimation and sample of convenience with saturation. Weekly about 40 patients are booked for the diabetic clinic, and it is assumed, as no formal data was available, that at least 50% of the patients booked will attend the clinic. The patients follow up every 3 months, therefore after 3 months, all the patients would have had an opportunity to participate in the study.

Using Cochran's sample size formula, a sample size with a 95% confidence level, a 5% error margin, a study population of 240 and a population proportion of 50%, a sample size of 150 were selected.

Qualitative study

A total of 10 focus group discussions were conducted, with each group consisting of 6 to 8 patients (Morgan,1996) during the data collection period. As the study was conducted over 3 months, it was convenient for the researcher to conduct 1 focus group per week. Ideally, 12 focus groups were targeted but to ensure that service delivery was maintained only 10 focus group discussions were conducted.

Sample Selection

Quantitative Method

Inclusion Criteria

- All males and females.
- Confirmed Type 2 Diabetes Mellitus patients (WHO, 2019).
- ≥18 years of age.
- Residing in the Dihlabeng rural area who are patients of the Dihlabeng Regional Hospital Diabetic Clinic.
- Willing to consent to participate in the study.

Exclusion Criteria

- Patients unable to mobilise (e.g. quadriplegic or bedridden).
- Type 1 diabetes mellitus.
- Gestational diabetes mellitus.
- Patients with multiple endocrine diseases.
- Medical conditions where physical activity is contraindicated.
- Mental incapacity that makes it difficult to comprehend and cooperate with the instructions and recommendations for physical activity.

All patients attending the clinic were given the information sheets and the researcher explained the study to them, informed consent was granted to the researcher. The researcher ensured that the inclusion and exclusion of criteria were met by asking the patients the inclusion criteria and exclusion criteria. The questionnaire also prompted the participants to stop participating in the study if the sample selection criteria were not met.

Qualitative Method

Inclusion Criteria

Participants must have completed the quantitative component and met the quantitative inclusion criteria.

Exclusion Criteria

Participants who had not completed the quantitative component or were unable, due to physical and mental disability, to verbalise their opinions.

3.4 Data collection

Measurement and instruments

The study utilised a researcher-designed questionnaire to assess the knowledge level of physical activity level of the patients and their attitudes.

The questionnaire (Appendix 6) consisted of 3 sections. Section 1 consisted of questions regarding demographics and served as an additional tool to ensure that patients did not continue with the questionnaire if they did not meet the inclusion criteria. In the second section, the level of physical activity was determined using the International Physical Activity Questionnaire (IPAQ). Section 3 was based on the Primary Healthcare Standard Treatment Guidelines and the Essential Medicine List of South Africa. This section was subjected to evaluation by the supervisors of the study. Section 1 and Section 3 of the questionnaire were designed by the researcher for this study. The questionnaire was available in English. Healthcare providers working at the clinic were available to assist with translation to Afrikaans or Sesotho when needed.

After completing the questionnaire, patients were invited to participate in dialogue regarding physical activity and diabetes. The focus groups utilised a researcher-designed framework (Appendix 10). The attitude of the patients regarding physical activity was determined using the framework. The discussions identified what the community requires in a physical activity programme and what is culturally, socially and practically acceptable in the community. The framework was not externally validated.

'Digital Audio' Voice Recorder Rechargeable 8G USB Dictaphone Mp3 voice recorder was used to record the sessions. The audio data was exported to MP3 format and was stored and saved securely on the personal computer of the researcher.

Pilot Study

A pilot study was conducted before the main study and ten patients were asked to fill in the questionnaires (Appendix 6). The number of patients asked to participate in the pilot study represented the maximum number of participants in a focus group. After completing the questionnaires, participants were invited to partake in the focus group discussion. The purpose of the pilot study was to identify any logistical problems with the implementation of the main study and was used to identify whether the patients

would be able to complete the questionnaires and whether there were any confusing or unclear parts of the questionnaire. This was used to plan how many healthcare staff were needed to be available to assist. No logistical problems were identified in the pilot study. Participants did not have difficulties to complete the questionnaire. No changes were made to the main study after the pilot study.

Data from the pilot study was not used in the main study.

Main Study

The study evaluated the attitude towards and knowledge about using physical activity as a treatment method for type 2 diabetes mellitus and determined the type of physical activity patients would like.

A self-administered questionnaire was distributed among patients who attended the weekly Diabetic clinic at Dihlabeng Regional Hospital who met the inclusion criteria. The study took place over two months when the desired minimum sample size of 150 patients was acquired.

After completing the survey, the participants were invited to participate in dialogue regarding physical activity and diabetes, the qualitative part of the study. A single focus group type was used for the discussions. The group size ranged from 6 to 8 members, composed of participants who had already completed the questionnaire and willing to participate in the focus groups. Therefore, a sample of convenience was used. These participants all had in common that they were type 2 diabetics and resided in the Dihlabeng rural area. As these participants already completed the questionnaire, they already met the focus group inclusion criteria which was the same as the criteria for the quantitative study with the addition that the participant had to complete the questionnaire before participation in the focus group discussions. The exclusion criteria remained for the quantitative study with the addition that participants who are not able to communicate verbally due to a physical/mental impairment are also excluded. The researcher conducted focus group discussions while recording the conversations. One of the nursing staff assisted with any translation when needed. The discussion followed a list of pre-selected key points and format, open questions were used to obtain the information as outlined in Appendix 10. The focus group discussion took place in the waiting room of the clinic and lasted about 10 minutes.

Participants randomly chose where they sat in the waiting area where the focus group took place. The focus groups were conducted in English, and if necessary, translation was done to Afrikaans and Sesotho assisted by a healthcare provider and researcher. The focus group discussions helped the researcher to understand people's attitudes regarding physical activity and diabetes mellitus. This helped to assess their livelihood practices and identified challenges the community faced regarding physical activity. Over 2 months 10 focus groups were conducted.

The data acquired were used to develop a physical activity programme, designed by the researcher. Specifically, data were divided into three groups, namely, characteristics of the ideal community physical activity programme, community attitude regarding physical activity and barriers preventing physical activity in the community.

Development of a Community Tailored Physical Activity Programme

The physiotherapy department at Dihlabeng Regional Hospital assisted the researcher in selecting appropriate physical activities for the programme. The framework is outlined in Appendix 11 and is self-designed by the researcher using the findings of Kok et., al. (2015). Table 3.1 provides the framework for the development of a community-tailored physical activity programme.

Table 3.1 Framework for the development of a community-tailored physical activity programme

Framework for Physical Activity Programme	**Application in the Dihalbeng rural area**
Patient population **The programme should be designed specifically for patients with diabetes mellitus type 2 residing in the Dihlabeng rural area.**	Patients all residing in Dihlabeng rural area with confirmed type 2 diabetes mellitus

Recruitment for the physical activity groups **Using data from the patient a recruitment process should be identified.**	Recruitment to happen at clinics where patients have contact with healthcare workers.
Type of physical activity **The data from the study is to be used to identify the type of physical activity that patients want. Specific exercises will be selected to meet the need of the patients.**	Aerobics and strength exercises to be included.
Tailoring programme to individuals **The programme should be pliable and should have room for easy individual tailoring as per the medical and physical/mental condition of the patient.**	Patients should also be issued a home programme with different options of physical activities to perform and should be easily adjusted to suit an individual's level of fitness and medical condition.
Location and supervision **A suitable location should be identified from the data provided in the study. A person responsible for the implementation and supervision of the programme should be identified, preferably someone with experience in the management of healthcare projects.**	The location is based on the local community. Some communities have access to an indoor community hall while others do not. These patients should do the physical activity programme at the clinic. Supervision to be done by local physiotherapist.

Physical activity frequency and duration and group composition **Utilising the data from the study, a suitable duration and frequency for the physical activity should be determined.**	3 sessions a week of at least 30 minutes. Ideally 10 to 20 participants per session
Participant adherence **For an effective physical activity programme, a specific system needs to be identified to ensure adherence to the programme. The use of a social support system to help with compliance should be implemented before starting the programme.**	Attendance of participants is to be monitored by a healthcare worker taking the lead of the session.
Sustainability and Scalability **Resource implications should be considered keeping in mind that resources are limited in the community. The programme should be adaptable for various size groups with the availability of resources in mind.**	Resources in the Dihlabeng area are limited. Therefore, bodyweight exercises should be the norm. Use of homemade equipment should also be encouraged e.g. water bottles filled with water to be used as weights.
Measurement of Progress **The programme should be designed so that progress can be quantified**, **and exercise intensity adjusted as needed. This includes the collection of data on programme outcomes such as attendance rates, changes in**	Participants are to be monitored by healthcare workers taking the lead of the session.

fitness level, and participant satisfaction. This information should be used to refine the programme and make adjustments.	

3.5 Data analysis

Qualitative data was analysed using content analysis after audio data was transcribed into MS Word. Data was coded according to categories and then reoccurring themes were identified. Thematic analysis is a flexible and widely used method for identifying, analysing, and reporting patterns (themes) within qualitative data. The researcher identified key themes related to participants' attitudes, preferences, barriers, and perceptions of exercise, and organised the findings accordingly. The thematic analysis allowed for a comprehensive exploration of participants' perspectives on exercise, providing insights into participants' attitudes regarding physical activity as a treatment modality for type 2 diabetes mellitus. An inductive approach was used.

Quantitative data was captured in MS Excel© and coded by the researcher. STATA SE 18© was used to analyse data.

Descriptive statistics were used to summarise participants' characteristics, knowledge, attitudes, and practices related to type 2 diabetes mellitus. Statistical methods were employed to assess associations between variables, particularly focusing on the relationship between participants' level of physical activity and other variables. The analysis included the calculation of median scores, percentages, and p-values to determine the significance of these associations. Pearson Chi-square and Fisher's Exact test analysis were used to evaluate the relationship between variables. A p-value of less than 0.05 was determined as significant.

Table 3.2: Quantitative data analysis

Objectives	Variables	Type of data	Analysis
To determine the knowledge that these persons have towards physical activity as a treatment modality.	Level of Knowledge	Categorical	Pearson Chi-Square test, Fisher exact test
To determine the HbA1c% to current level of physical activity, employment status, knowledge of physical activity and attitude towards physical activity.	HbA1c% Level of Physical Activity Employment status	Categorical	Pearson Chi-Square test, Fisher exact test

3.6 Validity and reliability

Validity and reliability in this study were ensured by:

- Use of an appropriate study design
- Data entries were checked multiple times for accuracy.
- Data analysis was done in consultation with a biostatistician.

Data collection tools:

- Questionnaire development, to test the knowledge of the participants, was based on the South African Department of Health Essential Medicine and Standard Treatment Guidelines. The questionnaire was reviewed by the three supervisors of this study who are experts in Sports and Exercise medicine. The questionnaire was self-designed by the researcher as no standardised questionnaire was available for this purpose. The questionnaire was tested during the pilot study and no problems were identified.
- The International Physical Activity Questionnaire is validated internationally in various countries and was found to be a reliable and valid tool for assessing self-reported physical activity (Craig, et al., 2003). A reasonable validity in older populations (mean age 71.8 years) has also been established (Cleland, et al., 2018)

- The self-designed interview framework was developed by the researcher. Content validity was established through a comprehensive review of relevant literature and supervisor feedback, ensuring that the questions covered all critical aspects of the research topic.

3.7 Budget

The study was self-funded by the researcher. The majority of the expenses related to the printing of the participant information sheets, consent forms and questionaries. No external funding was received and no application to receive funding was made. No costs were related to the data transcription, interpretation or analysis. This was done by the researcher with support from the University of the Witwatersrand Biostatistics Department. There was no cost involved in obtaining patients' files.

Item	Description	Amount
Printing	Consent Forms (170 participants x 2 page x R3.50)	R1190
	Information Forms (170 x1 page x R3.50)	R590
	Questionnaires (170 x 4 pages x R3.50)	R2380
Stickers	To be placed in patients' folders (170 patients x1 sticker each)	R150
Audio recorder	'Digital Audio': Voice Recorder Rechargeable 8G USB Dictaphone Mp3 Player Barcode MPTAL00174773	R450
Transcription of Audio Recordings	Transcription to MS Word from Audio recordings	R1430
Total		**R6190**

3.8 Project Timeline

Delays in obtaining approval to conduct the study resulted in significant delays with regard to the start of the data collection process. As the study was conducted in the Free State province, the Free State Department of Health had to approve the study. Initially, there was some resistance to accepting the ethics approval from the University of the Witwatersrand Human Research Ethics Committee as the committee sits in another province.

January - May 2022	**June – August 2022**	**September -December 2022**	**January February 2023**	**March 2023**	**April - September 2023**	**November to December 2023**	**January 2024**	**February to March 2024**
Research proposal development	Protocol development, submission for ethics approval	Submission of protocol to the faculty	Reviewed protocol submitted	Resubmission for approval	Department of Health Free State submission process	The pilot study, followed by the main study and data capturing	Results and data analysis	Submission of research

3.9 Ethical Considerations

Approval for this study was obtained from the Human Research Ethics Committee (Medical) (Appendix 1) and the Postgraduate Committee of the University of the Witwatersrand (Appendix 2). Approval was also granted by the Free State Head of the Department of Health (Appendix 3) as well as the Hospital Management of Dihlabeng Regional Hospital (Appendix 4). Data collection only commenced after approval was received.

An information letter (Appendix 5) and a questionnaire (Appendix 6) were distributed to participants. The information letter described the purpose of the study, ethical approval, and the rights of participants to anonymity and withdrawal at any time. Participation was voluntary.

Participants consented to data collection (Appendix 7), focus group discussions (Appendix 8) and audio recording of the focus group discussions (Appendix 9).

No information that could potentially identify the participants was collected. Questionnaires were returned to the researcher by placing anonymously in a box at the clinic. Only the researcher, supervisors and biostatistician had access to the raw data. Raw data, including audio recordings, were stored on a biometrically secured computer that only the researcher could access. Anonymity and confidentiality were thus ensured.

3.11 Summary

The research methodology of the study was discussed. The results of the study will follow.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter will discuss the results of the study.

4.2 Results

4.2.1 Quantitative data

4.2.1.1 Gender

Out of the 150 participants, 37% (n=55) were male and 63% (n=95) were females.

4.2.1.2 Age

The mean age of the patients was 56.8±12.7 years. The age range of the participants was 21 to 96 years.

4.2.1.3 Level of education

Figure 4.1 shows the level of education participants achieved.

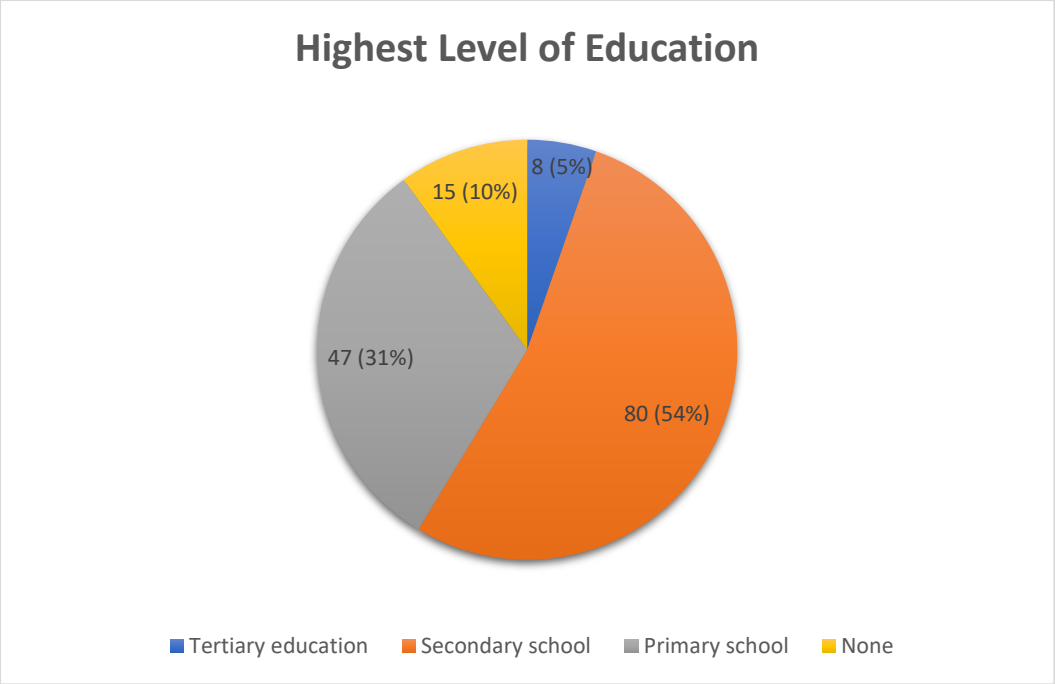


Figure 4.1: Level of education of participants

4.2.1.4 Employment status

Figure 2 shows the employment status of the participants. Most of the participants were retired 58 (39%).

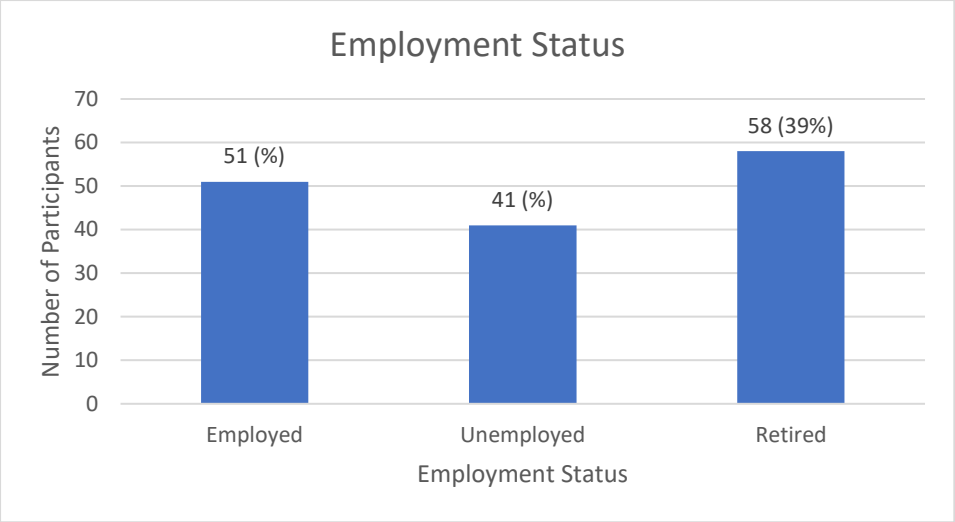


Figure 4.2: Employment status

4.2.1.5 Source of income

Figure 4.3 shows the source of income of participants. Most participants receive a South African Social Security Agency (SASSA) grant.

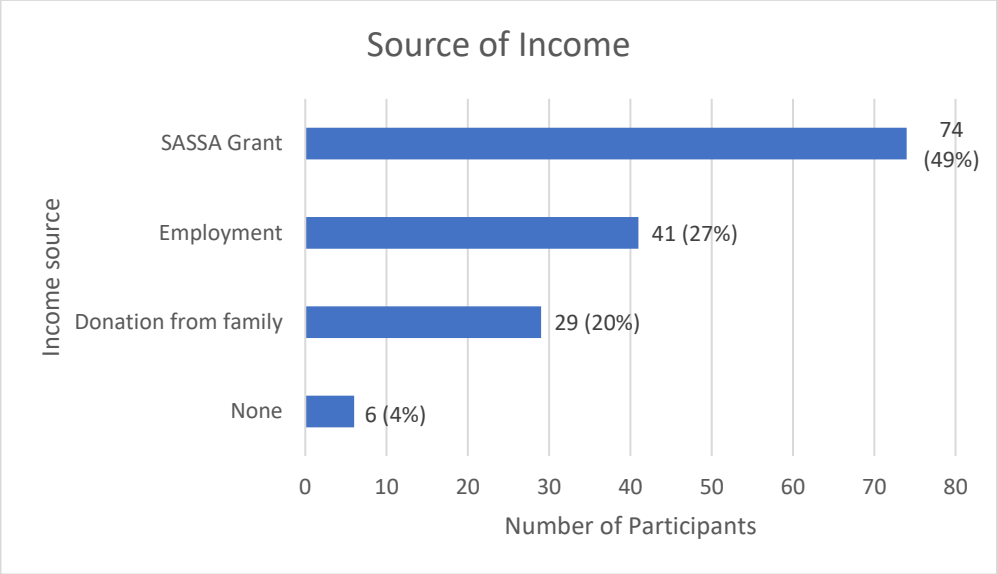


Figure 4.3: Source of income of participants

4.2.1.6 Dwelling

Most of the participants live in a house, 131 (87%). Of the participants, 19 (13%) either live in an informal settlement or are homeless.

4.2.1.7 Comorbidities

Figure 4.4 gives an overview of the comorbidities participants have. Most of the participants had hypertension, 140 (93%), followed by hypercholesterolaemia, 59 (39%), and arthritis, 30 (20%). There were only 6(4%) patients out of the 150 participants that stated they had no comorbidities.

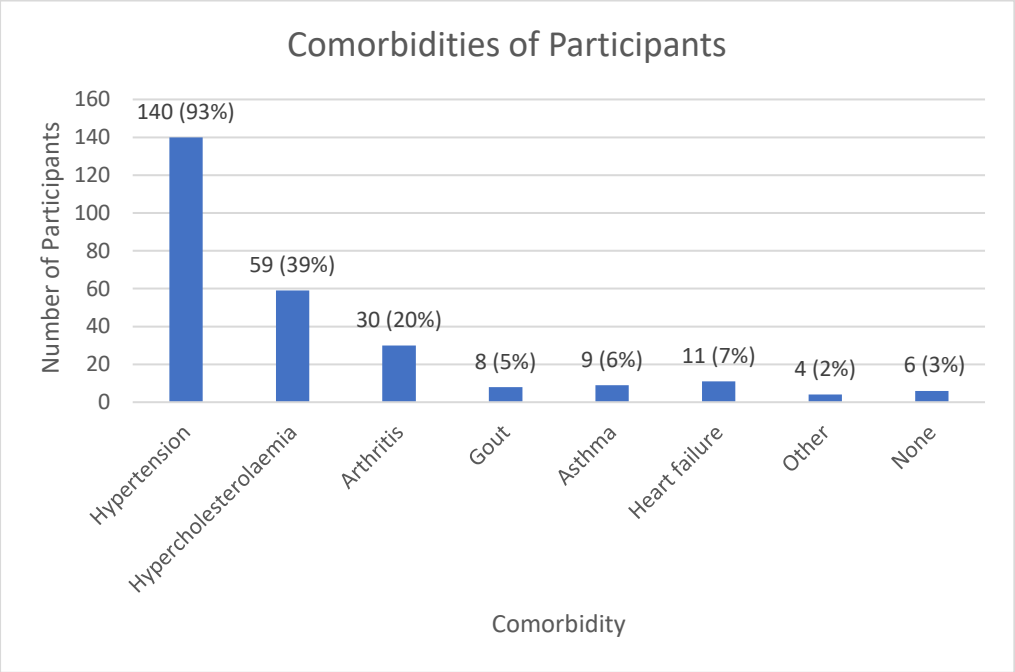


Figure 4.4: Comorbidities of the participants.

4.2.1.8 Access to gym, sports and exercise facilities

73% (n=110) of participants do not have access to any facilities.

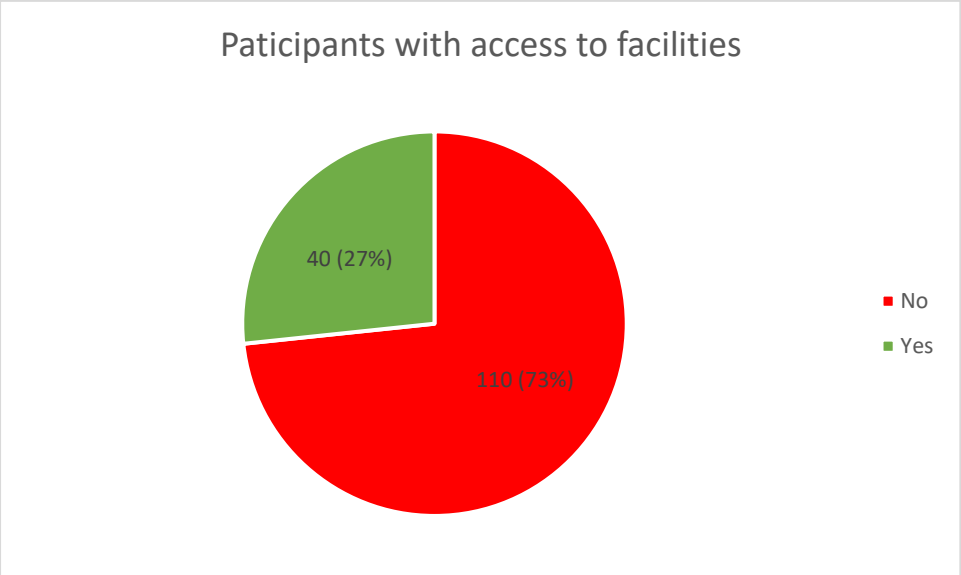


Figure 4.5 Access to gym, sports and exercise facilities.

4.2.1.9 Diabetic diet adherence

Of the 150 participants 41 (31%) self-reported that they adhere to a diabetic diet as per the guidelines given to them by the hospital dietician based on the South African Essential Medicine List and Standard Treatment Guidelines.

4.2.1.10 Diabetic medication use

The most common drug used by participants was metformin 142 (95%). Of all participants, 55 (37%) also used insulin for their type 2 diabetes mellitus.

4.2.1.11 Body mass index

Only 23 (15.3%) of patients were classified as having a normal body mass index.

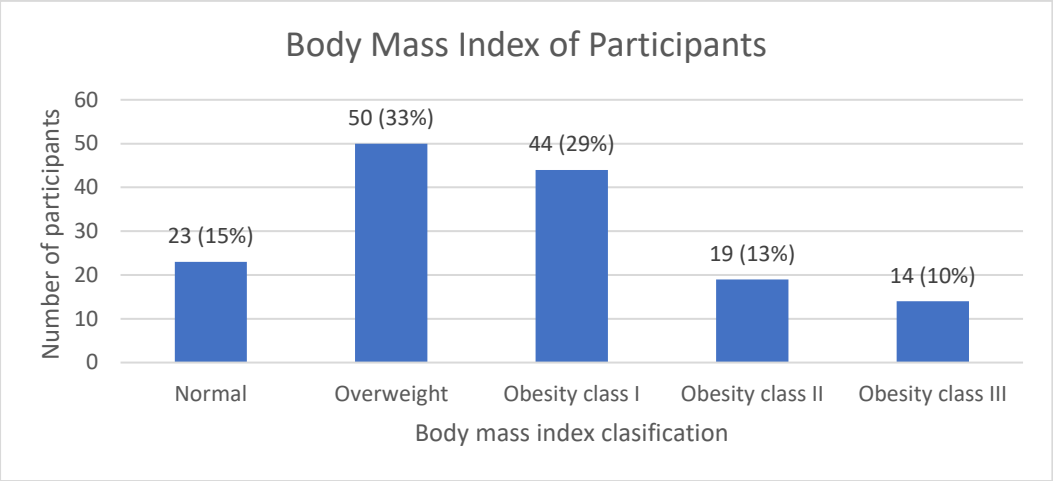


Figure 4.6: Body Mass Index of participants

4.2.1.12 HbA1c% results

Using the targets set by the South African Standard Treatment Guidelines only 38 (25%) of participants' HbA1c% are within the target range, 7% or less. The average HbA1C% for the patients was 8.49%.

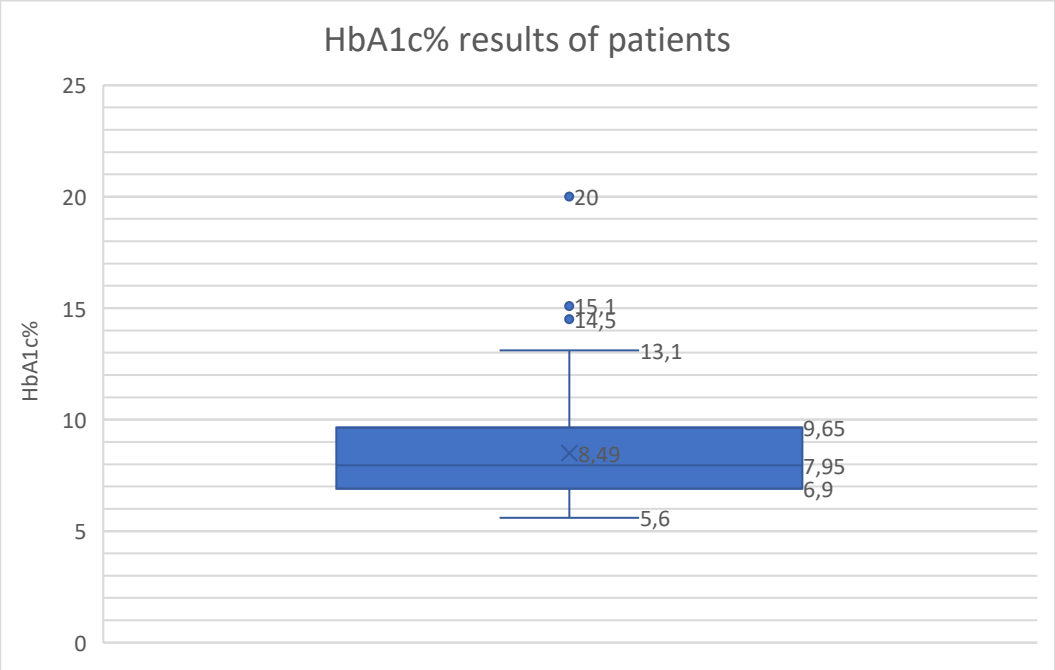


Figure 4.7: Box and Whisker Plot HbA1c% of participants

4.2.1.13 Level of physical activity according to the International Physical Activity Questionnaire (IPAQ)

Figure 8 shows the level of physical activity of participants. The IPAQ classified 66 (44%) of participants in the low physical activity group.

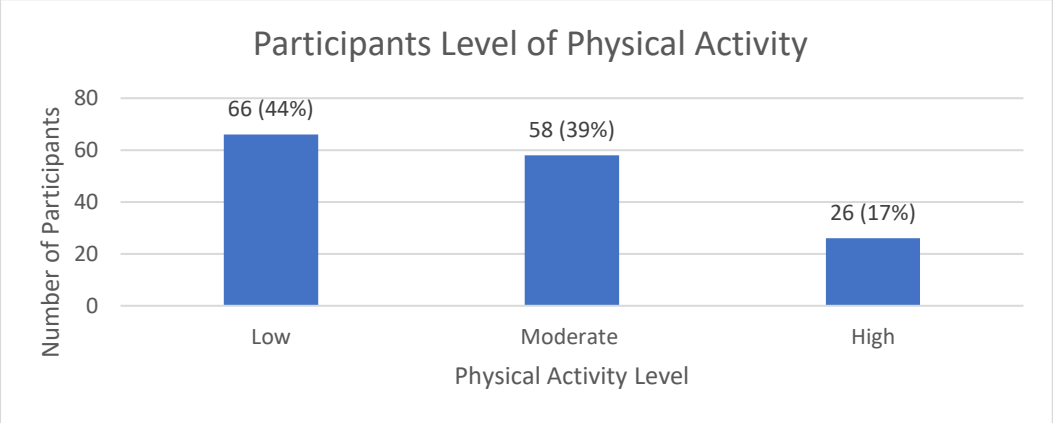


Figure 4.8: Level of Physical Activity Categories

4.2.1.14 Level of knowledge regarding physical activity and type 2 diabetes mellitus

Participants were assessed regarding their knowledge of physical activity as a treatment modality for type 2 diabetes mellitus. Most participants, 86 (57%) had moderate to good knowledge regarding physical activity as a treatment modality for type 2 diabetes mellitus. Values of more than 70% were classified as good and in 3 categories for ease of analysis and interpretation.

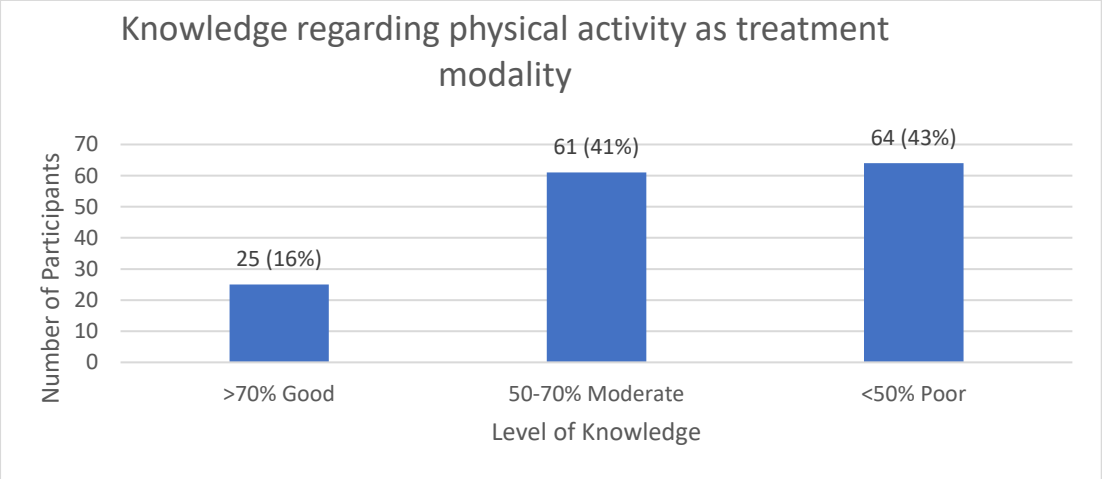


Figure 4.9: Level of knowledge of physical activity as a treatment modality for type 2 diabetes mellitus

Table 4.1 summarises the responses of patients in the knowledge section.

Table 4.1: Knowledge Questions and Participants Results.

Knowledge of Physical Activity as Treatment for Type 2 Diabetes		
Variable	**Correct answer**	**Correct response frequency (%) n=150**
The minimum minutes a type 2 diabetic patient should exercise per week is 150 minutes.	TRUE	99 (66)
Type 2 diabetic patients should exercise ONLY on weekends.	FALSE	94 (63)
Exercise makes the medication (insulin/ metformin) work better.	TRUE	113 (75)
There are no benefits for type 2 diabetes to exercise.	FALSE	87 (58)
Any exercise is dangerous for patients with type 2 diabetes	FALSE	119 (79)
A sugar reading at any time should be at least 15 mmol/l in a patient with type 2 diabetes mellitus BEFORE exercising.	FALSE	114 (76)
A snack like an apple should be eaten before starting vigorous exercise to prevent low sugar.	TRUE	112 (75)
A single exercise session should last at least 30 minutes to be beneficial to the treatment of diabetes.	TRUE	101 (67)
Treatment of my diabetes with exercise is not my responsibility but those of my doctor	FALSE	86 (57)
Sitting and watching television is sufficient exercise for a patient with type 2 diabetes.	FALSE	97 (65)

4.2.1.15 Level of physical activity compared to participant characteristics.

Multiple characteristics of participants were identified and compared to the participant's level of physical activity as shown in Table 4.2 below.

		Level of Physical Activity frequency (expected frequency)			p-value	Pearson Chi-square	Fisher Exact Test
Characteristics	Levels	Low	Moderate	High			
Gender	Male	29 (24)	20 (21.3)	6 (9.5)	0.158	3.690	0.174
	Female	37 (41.8)	38 (36.7)	20 (16.5)			
Body mass index (BMI) (kg/m^2)	Normal	12 (10.1)	8 (8.9)	3 (4.0)	0.149	12.041	0.145
	Overweight	20 (22)	20 (19.3)	10 (8.7)			
	Obesity class I	24 (19.4)	16 (17.0)	4 (7.4)			
	Obesity class II	4 (8.4)	11 (7.3)	4 (3.3)			
	Obesity class III	6 (6.2)	3(5.4)	5 (2.4)			
HbAC%	Controlled (≤7%)	18 (16.7)	13 (14.7)	7 (6.6)	0.808	0.427	0.851
	Non-control (>7%)	48 (49.3)	45 (43.3)	19 (19.4)			
Highest level of education	Tertiary education	2 (3.5)	2 (3.2)	4(1.4)	<0.001	42.674	<0.001
	Secondary school	19 (35.2)	41(30.9)	20 (13.9)			
	Primary school	36 (20.7)	10 (18.2)	1(8.1)			
	none	9 (6.6)	5 (5.8)	1 (2.6)			
Employment status	Employed	10 (18.0)	17 (15.9)	24 (7.1)	<0.001	158.363	<0.001
	Unemployed	0 (18)	40 (15.9)	1 (7.1)			
	Retired	56 (25.5)	1 (22.4)	1 (10.1)			
Source of income	Employment	0 (18)	41 (15.9)	0 (7.1)	<0.001	186.459	<0.001
	None	0 (2.6)	0 (2.3)	6(1.0)			
	SASSA grant	57 (32.6)	17 (28.6)	0 (12.8)			
	Donation from family	9 (12.8)	0 (11.2)	20 (5.0)			
Access to sports facilities	No	52 (48.4)	39 (42.5)	19 (19.1)	0.349	2.106	0.359
	Yes	14 (17.6)	19 (15.5)	7(6.9)			
Knowledge score	>70%- Good	13(11)	8(9.7)	4(4.3)	0.907	0.727	0.754
	50-70% Moderate	27(26.8)	24(24.7)	10(10.6)			
	<70% Poor	26(28.2)	58(58)	26(26)			

Table 4.2: Level of physical activity of participants compared to characteristics.

4.2.2 Qualitative data: Focus Groups

4.2.2.1 Participants

Out of the patients who completed the questionnaire, 42.67% (n=64) took part in the focus group discussions. Additionally, most focus group participants were female, accounting for 56.25% of the total. Table 4.3 shows the characteristics of the different focus groups.

Table 4.3: Focus Group Characteristics

Focus Group number	Number of Participants	Male	Female
1	6	2	4
2	6	2	6
3	7	3	4
4	10	5	5
5	7	3	4
6	6	1	5
7	6	5	1
8	5	3	2
9	6	3	3
10	5	1	4
Total	64	28	36

4.2.2.2 Duration

A total of 85 minutes of focus groups were conducted resulting in an average of 8.5 minutes per focus group.

4.2.2.3 Attitudes towards physical exercise as a treatment for type 2 diabetes mellitus

Generally, patients were excited about using exercise as a treatment modality:

“Participant 2 (Male, Focus group 1): I feel excited when I am doing exercises, I feel good.

Participant 1 (Female, Focus group 9): Very good, it (exercise) is exciting.

Participant 1 (Male, Focus group 10): Excited, I feel excited."

None of the patients felt sad or scared to exercise. The general attitude was positive towards physical activity. One participant did however mention that she is feeling lazy and not keen on physical activity, yet the attitude was still positive towards physical activity.

4.2.2.4 Health Benefits

Participants understand that there are health benefits to physical activity, although their understanding is not that clear to specifically identify the specific benefits:

"Participant 2 (Female, Focus group 1): I think you get much energy after exercising."

A participant in Focus group 3 demonstrated this quite well:

"Interviewer (Focus group 3): Okay. So, why would you exercise if you have sugar? Is it good for you, bad for you?

"Participant 2 (Male, Focus group 3): Good blood flow."

Multiple other participants also mentioned that physical activity is good for them, but the understanding of why it is good for them, especially regarding physical activity as management for their type 2 diabetes mellitus is quite poor.

4.2.2.5 Characteristics of a physical activity programme for the community

Location

Most participants felt that a physical activity programme should occur indoors. Due to practical reasons:

"Participant 2 (Male, Focus group 1): Inside because the weather is unpredictable, so can't always do it outside (the) weather changes to fast, one day it is summer, and the next day is winter and raining."

A participant also made it clear that the space should be big enough:

"Participant 2 (Female, Focus group 2): For me is place where there is enough space."

Although the consensus was that the physical activity should take place at an indoor facility, some participants felt that that due to cultural factors, housework or safety concerns, the exercise should be done indoors in their own home.

"Participant 3 (Female, Focus group 2): Home is the best, I feel safe (female practising Islam)."

Some of the participants felt that the exercise could be done in the clinic while they were waiting. A reason for this is that they feel that it might be too expensive to do physical activity programmes in the community:

"Participant 3 (Female, Focus group 6): That is why I say now to do the exercise at the clinic, it would be too expensive rather than doing it (renting facilities) in the community."

The consensus was that the physical activity programme should be done in the community in an indoor facility.

Frequency

The frequency that participants preferred ranged from daily to 6 times a week. Most of the participants would like to have a physical activity programme 3 times a week.

"Interviewer (Focus group 2): … how often would you like to exercise?

Participant 2 (Female, Focus group 2): Three times a week."

One participant mentioned that he would like to exercise six days a week.

"Interviewer (Focus group 8): …Every day or how many…? How many days a week?

Participant 4 (Female, Focus group 8): Every day.

Interviewer (Focus group 8): Every day?

Participant 4 (Female, Focus group 8): Yes."

Duration

The duration of a physical activity programme varies between focus groups. Most of the participants would like a programme that is about 30 minutes to 1 hour in duration:

"Interviewer (Focus group 2): Yes, and how long would you like to exercise at once?

Participant 1 (Male, Focus group 2): Maybe 45 minutes."

It is also important to note that participants are not sure about what duration of exercise was safe for them:

"Participant 3 (Female, Focus group 3): I do not know (how long), because we are diabetic, and we have high blood then I don't know. The doctor (must) tell."

Gender composition of the group

The composition of the groups varied from mixed to female only. No mention was made of male-only groups. Overall, the mixed group composition was acceptable for most patients.

"Interviewer (Focus group 5): male or female mixed or?

Participant 3 (Male, Focus group 5): Mixed.

Participant 2 (Female, Focus group 5): For me, only ladies."

"Interviewer (Focus group 6): …would you like there to be only females in the group, only men or mixed?

Participant 3 (Male, Focus group 6): Mixed.

Participant 1 (Female, Focus group 6): Mixed."

The reason that some participants want female groups only is that they do not feel comfortable around male participants when doing physical activity:

"Participant 2 (Female, Focus group 2): I just don't feel comfortable around males."

Number of participants in physical activity session

The ideal number of participants ranges from 10 to 20 to as much as the venue can accommodate.

"Interviewer (Focus group 9): And how many people would you like to have in a group?

Participant 1 (Female, Focus group 9): Maybe, let me say maybe 10 people."

Interviewer (Focus group 9): And how many people would you like to have in a group?

Participant 1(Female, Focus group 9): Maybe, let me say maybe 10 people.

Interviewer (Focus group 9): How many are you when you go exercising?

Participant 3 (Female, Focus group 9): Ons kan 10 wees, ja. Dis genoeg."

The ideal group is 10 to 20 participants according to the focus group participants.

Type of physical activity

Most participants would like to do a combination of strength and aerobics physical activity in a programme:

"Participant 2 (Female, Focus group 5): I will always say a combination (of aerobics and strength)."

The need for a home physical activity programme

Participants felt that it is important to supply them with a home physical activity programme, but some participants might not do the programme as they are motivated by the people around them:

"Participant 4 (Female, Focus group 10): I am motivated when I am with people."

Who should take the lead at physical activity sessions?

Although participants feel the need for someone to assist them with physical activity, they do not believe that the local clinics will be able to provide such a service due to the clinics being understaffed.

"Participant 1 (Female, Focus group 2): No, at the clinic they do not have the time. They always tell you that they are short-staffed, no sister today. (The nursing staff) always complain. Don't think the clinic (staff) will help, but other people (will need to)."

Participants do however acknowledge that they might need help concerning the physical activity and the correct execution of the activity:

"Participant 2 (Female, Focus group 2): I think they can get other people to help us with exercises. Someone from the clinic, I think they're the best.*"*

4.3.2.6 Barriers that prevent physical activity in the community.

Lack of facilities, equipment, and recreational spaces

Facilities like parks and gyms are one of the greatest barriers in the community that prevent physical activity. Even if there are facilities participants were concerned about

the financial burden such a facility will place on members who wish to perform physical activity.

“Participant 1 (Female, Focus group 1): Even if we find a place, who will pay for it, the owner will come with unreasonable rent, most of us don’t work and are pensioners, we don’t have money to spend on facilities.”

For one female participant, this was not a problem, however. She said that their group could use the community hall for free on certain days.

“Participant 2 (Female, Focus group 2): We use the municipality hall for free. It is not something new, the community started a programme without the government. But I want the government to help. But it will take time – The government does not have anymore money.”

The theme of the government not being able to provide facilities or staff for such a programme was an ongoing concern in multiple focus groups.

One of the participants even stated that there were parks before, but now the parks are being used for a different purpose by some members on the community.

“Participant 1 (Male, Focus group 1): No (parks) not in mine, not in my community – they are washing cars where there were previously parks. None (parks) in the township areas anymore.”

Safety concerns

Participants in some areas of Dihlabeng felt unsafe to do physical activity outside in their community. One participant was concerned about safety due to drug use in the community: “*Participant 1 (Female, Focus group 2): Yes, it (safety) is a big concern because there’s too much ‘nyaope’ (drug) guys.”*

Most participants felt safe in their communities to do physical activity.

Lack of knowledge

There is a need for a qualified person to assist patients in the community with physical activity as some participants feel they do not know enough about physical activity. Participants did not specify a specific person.

“Interviewer (Focus group 6): Do you think you know enough about exercise?

Participant 2 (Male, Focus group 6) No, not at all. We know, but as I told you, other things about exercising, we need that trained person, so that we can learn the basics how to do that thing exactly…”

Employment

A participant mentioned that he might not have time to exercise due to his job taking up too much time:

“Participant 5 (Male, Focus group 9): It (my job) does not allow me to (exercise).”

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter presents a discussion of the results of the study

5.2 Discussion

The study conducted in Dihlabeng, South Africa, aimed to investigate the attitudes, knowledge, and levels of physical activity among patients with type 2 diabetes mellitus.

Data collection for this study took place from November to December 2023. Questionnaires were handed out to patients who met the inclusion and exclusion criteria at the diabetic clinic at Dihlabeng Regional Hospital. Approximately 210 patients attended the clinic during this time. A total of 156 patients completed the questionnaire of which 150 patients met the inclusion and exclusion criteria.

A total of 10 focus groups of 6-8 participants per group were conducted involving 64 (42.67%) participants.

The data collection was stopped when the sample size of 150 patients was reached. Ten focus group discussions were conducted, which was what was possible due to logistical challenges setting up the waiting room for the focus groups discussions. Focus group participants represented 42.67% (n=64) (Table 4.3) of patients who completed the questionnaire.

Among the participants 37% (n=55) were male. This observation is consistent with prior research suggesting that men are less likely to utilise healthcare clinics in rural South African contexts (Randera-Rees et al., 2023). In the study by Randera-Rees et al. (2023), they investigated the number of patients attending the clinic by sex. It was found in a review and meta-analysis of the epidemiology of type 2 diabetes mellitus in South Africa that the prevalence of type 2 diabetes observed was higher in females than males, 16.78% compared to 12.36% (Pheiffer, et al., 2021).

The mean age of the patients was 56.8 years (SD 12.7) as shown in figure 2. As the population ages the prevalence of type 2 diabetes increases (International Diabetes Federation, 2022).

In the present study, 80 (53%) participants attended secondary school. Only 15 (1%) of the participants had no formal education. This is less than the 9.8% of 244

participants who had secondary school education in a similar study done in 2018 in the Free State by Le Roux et al. (2018). The study by Le Roux et al. (2018) aimed to compile a demographic, anthropometric and knowledge, attitude and practices profile of adult patients with T2DM in the Free State province, South Africa public health care sector. The study population of Le Roux et al. (2018) included participants from multiple districts urban and rural in the Free State and only included 10 participants from the larger district that the Dihlabeng area is part of. Thus, the participants in the Dihlabeng area are more educated than the study by Le Roux et al. (2018).

The level of education affects the level of physical activity of the participants. Higher level of education results in an increase in physical activity according to Kari et al. (2020). In our study it was found that the higher the level of education, the higher the level of physical activity (Table 4.2). Participants with tertiary education were more likely to have a vigorous level of physical activity (p=<0.001). Participants with secondary school were more likely to have moderate levels of physical activity, while patients with primary school education were more likely to have low-level physical activity (p=<0.001). It was not determined why this was the case. This was also the case in a similar study conducted on type 2 diabetic patients in the Northern Cape Province, where it was found that there was a significant association between level of education and knowledge (p=0.0002) about type 2 diabetes mellitus and practices (p=0.0075) like regular physical activity (Alenbalu, et al., 2024).

In the study by Alenbalu et al. (2024), the majority of participants, mainly females, demonstrated good knowledge and positive attitudes towards type 2 diabetes mellitus, recognising symptoms, lifestyle modifications, and potential complications. However, their practices did not consistently align with this knowledge, with a significant association found between education level and knowledge of type 2 diabetes mellitus (p=0.0002). Recommendations included improving healthcare educational resources, providing tools for monitoring blood glucose, and developing evaluation tools during clinic visits to enhance diabetes management and prevent complications effectively. As both of these studies, the present one and Alenbalu et al. (2024), identified a significant relationship between level of education and practices it is important to emphasise the need for educational programmes and interventions to bridge the gap between knowledge and practices in managing diabetes.

Participants who are retired are more likely to fall in the low physical activity group than patients who are employed or unemployed ($p<0.001$). This is likely due to an increase in sedentary activity and is in keeping with the findings of Suorsa et. al. 2022 who found that upon retirement there is a decrease in physical activity and an increase in sedentary activity after monitoring participants for the transition to retirement (Suorsa, et al., 2022).

The most common comorbidity that participants had was hypertension, 140 (93%). In a study by Pillay (2022), conducted in Pietermaritzburg, Edendale Hospital Diabetic Clinic, it was found that most patients living with type 2 diabetes mellitus, 74% of the 822 participants that were reviewed, had hypertension as a comorbidity. Another common comorbidity is obesity, with 51% of participants falling into either class 1,2 or 3 obesity. Le Roux et al. (2018) found that 165 (65%) of participants in a similar study done in the Free State Province fell into one of the obesity classes. Pillay (2022) found that most of the participants that were reviewed at the Diabetic Clinic in Edendale Hospital did not reach the weight targets as set by the South African Guidelines (The Society for Endocrinology, Metabolism and Diabetes of South Africa Type 2 diabetes guidelines expert committee, 2017). In the South African rural setting, urbanisation and access to high-calorie and fatty food may also contribute to the development of diabetes type 2 (Bailey, et al., 2016). Access to high-calorie and fatty food was not determined in the Dihlabeng area.

Consistent with other studies the participants in the rural community are dependent on SASSA grants with 74 of the 150 participants stating that their income source is from SASSA (Turok, 2012). In this study, most of the grants can be assumed to be older person grants, a grant that you only qualify for if you are 60 years or older.

Participants that were received an SASSA grant were more likely to have low levels of physical activity ($p<0.001$), while participants who received donations from family were more likely to have a high level of physical activity ($p<0.001$) (Table 4.2). The reason for this has not been identified in the study but may be because patients in the age group 65 years are retired which is associated with a lower level of physical activity (Suorsa, et al., 2022).

Although 75% (n=112) of the participants had poorly controlled type 2 diabetes (HbA1c >7%), the relationship between the level of physical activity and HbA1c% is not statistically significant (p=0.880) in this population. It is however known that physical activity decreases HbA1c% by lowering blood glucose levels (Goodyear, et al., 1992).

According to the IPAQ section of the study, 44% (n=66) of participants had low levels of physical activity.

More than half (n=86) of the participants demonstrated moderate (n=61) to good (n=25) knowledge regarding physical activity as a treatment modality for type 2 diabetes mellitus compared to 64 participants who had poor knowledge. Most participants 58% (n=87) failed to acknowledge that there are health benefits for patients with type 2 diabetes when performing physical activity. This is in contrast with results reported by Mwimo et al. (2021) where most of the participants (313 out of 315) agreed that physical activity is beneficial to participants with type 2 diabetes. Mwimo et al. (2021) also found that in the 306 participants, 97.1% of participants do not feel that exercise is dangerous for participants with type 2 diabetes. Most of the participants in the Dihlabeng rural area, 119 (79%), believed that physical activity is safe for patients with type 2 diabetes.

In the present study, participants demonstrated awareness regarding the significance of blood glucose levels, acknowledging that a glucose reading of 15mmol/l is considered too high. Additionally, participants recognised the beneficial effect of physical activity in enhancing the efficacy of their medication. This finding aligns with the results reported by Alenbalu et al. (2024), who also observed that participants in their study population in the Northern Cape were knowledgeable about the recommended glucose targets for individuals with type 2 diabetes mellitus.

Such awareness among participants highlights the importance of education and patient empowerment in the management of type 2 diabetes.

The findings of our study reveal a noteworthy trend among participants, with a majority of 57% (n=87) attributing the responsibility of engaging in physical activity to their treating physicians rather than themselves. This reliance on healthcare professionals for guidance regarding physical activity identifies a potential gap in patient autonomy and self-efficacy in managing their health, particularly in the context of type 2 diabetes.

Such a finding suggests a need for enhanced patient education and empowerment initiatives to foster a sense of ownership and agency in managing their condition.

Comparing results with existing literature on perceptions of physical activity among individuals with type 2 diabetes yields intriguing insights. Andersen et al. (2019) conducted a qualitative study in Sweden examining patients' experiences of physical activity on prescription with access to counsellors in routine care. Their findings shed light on the complex nature of patient engagement with physical activity interventions, emphasising the importance of personalised support and counselling in promoting behaviour change. The Andersen et al. (2019) study emphasises the importance of tailored interventions that address all factors influencing patients' attitudes and behaviours towards physical activity.

In contrast to Mwimo et al. (2021), who reported a significant correlation between high physical activity levels and knowledge among type 2 diabetes patients in Northern Tanzania's Kilimanjaro region, our study did not find such an association ($p=0.907$).

In the context of our study, the absence of statistically significant findings suggests a lack of understanding of the relationship between participants' knowledge of physical activity and their actual engagement levels in physical activity.

This discrepancy in findings might suggest potential factors influencing physical activity behaviours in our study population. While Mwimo et al. (2021) identified a positive relationship between knowledge, attitudes, and physical activity levels, our study did not find evidence to support such a direct association. This may be attributed to differences in study populations, methodologies, or cultural contexts.

Our study contributes important insights into the complexities of promoting physical activity among patients with diabetes.

The absence of a significant link between participants' awareness of physical activity and their actual engagement levels emphasises the need for further exploration into the determinants of physical activity behaviours in this population. It should be noted that 13 out of 25 participants with good knowledge of physical activity had a low level of physical activity. This suggests that knowledge does not translate into action and is an area that needs to be further researched.

After conducting focus groups, the general attitude about physical activity as a treatment modality for type 2 diabetes mellitus was determined.

Several themes emerged during the interviews regarding the attitudes, physical activity preferences and barriers related to physical activity in the community.

Participants had varied attitudes towards physical activity, ranging from excitement and motivation to laziness, but most had a positive attitude toward physical activity. This is similar to a study done in Northern Tanzania where the majority of patients had a positive attitude towards physical activity as a treatment modality for type 2 diabetes mellitus (Mwimo, et al., 2021).

Participants acknowledged that physical activity has health benefits, but insight into why, was lacking at times. This might be due to a lack of knowledge as evidenced by the responses of the participants when asking them to explain the health benefits. This is also supported by the findings in the study by Mwimo et al. (2021).

Most participants would like to perform physical activity in a group, but some prefer a physical activity programme that they can do at home due to convenience or even lack of time. Participants that are employed might find it difficult to make time for physical activity after a long day's work. Like our study, a study in Kimberley, Northern Cape, South Africa found that employed type 2 diabetics neglect physical activity due to lack of time due to employment commitments (Alenbalu, et al., 2024). It should be noted that the participants in the Alenbalu et al. (2024) study were not classified as living in a rural area but as urban.

Common barriers to physical activity include lack of facilities, safety concerns, lack of knowledge and employment commitments.

The predominant barrier identified by participants in the Dihlabeng rural area for engaging in physical activity was the lack of facilities, equipment, and parks. This finding resonates with similar results reported by Pelletier et al. (2021), suggesting a consistent pattern across different geographical contexts. Pelletier et al. (2021) found that in both rural and urban areas of Canada a lack of access to facilities hinders physical activity. The absence of adequate infrastructure and human resources poses significant challenges for individuals trying to adopt and maintain active lifestyles in

both rural and urban settings. Such barriers can hinder access to safe and convenient spaces for physical activity, limiting opportunities for physical activities.

The parallel findings between our study and that of Pelletier et al. (2021) highlights the widespread nature of these challenges and the need for comprehensive strategies to address them. Interventions aimed at promoting physical activity should not only focus on individual-level factors but also address systemic barriers such as inadequate facilities and resources. By investing in the development and maintenance of infrastructure, as well as implementing policies to enhance access to recreational spaces and protect these spaces from illegal occupation, communities can create environments conducive to physical activity participation. One participant specifically mentioned that in his community the parks have been turned into carwash businesses.

Moreover, collaborative efforts involving stakeholders at multiple levels, including government, community organisations, and residents, are essential for devising sustainable solutions to overcome these barriers and promote active living in the community.

Safety concerns are another barrier that the community faces that hinders their ability to do physical activity especially outdoors. Participants mentioned that this is due to drug use in the community.

Participants preferred to participate in a mixed-gender group sessions of to 10 to 20 participants and there was interest in aerobics workouts and strength training exercises like squats and lunges.

Many participants expressed a desire for health education sessions alongside exercise programmes and there was also interest in receiving personalised exercise programmes or guidance from healthcare professionals.

Participants emphasised the importance of both community and clinic involvement in organising exercise programmes but would like the healthcare professionals to show them how to correctly perform the exercises.

The focus group discussions highlighted the complex interplay of attitudes and barriers influencing participants' physical activity in the community. Understanding these factors is crucial for community-tailored physical activity programmes that address the

diverse needs of the Dihlabeng rural community. Table 3.1 provided the framework that was used to develop such a programme.

Using the framework as set out in Table 3.1, a physical activity programme was designed in conjunction with the physiotherapy department at Dihlabeng Regional Hospital. A 3-day programme was designed with 2 in-person sessions and 1 session that participants can do at home. The in-person sessions do not require equipment and participants will be able to, if needed, perform these physical activities at home. A monthly information session is also included in the programme that is aimed at educating the community about the benefits of physical activity. Appendix 12 shows an example of a handout that can be given to the participants for a specific day's physical activity. This handout gives a visual representation with examples of physical activities that the participant should perform and is fully customisable by the physiotherapy department at Dihlabeng Regional Hospital. Before such a programme is implemented it should be trailed in the community – this is beyond the scope of this study. Table 5.1 gives an example of a weekly physical activity programme.

In summary, the ideal physical activity programme for the community should be led by a healthcare professional and accommodate 10 to 20 participants of mixed gender. Each session should last 30 minutes and be held three times a week, incorporating a combination of aerobic and strength exercises. The programme should be adaptable for home-based execution to increase accessibility. However, the community faces significant barriers, including a lack of facilities, insufficient knowledge, and safety concerns. To address these issues, educational sessions on physical activity as a treatment modality are essential for community members.

Table 5.1: Physical Activity Programme

Monday: Group Aerobics Session	
Duration: 1 Hour Location: Community Hall or Local Clinic Description: Led by a trained instructor, this session will focus on aerobic exercises to improve cardiovascular health. Participants will be performing various movements. This includes dancing, jumping jacks, and bodyweight exercises. The session will end with a cool down and stretching exercises to promote flexibility.	Warm-Up (10 minutes): Begin with light cardio exercises such as marching in place, arm circles, and gentle jogging. Follow with dynamic stretches to loosen up the muscles and increase blood flow. Main Aerobics Session (40 minutes): Start with low-impact movements like step touches, side lunges, and knee lifts to ease into the workout. Progress to higher intensity exercises including jumping jacks, high knees, and grapevines to elevate heart rate. Incorporate dance-inspired movements like salsa steps, cha-chas, and hip shakes for added fun and variety. Include intervals of strength exercises to build muscular endurance. Cool Down and Stretching (10 minutes): Finish with slower-paced movements and deep breathing to bring heart rate down gradually. Perform static stretches targeting major muscle groups. Hold each

	stretch for 20-30 seconds, focusing on relaxation and flexibility.
Wednesday: Home Workout	
Time: Participant's Choice Location: Participant's Home Description: Participants will follow a prescribed workout provided clinic, tailored to their fitness level and physical condition. The workout may include bodyweight exercises (e.g. lunges), yoga or Pilates routine. Participants are encouraged to dedicate at least 30 minutes to physical activity.	Warm-Up (5 minutes): Begin with light cardio. Perform dynamic stretches like arm swings, leg swings, and torso twists to improve range of motion. Strength and Conditioning Circuit (30 minutes): 3 sets of 10 Reps of body weight exercises. Five different body regions. Flexibility and Relaxation (10 minutes): Perform static stretches targeting major muscle groups. Hold each stretch for 20-30 seconds, focusing on deep breathing and relaxation.

Friday: Group Outdoor Jogging Session	
Duration: 30 Minutes Location: Community Hall, Clinic Description: This session will get participants to enjoy the outdoors while engaging in cardiovascular exercise through jogging or brisk walking in a group led by a healthcare worker. The group will embark on a guided jog or walk along a designated route, incorporating intervals of varying intensity to challenge participants and improve endurance.	Warm-Up (5 minutes): Brisk walk Interval Jogging/Walking (30 minutes): Alternate between jogging and walking intervals based on individual fitness levels. Begin with a 5-minute jog followed by a 2-minute brisk walk for recovery. Repeat the intervals for the duration of the session, gradually increasing intensity as tolerated. Focus on maintaining good posture, breathing rhythmically, and staying hydrated throughout the session. Cool Down and Stretching (10 minutes): Conclude the session with a gentle jog or walk to gradually lower heart rate and cool down the body. static stretches
Saturday: Health Education Talk	
Duration: 1 Hour Location: Community Clinic or Community Centre Description: In addition to physical activity sessions, the programme includes a weekly health education talk focused on topics such as nutrition, stress management, and the benefits of regular exercise	Engage in discussions and ask questions to enhance understanding and knowledge. This can be done once a month or term depending on the need of the community.

5.3 Summary

The analysis of the results of this study was discussed. The conclusion of the study will follow.

CHAPTER 6: CONCLUSION

6.1 Introduction

This chapter will present the conclusion. The limitations of this study will also be discussed, and recommendations will be made.

The study conducted in Dihlabeng, South Africa, aimed to investigate the attitudes, knowledge, and levels of physical activity among patients with type 2 diabetes mellitus. This research is crucial in understanding what level of physical activity patients performs as treatment for 2 diabetes in the Dihlabeng rural settings. The study's objectives were to determine physical activity patterns among individuals in the Dihlabeng area, assess their attitudes and knowledge towards physical activity, and design a community-tailored physical activity programme for type 2 diabetes management in the Dihlabeng rural context.

Ethical approval was obtained from the Human Research Ethics Committee of the University of the Witwatersrand, the Free State Department of Health, and the Postgraduate Committee of the University of the Witwatersrand. The research employed a mixed-method design, focusing on type 2 diabetes patients at the Diabetic Clinic at Dihlabeng Regional Hospital. A convenience sample was used. The study utilised a researcher-designed questionnaire incorporating demographic data, the validated International Physical Activity Questionnaire, and an assessment of patient's knowledge of their disease and its management based on South African guidelines. Focus groups were also conducted to gather qualitative data to better understand the patients' attitudes about physical activity as a treatment modality for their type 2 diabetes.

The results of the study highlighted several critical findings. Out of 150 participants, knowledge about physical activity as a treatment for type 2 diabetes was moderate to good, with 86 participants falling into this category. However, there was no statistically significant association between the level of knowledge regarding physical activity and the actual level of physical activity ($p=0.907$), indicating that other factors might influence physical activity levels. Participants generally recognised the health benefits of physical activity but struggled to articulate these benefits specifically for diabetes

management. During focus group discussions, many could only express vague benefits such as "physical activity makes my body feel good."

The attitude of participants towards physical activity was overwhelmingly positive. They expressed a strong desire to engage in physical activity but faced numerous barriers within their community. The lack of facilities, parks, and equipment was the most frequently mentioned obstacle. Participants noted that some recreational spaces had been repurposed for informal commercial uses, such as local car wash businesses, depriving the community of much-needed recreational areas. Safety concerns, particularly related to the prevalence of illicit substance use, also hindered their ability to participate in physical activity.

Interestingly, the study found that 44% of participants had low levels of physical activity according to the IPAQ. Further analysis revealed that the level of physical activity was significantly influenced by factors such as education level, employment status, and source of income. Participants with tertiary education were more likely to have higher levels of physical activity, while those with lower education levels, retired individuals, and those receiving a SASSA grant tended to have lower activity levels. This finding underscores the complex interplay between socioeconomic factors and health behaviours.

6.2 Limitations of the study

Despite the generally positive attitude towards physical activity, the study identified limitations. The research was conducted solely among patients at the Dihlabeng Regional Hospital Diabetic Clinic, who are referred from local clinics due to poor control of their condition. As a result, the findings may not be representative of all type 2 diabetes patients in the Dihlabeng area who are well-controlled. Additionally, the self-administered questionnaires, while useful, are subjective and rely on the honesty and understanding of the participants.

The study also recognised that the IPAQ, although a validated tool, may not fully capture the true level of physical activity in participants' daily lives, as it only considers one week of activity. The proposed physical activity programme, while tailored to the study population, may not be suitable for other communities with different needs or circumstances.

6.3 Implications of the study

The implications of this study on the attitudes, knowledge, and levels of physical activity among patients with type 2 diabetes mellitus in Dihlabeng, South Africa, are profound and multifaceted. These implications extend across public health, clinical practice, policy-making, and research, particularly within rural settings where the burden of chronic diseases like type 2 diabetes is significant. Understanding these implications is crucial for developing effective strategies to improve diabetes management and overall health outcomes in similar communities.

One of the primary implications of this study is the need for community-tailored public health interventions. The findings underscore that physical activity programmes must be designed specifically to address the unique needs and circumstances of rural communities. In Dihlabeng, participants expressed a desire to engage in physical activity but faced significant barriers, such as a lack of facilities, safety concerns, and limited knowledge about the specific benefits of physical activity for managing type 2 diabetes. This suggests that generic, one-size-fits-all interventions are unlikely to be effective in such contexts. Instead, public health strategies should focus on creating programmes that consider the local cultural, social, and environmental factors that influence physical activity. Additionally, there is a clear need for educational campaigns that target the community's understanding of how physical activity can be integrated into diabetes management. By improving knowledge and awareness, these campaigns could lead to better health outcomes and increased engagement in physical activity.

In clinical practice, the study highlights the importance of integrating more comprehensive guidance on physical activity into diabetes management plans. Healthcare providers, especially those working in rural or resource-limited settings, should place greater emphasis on advising patients on how to incorporate physical activity into their daily routines. This guidance should be practical and consider the barriers identified in the study, such as safety issues and lack of facilities. Moreover, the study suggests that patients prefer to engage in physical activity under the supervision of healthcare professionals. This finding underscores the need for healthcare workers to be adequately trained and involved in delivering physical activity

programmes. By doing so, healthcare providers can offer the necessary support and motivation to help patients adopt and maintain healthy lifestyle behaviours.

From a policy perspective, the study's findings point to the urgent need for improvements in community infrastructure. The lack of recreational spaces and facilities was identified as a significant barrier to physical activity in the Dihlabeng community. This highlights the necessity for policy interventions that focus on developing infrastructure in rural areas, such as building parks, gyms, and safe spaces where community members can engage in physical activity. Policymakers should prioritise these developments as part of broader public health strategies aimed at reducing the burden of lifestyle-related diseases like type 2 diabetes. Furthermore, the study raises safety concerns, particularly in areas where recreational spaces have been repurposed for commercial activities. Addressing these safety issues through stricter regulations and better urban planning is essential to ensure that communities have access to safe and adequate spaces for physical activity.

Socioeconomic factors also play a crucial role in shaping the implications of this study. The research revealed that physical activity levels are closely linked to factors such as education level, employment status, and income. Participants with higher education levels and those who were employed were more likely to engage in physical activity, while those with lower education levels, retired individuals, and recipients of social grants tended to have lower activity levels. This finding underscores the complex interplay between socioeconomic status and health behaviours. It suggests that public health interventions must be sensitive to these socioeconomic barriers. Policies that aim to improve education and employment opportunities could have a positive impact on physical activity levels, thereby contributing to better health outcomes for patients with type 2 diabetes.

6.4 Recommendations

Based on these findings, the study offers several important recommendations. For diabetic clinics, the research suggests that there is a need to enhance patient education regarding the specific benefits of physical activity for managing type 2 diabetes. It also highlights the importance of developing and implementing physical activity programmes led by healthcare professionals. These programmes should accommodate small groups of participants, incorporate both aerobic and strength

exercises, and be designed so that they can be performed at home if necessary. The study also emphasises the need for improving community infrastructure, such as creating more recreational spaces and ensuring the safety of these areas, to facilitate physical activity.

In terms of further research, the study recommends conducting similar investigations in other facilities to determine if the findings are consistent across different populations. It also suggests evaluating the feasibility of implementing the designed physical activity programmes in the community and conducting follow-up studies to assess its effectiveness in managing type 2 diabetes. Addressing the barriers to physical activity, particularly the lack of facilities and safety concerns, is crucial for reducing the burden of chronic lifestyle-related diseases on the healthcare system.

6.5 Conclusion

In conclusion, this study provides valuable insights into the attitudes, knowledge, and physical activity levels of type 2 diabetes patients in the Dihlabeng rural area. The findings underscore the need for tailored interventions that address both the physical and social barriers to physical activity in rural communities. The study highlights the positive attitudes of patients towards physical activity, despite the significant barriers they face, and calls for more resources and support to optimise the management of type 2 diabetes in rural South Africa. By addressing these challenges, healthcare providers can better support patients in adopting and maintaining healthy lifestyle behaviours, essential for managing their condition.

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APPENDICES

Appendix 1: Human Research Ethics Committee (Medical) Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R49 Dr C Vermaak

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M230419

NAME: (Principal and Co-Investigators)	Dr C Vermaak **DEGREE:** MSc
DEPARTMENT:	School of Therapeutic Sciences Department of Exercise Sports & Sports Medicine Medical School University
PROJECT TITLE:	*Identifying physical activity attitudes, knowledge and activity amongst people living with type 2 Diabetes Mellitus in Dihlabeng, South Africa, for the design of a community-tailored physical activity programme*
DATE CONSIDERED:	2023/05/05
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Professors P Gradidge and D Constantinou; Dr M Lichaba
APPROVED BY:	Professor P Ruff, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2023/10/25 **EXPIRY DATE:** 2028/10/24

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **April** and therefore reports and re-certification will be due in the month of **April** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator Date

Appendix 2: Post Graduate Committee Approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

26 June 2023
Person No: 2626570
PAG

Dr C Vermaak
22 Juta St
Heuwelsig
9301
South Africa

Dear Dr Cornel Vermaak

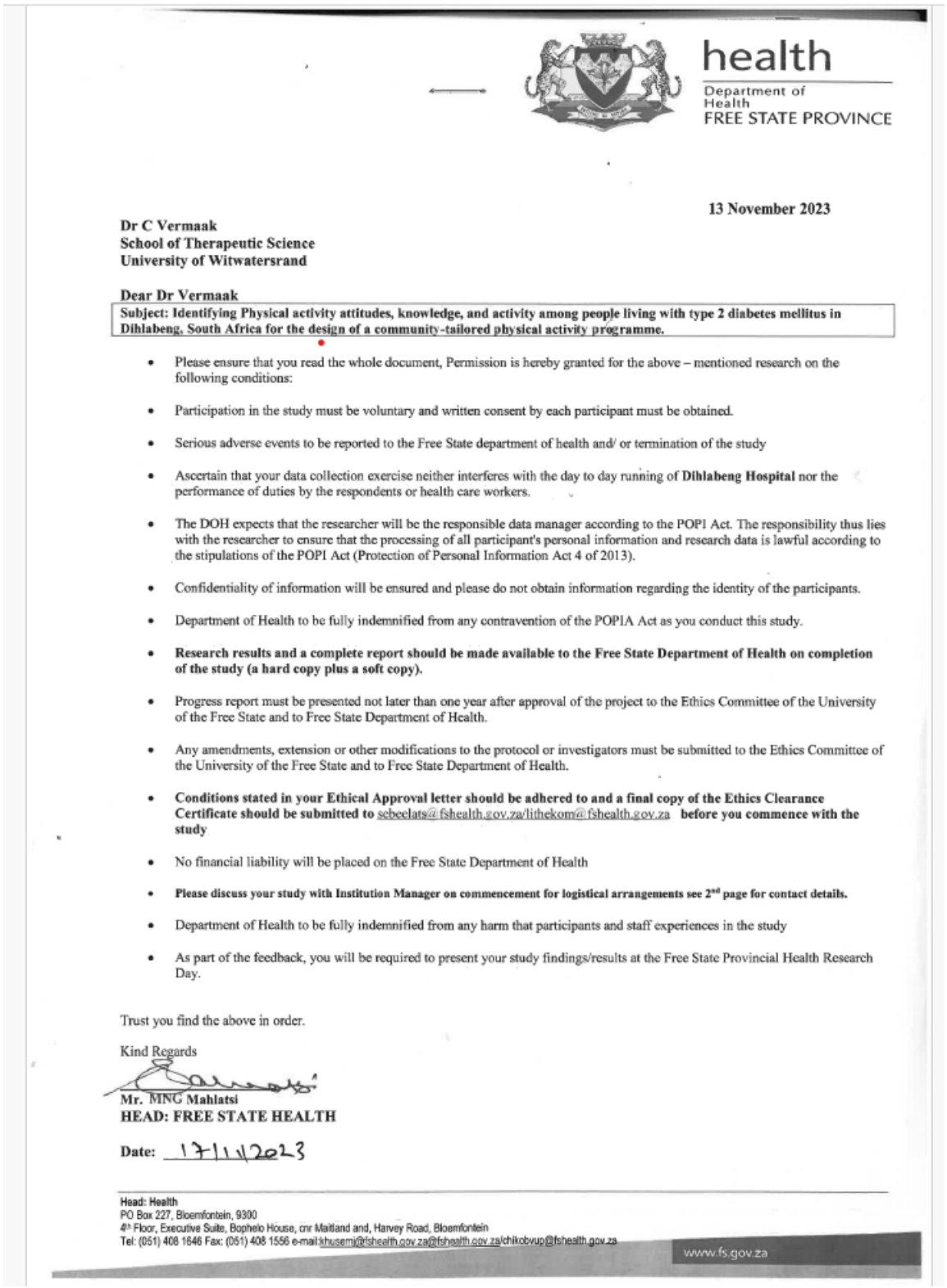
Master of Science in Medicine: Approval of Title

We have pleasure in advising that your proposal entitled *Identifying Physical activity attitudes, knowledge, and activity among people living with type 2 diabetes mellitus in Dihlabeng, South Africa for the design of a community-tailored physical activity programme* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 3: Approval from Free State Department of Health



health
Department of Health
FREE STATE PROVINCE

13 November 2023

Dr C Vermaak
School of Therapeutic Science
University of Witwatersrand

Dear Dr Vermaak

Subject: Identifying Physical activity attitudes, knowledge, and activity among people living with type 2 diabetes mellitus in Dihlabeng, South Africa for the design of a community-tailored physical activity programme.

- Please ensure that you read the whole document, Permission is hereby granted for the above – mentioned research on the following conditions:
- Participation in the study must be voluntary and written consent by each participant must be obtained.
- Serious adverse events to be reported to the Free State department of health and/ or termination of the study
- Ascertain that your data collection exercise neither interferes with the day to day running of **Dihlabeng Hospital** nor the performance of duties by the respondents or health care workers.
- The DOH expects that the researcher will be the responsible data manager according to the POPI Act. The responsibility thus lies with the researcher to ensure that the processing of all participant's personal information and research data is lawful according to the stipulations of the POPI Act (Protection of Personal Information Act 4 of 2013).
- Confidentiality of information will be ensured and please do not obtain information regarding the identity of the participants.
- Department of Health to be fully indemnified from any contravention of the POPIA Act as you conduct this study.
- **Research results and a complete report should be made available to the Free State Department of Health on completion of the study (a hard copy plus a soft copy).**
- Progress report must be presented not later than one year after approval of the project to the Ethics Committee of the University of the Free State and to Free State Department of Health.
- Any amendments, extension or other modifications to the protocol or investigators must be submitted to the Ethics Committee of the University of the Free State and to Free State Department of Health.
- **Conditions stated in your Ethical Approval letter should be adhered to and a final copy of the Ethics Clearance Certificate should be submitted to** sebeelats@fshealth.gov.za/lithekom@fshealth.gov.za **before you commence with the study**
- No financial liability will be placed on the Free State Department of Health
- **Please discuss your study with Institution Manager on commencement for logistical arrangements see 2nd page for contact details.**
- Department of Health to be fully indemnified from any harm that participants and staff experiences in the study
- As part of the feedback, you will be required to present your study findings/results at the Free State Provincial Health Research Day.

Trust you find the above in order.

Kind Regards

Mr. MNG Mahlatsi
HEAD: FREE STATE HEALTH

Date: 17/11/2023

Head: Health
PO Box 227, Bloemfontein, 9300
4th Floor, Executive Suite, Bophelo House, cnr Maitland and, Harvey Road, Bloemfontein
Tel: (051) 408 1646 Fax: (051) 408 1556 e-mail:khusemj@fshealth.gov.za/@fshealth.gov.za/chikobvup@fshealth.gov.za
www.fs.gov.za

Appendix 4: Approval from Dihlabeng Regional Hospital

Dihlabeng Regional Hospital

Department of Health
FREE STATE PROVINCE

Conditional Approval application for the Research Study: Attitudes, knowledge, and physical activity among patients with Type 2 Diabetes in Dihlabeng Regional Hospital, South Africa

The above proposed research project has been reviewed, and approval is given for this application, with final approval to be given subject to the approval of the Wits Ethics committee and ratified by the University of the Free State (UFS).

Dr C. Vermaak therefore has our permission to conduct this study at Dihlabeng Regional Hospital (DRH) once all of the requirements are in place.

Please feel free to ask for any further information required.

Kind regards,

DR WJ SELFRIDGE
MP 0639869
MBCHB

2023 -03- 31

CLINICAL MANAGER

Department of Health • Departement van Gesondheid • Lefapha La Bophelo Bo Botle
Dr WJ Selfridge, Acting CEO & Head: Clinical Services, Dihlabeng Regional Hospital, Eeufees St, Private Bag X3, Bethlehem, 9700, Tel. No. (058) 307-1032
Work Email: SelfridgWJ@fshealth.gov.za Private Email: SelfridgeWJ@gmail.com

Appendix 5: Participant Information Sheet

ATTITUDES, KNOWLEDGE, AND PHYSICAL ACTIVITY AMONG PATIENTS WITH TYPE 2 DIABETES IN DIHLABENG, SOUTH AFRICA

Dear Participant

I, Cornel Vermaak am collecting information on the attitudes, knowledge and level of activity among patients with type 2 diabetes mellitus in Dihlabeng, South Africa.

To be part of this study, you must be a patient of the Dihlabeng Regional Hospital's Diabetic clinic with sugar disease (Diabetes type 2). You have to be 18 years or older to participate. Unfortunately, only people with Sugar disease type 2 (Diabetes type 2) may be part of the study and people not able to exercise will also not be able to be part of the study.

You will be asked to complete a form with questions to help us understand how you feel about using exercise for the treatment of your sugar disease. You will also be asked how much you exercise. There is no right or wrong answer and let us know if you need any help.

To be part of this study is voluntary, 100% your own choice and you may decide to stop at any time without any consequences. You will not pay any money to be part of this study and you will not receive any money either. There is no danger to be part of this study and you will not be harmed in any way. It will take about 30-45 minutes to complete the questions. Thereafter we will talk about exercise and sugar disease for about 40 to 60 minutes. You should know that doing exercise can be dangerous. We will not be doing any exercise today! The information that you will give us will help us to create an exercise programme for you to help treat your sugar disease.

All personal information will be kept confidential – we will tell no one about your answers and we will not even know who answered the questions. You will not be asked to give any personal information like your cell phone number or ID number. The ethical clearance has been obtained from the Department of Health and the University of the Witwatersrand Human Research Ethics Committee. Please feel free to contact me for more information at 0788044675 or Vermaak.mail@gmail.com. Contact details for Ethical Committee if you have any concerns: If you have any concerns over the way the study is being conducted, please contact the Chairperson of this Committee who is Dr Clement Penny, who may be contacted by telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za.

Thank you for your willingness to participate! Cornel Vermaak (MBChB)

Appendix 6: Questionnaire

*Study Number*_____ *(office use only)*

Questionnaire

Questionnaire number:(office use only)

ATTITUDES, KNOWLEDGE, AND PHYSICAL ACTIVITY AMONG PATIENTS WITH TYPE 2 DIABETES IN DIHLABENG, SOUTH AFRICA

Please complete the following questions.

Section 1: Demographic data

1.1 Above 18 years? **(MARK APPLICABLE BLOCK WITH X)**

YES	NO

If NO please leave study

If yes How old are you _____ years

1.2 Confirmed **Type 2** Diabetes Mellitus? **(MARK APPLICABLE BLOCK WITH X)**

YES	NO

If NO please leave study

Most Recent HbA1%%:	Weight:	Height
kg	kg	cm

1.3 Residing in the Dihlabeng area? **(MARK APPLICABLE BLOCK WITH X)**

YES	NO

If NO please leave study

1.4 **NOT** bedridden or critically ill or any other endocrine disease eg Hypothyroidism / Hyperthyroidism? **(MARK APPLICABLE BLOCK WITH X)**

YES	NO

[redacted]

1.5 Gender **(MARK APPLICABLE BLOCK WITH X)**

MALE	FEMALE	OTHER

1.6 Level of education **(MARK APPLICABLE BLOCK WITH X)**

NONE	PRIMARY SCHOOL (GRADE 7/ STANDARD 5)	SECONDARY SCHOOL (GRADE 12/ STANDARD 10)	TERTIARY (COLLEGE/UNIVERSITY/TECHNICON)

1.7 Employment status **(MARK APPLICABLE BLOCK WITH X)**

UNEMPLOYED	RETIRED	PERMANENTLY EMPLOYED	CASUAL EMPLOYMENT	SELF EMPLOYED

1.8 Source of income **(MARK APPLICABLE BLOCK WITH X)**

NONE	SASSA GRANT	EMPLOYMENT	DONATIONS FROM FAMILY

1.9 Income per month **(MARK APPLICABLE BLOCK WITH X)**

LESS THAN R1000	R1000 TO R2000	R2000 TO R5000	MORE THAN R5000

1.10 Please select the block that most accurately describes your house: **(MARK BLOCK WITH X)**

NONE	BRICK HOUSE	SHACK/MOKHUKHU	OTHER: (SPECIFY)

1.11 Do you have access to a gym, sports, or exercise facilities? **(MARK APPLICABLE BLOCK WITH X)**

YES	NO

1.12 Please select the diseases that you have: **(MARK APPLICABLE BLOCK WITH X)**

HIGH BLOOD PRESSURE	ASTHMA	ARTHRITIS	HEART FAILURE
HIGH CHOLESTEROL	GOUT	(HYPOTHYROIDISM	OTHER: (SPECIFY)

1.13 Do you follow a diabetic diet? **(MARK APPLICABLE BLOCK WITH X)**

YES	NO

1.14 What medication do you use? **(MARK APPLICABLE BLOCK WITH X)**

I DO NOT KNOW	ASTHMA PUMPS	RIDAQ/ HYDROCHLOROTHIAZIDE LASIX SPIRACTIN	PHARMAPRESS/ ENALAPRIL PREXUM
ZOCOR/SIMVASTATIN	AMLOC/ AMLODIPINE	METFORMIN/GLUCOPHAGE	PARACETAMOL BRUFEN/ TRAMADOL
INSULIN / ACTRAPID /PROTOPHANE	ASPIRIN	PREDNISONE	OTHER(SPECIFY):
GLICLAZIDE, GLIMEPIRIDE	ATENOLOL CARLOC	PURICOS	

Section 2 Physical Activity

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise, or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

2.1 During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

☐ No vigorous physical activities ➔ ***Skip to question 2.***

2.2 How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

2.3 During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

☐ No moderate physical activities ➔ ***Skip to question 2.5***

2.4 How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

2.5 During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 2.7***

2.6 How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

2.7 During the **last 7 days**, how much time did you spend **sitting** on a **weekday**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Section 3 Knowledge regarding physical activity

(MARK ONE BLOCK WITH X)

3.1 The minimum minutes a Type 2 Diabetic patient should exercise per week is 150 minutes:

TRUE	FALSE

3.2 Type 2 Diabetic patients should exercise ONLY on weekends:

TRUE	FALSE

3.3 Exercise makes the medication (insulin/ metformin) work better:

TRUE	FALSE

3.4 There are no benefits for Type 2 Diabetes to exercise:

TRUE	FALSE

3.5 Any exercise is dangerous for patients with Type 2 Diabetes:

TRUE	FALSE

3.6 A sugar reading at any time should be at least 15 mmol/l in a patient with Type 2 Diabetes Mellitus:

TRUE	FALSE

3.7 A snack like an apple should be eaten before starting vigorous exercise to prevent low sugar:

TRUE	FALSE

3.8 A single exercise session should last at least 30 minutes to be beneficial to the treatment of diabetes:

TRUE	FALSE

3.9 Treatment of my diabetes with exercise is not my responsibility but those of my doctor

TRUE	FALSE

3.10 Sitting and Watching Television is sufficient exercise for a patient with type 2 Diabetes.

TRUE	FALSE

Appendix 7: Consent Form Data Collection

WITS UNIVERSITY

PARTICIPANT CONSENT SHEET – PATIENT RECORD RETRIEVAL

ATTITUDES, KNOWLEDGE, AND PHYSICAL ACTIVITY AMONG PATIENTS WITH TYPE 2 DIABETES IN DIHLABENG, SOUTH AFRICA

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study I am free to speak to any of these contacts.

Contact details:

Dr Cornel Vermaak, Principal Investigator, on Tel. No. 078 804 4675, or by e-mail at vermak.mail@gmail.com or

Professor Phillipe Gradidge, Supervisor, on Tel. No. 011 717 3363, or by e-mail on Phillipe.Gradidge @wits.ac.za

Professor P Ruff, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za

Name of Participant: _____
Date: _____
Place: _____
Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____

Appendix 8: Consent Form Focus Group Discussions

WITS UNIVERSITY

PARTICIPANT CONSENT SHEET – FOCUS GROUP DISCUSSION

ATTITUDES, KNOWLEDGE, AND PHYSICAL ACTIVITY AMONG PATIENTS WITH TYPE 2 DIABETES IN DIHLABENG, SOUTH AFRICA

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study I am free to speak to any of these contacts.

Contact details:

Dr Cornel Vermaak, Principal Investigator, on Tel. No. 078 804 4675, or by e-mail at vermak.mail@gmail.com or Professor Phillipe Gradidge, Supervisor, on Tel. No. 011 717 3363, or by e-mail on Phillipe.Gradidge @wits.ac.za

Professor P Ruff, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za

Name of Participant: _____
Date: _____
Place: _____
Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____

Appendix 9: Consent form Audio Recordings



CONSENT FORM FOR AUDIO RECORDING OF STUDY PARTICIPATION

ATTITUDES, KNOWLEDGE, AND PHYSICAL ACTIVITY AMONG PATIENTS WITH TYPE 2 DIABETES IN DIHLABENG, SOUTH AFRICA

I hereby consent to audio recording of the Focus Group discussion

.

I understand that:

- The recording will be stored in a secure location (a locked cupboard or password protected computer) with restricted access to the researcher and the research supervisor.
- The recording will be transcribed and any information that could identify me will be removed,
- The recordings will be erased within either (a) two (2) years of the publication of the research findings, or (b) six (6) years, if no publications arise from this research
- Anyone wishing to access this information in the future will first have to obtain the approval of the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg
- Direct quotes from my interview, without any information that could identify me, may be cited in the research report or other write-ups of research.

Contact details:

Dr Cornel Vermaak, Principal Investigator, on Tel. No. 078 804 4675, or by e-mail at vermak.mail@gmail.com or

Professor Phillipe Gradidge, Supervisor, on Tel. No. 011 717 3363, or by e-mail on Phillipe.Gradidge @wits.ac.za

Professor P Ruff, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za

Name of Participant: _____
Date: _____
Place: _____
Signature or mark _____

Witnessed by:

Name of Witness: _____
Signature: _____
Date: _____

Appendix 10: Focus Group Discussion Framework

This framework is to be used for every focus group discussion and ticked off after the relevant action is performed.

RECORDING STARTS: Focus group date, name of the researcher and the number of participants stated.

Date of Focus Group	Number of participants	Moderator name	Nursing staff assisting name
yyyy/mm/dd Time:	Total: Male: Female:	Cornel Vermaak	

Introduction (+-5 minutes)

The researcher introduces himself and states his role. It should be stated that participation in the focus group is voluntary and that it is recorded for data collection purposes.

Group participants introduce themselves and are individually asked to confirm their willingness to participate and to be recorded.

The researcher explains that the topic of discussion in the focus group is:

To get more in-depth information on perceptions, insights, attitudes, experiences, or beliefs regarding physical activity in the rural community of Dihlabeng to design a physical activity programme for the community.

The researcher explains that everyone is welcome to answer the questions and that we will each take a turn to answer the question.

Discussion about attitudes: (+-10 minutes)

How do you feel about physical activity as part of the treatment for your Diabetes?

- *Note feelings e.g. happy, confused, sad, exited*

What would your motivation be to use physical activity as a treatment?

- *Note any mention of health benefits and expand on them.*

Who is responsible for teaching you about physical activity?

Discussion about the ideal physical activity programme (+- 10 minutes)

Where would you like to attend a physical activity programme?

- *The researcher directs participants to identify a specific place.*
- *Prompts to be used include 1. At the local Clinic, 2. At home, 3. In a community-building accessible to all,4. outdoor area like a park or sport field*

How often would you like to do physical activity?

- Note how often in days.

How long would you like to do physical activity per session?

- Determine why that specific duration.

Who do you think should be responsible for arranging these exercise sessions?

- *The researcher should determine the role of a health professional in the exercise group.*

What type of physical activity would you like to do?

The researcher should explain the following types of exercise to the group using examples

- *Aerobic: e.g. Running, swimming, walking, playing soccer*
- *Resistance: e.g. using weights to train your muscles.*
- *Combination of both*

Would you like to have a physical activity programme to do at home?

Would you like to do the physical activity alone or in a group?

- *Determine the reason for the answer.*
- *If the group establish composition:*
- *Number*
- *Gender*

Discussion regarding barriers (+-10 minutes):

Is there anything that would prevent you from exercising?

Researchers should be aware of the following factors and should not prompt, but when mentioned should lead the group to elaborate on the specific factor.

- *Note non-verbal emotional cues e.g. happy, confused, sad, excited for each.*
- *Note group interactions during this discussion*
- *Unsafe*
- *Cultural Factors: How does your culture feel about exercise?*
- *No gym facilities or equipment*
- *Housework*
- *Lack of knowledge*
- *Lack of time*
- *Employment*
- *Lack of capacity/fitness*
- *Gender*
- *Age*

Closing (+-5 minutes)

The researcher asks if anyone wants to comment on any of the topics discussed today.

Participants are thanked for their participation in the focus group.

The researcher states that the focus group has concluded and states the number of participants at the end of the session and also mentions any problems during the discussion.

The researcher notes any events that stood out.

RECORDING END

Date of Focus Group	Number of participants	Moderator name	Nursing staff assisting name
yyyy/mm/dd Time:	Total: Male: Female:	Cornel Vermaak	

Appendix 11: Framework for the development of a physical activity programme.

Designed by the researcher using the findings of Kok et. al. (2015).

Patient population

The programme should be designed specifically for patients with diabetes mellitus type 2 residing in the Dihlabeng rural area.

Recruitment for the physical activity groups

Using data from the patient a recruitment process should be identified.

Type of physical activity

The data from the study is to be used to identify the type of physical activity that patients want. Specific exercises will be selected to meet the needs of the patients.

Tailoring programme to individuals

The programme should be pliable and should have room for easy individual tailoring as per the medical and physical/mental condition of the patient.

Location and supervision

A suitable location should be identified from the data provided in the study. A person responsible for the implementation and supervision of the programme should be identified, preferably someone with experience in the management of healthcare projects.

Physical activity frequency and duration

Utilising the data from the study, a suitable duration and frequency for the physical activity should be determined.

Participant adherence

For an effective physical activity programme, a specific system needs to be identified to ensure adherence to the programme. The use of a social support system to help with compliance should be implemented before starting the programme.

Sustainability and Scalability

Resource implications should be considered keeping in mind that resources are limited in the community. The programme should be adaptable for various size groups with the availability of resources in mind.

Measurement of Progress

The programme should be designed so that progress can be quantified, and exercise intensity adjusted as needed. This includes the collection of data on programme outcomes such as attendance rates, changes in fitness level, and participant satisfaction. This information should be used to refine the programme and make adjustments.

Appendix 12: Example of physical activity programme handout.

PhysioTools
Work with the Best

Personal exercise program

General Aerobic exercises

Bethlehem
Bethlehem

Provided by Dihlabeng Physiotherapy
Provided for
Training start date 3/1/2024



©PhysioTools Ltd

Stand.

Walk for 1-5 min on the spot



©PhysioTools Ltd

Stand.

March in place for 2 minutes..



©PhysioTools Ltd

Stand.

Walk on your toes for 1 minute.



©PhysioTools Ltd

Stand.

Walk on your heels for 1 minute.


©PhysioTools Ltd

Stand.

Walk up and down stairs.

Walk up and down stairs. 20 steps up and down


©PhysioTools Ltd

Standing with hands clasped in front of you.

Lift both arms straight forward over your head. Separate your arms sideways and take them back down to the starting position.

Repeat 22 times.


©PhysioTools Ltd

Stand or sit holding a pole/stick with your arms down and in front of you.

Lift arms straight up and then lower the stick behind your neck. Lift arms up and then return to starting position.

Repeat 20 times.


©PhysioTools Ltd

Sit and lift one arm.

Bend to the side with your arm reaching over your head. Breathe in, then breathe out and return to the starting position.

Repeat 5 - 10 times.


©PhysioTools Ltd

Sit. Hold your hands and lift your arms over your head.

Breathe in and slowly bend to the side. Breathe out and return to the starting position.

Repeat 2 - 5 times.



©PhysioTools Ltd

Sitting on a chair.

Lift your leg up off the seat keeping the knee bent. Return to starting position.

Repeat 20 times up and down with both legs



©PhysioTools Ltd

Sitting on a chair or on a table. Hold on to the chair.

Straighten your knees and make small "scissor movements" with your legs.

Repeat 10 times.



©PhysioTools Ltd

Stand straight.

Lift one knee.

Repeat 10 times with both legs



©PhysioTools Ltd

Stand straight. Take a step forwards and take the weight onto the front leg.

Push off your front leg bringing legs back together. Repeat with other leg.

Repeat 5 times.



©PhysioTools Ltd

Stand.

Push up on your toes. Repeat 5 times.



©PhysioTools Ltd

Stand holding on to a support with one hand and to the ankle with the other hand.

Pull the ankle towards your bottom, then try to straighten the knee approx. 20 secs. while resisting with your hand. Relax your leg and repeat the exercise pulling the ankle a little bit further. Return to starting position.

Repeat 2 times.



©PhysioTools Ltd

Stand.

Lift your leg and point your foot forward, side ways and to the back.

Repeat _____ times.



©PhysioTools Ltd

Stand with legs astride and straight.

Bend one leg and put your hands on the knee. Bend your leg even more and put more weight on the leg. You will feel stretching on the inside of the thigh on the straight leg. Hold approx. 20 secs.

Repeat 2 times.



©PhysioTools Ltd

Stand on one leg.

Pass a ball under your knee.

Repeat 5 times with both legs



©PhysioTools Ltd

Stand in a walking position with the leg to be stretched straight behind you and the other leg bent in front of you. Take support from a wall or chair.

Lean your body forwards and down until you feel the stretching in the calf of the straight leg. Hold approx. 30 secs. - relax. Stretch the other leg.

Repeat 2 times.



©PhysioTools Ltd

Crawling position.

Lift opposite arm and leg to horizontal position. Hold 5 - 10 secs. Try to keep your body still.

Repeat 5 times.



©PhysioTools Ltd

Sitting with your hands clasped behind your head.

Bend your head forward until you feel a stretch behind your neck. Gently pull your head further forward. Hold approx. 20 secs.

Repeat 2 times.



©PhysioTools Ltd

Sit with the back straight and feet firmly on the floor.

Bring your chin to your chest and round the upper trunk keeping head and shoulders relaxed. Keep your bottom firmly on the seat.

Repeat 3 times.



©PhysioTools Ltd

Stand or sit.

Push shoulders forward, stretch the arms diagonally forwards and down keeping your chin in. Hold stretching 20 secs.

Repeat 2 times.