

**FACTORS ASSOCIATED WITH GLYCEMIC CONTROL  
AMONG TYPE 2 DIABETES MELLITUS PATIENTS  
ATTENDING MATHARI NATIONAL TEACHING AND  
REFERRAL HOSPITAL, NAIROBI COUNTY**

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**Factors associated with glycemic control among type 2 diabetes mellitus patients attending Mathari National Teaching and Referral Hospital, Nairobi County**

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**A thesis submitted in partial fulfilment of the requirements for the degree of Master of Public Health in the Jomo Kenyatta University of Agriculture and Technology**

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## DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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## **DEDICATION**

I dedicate my thesis to my loving mother Salome Wangui, siblings Patrick, Peter, Joseph, Lucy, Anne, Pauline, Alice and Carol for your spiritual, emotional and financial support throughout the course at Jomo Kenyatta University of Agriculture and Technology and the entire community that I serve with regard to Non- Communicable diseases, particularly diabetics. I do also dedicate this work to Mwalimu James Kamanda and Phyllis Muiruri. I finally dedicate my work to Royal media Services particularly Mrs Macharia, Benjamin Wangari, Jeff Kuria, Wambui Muturi, Kamau Kang'ethe and Githinji for giving me a platform to continue creating awareness on Diabetes to Kenyans looking for this knowledge.

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## **ABBREVIATIONS AND ACRONYMS**

<b>ADA</b>	American Diabetes Association
<b>AKUH</b>	Agakhan University Hospital
<b>CDIC</b>	Changing Diabetes in Children
<b>CDC</b>	Centres for Disease Control and Prevention
<b>DNCD</b>	Division of Non-Communicable Diseases
<b>DCCT</b>	Diabetes Controlled Clinical Trials
<b>DSME</b>	Diabetes Self-Management Education
<b>ERC</b>	Ethical Review Committee
<b>FBS</b>	Fasting blood sugar
<b>HDL</b>	High Density Lipoprotien
<b>IDDM</b>	Insulin-dependent diabetes mellitus
<b>IDF</b>	International Diabetes Foundation
<b>ITROMID</b>	Institute of Tropical Medicine and Infectious Diseases
<b>ISO</b>	International Standard Organisation
<b>KEMRI</b>	Kenya Medical Research Institute
<b>KNH</b>	Kenyatta National Hospital
<b>LMIC</b>	Low and middle income countries
<b>LDL</b>	Low Density Lipoprotiens
<b>MNTRH</b>	Mathari National Teaching and Referral Hospital
<b>MOH</b>	Ministry of Health
<b>MPHS</b>	Ministry of Public Health and Sanitation

<b>NDS</b>	National Diabetes Statistics
<b>NHANES</b>	National Health and Nutrition Examination Survey
<b>NIH</b>	National Institute of Health
<b>SPSS</b>	Statistical Package for the Social Sciences
<b>T1DM</b>	Type 1 diabetes mellitus
<b>T2DM</b>	Type 2 diabetes mellitus
<b>UKPDS</b>	United Kingdom Prospective Diabetes Study
<b>UACR</b>	Urine for Albumin Creatinine Ratio
<b>UON</b>	University of Nairobi
<b>WHO</b>	World Health Organization
<b>WDF</b>	World Diabetes Federation

## DEFINITION OF OPERATIONAL TERMS

- Type 2 Diabetes** – This the common type of diabetes mostly affecting people of 40 year and above but currently affecting people even younger than 35 years of age characterized by high blood glucose levels as a result of insulin resistance, insensitivity and or both.
- Glycemic Control** – This term refers to the recommended or optimal body blood glucose levels that a person living with diabetes should maintain at anyone given point in time. The optimal glycemic control is determined by glycated hemoglobin test.
- Glycated hemoglobin (HbA1c)** - Is a profile indicator for glycemic control that indicate an avarege blood sugar level in the body for the last 3 to 4 months with figures  $< 7\%$  indicate good glycemic control while  $> 7\%$  indicate poor glycemic control.
- Hyperglycemia** – Also called high blood glucose levels. It's a condition where an individual gets excessive accumulation of glucose circulating in the blood plasma. Optimal targets fasting blood sugar was considered to be between 4 – 6.1 mmols/L.
- Study participants** – They are the study subjects in the study and interchangeably used as respondents and diabetes patients.
- Optimal targets** – Recommended levels/ranges of different profiles of glycemic control as indicated in the results of this study.



**Sub – optimal/off optimal targets** – Levels that are above or below the recommended targets of different profiles of glycemic control indicated in the results of this study.

## ABSTRACT

With the prevalence of diabetes escalating globally, diabetes prevalence in Kenya is estimated to be 4.56% with an approximate 12% and 2.7% in both urban and rural settings respectively. Many patients are still referred to national referral hospitals and even outside country for specialized end organs damage care due to poor glycemic controls. The study determined factors associated with glycemic control, among T2DM patients attending Mathari National Teaching and Referral Hospital diabetes clinic Nairobi, Kenya. A descriptive cross sectional study design was applied and a systematic random sampling technique to recruit 149 study subjects. Scientific and Ethical approval was sought from KNH/UON- ERC before data collection. Quantitative data was collected using a structured questionnaire and a guide was used for qualitative data (one key informant interviews and two focus group discussions). Blood samples were drawn to determine HbA1c, lipid profile, blood sugar and urine for microalbumin Creatinine Ratio levels. Data was analyzed using Statistical Package for Social Scientists version 20 (SPSS). Descriptive analysis was used to summarise the data and associations between variables were tested using Chi Square statistics. Differences between parameters estimates were deemed statistically significant at  $p < 0.05$ . Qualitative data was analyzed thematically after translation and transcription. The mean age of the study participants was 54.9 (SD  $\pm$  10.14) and a total of 122 (81.9%) out of 149 T2DM patients had poor glycemic control with a mean HbA1c of 9.1%. Over three quarter 135 (90.6%) had uncontrolled FBS, 37.6% with elevated T-Chol, 60.4% having dyslipidemia and 35.4% having moderate to severely increased UACR. Gender (OR = 3.029, 95% CI: 1.287 – 7.129,  $p = \mathbf{0.010}$ ), FBS (OR = 8.14, 95% CI; 2.541 - 26.0810,  $\mathbf{p = 0.001}$ ) and using drugs for other co-morbidities OR = 2.519, 95% CI; 1.009 - 6.288,  $\mathbf{p = 0.035}$ ) were significantly associated with glycemic control. This study revealed a high burden of poor glycemic control among T2DM patients attending Mathari Teaching and Referral Hospital and thus emphasis on improving awareness and management through structured diabetes education programs to fill the practice gap in glycemic control. Keeping tight control of FBS and routine screening for co-morbidities like hypertension, kidney disorders and dyslipidemia to prevent premature development of complications.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

Diabetes Mellitus is a non – communicable disease characterized by hyperglycemia as a result of defects in insulin secretion, insulin action, or both. Prolonged hyperglycemia may lead to irreversible long-term damages and or multiple organ failure especially eyes, kidneys, nerves, heart, and blood vessels (ADA, 2013). Diabetes mellitus is currently a global public health concern in the 21<sup>st</sup> century as its scale of challenge affect all people regardless of age or social class (International Diabetes Federation, 2015).

The global prevalence of people living with diabetes mellitus among adults aged 27 -79 years by 2015 was estimated to be 415 million and the number is projected to rise upto 642 million in the year 2040 if nothing is done to prevent the disease of which 318 million adults have impaired glucose tolerance (IDF, 2015).

Type 1 Diabetes Mellitus (T1DM) is an autoimmune disease in which T lymphocytes (White blood cells) attack insulin-producing pancreatic beta cells and accounts for 5-10 percent of all diabetes cases (Herold et al., 2002). The exact cause of T1DM has yet to be identified but risk factors may be genetic or environmental. T2DM refers to an impaired sensitivity to glucose in the cells of the body making up to 90% of all diabetes cases worldwide (ADA, 2013). As the pancreas increases the production of insulin with an aim of compensating the decreasing effectiveness; over the time this organ loses its functional ability to produce enough insulin resulting to consistently hyperglycemia (ADA, 2006).

According to National Health Statistics and Center of Diseases Control, the number of newly diagnosed diabetes in America aged 20 years and above is 1.7 million (CDC & NDS, 2014). Glycemic control is a term which refers to the optimal levels of blood glucose in a person living with type two diabetes (Adams, 2008). For a successful control of risks resulting to long-term diabetic complications, optimal glycemic control is paramount thus; controlling of blood glucose levels, blood pressure, lipids including cholesterol and triglycerides and regular exercises is necessary (WHO, 2008).

World Health Organization and International Diabetes Federation estimated that almost half of the people are unaware of their diabetes status which is a global and a local threat to health and productivity in the 21<sup>st</sup> Century (Yadav et al., 2013). In the start of 20<sup>th</sup> century the disease was not considered a medical priority in Africa unlike today where the world is facing a fast growing number of people living with diabetes with a big number coming from low resource settings regions. Previous studies have demonstrated an increased incidence of diabetes mellitus over the recent years and the trend expected to double (Kengne, Dzudie, Fezeu, & Mbanya, 2006). A recent study in Australia estimated that, for every 5 newly diagnosed cases of diabetes, there are 4 undiagnosed cases (Valentine et al., 2011).

A study done by (Mbanya, Motala, Sobngwi, Assah, & Enoru, 2010) estimated that DM is on the rise at the recent past with at least every four out of five people with diabetes living in low and middle income countries (LMIC). Sub-optimal glycemic control may lead to early onset of irreversible diabetes complications which include retinopathy leading to blindness; nephropathy leading to renal failure; peripheral neuropathy with

risk of foot ulcers, amputations, and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction (ADA , 2013).

Insufficient documentation of diabetes data has resulted into lack of diabetes care geto be given a priority with diabetes not getting reflected as a primary cause of death, where the main cause may have been one of the typical diabetes complications such as heart attack, stroke or kidney failure (Maahs et al., 2014). The estimated global expenditure on diabetes is about USD 465 billion out of which 80% is attributed to developed countries and only 20% is available for the developing countries. In United States of America alone diabetes costed the health care system \$ 245 in the year 2012 for both (Direct and indirect), this translated to an average medical expenditures among people living with diabetes to be 2.3 higher than people without diabetes (CDC & NDS, 2014).

The numbers of Disability Adjusted Life Years in Mexico due to diabetes increased from 7.31% in 1995 to 9.21% in the year 2005 and was attributed to amputations at 2.62%, to 5.83% as a result of retinopathy, and 0.94% due to diabetic foot and neuropathy (Berlanga et al., 2013). Despite the efforts put in place, the insufficiency of effective diagnosis equipments, essential drug therapies, advanced technology, diabetes education, fight to limit disabilities and life threatening complications has not been achieved (ADA, 2013). Surprisingly as much as modern medicine is being advocated for; cultural values in diabetes care should not be left out. A study in Sudan revealed people are embracing overweight and obesity a significant markers of affluence, strength and wealth in both men and beauty in women with thinner people being said to be sick (Mohamed Ahmed & Hassan Ahmed, 2001).

Significant effort is needed in prevention and control of diabetes mellitus and should be practically implemented to stem the rising cases of this condition. Across the world, health services will soon be crippled as the costs incurred in disease treatment and its irreversible complications is rising every now and then. Previous studies revealed that intensive glycemic controls had an effect in reducing incidences and progression of micro vascular complications (neuropathy, retinopathy at 76% reduced risk, and nephropathy at 50% reduced risk, in type 1 diabetes (DCCT, Group, 1993).

Glycemic control is the preventive mechanism in reduction of micro and macro vascular diabetes complications, thus people living with diabetes should have their HbA1c tested every 3 to 6 months to guide in the management therapy (Holman, Paul, Bethel, Matthews, & Neil, 2008). T2DM patients should be encouraged to achieve the target glycemic control although some factors like age (elderly), long duration of disease and co morbidities may hinder the target levels unlike the younger ones who can achieve tight controls. Most patients especially the elders of 65 years and above are considered to be safer with an HbA1c of < 7.5 – 8.0%, this is because as age progresses there is poor self-care with low or no psychosocial and financial support from different sectors and well as high risk of hypoglycemia (Smith et al., 2010).

A recent study in Malaysia reviewed that maintaining the right glycemic control is key in prevention of diabetes related complications. The study further found out that regardless of intensive management, most of the patients had uncontrolled mean HbA1c (Abougalambou, Mohamed, Sulaiman, Abougalambou, & Hassali, 2010). Majority had a mean HbA1c of 8.7% and 22% had achieved the target goals of <7 % (Mafauzy, Hussein, & Chan, 2011).

One of the major study conducted among type 2 diabetes reported that patients with optimal glycemic undergoing intensive management therapy were less likely to experience diabetes complication like retinopathy, nephropathy and possibly neuropathy and had achieved a mean HbA1c of 7.0% while those undertaking conventional therapy having a a mean HbA1c of 7.9% with an estimated 25% risk reduction of diabetes micro vascular complication (UKPDS, 1998). The same study revealed that a drop of HbA1c drop by 1% reduces risk of mortality due to diabetes by 25%, diabetes associated complication by 31%, heart attacks by 18%, 15% reduction risk of having a stroke and 35% reduction risk of having microvascular complications (UKPDS, 1998).

One study revealed that some of the demographics factors which influenced glycemic control were age, sex, level of education, income, living conditions and patient's ability to cope with their condition/disease (Reece, Coustan, & Gabbe, 2004). A study done in Kenya found out that financial burden in the society in managing diabetes and the cormobidities and related complications remains a great challenge. With high cost of care, no available and accessible blood glucose monitoring devices, drugs and hospital admissions. This results to patients and relatives incurring direct and indirect financial burden due to low productivity, loss of jobs and family resources being diverted to managing the disease (Maina, Ndegwa, Njenga, & Muchemi, 2010).

The trend of type 2 diabetes patients is on the rise and this call for more similar studies to support Mathari National, Teaching and Referral Hospital achieve its standard of care to diabetes patients. The diabetes outpatient clinic has registered 700 T2DM patients with the number increasing since 2008.

## **1.2 Statement of the Problem**

Diabetes as a condition still remains a public health burden and world wide silent pandemic in the 21st century. However a great challenge faces the management of the disease due to poor documentation and no proper reporting systems which result to many patients ending up with early onset of diabetes related complications that leads low productivity as well as premature deaths due to poor glykemic controls (Shaw, Sicree, & Zimmet, 2010). With regards to Disability Adjusted Life Years Mexico attributed to poor glykemic control reported an increase from 7.31% in 1995 to 9.21% in the year 2005 secondary to diabetes and this was mostly attributed to amputations at 2.62%, retinopathy at 5.83% and 0.94% due to neuropathy resulting to diabetic foot (Berlanga et al., 2013). There is still low availability of technology, with little or no affordable quality essential drugs which are not readily available in public health facilities. This remains key in ensuring optimal glykemic control among T2DM patients especially in Sub - Saharan Africa (Dunstan et al., 2002; Magliano et al., 2008).

Failure of patients not achivieng optimal glykemic control targets have been associated with low income, lack of proper knowledge and empowerment on self glykemic management, poor practice on diet, physical activity, inappropriate drugs and management (IDF, 2015). A recent study at the ministry of health indicated that inadequate training of primary health care workers, lack of access to essential diabetes medication and technology, low level of awareness among patients and failure to proper documentation of diabetes data has resulted to sub-optimal glykemic controls. Though there is no evidence for diabetes budget patients die from early onset of irreversible complications (Maina et al., 2010).



Kenya reported mortality increase from 6.9% to 7.2% of all deaths between the year 2000 and 2001 which resulted from Non-communicable diseases diabetes being one of them. With most studies being done in Kenyatta National and Referral Hospital which has many diabetes specialist and well funded, Mathari National Teaching and Referral hospital has no visiting or resident Diabetologist, no available drugs, no adequate technology in terms of diabetes patients annual checkups despite the increasing number of patients in the diabetes clinic who are treated by a new doctor every other visit which may lead to lack of proper continuity of care. If prompt management is not provided patients are likely to have poor glycemic controls, they are likely to have serious preventable complication like eyes, kidneys, nerves and heart diseases thus this study was conducted to determine the factors associated with glycemic control among patients attending diabetes out patient clinic.

### **1.3 Justification**

For patients to achieve optimal glycemic control regular monitoring of profile indicators (HbA1c, lipid profiles, blood glucose and urine for albumin/creatinine ratio) should be paramount. Patients not adhering to the prescribed medications, diets and physical activities may result to uncontrolled glycemia and chronic illness like heart disease and cancer burdening already overstretched health care systems (ADA, 2006). Countries in Cameroon like any other Sub Saharan African country revealed that diabetes foot ulcers is the second commonest cause of hospital re-admissions causing prolonged bed occupancy in most hospital (Kengne et al., 2006).

Most of the Diabetes studies in Kenya have focused on complications, risk factors, knowledge and practices of diabetes and socio-economic aspect although glycemic control target remains a challenge among diabetic patients. Since the clinic was started in February, 2008 with 4 registered patients, the clinic has 700 registered patients with an average of between 5 - 10 new patients a month. Being a National Hospital, there was need to undertake this study so as to find out how best the hospital through the state can improve the care as well as empowering the diabetes patient in self management.

A representative minimum sample size of 149 patients was selected to participate in the study. The findings of this study will open up opportunities for more studies, guide policy makers on the best way to successfully implement NCDs training, encourage public private partnership and mobilizing patients to participate in diabetes support group. Guidelines and control strategies in terms of equipping the facility with diagnostic and monitoring equipments for diabetes in urban settings in Kenya and other developing countries.

#### **1.4 Research Questions**

1. What are the socio-demographic and socio-economic characteristics of T2DM patients?
2. What are the profile indicators of glycemic control (Blood glucose, HbA1c, lipids and urine albumin/creatinine ratio) among T2DM patients?
3. What is the awareness and practices associated with glycemic control among T2DM patients?

## **1.5 Objectives**

### **1.5.1 General Objective**

To determine factors associated with glycemic control among type 2 diabetes patients attending Mathari National Teaching and Referral Hospital Nairobi County.

### **1.5.2 Specific objectives**

1. To determine the social demographics and social economic characteristics of T2DM patients.
2. To determine the profile indicators of glycemic control levels (Blood glucose, HbA1c, lipids, blood pressure and urine albumin/creatinine ratio) among type 2 diabetes patients.
3. To determine the awareness and practices associated with glycemic control among T2DM patients.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Global Prevalence of T2DM**

Diabetes mellitus is a chronic condition that results from disorders of insulin production and/or action in the body. Insulin is a hormone made by the pancreas that helps glucose to leave the blood and enter the cells of the body to be used for energy (WHO, 2008). With diabetes turning a global public health burden of the 21<sup>st</sup> century; there is need for the society to take precaution as the disease affects everyone regardless of age and social class. The global prevalence of people living with diabetes mellitus among adults aged 27 -79 years by 2015 was estimated to be 415 million and the number is projected to rise upto 642 million in the year 2040 if nothing is done to prevent the disease. The global economic expenditure of Diabetes by the year 2013 was estimated to be 465 billion dollars (IDF, 2015).

A study conducted in United States of America estimated diabetes management costs to the health care system \$ 245 in the year 2012, which is an average medical expenditure (CDC & NDS, 2014). World Health Organization and IDF terms diabetes as an epidemic and the leading cause of death worldwide with T2DM prevalence increasing worldwide as a result of increased longevity, sedentary lifestyles and overweight and obesity (IDF & WHO - AFRO, 2006).

There is an epidemiological transition from communicable to non-communicable diseases with the trend resulting to an increased rate of chronic conditions such as heart disease, diabetes, high blood pressure, osteoarthritis and cancer. This increase is likely to

be noticed in developing countries causing a major socioeconomic and public health crisis sooner than expected ( CDC & NDS, 2014).

A diabetes specialist from Cameroon revealed that the disease is on the rise both globally and locally particularly in Sub- Saharan Africa with every four out of five diabetes patients living in low and middle income countries (Mbanya et al., 2010).

## Diabetes: A global emergency



Estimated number of people with diabetes worldwide and per region in 2015 and 2040  
(20-79 years)



IDF Diabetes Atlas, 7<sup>th</sup> edition

**Figure 2.1: Global estimate of people living with diabetes regionally in 2015 – 2040 (27 – 79 years) (IDF Atlas, 2015).**

## **2.2 African Region aspect of T2DM**

World Health Organization estimated over seven million Africans were living with diabetes ranking it the fourth main cause of death in the developing countries. The IDF Atlas estimated that 10.8 million people were living with diabetes in sub-Saharan Africa by the year 2006 and was projected to rise to about 18.7 million come the year 2025. This is an estimated 80% increase which exceeds predicted worldwide increase of 55% (WHO, 2008).

International Diabetes Federation (IDF) projects a rise in to increase to 95% by 2010 from the current 0.5 to 3% range across the continent where Sub -Saharan Africa will experience a disease double burden on non- communicable and communicable diseases although communicable disease still dominates in many countries (Murray & Lopez, 1997).

Sub Saharan Africa still faces a gap in diabetes information as well as low cost of care which is evidenced by early diabetes complications resulting from late diagnosis, lack of essential medical attention resulting to inappropriate disease management hence heavy social economic burden of diseases catered for by patients or family diverting their resources to this care (J.-C. Mbanya & Mbanya, 2003).

With most Africans adopting western lifestyles as well as urbanization, most people have abandoned their traditional cultural practices in developing countries which included regular and vigorous physical activities, intake of high fiber and whole grain diet rich in vegetables and fruits. Thus people are relying on motorcycles and cars transport, unhealthy diets rich in fats, sugars and salts (Mbanya et al., 2010).

As the era of HIV/AIDS epidemic still remains attention to the world, recent data estimate a likelihood of similar global challenge due to high morbidity and mortality resulting from diabetes and its related complications (Merson, 2006; Roglic et al., 2005). World Health Organization estimates that, more than one-third of African women and a quarter of men to be overweight which is a modifiable risk factor to T2DM and this will rise to 41% and 30% respectively in the next 10 years further reported that most African countries, including South Africa still face a number of problems related to the management and treatment of the disease (WHO, 2008).

Lack of diabetes patients accessing the already scarce available essential drugs, uncontrolled high cost of care and inadequate diagnostic tools and above all the challenge of HIV/AIDS, tuberculosis has resulting to slowed efforts in prevention and management of both non-communicable and communicable diseases in Africa (CDC & NDS, 2014).

With the most countries suffering due to inadequate health facilities, patients end up seeking medical attention from Herbalist and with number of patients rising primary health care structure ends up not getting the right figures of disease burden (Motala et al., 2002).

The major Risk factor for diabetes remains the same in Sub-Saharan Africa either, non-modifiable, such as increasing age and ethnicity or modifiable, such as urbanization, obesity and physical inactivity. Lifestyle changes still remains an attribute of diabetes prevalence in the African regions well as urbanization resulting to many people being overweight and obesity due to physical inactivity (Monteiro, Conde, Lu, & Popkin, 2004).

With many patients not achieving their optimal glucose levels, uncontrolled blood pressure, inappropriate patients' care and follow-up, lack of adequate human resource in health care facilities, early onset of complication and lack of continuous diabetes education was found to hinder patients in achieving glycemic control (Whiting, Hayes, & Unwin, 2003). As associations play a big part in diabetes activities in diabetes management, many African countries still struggles to set diabetes strategies structures, with majority of them having no diabetes associations.

### **2.3 Kenyan (National) aspect of T2DM**

A study done in Kenya indicated that the prevalence of T2DM in the general population to be 12% in urban parts of Kenya (Christensen et al., 2009). International Diabetes Federation (IDF), estimates that in every 30 seconds, a person living with diabetes loses a limb through amputation globally. Kenya has not been spared by this pandemic as the country is faces an epidemiological transition due to technological advancements that are affecting and changing lifestyle behaviours of the populations.

For good achievement of primary prevention goals of reducing T2DM, it's critical to put emphasis on increasing the levels of physical activities and encourage regular consumption of healthy balanced diet and physical activities among the populations (Motala, Esterhuizen, Gouws, Pirie, & Omar, 2008).

Governments should come up with structures that's empower various communities from engaging in environments that favours consumption of unhealthy meals, sedentary lifestyle and physical inactivity as the end results is unmanageable co-morbidities like obesity, diabetes, cardiovascular diseases and dyslipidemia as witnessed in Kenya, Sub-



Saharan Africa and other developing countries. A double burden transition of infectious (communicable) and NCDs poses a big threat due to environmental and economic incapability of dealing with the ensuring proper approach of the disease burden. As per the WHO prediction, by the year 2020 NCD's projection will result to seven out of every 10 deaths in developing countries. It's estimated that in Kenya over two million people may be living with diabetes which is roughly a third of the actual number of diabetes cases in the country thus this calls for action (WHO, 2008).

The country may experience upto 10 million rise of diabetes cases by the year 2025 which may pose a great economic burden and public health challenge to the already strained healthcare system where people seek medical attention when the condition is already deteriorated (WHO, 2008). This is contrary to developed countries where strong medical schemes exist and frequent medical check-ups is a pillar to primary disease prevention in avoiding and delaying diabetes complications and co-omorbidity (ADA, 2014).

The greatest challenge in providing diabetes care services is because most specialist care providers are located in urban areas and therefore those in rural areas face significant challenges and thus don't receive timely, safe and quality diabetes care with referrals done when its too late (Landon, Loudon, Selle, & Doucette, 2004).

In Kenya diabetes is still on the rise and majority of people living with diabetes are elderly who face a challenge on diabetes knowledge as well as poor attitudes and practices on how to cope and manage themselves (Maina et al., 2010). Tertiary clinics within the country have reported a 4.6% prevalence of diabetic foot ulcers with poor glycemic control being a risk factors of diabetic foot ulcers followed by diastolic

hypertension, dyslipidaemia, infection and poor self-care. This calls for efficient and effective attention in managing the above risk factors in patients with or without diabetes foot ulcers in this clinic (Otieno, Vaghela, Mwendwa, Kayima, & Ogola, 2005).

#### **2.4 Clinical features of T2DM**

The key Classical presentations as a result of persistence hyperglycemia due to Diabetes mellitus include: polyuria, polydipsia, polyphagia, dehydration and blurred vision based on the cause of the disease (ADA, 2013).

#### **2.5 Diagnosis of T2DM**

For diabetes mellitus to be diagnosed confirmatory tests which are either fasting plasma glucose of 7.0mmol/l, two-hour plasma glucose (2hPG) 11.1mmol/, plasma glucose above 11.1mmol/l 2 hours after 75 glucose load or a HbA1c above 6.5%; with polydipsia, polyuria, polyphagia and unexplained weight loss (ADA, 2014). Most of T2DM patients are diagnosed at age of 40 years with many being diagnosed as early as 35 years (Ministry of Public Health and Sanitation, 2010). Rate of diabetes is high in developing countries due to increased industrialized, which leads to an estimate that in every new diabetes case diagnosed there are about 5 undiagnosed (Magliano et al., 2008). Although Glycated Hemoglobin is used for diagnoses, levels have been found to vary among different ethnic groups and race with African American have been reported to have relatively higher HbA1c (P. R. Kumar et al., 2010).

Both developed and developing countries should invest heavily to achieve good glycemic control among diabetes patients and ensure improved healthcare systems as the disease is associated with morbidity and irreversible complications which leads to

immature deaths which adversely effect the economy and growth of developing countries (J.-C. Mbanya & Mbanya, 2003).To make the right diagnosis, diffent tests of blood glucose measurement are needed which include fasting plasma glucose greater than 7.0 mmol/l or postprandial (2hours after a meal) plasma glucose greater than 11.1mmol/l (S. Kumar, Singh, Vasudeva, & Sharma, 2012).

## **2.6 Management of T2DM**

Diabetes remains incurable but can be managed following tight glyceimic controls which is key in maintaining good lipid levels, weight management and blood preassure. Diabetes patients are recommended to follow advice provided by healthcare providers like exercising,regular meal intervals as well as keeping the assigned clinic appointments (Khattab et al, 1999). Studies done in three different regions-United Kingdom Prospective Diabetes Study Group, the Diabetes Control and Complications Trial, and the Kumamoto indicated that early detection of diabetes and achieving glyceimic controls are vital inreduction of development of micro vascular complications — retinopathy, nephropathy, and neuropathy of diabetes, United Kingdom Prospective Diabetes Study (UKPDS, 1998).

The primary objective of managing T2DM can be achieved through an individual lifestyle modification through regular physical activities, healthy balance diet as well as self blood glucose -monitoring. Provision of both clinical management and self centered diabetes care to the patient considering and respecting individual needs and values. This should be done with bases that guides and regulate care giver not to jeopardize patient's rights and their values in making various clinical decisions (Stratton et al., 2000).

As much as nutritional management remains a core principal in managing diabetes, there is need to encourage patient's education and impact of the right information be emphasized for patients to have independent care (Howe & Anderson, 2003).

Knowledge on diabetes through diabetes remains a key weapon as this helps people assess their risk of developing diabetes, motivate them to seek proper treatment and care, and inspire them to take control of their disease. In the interest of communities, the countries should design and develop a comprehensive health promotion strategy for diabetes mellitus and its related risk factors. This is equally important to design and implement suitable diagnostic, management and treatment policies to ensure people with diabetes are taken care (J. C. N. Mbanya, Motala, Sobngwi, Assah, & Enoru, 2010a).

With many institutions having inappropriate screening equipments, unstructured psychosocial support therapy and uncontrolled blood sugar levels there is a risk of development of irreversible complications like blindness, amputation, heart disease and stroke which increases the mortality due to diabetes (Motala, 2002). Reports available suggests that T2DM can be prevented by identifying populations at risk, identifying and addressing the risk factors especially modifiable factors early in life. This can be achieved through lifestyle modification which include being physical activity, healthy diet, stop smoking, weight loss which proved to be more effective than drugs in preventing or delaying the onset of DM in high risk populations (J. C. N. Mbanya et al., 2010b).

## **2.7 Public Health implication of T2DM**

Diabetes is considered as one of the greatest public health challenges being faced in the 21st Century because the annual deaths estimation is 3.8 million as a result of

complications and related Co-morbidities which is distablizing both human health and resources. Unfortunately the disease has been neglected from both personal and communities with very little or no development and funding from the state parties and key stakeholders (J. C. N. Mbanya et al., 2010b). Throuought the management of this condition, prevention remains a fundamental public health goal which should be coupled with structured effective strategies in identifying high-risk populations. Although efforts to control and manage diabetes remains a challenge due to low case detection rates, patients unable to attain optimal glycemic control targets and development of co-morbidities like Dyslipedimia, Hypertension as well as high cost of care related to irreversible premature diabetes complications (WHO, 2008).

A study conducted in India revealed that there little or no data reflecting the prevalence of Diabetes Retinopathy among other micro vascular complications. This is not only a challenge in India but worldwide which will endup hindering the relevant stakeholders priorities decicion making and right policies meant to strengthens the care of diabetes. This challenges calls for continuous routine monitoring and provision of intensive management and control of modifiable risk factors to decrease the rate of retinopathy development amng T2DM patients (Mohan & Pradeepa, 2009).

Further the the study explored that rural communities in India just like any other developing countries like Kenya faces challenges like low awareness as a result of cultural beliefs and/or illiteracy, lack of diabetologists in health care facilitieswhich are not easily available and accessible due to prevailing poverty (Mohan & Pradeepa, 2009).

Due to discrimination faced by people living with diabetes from both family level and society level, psycho-social stigma, patients unable to sustain the prescribed diet by nutritionist and fear of developing complications, patients are likely to end-up having devastating psychological disorders (Lustman et al., 2000). As the patient undergo their management, in case an irreversible diabetes complication sets in, chances of one's quality of life getting impaired are always high (Holmes et al., 2000).

Diabetes has been marked as the leading cause of chronic kidney disease, cardiovascular diseases, stroke, blindness and amputations resulting from non-traumatic injuries (ADA, 2013). Diabetes prevalence is on the increase with many cases reported to be associated with increased early onset of diabetes complications among them retinopathy especially poor glycemic control causing inevitable complication (Ruta et al., 2013).

Most shocking is that the risk of an individual dying from diabetes doubles that of a non-diabetic person of the same peer group (Roglic et al., 2005). The existing insulin usage has had a tremendous change in the disease management, though in Kenya the financial strain is unbelievable. Although, on its own, diabetes is not a very expensive disease to manage, other conditions that come along with it like hypertension are quite expensive to maintain (Van Driel, De Sutter, Christiaens, & De Maeseneer, 2005). With the population increasing in the world, and poverty levels being on the rise; there is fear of ethnicity as well as security instability and HIV/AIDS thus the little resources to assist the poor cater for their medical conditions being exploited by the mighty (Turner, 2014). Despite commendable efforts by the international community to control the disease, more time is needed to curb diabetes at the current rate and diabetes remains one of the most deadly, and disabling disease in the developing World. Still more disturbing is that

unlike most other major diseases, its burden is spread across all but is responsible for the deaths of many productive individuals (Murray & Lopez, 1997).

This undermines the economic productivity of the individual and the well being of the family. The link between diabetes and diminished growth suggests that there is a role for health programs such as therapeutic means in improving not only the health of those living in the developing World, but also such individual's wealth while economic impact of diabetes follows from its characteristic age distribution (WHO, 2008).

In South Africa, majority of diabetes patients seek medical care from faith and traditional healers after or before consulting a medical practitioner unfortunately there traditional healers don't refer these patients to hospitals promptly till when its too late (Peltzer et al., 2001). It affects all age groups, but its greatest impact is on economically productive adults.

## **2.8 Socio-economic impact of T2DM**

Socio-economic aspect may influence health outcomes through individual health behaviors, access to care, and processes of care. A substantial body of literature demonstrates that in the general population, material and social deprivation are directly related to disease incidence and prevalence and inversely related to health status (Lynch, Kaplan, & Shema, 1997). Various studies have addressed the relation between socio-economic status and mortality due to development of chronic conditions (Lynch et al., 1997) such as diabetes mellitus, cardiovascular disease, and cancer. In United States of America, there has been an increased diabetes estimated cost between the years 2007 – 2012 from \$174 billion to \$245 billion which is a 41% increase (ADA, 2013). A study in

Tanzania found out that health budget allocation per person was \$2 per year and yet the diabetes of care was estimated to be \$138 per person per year (Chale, Swai, Mujinja, & McLarty, 1992). A similar study five years estimated the cost of managing complication resulting from diabetes as the second consuming outpatient medical care with the country using \$ 839,392 which was 30% of medical budget in the country(Chale et al., 1992).

Although effective therapies are available for managing diabetes, preventing and treating any complications, the care is under utilized, by people from low socio-economic status. People from high socio-economic status have been found to access quality care, social support, and community resources. It may also influence diabetes-related knowledge, communication with providers, ability to adhere to recommended medication, exercise, and dietary regimens, and treatment choices (Brown et al., 2003).

## **2.9 Microalbuminuria and T2DM**

Testing urine for albumin-to-creatinine ratio for T2DM patients reflects whether there is excretion of albumin thus being accepted as an indicator that may predicts comorbidities of public health outcomes in T2DM which include hypertension and renal failure (Brantsma et al., 2006).

Study done by the United Kingdom Prospective Diabetes Study (UKPDS) revealed that a when blood pressure is reduced from 154/87 to 144/82 mm/Hg, there is an absolute risk reduction of of 8% in patients with T2DM from developing microalbuminuria over a period of six years (UKPDS, 1998).



## **CHAPTER THREE**

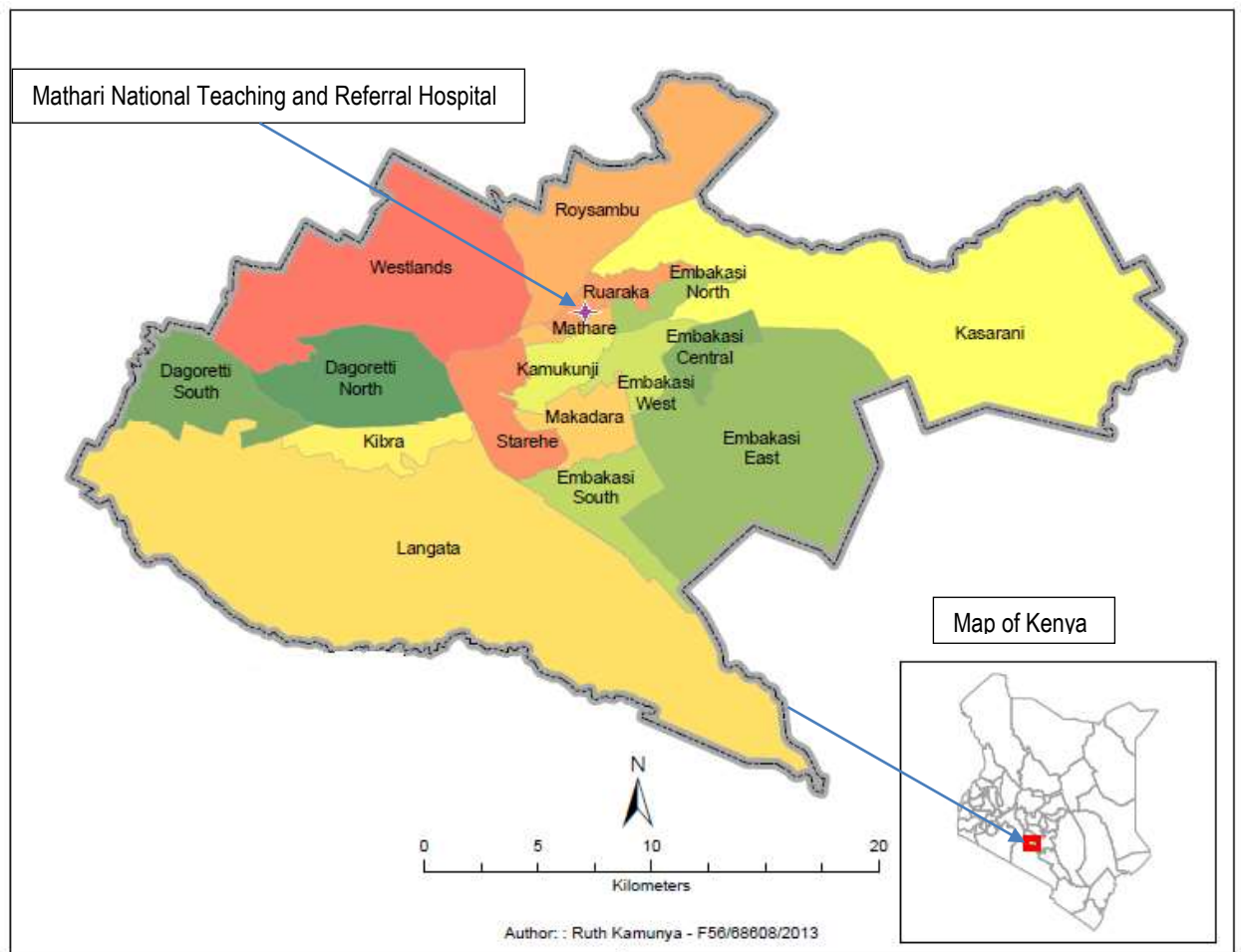
### **MATERIALS AND METHODS**

#### **3.1 Study site**

This study was conducted at Mathari National Teaching and Referral Hospital diabetes out patient clinic, Nairobi County. The hospital is situated at Mathare Hospital Ward Mathare constituency which has approximate population of 193,416 adults and about 3 square kilometers and 5 kilometers from Nairobi City Centre.

The hospital was commissioned as a National and Referral Hospital on September 2013 and it's the biggest psychiatric hospital in the country. In the year 2008 a diabetes clinic was set at the premises to ease the congestion of patients attending Kenyatta National Hospital referred from health centres within Nairobi Sub – County and surroundings. Most of the patients are referred from the general outpatient clinic after the doctor makes the diagnosis and directed to the diabetes clinic for follow-up. The clinic registers five to ten new diabetes patients a month with a total of 700 patients as per the records during the time study was conducted. The clinic had few type 1 diabetes mellitus cases (around seven cases) during the time the study was being conducted. Although the hospital doesn't have a diabetologist, different medical doctors on duty review patients on Monday and Thursday attending to an average of 14 to 15 patients. The clinic is managed by a Kenya Registered Community Health Nurse (clinic incharge) who runs the clinic daily because of walk in and triage patients before they consult the doctor on duty. There has been no study done in this facility in line with diabetes. During the clinic days, patients blood glucose test, blood pressure, weight are taken. The hospital doesn't

test for glycated hemoglobin with only those who can afford get the test done in private laboratory. There are is a general ward where those who are critically ill get admitted and discharged through the diabetes clinic for nutritional advice and diabetes education and doctors review and follow up. The medical team comprises of a doctor, two nurses, one nutritionist and students stationed at the clinic from UON medical school or Kenya Medical Training College.



**Figure 3.1: A map of Kenya indicating the study site (Source: Google maps)**

### **3.2 Study Design**

A Descriptive cross-sectional study design was adapted with both quantitative and qualitative approaches of data collection utilized among consenting T2DM patients attending Mathari National Teaching and Referral Hospital Nairobi County.

### **3.3 Study Population**

The clinic has seven hundred registered patients attending Mathari National Teaching and Referral Hospital diabetic clinic.

### **3.4 Inclusion criteria**

1. Confirmed T2DM diabetes patients.
2. Patients aged 35 years and above and regularly attended clinic.
3. Patients who were willing to participate in the study.
4. Patients who accepted and signed an informed consent.

### **3.5 Exclusion criteria**

1. Confirmed diabetic patients less than 35 years.
2. Patients who qualified but not willing to participate in the study.
3. Patients attending the health facility and are not diabetic.
4. Patients who were very sick to participate in the study.

### **3.6 Sampling Technique**

A systematic random sampling technique was used to select the minimum sample size where first subject was selected using a simple random sampling and then every fifth subject was selected for the study. Data was collected daily at diabetes out patient clinic

after recruiting participants who consented into the study until the required sample was achieved.

### 3.7 Sample size determination

The minimum sample size was determined using the (Cochran's, 1977) formula. A Study conducted in Kenya indicated that the prevalence of T2DM in the general population to be 12% in urban parts of Kenya (Christensen et al., 2009). A prevalence of 12% was used. A true proportion was determined at 95% confidence level. A ten percent (10%) was added to cater for the non response among the selected study participants (Naing, Winn and Rusli, 2006).

$$n = \frac{z^2 p q}{d^2}$$

Where

**n**= minimum sample size

**Z**= 1.96 standard deviation correspondence to 95% CI)

**p** = Prevalence of T2DM at 12% in Urban Kenya (Christensen et al., 2009).

**d** = 0.05 (Level of precision at 5%)

$$n = \frac{(1.96)^2 (0.12) (1-0.12)}{0.05^2} = 163$$

Since the target population is below 10,000 a finite correction formula was applied to get a working sample size.

$$nf = \frac{\frac{no}{N}}{1 + \frac{no-1}{N}} = \frac{\frac{163}{700}}{1 + \frac{163-1}{700}} = \frac{163}{1.23428} = 133$$

10% was added to cater for non-response.

$$n = 133 + 10\%$$

**n = 149 participants**

### **3.8 Data collection**

This study population was attending diabetic clinics at Mathari National Teaching and Referral Hospital Nairobi County. Quantitative data was collected using a structured questionnaire to capture issues such as socio-demographic and economic characteristics, awareness and practices associated with glycaemic control and lifestyles changes, among others after translation from English to Kiswahili (Appendix 2). Data was collected daily where the researcher and one research assistant administered the questionnaires with each interview taking between 30 to 45 minutes.

Qualitative data was collected using two Focus Group discussions comprising between eight to twelve members. Participants were purposively selected to participate in each of the group. First group had eleven participants 3 males and 8 females who participated in the discussion that lasted for about 45 minutes. Second group involved 10 participants (5 males and 5 females) participants respectively which captured issues on glycaemic control (Appendix 3) with the discussions taking approximately one hour. The two groups were moderated by the researcher as the assistant took notes for backup (the first group accepted to be tape recorded but the second group declined).

A Key Informant Interview with the diabetes clinic incharge was conducted using a guide (Appendix 4) which captured issues like diabetes management and challenges faced at the clinic. The interview took approximately 35 minutes moderated by the researcher and one research assistant took notes as back up.

### **3.8.1 Clinical and Anthropometric assesments**

#### **3.8.1.1 Blood pressure**

Blood pressure (mm/Hg) of each participant was determined with a sphygmomanometer. The patient sat and rested for a few minutes with the arm held at a position that is around the heart. Blood pressure was measured twice and recorded from a mean of two measurements as per (ADA, 2014).

#### **3.8.1.2 Body Mass Index (BMI)**

Heights in metres and weights in kilograms of patients were measured using a staturimeter and weighing machine respectively. A computation was done from the two measurements so as to get their respective BMI categories in accordance with (ADA, 2014).

$$\text{BMI} = \frac{\text{Weight (kgs)}}{\text{Height (m)}^2}$$

### **3.8.2 Collection and Storage of pathological samples**

#### **3.8.2.1 Blood samples**

Blood samples from the participants who consented was drawn at study site during the interview days by a trained phlebotomist from Lancet Kenya Laboratory who collaborated with the Hospital laboratory in charge. Six millilitres of blood from median cubital vein in of each participant was drawn for determining HbA1c, Fasting blood sugar and lipid profile levels.

All the selected participants were called a day before and adviced to attend the clinic without taking breakfast and their medication so as not to affect accuracy of collecting

and analyzing both fasting lipid profiles and blood sugar. A tourniquet was applied approximately 10 centimeters above the intended puncture site and tightened (tourniquet should not be left tightened around the arm for a prolonged period of time. Participants was explained that its time to draw blood as the phlebotomist smoothly insert the needle into patients vein with bevel facing upwards. The needle holder was held in position. The first plain tube was used to collect 2mls blood for lipid profile, EDTA tube collected 2mls blood for HbA1c and sodium fluoride bottle was used to collect 2mls blood for blood glucose.

The blood in each tube containing a reagent was gently mixed accordingly. Then the tourniquet was removed from the arm after drawing the last specimen. The needle was removed and discarded immediately into the sharp container and then some pressure was applied on the punctured site with a dry cotton wool until bleeding stops then an Elastoplast was applied and patient instructed to remove after. Tubes were labelled according to the participant questionnaire barcoding and file number.

Blood in the plain tube for lipid profile sample was spun (separation of cells from serum avoid haemolysis that may affect the results) this is done by centrifugation at 4000 revolution per minute gravity for 4 minutes. Specimens were packed in a cooler box which has a controlled temperature of + 2 to + 8 degrees centigrade and then transported to the laboratory for analysis. The information obtained and all the results were discussed with patient and health provider to enhance quality of care to the study participants.

### **3.8.2.2 Urine Collections**

The phlebotomist also instructed participants on how to correctly get their urine sample using sterile specimen bottles which was transported to laboratory within 2 hours from collection site for analysis. This sample was tested to determine early onset of diabetes nephropathy.

### **3.8.3 Laboratory Methods**

All the samples were analysed immediately within 3 hours as per the laid Standard Operating Protocols at Pathologist Lancet Kenya Laboratory by a qualified and registered laboratory technician using Cobas Integra 400/800 plus. This is an automated machine with a continuous random – access instrument /analyzer intended for invitro determination of clinical chemistry for serum, whole blood and urine. The machine is estimated for larger throughput workloads of approximately 200 samples per day utilising photometric analysis. Profile indicators cut offs guidelines were inline with American Diabetes Association Guidelines (ADA, 2014).

#### **3.8.3.1 Determining the HbA1c profiles**

**Test Principle** - An anticoagulant whole blood is haemolyzed automatically on a Cobas Integra 400/400 plus 800 analyzer with Cobas Integra hemolyzing reagent. The method uses Tetradecyltrimethylammonium bromide as the detergent in the hemolyzing reagent to eliminate interference from leucocytes. HbA1c determination was based on turbidimetric inhibition immunoassay for haemolyzed. Liberated Hemoglobin in hemolyzed blood was converted to derivative having characteristic absorption spectrum measured bichromatically during pre- incubation phase of Immunological reaction. Final



results were expressed as a percentage (%) HbA1c and calculated from HbA1c/hemoglobin ratio HbA1c < 6.0% / 42 mmol/L (Normal ranges) for non-diabetics and < 7.0 % / 53 mmol/mol optimal target for T2DM, (ADA, 2014).

### **3.8.3.2 Determining the fasting blood glucose profiles**

**Test Principle-** Blood glucose was analysed was tested using UV test; Enzymatic reference method with hexokinase. Results was expressed in mmols/litre. As per the International Diabetes Federation Guidelines, optimal FBS targets for T2DM between 4 - 6.1 mmol/l (110 mg/dl) was adapted by the current study (IDF, 2015).

### **3.8.3.3 Determining the lipid profiles**

**Test Principle** Lipid profile determination was done using enzymatic colorimetric method. Cholesterol esters are cleaved by action of cholesterol esterase to yield free cholesterol and fatty acids. Cholesterol oxidase then catalyzes the oxidation of cholesterol 4-en-3-one and hydrogen peroxide. The colour intensity of the dye formed is directly proportional to cholesterol concentration. The laboratory results were sent to the clinic incharge to be attached in each patient file to facilitate right clinical judgement by the healthcare team aimed at improving patient care in achieving optimal glycemic control.

### **3.8.3.4 Determining the urine for albumin/creatinine ratio profiles**

**Test Principle-** This was performed using Immunospectrometric assay. The human albumin forms a precipitate with a specific antiserum which is determined

turbidimetrically as per Kidney Disease Improving Global Outcomes Guidelines (KDIGO, 2012).

#### **3.8.4 Laboratory Quality Assurance and Control:**

This was done at Pathologist Lancet Kenya Laboratory which is accredited by South Africa National Accreditation Service (SANAS) as per the ISO MOH 62 which ensures that both internal and external Quality Control and Assurance are met.

#### **3.8.5 Research variables**

##### **3.8.5.1 Independent Variables**

The independent variables of interest were: age, gender, education levels, and occupation and duration of diabetes, comorbidities, diabetes knowledge and practice among others.

##### **3.8.5.2 Dependent Variables**

Main dependent variable was glycemic control which refers to the recommended or optimal body blood glucose levels that a person living with diabetes should maintain at anyone given point in time which was determined by the HbA1c test (Adams, 2008).

#### **3.8.6 Data Management and Analysis**

##### **3.8.6.1 Data Management**

Data was stored in electronic storage devices like hard disk, files containing the data was password encrypted. This storage was maintained before and after analysis.

### **3.8.6.2 Data analysis**

Both quantitative and qualitative approaches were used for data analysis. Quantitative data from questionnaires was coded and entered into the computer using Excel spreadsheet for computation of descriptive statistics (frequency and cross tabulations). Statistical Package for Social Scientists (SPSS) version 20 for analysis. Associations between dependent variable (HbA1c) and various independent variables were tested using Chi-Square statistics. A  $p < 0.05$  was considered statistically significance. Knowledge score for these categories with each of the correctly identified response was given a score of one point. With regards to the listed responses per category, if a respondent managed to correctly identify at least of them correctly the respondent was deemed to have good knowledge. Using median score as the cut-off point the individual knowledge scores were then categorized as good knowledge of diabetes, symptoms and complications of diabetes.

For the overall practices adherence scores, the respondent answered 'yes', 'no' or 'don't know' to a set of 6 diabetes management practices questions where Yes = 1, No and/or don't know = 0 (Maina et al., 2010). Qualitative data was categorized in themes according to the objectives after transcription and translation into English from different languages (where applicable), results was categorized into themes and presented in verbatim forms.

### **3.8.7 Ethical Consideration**

Approval for Scientific and Ethical clearance was sought from the KNH-UON Scientific Ethical Review Committee **Ref (P340/05/2015)**. The copy of approval letter and

proposal was presented to the Hospital administration (Medical Supritendant) who cleared the researcher to carry out the study in the Hospitals Diabetes Clinic. Respondents were assured that their participation was voluntary and that they were free to withdraw from the study at any time. Informed consent was obtained before administration of questionnaire and all the participants requested to allow the use of a tape recorder during the focus group and key informant discussions. Only one group accepted to be recorded.

### **3.8.8 Limitations of the Study**

The study was restricted to one site and may not be generalized to other areas with different demographic characteristics.

There was resistance from some visiting doctors who felt that it was time consuming as they had no much time to wait for the patients to be interviewd and treated.

## CHAPTER FOUR

### RESULTS

#### 4.1 Quantitative Analysis

##### 4.1.1 Sociodemographic characteristic of the study participants

The mean age of respondents was 54.9 years (SD  $\pm$  10.14; median 54) with the youngest respondent being 35 years while the oldest was 81 years. Out of the 149 patients, 67 (45.6%) were in the age group of 41 to 55 years while 59 (40.1%) were between 56 to 70 years old.

The two age groups accounted for 85.6% of the total respondents. There were 46 (30.7%) males and 103 (69.1%) females. Majority of the respondents, 112 (75.1%) resided within Nairobi County. Over 70% of the study participants, 106 (71.1%) were married at the time of the study.

Furthermore, results indicated that 63 (42.3%) had attained secondary school education while 60 (40.2%) had attained primary school education. Slightly over half the study participant, 79 (53.0 %) main occupation was self-employment and 23 (15.4 %) formally employed. (Table 4.1).

**Table 4.1 Sociodemographic characteristics of the study participants**

<b>Variables</b>		<b>n =149</b>	<b>%</b>	<b>95% CI</b>
<b>Age</b>	(Years) Mean 54.9 (SD ± 10.14) Median = 54 Min 35 Max 81)			
<b>Age Group</b>	25-40 years	11	7.5	3.74 - 13.83
	41-55 years	67	45.6	36.82 - 53.32
	56-70 years	59	40.1	31.69 - 47.93
	>70 years	10	6.8	3.27 - 11.99
<b>Sex</b>	Males	46	30.9	23.57 - 38.95
	Females	103	69.1	61.05 - 76.43
<b>Region of Residence</b>	Central	27	18.1	12.29 - 25.26
	Eastern	5	3.4	1.01 - 7.66
	Nairobi	112	75.1	67.43 - 81.87
	Nyanza	5	3.4	1.01 - 7.66
<b>Residence</b>	Urban	145	97.3	93.27 - 99.26
	Rural	4	2.7	0.74 - 6.73
<b>Marital status</b>	Single	15	10.1	5.74 -16.06
	Married	106	71.1	63.16 -78.26
	Widowed	17	11.4	6.79 – 17.64
	Divorced/Separated	11	7.4	3.74 – 12.83
<b>Religion</b>	Muslim	3	2.0	0.43 – 5.77
	Christians	146	98.0	94.23 – 99.58
<b>Education</b>	No formal education	13	8.8	4.73 – 14.46
	Primary school	60	40.2	32.32 – 48.61
	Secondary School	63	42.3	34.24 – 50.64
	Tertiary	13	8.7	4.73 – 14.46
<b>Occupation</b>	Formal employees	23	15.4	10.04 – 22.26
	Self employed	79	53.0	44.68 – 61.24
	Casual	12	8.1	4.23 – 13.65
	Unemployed	35	23.7	16.94 – 31.12

**4.1.2 Socioeconomic characteristics of the study participants**

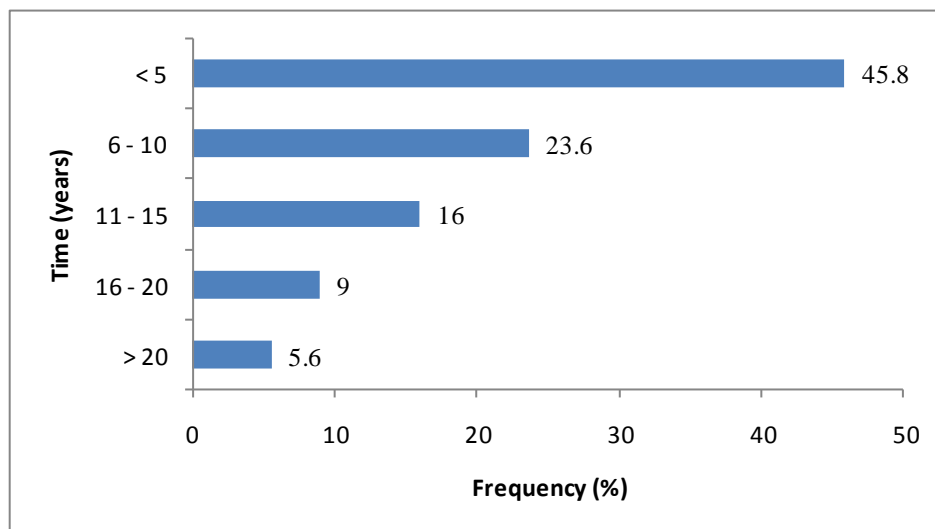
Results revealed 94 (63.1%) out of 149 participants level of income was less than Kes 10,000 a month. With regards to house ownership, 77 (52.0%) of the study participants lived in rented house while 66 (44.6%) owns their homes. The study further revealed that over two thirds 115 (77.2%) of the study participants lived in permanent houses. Most of the study participants, 67 (45.3%) lived in houses with more than 4 rooms. (Table 4.2).

**Table 4.2: Socioeconomic characteristics of the study participants**

<b>Variables</b>	<b>n</b>	<b>%</b>	<b>95% CI</b>
<b>Level of income(Kes)</b>			
< 5,000	51	34.2	26.7 – 42.44
5,001 – 10, 000	43	28.9	21.74 – 36.44
10,001 - 15,000	13	8.7	4.73 – 14.46
15,001 – 20,000	15	10.1	5.74 – 16.06
< 20,000	27	18.1	12.29 – 25.26
<b>House ownership</b>			
Housed	5	3.4	1.09 – 7.66
Rented house	77	52.0	43.36 – 59.3
Self-owned	67	45	36.82 – 53.32
<b>Type of house</b>			
Permanent	115	77.2	69.59 – 83.65
Semi-permanent	19	12.8	7.86 – 19.19
Temporary	15	10.1	5.74 – 16.06
<b>Main material of house floor</b>			
Cement	104	69.8	61.75 – 77.04
Ceramic tiles	23	15.4	10.04 – 22.26
Other	22	14.8	9.49 – 21.49
<b>House roofing material</b>			
Concrete	35	23.5	16.94 – 31.12
Iron sheets	102	68.5	60.35 – 75.82
Asbestos	3	2.0	0.42 – 5.77
Roofing tiles	9	6.0	2.79 – 11.16
<b>Number of rooms in house</b>			
1	35	23.6	16.94 – 31.12
2	35	23.6	16.94 – 31.12
3	10	6.8	3.27 – 11.99
>4	69	46.4	38.11 – 54.65
<b>Source of water</b>			
Bore hole	4	2.7	0.74 – 6.73
Tap water	137	91.9	86.35 – 91.95
Vendors	7	4.7	1.91 – 9.44
Well	1	0.7	0.02 – 3.68
<b>Source of lighting</b>			
Electricity	136	91.3	85.54 – 95.27
Kerosene	11	7.4	3.74 – 12.83
Solar	2	1.3	0.16 – 4.76
<b>Fuel for cooking</b>			
Electricity	5	3.4	1.09 – 7.66
Kerosene	23	15.4	10.04 – 22.26
Gas	91	61.1	52.75 – 68.95
Firewood	10	6.7	3.27 – 11.99
Charcoal	20	13.4	8.39 – 19.97

### 4.1.3 Duration of diabetes since diagnosis of the patients

Majority of the participants 53.2% had been diagnosed with diabetes for periods longer than five years. The mean duration since diagnosis of diabetes was 8.09 years (SD  $\pm$  6.65; median 6.5). The shortest duration since diagnosis was 1 year with the longest duration since diagnosis being 28 years. The patients most recently diagnosed with T2DM 66 (45.8%) were five years and below. (Figure 4.1).



**Figure 4.1 Duration of diabetes since diagnosis of the patients**

### 4.1.4 Knowledge of diabetes of the study participants

Diabetes knowledge among participants on signs and symptoms, risk factors and complications with a multiple response admissible. Frequencies revealed that the mostly identified symptoms was excessive urination 69.8% and excessive thirst 64.4% was the most reported sign and symptom while on diabetes risk factors inheritance was at 44.3%, stress 31.5%, unhealthy diet 22.8% while 13.4% reported that consuming of a lot sugar as a diabetes risk factor. Mostly recorded complications were Kidney failure 55.0%, Blindness 53.7% stroke 34.9% and erectile dysfunction at 30.9% (Table 4.3).

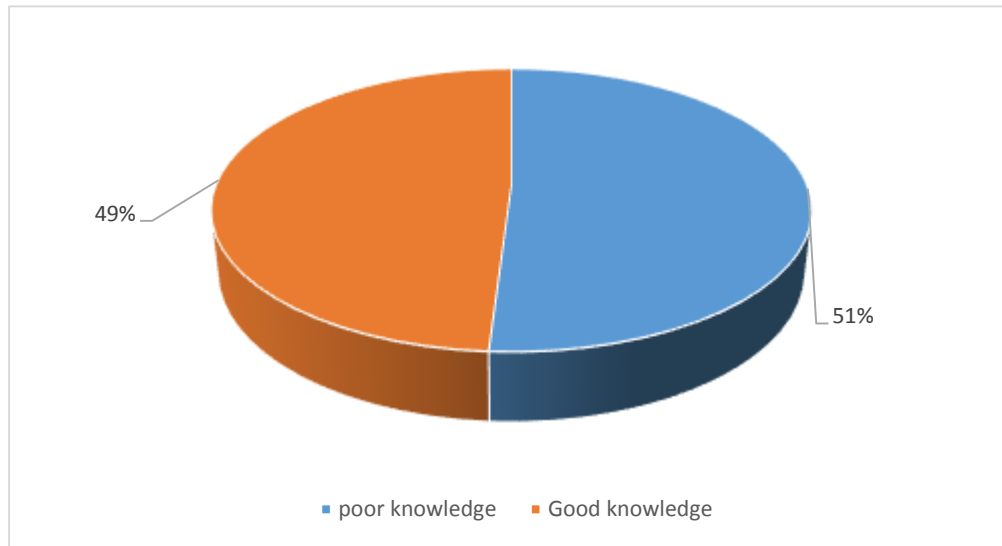


**Table 4.3: Knowledge on signs and symptoms, risk factors and complications of diabetes of the study participants**

<b>Knowledge category</b>	<b>Responses</b>	<b>n</b>	<b>%</b>
How do you tell one has diabetes ( <i>Signs and Symptoms</i> )	Excessive urination	104	69.8
	Excessive thirst	99	64.4
	Blurred Vision	76	51.0
	Fatigue	58	39.0
	Loss of weight	37	24.8
	Numbness	26	17.4
	Recurrent boils	6	4.0
	Don't know	15	10.1
Diabetes risk factors	Hereditary	66	44.3
	Stress	47	31.5
	Unhealthy Diet	34	22.8
	Overweight/Obesity	32	21.5
	Lack of exercise	27	18.1
	Excessive alcohol consumption	23	15.4
	Taking a lot of sugar	20	13.4
	Curse	10	6.7
	Over smoking	7	4.7
Don't know	23	15.4	
Diabetes Complications	Kidney failure	82	55.0
	Blindness	80	53.7
	Stroke	52	34.9
	Erectile dysfunction	46	30.9
	Amputation	40	26.8
	Heart attack	39	26.2
	Don't know	17	11.4

#### **4.1.5 Overall knowledge on diabetes of the study participants**

Results revealed a cumulative knowledge mean score from 149 participants was 7.15 (SD  $\pm$  3.35; median 6.0) with a minimum score of 1 while and a maximum score of 15. Scores below 6 was deemed poor knowledge which comprised 76 (51.0%) while those who had scored above 6 were classified as having good knowledge 73 (49.0%). The findings are presented in Figure 4.2.



**Figure 4.2: Overall level of knowledge on diabetes of the study participants**

#### **4.1.6 Management practices for diabetes of the study participants**

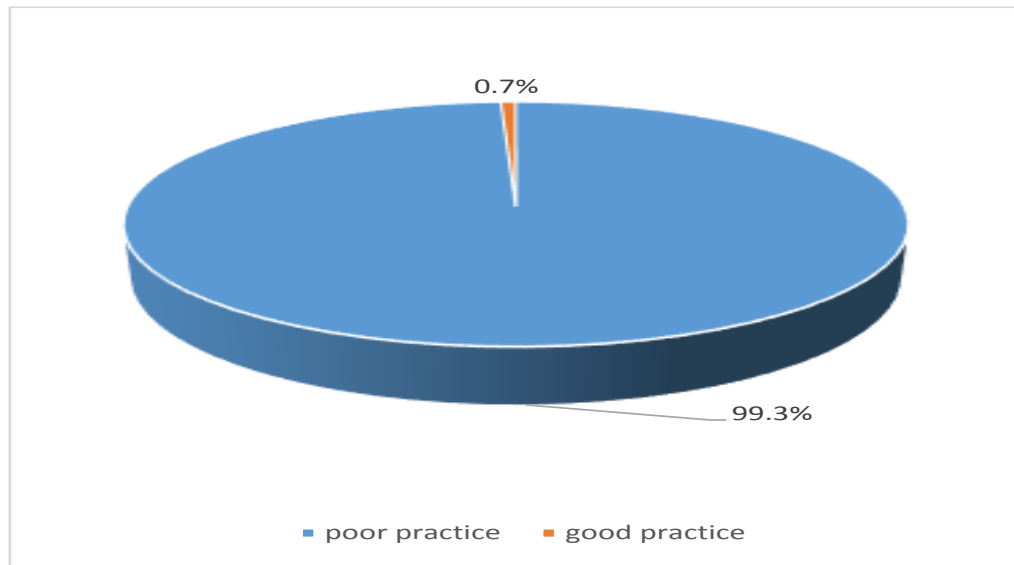
With regards to diabetes management practices, out of the 149 participants, 95 (63.8%) reported to follow recommended diet, 46 (30.9%) did not while 8 (5.3%) did not know. At least 17 (11.4%) had a clinic hotline numbers, 126 (84.6%) did not have. Over a half of the study participants 104 (69.8%) kept appointment days and 40 (26.8%) did not. Three quarters 111 (74.5%) adhered to medication, 30 (20.1%) did not while 8 (5.3%) did not know. A majority 80 (53.7%) reported to skip medications at times. Almost a half 71 (47.7%) could detected low blood sugar through symptoms, while 33 (22.1%) could not detect low sugar levels and 45 (30.3%) didn't know about low sugar levels (hypoglycemia). The findings are presented in (Table 4.4).

**Table 4.4: Management practices for diabetes of the study participants**

<b>Variables</b>	<b>Response</b>	<b>n</b>	<b>%</b>	<b>95% CI</b>
Follow recommended diet	Yes	95	63.8	55.49 – 71.47
	No	46	30.9	23.57 – 38.95
	Don't know	8	5.3	2.35 – 10.31
Have hotline number	Yes	17	11.4	6.79 – 17.64
	No	126	84.6	77.74 – 89.96
	Don't know	6	4.0	1.49 – 8.56
Keep appointment days	Yes	104	69.8	61.74 – 77.03
	No	40	26.8	19.92 – 34.71
	Don't know	5	3.3	1.09 – 7.66
Adhering to medication	Yes	111	74.5	66.72 – 81.28
	No	30	20.1	14.02 – 27.48
	Don't know	8	5.3	2.35 – 10.31
Are there times you skip medication	Yes	69	46.3	38.11 – 54.65
	No	80	53.7	45.35 – 61.89
Detect low blood sugar by signs and symptoms	Yes	71	47.7	39.41 – 55.98
	No	33	22.1	15.76 – 29.67
	Don't know	45	30.2	22.96 – 38.25

#### **4.1.7 Practice scores of the study participants**

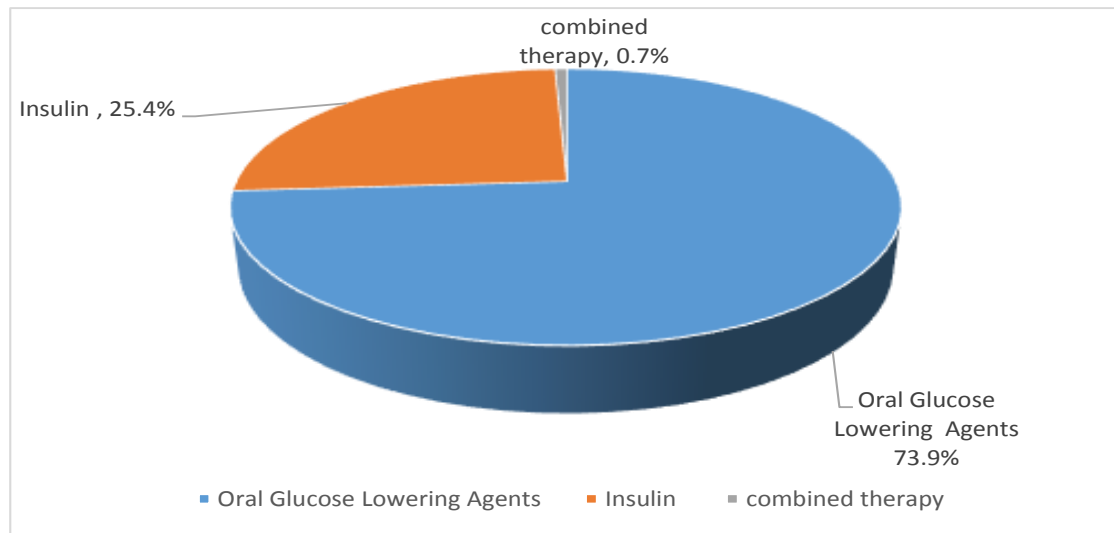
The mean score for practice was 2.26 (SD  $\pm$  1.20; median 3.00). A proportion of 0.7% from the study participants practiced at least 5 out of the 6 recommended while 13.4% practice none of the management practices. The practice score was then used to categorize the respondents as either adhering or non-adhering to diabetes management. Those who scored a score of 5 (above 80% practice score) were categorized as adhering while those with below that were classified as non-adhering. From the practice score, only 1 (0.7%) of the respondents had good practice while 99.3 had poor practice. The findings are presented in Figure 4.3.



**Figure 4.3 Practice score of the study participants**

#### **4.1.8 Diabetes medication of the study participants**

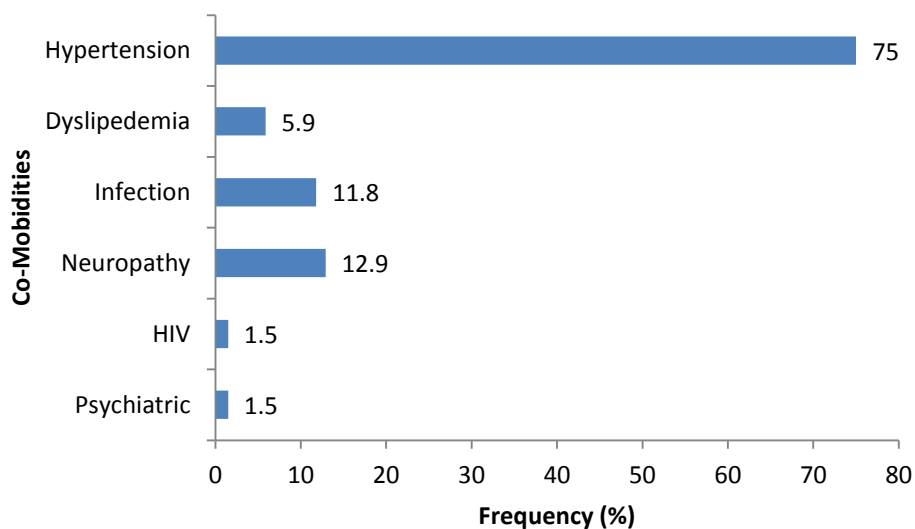
From the study participants, 142 (95.3%) reported as having been on diabetes prescription drugs with only 7 (4.7 %) not on drugs for diabetes. Among those on prescription drugs, 105 (73.9%) were on Oral Glucose lowering tablets among them Metformin, Glibenclamide, Stagliptine and Gliclazide, 36 (25.4%) were on insulin injection therapy (Mixtard and Humilin) insulins were the commonly used insulin while only 1 (0.7%) was both oral glucose lowering tablets and insulin therapy. The findings are presented in Figure 4.4.



**Figure 4.4 Distribution of diabetes medication of the study participants**

**4.1.9 Medications for other co-morbidities of the study participants**

Out of 149 study participants 71 (47.7%) were reported to be on medications for other condition other than diabetes. Majority of those on medications for other co-morbidities where 51 (75%) were on antihypertensive, 6% on Statins and 12.9% on neuropathy medications. The findings are presented in Figure 4.5.



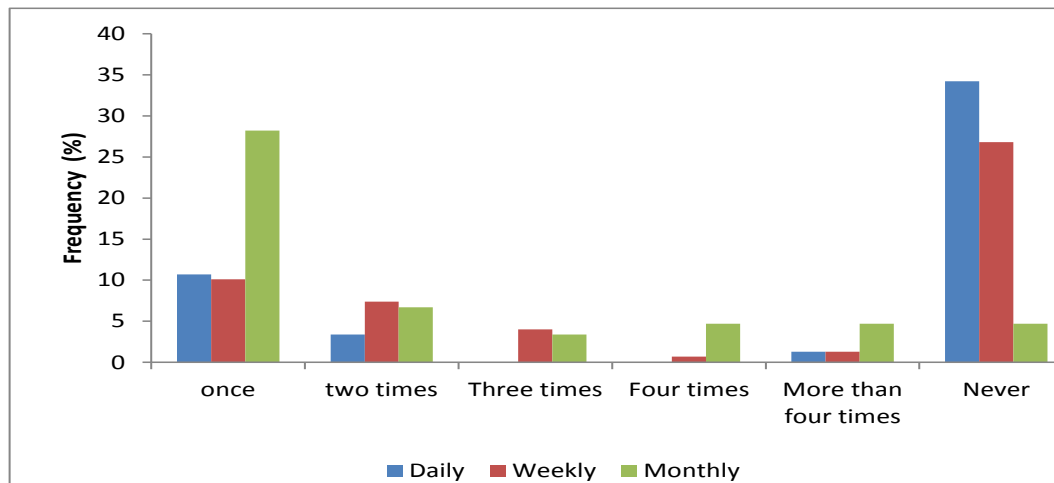
**Figure 4.5: Medications for other co-morbidities of the study participants**

#### **4.1.10 Monthly expenditure of diabetes medication of the study participants**

Out of 149 participants, majority of the respondents reported an estimated monthly expenditure of up to Kes 5,000 on diabetes management, 55 (36.9 %) spending below Kes 1,000 on diabetes management and 3.4% were reported spending more than Kes 5,000 monthly. Almost a half, 69 (46.3%) of the respondents reported to be skipping diabetes medications. The main reason for skipping was because of lack of money 43 (45.3%), 30 (31.6%) forgetting to take medication, 18 (18.7%) lack of drugs from health facility, 3 (3.3%) dislike of medications and 1 (1.1%) long distances from health facility.

#### **4.1.11 Glucose monitoring practice of the study participants**

Slightly over half of the study participants 75 (50.3%) reported that they had been advised on self-blood glucose monitoring. However, 42 (28.2%) of the study participants owned personal glucometers. The results indicated that 16 (10.7 %) of the respondents performed daily glucose monitoring, 15 (10.1%) at least once a week and 42 (28.2%) monitored at least once a month with 4.7% of the respondents reported never testing their glucose levels within a month's period. Those without glucometers reported that they monitored blood sugars during the clinic appointment days 104 (69.8%), 11 (7.4%) visited chemist outlet to take the glucose levels tests. The findings are presented in (Figure 4.6).



**Figure 4.6: Diabetes management by Glucose monitoring of the study participants.**

#### **4.1.12 Diet and exercise practices of the study participants**

With regards diabetes management 130 (87.2%) of the study participants had been advised on diet being part of management. Furthermore 99 (66.4%) of the study participants were involved in various exercises with walking/jogging being the most engaged form of exercise which accounted to 89 (76.1%).

#### **4.1.13 Profiles indicators of glyceimic control of the study participants**

Out of the 149 participants, the mean BMI was 27.9 (SD  $\pm$  4.7 kg/m<sup>2</sup>; median 27.7 kg/m<sup>2</sup>), 34 (22.8%) were within the normal ranges of BMI (18.5 to 25 kg/m<sup>2</sup>) while 111 (74.5%) were classified as over weight and obese. Results further revealed that, participants mean fasting blood sugar was 11.5 SD  $\pm$  4.8 (mmol/L) with a median of 4.8 (mmol/L) with 135 (90.6%) uncontrolled fasting blood sugars levels above 6.1 mmol/L and 14 (9.4%) had optimal targets. Participants mean blood pressure was 129/80 mm/Hg. Results from the laboratory indicated that, patients mean HbA1c was 9.1 % (SD  $\pm$  2.0; median 8.8%) from which 27 (18.1%) had good glyceimic control of < 7 % and

122 (81.9%) had poor glycemic control of > 7 %. With regards LDL 60.4% of the study participants had dyslipidemia with a mean of 3.0 mmol/L and 36.9 % had elevated Triglycerides with a mean of 1.8mmols/L SD  $\pm$  1.8mmol/L. The findings are presented in (Table 4.5).

**Table 4.5: Distribution of glycemic control profile indicators of the study participants**

Variables		Optimal targets	Min	Max	n	%
HbA1c (%)	Good glycemic	<7%			27	18.1
	Poor glycemic Mean 9.1SD $\pm$ 2.0, Median-8.87	>7%	5.0	<b>14.7</b>	<b>122</b>	<b>81.9</b>
BMI (kg/m <sup>2</sup> )	Underweight	<18.5			4	2.7
	Normal	18.5-24.9			34	22.8
	Overweight/Obese Mean 27.9SD $\pm$ 4.7,Median-27.9	> 25.0	18.0	<b>41.1</b>	<b>111</b>	<b>74.5</b>
FBS (mmol/L)	Normal range	4-6.1			14	9.4
	Hyperglycemic Mean 11.5,SD $\pm$ 4.8,Median-10.3	> 6.1	4.8	<b>24.6</b>	<b>135</b>	<b>90.6</b>
SBP (mm/Hg)	Optimal	<130			94	63.1
	Off optimal Mean 129SD $\pm$ 16,Median-130		100	200	55	36.9
DBP (mm/Hg)	Optimal	<80			103	69.1
	Off optimal Mean 80.2SD $\pm$ 10.4,Median-80		60	100	46	30.9
T.Cho (mmol/L)	Optimal	<5.0			93	62.4
	Off optimal Mean 5.1SD +1.2, Median-5.0		1.9	9.5	56	37.6
LDL (mmol/L)	Optimal	<2.6			59	39.6
	Off optimal Mean 3.0SD $\pm$ 1.0,Median-3.0		0.6	6.1	<b>90</b>	<b>60.4</b>
HDL (mmol/L)	Below optimal	>1.2			43	28.9
	Optimal levels Mean 1.3SD $\pm$ 0.4,Mediann-1.2		0.1	2.3	106	71.1
TGS (mmol/L)	Optimal	<1.7			94	63.0
	Off optimal Mean-1.8SD $\pm$ 1.4,Median-1.4		0.5	13.2	55	36.9
UACR	Normal to mildly increased	<3.0			96	64.4
	Moderately increased	3.0 - 30.0			36	24.2
	Severely increased	>30.0			16	11.4
	No results				1	0.7
	Mean 19.0SD $\pm$ 63.9 Median1.7		0.2	529.5		



#### 4.1.14 Sociodemographics and economic characteristics associated with glycemic control

Participants glycemic control was classified using HbA1c where levels < 7% good and > 7% as having poor glycemic control. Gender was significantly associated with the glycemic control (OR = 3.029, 95% CI: 1.287 – 7.129, **p = 0.010** with no statistical significance of participants education level (p = 0.322). Neither occupation nor level of income showed any statistical significance with glycemic control at a p = 0.985 and p = 0.723 respectively. Residence had no statistical significance with glycemic control (OR = 0.647, 95% CI; 0.065 - 6.475, p = 0.55). The findings are presented in (Table 4.6).

**Table 4.6: Sociodemographics and economic characteristics associated with glycemic control**

Variables		Good control < 7%		Poor control >7%		n-value	OR (95% CI)
		n	%	n	%		
Age group	<25 - 40 years	0	0	11	9.1	0.229	N/A
	41 - 15 years	11	42.3	56	46.3		
	> 56	15	67.6	54	44.6		
Gender	Male	14	51.9	32	26.2	0.010	3.029 (1.287 – 7.129)
	Female	13	48.1	90	73.8		
Marital status	Single	1	3.7	14	11.5	0.515	N/A
	Married	22	81.5	84	68.9		
	Widowed	2	7.4	15	12.3		
	Divorce/separated	2	7.4	9	7.4		
Residence	Urban	25	96.2	116	97.5	0.551	0.647 (0.065 – 6.475)
	Rural	1	3.8	3	2.5		
Household Members	<3	10	40	63	52.5	0.523	N/A
	4 – 7	14	56	53	44.2		
	>7	1	4	4	3.3		
Formal education	Informal	2	7.4	11	9	0.322	NA
	Primary	13	48.1	47	38.5		
	Secondary	12	44.4	51	41.8		
	Tertiary	0	0	13	10.7		
Work status	Formal Employed	5	18.5	31	25.4	0.985	NA
	Self employed	16	59.3	62	50.8		
	Unemployed	6	22.2	29	23.8		
Levels of Income (Kes)	<5,000	8	29.6	43	35.2	0.723	
	5,001 to 10,000	9	33.3	34	27.9		
	> 10,001	10	37.0	44	36.1		

#### **4.1.15 Profile indicators associated with glycemic control**

Results indicated no significance of both systolic and diastolic blood pressure and glycemic control (OR = 1.211, 95% CI; 0.502 - 2.918,  $p = 0.423$ ) and (1.711, 95% CI; 0.639 - 4.562,  $p = 0.201$ ) respectively although most participants (66.7% and 77.8%) with optimal systolic and diastolic blood pressure had good glycemic control. Serum total cholesterol was not significantly associated with glycemic control (OR = 1.508, 95% CI; 0.611 - 3.733,  $p = 0.252$ ). The results showed that 63% of the participants with off optimal target LDL had good glycemic control while 61.3% of the same population had poor glycemic control. There was no significance between LDL and glycemic control (OR = 0.934, 95% CI; 0.394 - 2.215,  $p = 0.529$ ). There was statistical significance between fasting blood sugar and glycemic control as 95.1% of participants with elevated fasting sugars had poor glycemic control and 29.6% with fasting blood sugar within target had good glycemic control (OR = 8.14, 95% CI; 2.541 - 26.0810,  $p = 0.001$ ). There was no statistical significance between HDL and glycemic control (OR = 1.333, 95% CI; 0.545 - 3.262,  $p = 0.34$ ). Above 66.7% of participants with optimal serum triglycerides had good glycemic control with 38.2% of participants having off optimal triglyceride levels having poor glycemic control. There was no significance between serum triglycerides and glycemic control (OR = 1.243, 95% CI; 0.515 - 2.999,  $p = 0.4$ ). With regard to urine for micro albumin creatinine ratio, 35.5% with moderate to severe levels albumin creatinine ratio had poor glycemic control although no statistical significance between the two ( $p = 0.618$ ). The findings are presented in (Table 4.7).

**Table 4.7: Profile indicators associated with glycemic control**

Variables		Good Control <7%		Poor control >7%		p-value	OR (95% CI)
		n	%	n	%		
SBP	Optimal	18	66.7	76	62.3	0.423	1.211 (0.502 - 2.918)
	Off optimal	9	33.3	46	37.7		
DBP	Optimal	21	77.8	82	67.2	0.201	1.71 (.639 - 4.562)
	Off optimal	6	22.2	40	32.8		
BMI	Underweight	0	0	2	1.7	0.752	N/A
	Normal	7	25.9	27	22.5		
	Overweight	20	74.1	91	75.8		
T-Chol	Optimal	19	70.4	74	61.2	0.252	1.508 (0.611 - 3.733)
	Off optimal	8	29.6	47	38.8		
LDL	Optimal	10	37.0	46	38.7	0.529	0.934 (0.394 - 2.215)
	Off optimal	17	63.0	73	61.3		
FBS	Normal range	8	29.6	6	4.9	<b>0.001</b>	8.14 (2.541 - 26.0810)
	Hyperglycemi	19	70.4	116	95.1		
HDL	Below	9	33.3	33	27.3	0.34	1.333 (0.545 - 3.262)
	Optimal	18	66.7	88	72.7		
TGS	Optimal	18	66.7	74	61.7	0.4	1.243 (0.515 - 2.999)
	Off optimal	9	33.3	46	38.3		
UACR	Normal	18	66.7	78	64.5	0.618	
	Moderately	5	18.5	31	25.6		
	Severely	4	14.8	12	9.9		

Key FBS (fasting blood sugar), BMI (Body Mass Index), SBP (Systolic Blood Pressure), DBP (Diastolic Blood Pressure), Total Cholesterol, LDL (Low Density Lipoproteins), HDL (High Density Liprotiens), TGS (Triglycerides), UACR (Urine for Albumin Creatinine Ratio).

#### 4.1.16 Knowlegde and other factors associated with glycemic control

Patients knowledge on diabetes mellitus risk factors, symptoms and complications was not statistical associated with glycemic control (OR = 1.117, 95% CI; 0.479 – 2.606, p = 0.486). There was a statistical significance between glycemic control and treatment for other co-morbidities (OR = 2.519, 95% CI; 1.009 - 6.288, p = **0.035**). Physical activity was not significantly associated with glycemic control (OR = 1.273, 95% CI; 0.545 - 2.971, p = 0.364). Results further showed that 74.1% of participants following the prescribed diet had good glycemic control while 64.1% of the same group had poor

glycemic control although this was not significantly associated with glycemic control (OR = 0.625, 95% CI; 0.244 - 1.600, p = 0.226). Seventy four percent 74.1% of participants following clinic appointments date, had good glycemic control while 71.2% had poor glycemic control although there was no statistical significance (OR = 0.864, 95% CI; 0.335 - 2.232, p = 0.483). (Table 4.8).

**Table 4.8: Knowledge and other factors associated with glycemic control**

Variables		Good control		Poor control		p -value	OR (95% CI)
		<7%	>7%	<7%	>7%		
		n	%	n	%		
Diagnosis period	<5 years	11	42.3	55	46.6	0.587	N/A
	6 - 10 years	9	34.6	25	21.2		
	11 - 15 years	4	15.4	19	16.1		
	16 - 20 years	1	3.8	12	10.2		
	>20 years	1	3.8	7	5.9		
Diabetes knowledge	Good	16	59.3	69	56.6	0.486	1.117 (0.479 – 2.606)
	Poor Knowledge	11	40.7	53	43.4		
Management Practice	Poor Practice	26	96.3	122	100	0.181	0.963 (0.894 - 1.037)
	Good practice	1	3.7	0	0		
Co-orbidities Medication	Yes	17	68	54	45.8	<b>0.035</b>	2.519 (1.009 - 6.288)
	No	8	32	64	54.2		
Monitor Glucose	Daily	5	33.3	18	22.5	0.56	NA
	Weekly	4	26.7	14	17.5		
	Monthly	5	33.3	40	50		
	Never	1	6.7	8	10		
Do exercise	Yes	15	55.6	70	61.4	0.364	1.273 (.545 - 2.971)
	No	12	44.4	44	38.6		
Manage low Sugar levels	Yes	13	100	55	84.6	0.142	1.182 (1.065 - 1.311)
	No	0	0	10	15.4		
Follow diet	Yes	20	74.1	75	64.1	0.226	0.625 (0.244 - 1.600)
	No	7	25.9	42	35.9		
Have hotline	Yes	3	11.1	14	12	0.602	1.087 (0.289 - 4.086)
	No	24	88.9	103	88		
Keep appointments	Yes	20	74.1	84	71.2	0.483	0.865 (0.335 - 2.232)
	No	7	25.9	34	28.8		
Diabetes expenditure Kes	<1000	11	44	44	37.3	0.333	NA
	1001 – 5000	11	44	68	57.6		
	>5000	2	8	3	2.5		

## **4.1 Qualitative Thematic Results**

### **4.2.1 Focused Group Discussion**

#### **4.2.1.1 Introduction**

Two focused group were conducted at MNTRH that comprised of both male and female discussant. The first group comprised of 12 participants (4 male and 8 female), while the second group comprised of 10 participants (5 males and 5 females). This was critical to enable the study give realistic findings upon which the emerging discussions and recommendations would be anchored.

This group had an age between 35 and 81 years and the exercise took during the month of October, 2015. The Researcher moderated the interviews while the assistant took note and noted the questions from the discussants. One group was tape recorded after they all consented to undertake the discussion while the second group declined to be recorded for reasons they could not disclose. Each FGD took approximately 45 minutes after which translation and transcription was done manually.

The study explored the views of discussants extensively on the social dynamics regarding knowledge/awareness and practices of glycemetic control among T2DM patients. The themes emerging about knowledge and various practices are discussed below.

#### 4.2.1.2 Discussants response on diabetes Knowledge

The study sought to establish the knowledge and experience regarding diabetes by asking issues related to diabetes development and feelings, signs and symptoms of diabetes.

*“The study noted that majority said that they are not aware of how one gets diabetes mellitus neither do they know the signs and symptoms as they thought it’s out of too much work sun or work they are drinking a lot of fluids. More so one discussant said that, More so on diagnosis they were only put on medication and told that they have diabetes” (FGD female 52 years).*

Although an elderly female discussant passionately observed that;

*“I felt thirsty then got a boil which took so long to heal when I went to hospital I got tested and was advised that I’m diabetic” (FGD female 60 years).*

Another discussant felt that diabetes comes about when;

*“Lack of enough insulin in the body to control (sukari) sugar levels in the body which the body need” (glucose becomes too much in the blood and turns to be poisonous in the system). Purely lifestyle, diet, exercise, body types (big body, body unable to control sugar levels)” (FGD male 68 years).*

### **Annual checkups**

The study went further on seeking from the Discussant on their Knowledge on annual glyceimic control profile indicators levels especially HbA1c, lipid profile and urine micro albumin.

The study found out that ‘over a three quarter of the discussant did not know about the above tests and have never done them. The study further established that

*“Three discussant have had their cholesterol checked and they don’t know the importance of the HbA1c, cholesterol and urine micro albumin test in glyceimic control”.*

All the participants said that whenever you get to the consultation room the doctor will only write a paper and tell you to go for laboratory tests.

They unanimously went to reveal that

*“Once the results are ready and the doctors sees them they write the prescription and you end up not knowing what was tested” (FGD discussants).*

The study also to establish from the discussant why doctors do not discuss the test results;

*“The reason was because the doctors are changed weekly and they don’t have enough time to explain the results as there are many patients to be cleared. Also, we don’t know even which tests we need to be tested or examinations needed for our condition” (FGD discussants).*

The discussant also reported that;

*“Whenever you ask, the answer is all is well now you don’t know what next and as far as the doctor give you the laboratory request without explanation how will I know and after that expensive drugs and yet you are told all is well”.*(FGD discussants).

On their feelings regarding screening for annual diabetes check up of the participants said

*“It was a benefit to them for getting all the tests done for free and they believe the results are beneficial to the doctor and a few believed its benefits them to know the average blood glucose levels for the last 3 months but in terms of interpretation, though they don’t know the benefit of the annual test in glyceimic control.*

As one discussant boldly said

*‘I only know about blood sugar check as the only test for a diabetes patient.’*  
(FGD Male 64 years).

### **Short and long term effects on uncontrolled diabetes**

The study inquired from the discussant their views on the long and short term effects of uncontrolled diabetes. One of the discussant said;

*“When the sugar levels are high there is risk of damaging the eyes, nerve, fallings and erectile dysfunction”* (FGD female 48 years).

While another discussant was emphatic that;



*“Inner organs like kidneys and eyes might get damaged”* (FGD male 54 years).  
*In fact, majority felt that diabetes causes complications which they are not specific about* (FDG discussants).

### **Preventing diabetes and its complications.**

The study sought the views of the discussant regarding the prevention of complications of diabetes. It was evident most of the discussant felt that;

*“You can even go mad because of diabetes. Lifestyle is a key cause which should be highly observed i had no diabetes at a young age but after changing my lifestyle i got the condition, when glucose is in excess in the blood there are high chances of damaging vital organs and no doctor will reverse a complication eithers.”* (FDG Male 68 years).

The discussants said that prevention of diabetes is possible by

*“Avoiding sugary products, sodas, and use of food in proportions as well as taking milk and vegetables, having the knowledge because we have known all what brings about diabetes and if there is a family history it’s good to take precautions on diet”* (FGD female 64 years).

One of the discussant strongly felt that;

*“According to my own opinion it’s good for everyone to volunteer and get tested for sugars levels as out of ignorance and lack of awareness there are very many people having diabetes and they are not aware. So, it’s vital for people to be educated on importance of testing the sugar levels and be guided accordingly and not only once for a routine just like HIV screening. As with*

*early detection it's easy to control blood sugar levels and stop complications” (FGD Female 36 years).*

Another suggested that;

*“Avoiding wounds and open skin as well as walking bare feet, putting on right shoes when walking, trimming the nails and avoid damaging the skin and eating healthy, exercising, reduce or stop taking sugary product like soda and juices, and eat small portions of starchy foods” (FGD female 48 years).*

#### **4.2.1.3 Discussants response on Glycemic control Practices**

On diabetes management, the study found out from discussants. This was critical so as to find some ways through which they were able to cope problems posed by non-communicable diseases like diabetes.

The discussants reported that

*‘We manage with food, following the prescribed diet given at the hospital and exercises’.*

The discussants also reported that most of their time is used to work and even if no work one can raise up and walk or involve in a physical activity instead of sleeping and idling. They said one can also visit and share with others. It was notable that one discussant said

*“The best way to manage the diabetes condition was ‘first accept yourself and say I have diabetes and I have accepted the condition’ (FDG male 68 years).*

In addition, another discussant stated that

*‘Accepting yourself enables you not to have a lot in mind, thus accept to take your medications and follow the advice given’.* (FGD Female 62years).

A lady discussant was more categorical where she averred that;

*“First is healthy diet, follow the advice given, Second take your prescribed medication accordingly and don’t mix with herbs, third is to learn more about the condition you are being managed for because you are researching to know more same with us lets learn more and finally exercise and reduce stress because it enables you learn your life well”* (FGD Female 48 years).

Another discussant noted that;

*“To add on that monitoring blood sugars is vital so that you may know how to use your medications. To me that is important because without testing you won’t manage properly”* (FGD Male 54 years).

*“The discussants observed that using the right diet with a lot of vegetables reduce starches and reduce animal proteins and taking the medications as prescribed. In deed ‘use the drugs properly and seek medical advice when feeling unwell as well as keeping appointment dates”* (FGD Male 54 years).

Although one discussants reported that

*“Most of diabetes patients continue to eat unhealthy foods thus so much campaign is needed as well as sensitizing the community on diabetes and its*

*management and getting the services closer to the community” (FGD Female 35 years).*

### **Communication**

The study sought to explore the views of discussants on how they got communication and other information regarding diabetes and days for attending diabetes clinic.

It was notable that ‘Majority said chemist and private clinic as the clinic days are two in a week.

Conversely, an elderly lady reported that;

*“One should avoid herbalist because he/she wasn’t there during your diagnosis thus I should follow the clinic days and advise given”.* (FGD female, 46 years).

While another middle-aged lady felt that;

*Before seeking any medical attention, I always test my glucose levels”* (FGD female, 42 years).

### **Challenges of controlling Blood glucose**

In regards to diabetes management practices the discussants expressed various challenges that hindered them in achieving the target glycemic control which are explained below.

### **Family challenges**

One elderly male discussant observed;

*“It’s so unfortunate as when you tell a family member you have diabetes they think you want money from them especially the young generation and they even avoid visiting you. They do*

*whatever they want and feel they are mature enough to take care of themselves”.* (FGD male 68 years).

While a female discussant felt that;

*“At times, they don’t even know what diabetes is and don’t even want to be associated with the sick and they feel as if you are pretending and you want money* (FGD female 56 years).

In similar opinion, a male discussant noted that;

*It’s so amazing because vegetables and fruits are very vital in managing glycaemia yet they are very expensive. As the patient take charge and control everything by ensuring you have everything in place instead of bothering people who are not interested in your sickness. Above all acceptance is a key component in ensuring optimal glycaemia.* (FGD male 68 years).

It was notable that one male elderly discussant averred that

*“So unfortunate that diabetes is a very expensive condition to manage because if you can’t manage to buy medications, laboratory charges or even buying most of the prescribed diet like brown foods needed there is a lot of expenses more than a non-diabetic case”.* (FGD male 68 years).

It was interesting that all discussant were in agreement that;

*The condition is so expensive and if you have no money you deteriorate physically and psychologically hence sugars go very high. You might even miss the medications and when you request*

*a family member to assist you, some will and others will ignore you thus it's very important to open up about the condition so as to get assisted. (FGD discussants).*

In fact, one of the male discussant felt that;

*"It's unfortunate because not every family member is willing to assist or even cooperate as you go through the suffering for example if you tell them of the type of food you are supposed to eat they don't even care. Whenever you feel hungry and the sugar levels are low they say that you are greedy. Above all the same members start making the other members that you are not sick but just pretending" (FGD male 56 years).*

### **Social challenges**

During the heated discussion, one elderly discussant remarked;

*"You have to appreciate yourself and leave those who are not interested as the society accepts those patients who have accepted themselves, but if you have not accepted yourself no one will accept you. It's unfortunate how society deals with diabetes patients as one of my friend left church and he had injected himself and forgot to take breakfast. On his way home, he started staggering and feeling weak as a result of Hypoglycemia instead of people assisting or asking his problem instead they were asking" haka kame kunywa pombe gani" (What kind of brew has he consumed) after that I became unconscious and woke up in a*

*hospital bed so it's good for the society to learn more about diabetes” (FGD male 65 years).*

It was notable that;

*“Majority said that controlling diabetes without knowing the glucose levels is hard, drugs are very expensive to buy especially the new drugs in the market as well as issues with taking food that you even don't have knowledge about” (FGD discussants).*

Nevertheless, a female discussant reported that;

*“When you borrow money from children or friends to buy medication they think that you are a conman.” (FGD female 40 years).*

While a male discussant felt that;

*“There is no enough money to buy food and spare some for drugs as most of the time the hospital pharmacy has no drugs and Doctors prescribe very expensive drugs” (FGD male 48 years).*

An elderly female discussant noted that;

*“Travelling is normally a challenge because if you are unwell or experiencing hypoglycemia, people start avoiding you during such tours and they don't understand you and hence classify you as a pretender” (FGD female, 64 years).*

The study noted that majority of the discussants said that;

*“Isolation and stigma is there among people living with diabetes, so if one is going for a journey take prior preparation so as to*

*avoid stopping overs every now and then, thus take little fluids also follow the advice given because most of the time family members and friends will end up frustrating you as it's not them suffering. (FGD discussants).*

While a female discussant felt that;

*“When you have diabetes it's a death sentence hence you are seeking for financial assistance to make yourself rich before death” (FGD female 48 years).*

Ultimately a male discussant strongly pointed out that;

*“With diabetes, don't sympathize so much rather accept and move on so don't think about it so much but live a normal life like any other person” (FGD male 56 years).*

### **Discussants were asked on how diabetes can be prevented in children**

The study went further to seek views and thought of discussant on ways that children can use to prevent diabetes. The findings are presented in the subsequent subsection.

One discussant noted that;

*“The fact that I have diabetes and aware of how I should take care of my diet, even my children should be guided on what to eat but for instance if I tell them not to use sugar they can even run away from home as they believe this is olds people disease” (FGD Female 54 years).*

While another felt that;

*“Even if they are not our children they are grandchildren. You find that these grandchildren are not ready to stop taking sugary*



*products even if you tell them they will only call you analogue.”(FGD Male 71 years).*

While on children, one discussant felt noted that;

*“I will tell them to have balanced diet if its vegetables, half a plate, quarter ugali and fruits in moderation but unfortunate they want to take Pizza and Chips Mwitu” (FGD female 52 years).*

While another male discussant suggested;

*“Cook the food as a family meal as this will make everyone to take a healthy meal. But when you tell the children to take tea without sugar they can't” (FGD male 68 years).*

Another male discussant noted that;

*“If you stop them from taking what they want to take at home they strike eating from the house” (FGD male 57 years).*

A female discussant also added that;

*“I normally prepare one family meal for everyone so that we can all eat a healthy meal although the young children are uneasy thus its government responsibility to educate the young on the importance of healthy diet” (FGD Female 58 years).*

It was notable that majority of the discussant suggested that;

*“We should put more emphasis in educating the young about diabetes especially in terms of healthy diet although it's challenging as they say diabetes is for the old. (FGD male 56 years).*

### **Ways of helping those with diabetes**

The study asked the discussants the question ‘what do you think you’re Healthcare Providers and the government should do best to assist you on managing you blood sugar levels?’

Majority of the discussants emphatically averred that

*“We would suggest that doctors should be reviewing “our medication on and off as one drug over a long duration of time might become resistance” (FDG discussants).*

All the discussants resoundingly suggested that

*“There should be a forum for counseling to diabetes patients as once you are diagnosed no one takes time with you more over you are told your sugars levels are too high while your body feels okay and such kinds of activities should continue” (FDG discussants).*

In fact, the discussants overwhelmingly stated that

*“Because the doctors are the one who knows their clients they should lead in guiding us on joining diabetes support groups to enable us get better assistance and follow-up and the government should ensure that Diabetes medications are dispensed for free like for Tuberculosis, Malaria and HIV as this the only way to ensure proper glucose control” (FDG discussants).*

In addition, majority of the discussants said that consulting clinicians should be given intensive training about diabetes care and more staffs to get employed to ease the access of these services at a community level. On the other hand, the study went on enquiring from the discussants whether they were in a diabetes support group.

*It was established that 'although they believe it's important to support each other none of the participant was in any diabetes support group. Asked why they were not in the support group; the reasons were that they don't know about existence of such groups.*

The study established that

*"Majority got a lot of information every time they go to the clinic. They also said every time they got to the clinic there was a different doctor making the follow-up an issue. Others talked of getting the information from friends. The Nurse in charge has been instrumental to them and they were unhappy she was going to study Psychiatry nursing" (FDG discussants).*

A female discussant noted that;

*"Most of the time on the radio, clinic and during the study period but never heard a government official coming up clearly to tell us the way forward furthermore herbalist say that they cure diabetes in two weeks and it's the same government that license them. The government is failings us and one is protecting us because there are even no drugs in hospitals" (FGD female 46 years).*

Another female discussant, emotionally noted that

*"There is a strong family history of diabetes in my family and two of my elder brothers were visiting herbalist after incurring a lot of expenses from buying their drugs. One of them got very ill and was taken back to the herbalist who said I do nothing to him take the patient to Kenyatta Hospital and in a weeks' time he died of Kidney failure secondary to intoxication of the herbal drugs.*

*Thus, I urge the government to close those facilities and protect its citizens)”*

(FGD female 44 years).

Moreover, another male discussant observed that;

*“The cost of drugs should be considered because if you don’t have money you can’t even buy food as well as buying cooking oils which are way very expensive. We always hear of Youth Funds, Women development fund and no men development fund and diabetes care. I challenge the government as to why they give free TB drugs which is curable and Diabetes is also a public health concern which is incurable”. (FGD male 52 years).*

#### **4.2 Key Informant Interview**

Patients support the informants observed that;

*“It’s also good for the patients to be assisted by the government and health facilities to look for ways of ensuring that all diabetes patients are provided with right drugs and done all their annual tests at the right time so as to prevent diabetes complications and improving their quality of life” (KII, 2016).*

#### **Informant’s observation on challenges facing the diabetes clinic**

The study sought to explore the challenges that the diabetes clinic faced on the study site. The was informed by the informant that;

*“Despite the fact that we try our best in giving the expected care there is no medications in the hospital thus patients are forced to do their test as well as buying their drugs out of the hospital unlike TB and malaria patients who are given their drugs for free (KII, 2016).*

The study further sought to explore views of informants and the staff on ways of enhancing quality service on diabetes care and other non-communicable diseases by the patient/ health care worker/ facility and the Government? The study established from the informants that;

*“T2DM as a non-communicable disease should be taken with a lot of seriousness because it doesn’t spare even the medical personnel’s, rich or poor thus it’s everyone right to get screened for diabetes and get early and prompt care”* (KII, 2016).

In terms of training of personnel, the informant noted that;

*“Trainings should be done also to the health professionals on diabetes care and Mathari being a National and Teaching hospital it’s the high time that the government should deploy a Diabetes specialist or train one of the doctors in the hospital”* (KII, 2016).

The informants strongly felt that;

*“More so the hospital should be provided with proper Diagnostic/laboratory equipment for ensuring that all patients are tested for their annual checkups as well as having sufficient diabetes and hypertensive drugs in the facility to enable achieve good glycemic control targets and improve quality of life among the diabetes patients”* (KII, 2016).

In conclusion, the informant averred that;

*“The hospital should always emphasis on creating more awareness by carrying outreach services to the community members and liaising with other stakeholders to collaborate in Diabetes Care”* (KII, 2016).

## **CHAPTER FIVE**

### **DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Discussions**

With the global burden of Diabetes estimate being 415 million, if no measures taken, the figures might rise to 642 by the year 2040 (IDF, 2015), Kenya like any other African country is struggling in making all the citizen achieve essential healthcare to all as per the third Sustainable development goal with most diabetics patients are facing challenges in Glycemic control management.

##### **5.1.1 Socio-demographic and socioeconomic characteristics of the study participants**

Majority of the study participants were between the age of 41-55 ; this is in line with other studies that indicated that people in age group of 50-60 years are the majority affected by T2DM (King, Aubert, & Herman, 1998). The study further found out that a higher prevalence of poor glycemic control was present in the same age group, those who were married, females gender, those who had attained secondary education, self-employed, and those who lived in urban area, those with three and below number of households members.

It was further detected that a higher prevalence of good glycemic control was exhibited by those of age group of 56 – 70 years, married, male, those who had between 4 and 7 household members, primary education, self-employed, those earned Kes 5,001 - 10,000 per month, from urban residence.

## **Glycemic control**

In this study, overall glycemic control was poor with only 18.1% of the study participants having good glycemic control while 81.9% had poor glycemic control of HbA1c > 7% with mean HbA1c was 9.1 % (SD ± 2.0). The current showed significantly high level of poor glycemic as compared to studies conducted in Chennai India which reported 78.6% having  $\geq 7\%$  (Gopinath, 2013), Saudi Arabia reporting 78% with HbA1c  $\geq 7\%$  (Harrabi, Al Harbi, & Al Ghamdi, 2014), in Cameroon and Guinea showing 74% of HbA1c  $\geq 7\%$  (Camara et al., 2015). Interestingly studies carried out in Germany and Japan showed 45% and 65% respectively having managed to achieve optimal HbA1c targets for T2DM patients. The current findings however were slightly lower compared to ADA Guidelines report (2008) that 26.3% of T2DM had good glycemic control. The difference between the current study findings and that of developed countries (Germany and Japan in this case) could be as a result of knowledge difference of participants between developing and developed countries, lack of uniform guidelines for assessing and management of glycemic control for physicians to set the cut off, and health insurance and the difference in health insurance access and coverage at primary care (Ali, Bullard, Imperatore, Barker, & Gregg, 2012; Islam et al., 2015). Despite of self glucose monitoring not being statistically associated with glycemic control ( $p = 0.56$ ), continuous glucose monitoring American Diabetes Association recommends that routine HbA1c after every three months and self blood glucose monitoring to be a vital aspect in achieving optimal glycemic control and thus prevent episodes of hypoglycemia and other longterm complications (ADA, 2017).

### 5.1.2 Factors associated with glycemic control

Gender, using drugs for other co-morbidities and fasting blood sugar (FBS) were found to be important factors associated with glycemic control. Poor glycemic control was significantly higher in females than in males which is in line with a previous study by (Kautzky-Willer, Kosi, Lin, & Mihaljevic, 2015) where women with T2DM had significantly higher HbA1c levels. Significantly fewer women achieved target HbA1c levels of less than 8% compared to men. The current study further found that gender was statistical significance with glycemic control majority of women 90 (73.8%) had poor glycemic control which contrasted with other studies that showed no significant association (Brice Reynolds, Walker, Campbell, & Egede, 2015). Using drugs for other comorbidities was found to be significantly associated with glycemic control which was in line with the study by (Eticha T, 2016). The study further found a significant association between FBS and glycemic control with a  $p = 0.001$  with a similar study in Chennai India showing an association between fasting blood sugar and glycemic control (Laxmikanth, Siddiqui, & Neha, 2013). The study further found no significance between BMI and glycemic control although the mean BMI was 27.9 kg/m<sup>2</sup> with most participants being overweight or obese. This concurred with a study done in Malaysia (Abougambou & Abougambou, 2015) and was contrary to a study done by (Nichols, Hillier, Javor, & Brown, 2000) which indicated a significance of BMI and glycemic control. In that same study, disease duration was significantly associated with glycemic control which was not the case in the current study findings  $p = 0.587$ . With regards to the current study findings, there was no statistical significance between age and glycemic control which was similar to a study conducted in India that reported no



correlation between age and glycemic control (Gopinath B et al., 2013). Obesity has been reported as a factor associated with poor glycemic control among T2DM may hinder managing and controlling patients' glycemic levels (M. Khattab, Khader, Al-Khawaldeh, & Ajlouni, 2010).

The study found no significant association between participants age ( $p = 0.229$ ), LDL ( $p = 0.529$ ), HDL ( $p = 0.34$ ) and systolic blood pressure ( $p = 0.423$ ) and diastolic blood pressure ( $p = 0.201$ ) although around 6% of the participants have been put on Statins, more than 60% of them had dyslipidemia whichs make a diabetic patient to be 2 -5 times higher risk of coronary artery disease and other macrovascular disorders non a non – diabetic person (MPHS, 2010). This was consistent with (Firouzi, Barakatun-Nisak, & Azmi, 2015). Hypertension being a cardiovascular risk factor to T2DM patient was, three quarters of the study participants were on antihypertensive which enabled them to attain mean BP of 129/80mm/Hg, optimal target recommended by Kenya National Clinical Guidelines for Management of Diabetes Mellitus, Ministry of public health and Sanitation (MPHS, 2010). With regards to T2DM, dyslipidemia is a coronary artery disease and macro vascular disorders risk factor and 2-5-fold than in non-diabetic subjects, less than 6 % of the patients were on lipids medication although 37.6% and 60.4% had optimal total cholesterol and LDL. This was supported by the FGD group members who unanimously said:

*“The reason was because the doctors are changed weekly and they don't have enough time to explain the results as there are many patients to be cleared. Also, we don't know even which tests we need to be tested or examinations needed for our condition”* (FGD discussants).

The discussants unanimously went further saying:

*“Whenever you ask, the answer is all is well now you don’t know what next and as far as the doctor give you the laboratory request without explanation how will I know and after that expensive drugs and yet you are told all is well”.*(FGD discussants).

This was also backed up by the informants strongly said that;

*“More so the hospital should be provided with proper Diagnostic/laboratory equipment for ensuring that all patients are tested for their annual checkups as well as having sufficient diabetes and hypertensive drugs in the facility to enable achieve good glycemic control targets and improve quality of life among the diabetes patients”* (KII, 2016).

This could also be due to the fact that over half of the participants were reported to be skipping their medication. The Key informant also had this to say

*It’s also good for the patients to be assisted by the government and health facilities to look for ways of ensuring that all diabetes patients are provided with right drugs and done all their annual tests at the right time so as to prevent diabetes complications and improving their quality of life”* (KII, 2016).

### **5.1.3 Knowledge and Practices**

From the current study 51% of participants had good knowledge on diabetes (causes, symptoms and complication) while 49% had poor knowledge. Despite the good level of

knowledge among the study participants, 99.3% had poor practice methods in controlling their glucose levels.

The participants' knowledge level was pretty good although the practice was poor, this showed no significance between diet, exercise and glucose monitoring with glycemic control. This was in contrast with similar studies that showed that self-management behaviors were associated with poor glycemic control (Angamo, Melese, & Ayen, 2013; M. Khattab et al., 2010; Sanal, Nair, & Adhikari, 2011). Lifestyle modification remains a pillar in diabetes management which encompasses dietary habits, physical activities, weight loss, quitting smoking and alcohol cessation so as to reduce the risk of cardiovascular diseases. (Model, 2015). Another study in Malaysia showed the knowledge and glucose monitoring as determinants of glycemic control among T2DM patients (Wijesinha, 2007). On the same note an FDG discussant quote that:

*“So, unfortunate that diabetes is a very expensive condition to manage because if you can't manage to buy medications, laboratory charges or even buying most of the prescribed diet like brown foods needed there is a lot of expenses more than a non-diabetic case”.* (FGD male 68 years).

While

*“Majority said that controlling diabetes without knowing the glucose levels is hard, drugs are very expensive to buy especially the new drugs in the market as well as issues with taking food that you even don't have knowledge about”.* (FGD discussants).

The clinic in-charge also noted that

*More so the hospital should be provided with proper Diagnostic/laboratory equipment for ensuring that all patients are tested for their annual check - ups as*

*well as having sufficient diabetes and hypertensive drugs in the facility” (KII, 2016).*

She aggressively said that:

*“The hospital should always emphasis on creating more awareness by carrying outreach services to the community members and liaising with other stakeholders to collaborate in Diabetes Care” (KII, 2016).*

## **5.2 Conclusions**

Based on the specific objectives from the current study of T2DM patients attending Mathari National Teaching and Referral Hospital, Nairobi County; following conclusions were arrived at;

- First, majority of the study participants were between 41- 55 years, female, living in urban areas, married, Christians, had attained secondary school education, were self-employed and earned less than Kes 5,000 a month.
- Second, over three quarter of the study participants (81.9%), had poor glyceimic control with a mean HbA1c of 9.1%. The current study revealed female gender was more affected than their male counterpart.
- Third, 75% of the participants on the current study were being treated for hypertension and 6% on statins (although 37.6%, 60.4%, 71.1% and 36.9% had off optimal levels (dyslipidemia especially high LDL) of TC, LDL, HDL and TC respectively). Moreso gender, fasting blood sugar and treatment for other cormorbidities were found as factors significantly associated with poor glyceimic control in the current study.

- Finally most of the participants had relatively good knowledge 73 (49.0%). although the study found out that their practices were poor.

Half the participants had good knowledge on diabetes but 99% had poor practice.

### **5.3 Recommendations**

Based on the conclusion of this study, it can be recommended that;

- First, measures must be put in place to promote education for diabetes patients, emphasize more on self-care practices especially to women. The government needs to improve availability of channels that will improve the livelihoods of patients through self-help groups and entrepreneurship. Above all ensure men are sensitized to improve their health seeking behavior as well as taking services closer to the community.
- Second, the large proportion of patients' poor glycemic controls being at worrying level need immediate address. Thus routine monitoring of HbA1c, Lipids and Urine for albumin creatinine ratio and hypertension as this will ensure early detection of comorbidities as well as prevention on early onset of complications by ensuring prompt controls of FBS. This will enable the clinicians prescribe the right drug on time and ensure proper managements as per the National Diabetes Guidelines.
- Third, strategies need to be laid down to curb poor glycemic control through improving diabetes knowledge, improving diabetes care management of the patients, strict self-care and self glucose monitoring by making it possible for patients to get affordable glucose meters, healthcare seeking behaviors and

training of specialized healthcare professional on Diabetes. Kenyan government should support and embrace training and research in healthcare sector so as to ensure evidence based policy making for better decision making at both National and County level.

- Finally, continuous diabetes education should be paramount to every diabetic patient as well as the general public to enlighten everyone on the need of ensuring good glycemic control through awareness programs and need to put into practice what one has been advised on with an aim of reducing the burden of poor glycemic control resulting to early onset of diabetes complications.

Support and improve optimal glycemic controls among diabetes patients so as to avoid or delay both short and long term complications like nephropathy, neuropathy and blindness among others. With regards to which HbA1c, Lipid profiles and Urine for Albumin Creatinine ratio should be made routine and accessible by patients at clinical practice.

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## **APPENDICES**

### **Appendix 1: Participant Consent Information Form**

**Title of the study: Factors Associated with Glycemic Control among Type 2 Diabetes Patients Attending Mathari National teaching and Referral Hospital, Nairobi County.**

#### **Investigators**

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### **PART A**

#### **Introduction**

My name is James Ngoyo, a Master's Science student in Public Health from faculty of Health Sciences, Jomo Kenyatta University of Agriculture and Technology (Principle Investigator).

You are invited to participate in this study. You have been selected as a possible participant in this study. We ask that we read and explain this form to you as you ask any questions you may have before agreeing to be in this study. Improved diabetes care has resulted to good health and reduced chances of complications among patients. This study is about factors associated with glyceamic control among type 2 diabetes patients attending Mathari National Teaching and Referral Hospital in Nairobi County.

### **Purpose of the Study**

The purpose of this study is to determine the factors associated with glyceamic control among type 2 diabetes patients attending Mathari National Teaching and Referral Hospital Nairobi County. The study will provide important information on the circumstances surrounding blood sugar control among patients. The study findings will help in informing policies and programs to facilitate better management, control and implementation of the set guidelines for diabetes patient.

### **Study procedures**

If you agree to take part in this study, you will be interviewed on various issues such as socio-economic and demographic characteristics, awareness and practices of blood glucose control among others. You will be directed in an identified room for your blood sample collection to test 3 – 4 months average blood sugar (HbA1c), cholesterol and blood sugar levels. In order to get exact and correct measurements from your blood sample it is very important that you will be fasting. Please ensure that you have not eaten or been drinking anything for at least 8 hours before the blood test is done. Please do not take your oral anti diabetic medication or insulin until after the blood measurement has been taken. Any other medication you can take as usual, if necessary with a small

amount of water. A tourniquet will be applied on your arm and will be requested to fold your long-sleeve attire and cooperate for blood to be drawn by a phlebotomist. Please wait with medicines that should be taken with food until after the blood measurements. You will also be requested to use the toilets and get a urine sample for Microalbumin levels.

**Risk, Stress or Discomfort:** There are no foreseen risks associated with this study but slight discomfort blood sample is drawn from your vein for testing the 3 - 4 months average blood sugar (HbA1c), Cholesterol levels and blood sugar levels.

### **Benefits**

You will benefit by knowing your HbA1c levels (this estimates you're past three months average blood glucose levels), Lipid profile levels and micro albumin levels which will guide your doctor to appropriately advise regarding to improve your diabetes care. All the results will be put in individual patients files. You will be given a copy and test results. The policy makers in the hospital will also use the results of my study in lobbying for diagnostic materials and capacity building. The study will also benefit the society in terms of awareness which will enhance prevention and control of diabetes mellitus.

### **Right to refuse or withdraw:**

Your participation is voluntary. You may withdraw from this study at any time without any penalty.

### **Confidentiality**

Data, including questionnaires and files from the study, will be kept in locked cabinets during the study. Your data and specimen will be labeled only with your study code, not

your name. Your identity will be kept confidential. Only you and the doctor who will access your laboratory results.

### **Costs**

There is no cost to participate in this research study.

Do you have any questions?

Do you agree to participate in the study?

### **Voluntary nature of the study**

Participation in this study is voluntary. If anything is not clear or if you need further information, we shall provide it to you. Your decision whether or not to participate in this study will not affect your current or future relations with this facility or the other institutions involved.

### **Contacts and Questions**

The researcher conducting this study is James Nduati. You may ask any questions you have now, or if you have questions later, kindly contact him through this number: 0721258854, e-mail [jamngoyo@yahoo.com](mailto:jamngoyo@yahoo.com) or the following:

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If in case you have a question concerning your rights of participation, you should contact; The Chairman, **Kenyatta National Hospital/University of Nairobi Research and Ethics Committee, Prof. A.N Guantai telephone number 2726300 ext. 44355/44102**

You will be given a copy of this form to keep for your records.

## **PART B: CONSENT FORM**

### **Declaration of the participant**

I Miss, Mrs \_\_\_\_\_ (study participant) have read/been read to the information in **PART A** and had the opportunity to ask questions and all were answered satisfactorily. I understand the aim of the study and what will be required of me if I take part in the study. The risks and benefits if any have been explained to me. I understand that at any time that I may wish to withdraw from this study I can do so without giving any reason and without affecting my work.

I realise that I will be interviewed once. I consent voluntarily to participate in this study.

Signature or left thumb print \_\_\_\_\_

Date \_\_\_\_\_

Name of Investigator: \_\_\_\_\_

Signature of Investigator: \_\_\_\_\_

Date \_\_\_\_\_

## **Kiambatisho 1: Fomu ya idhini (Consent form in Swahili)**

**Mada ya utafiti: Vipengele vinavyohusishwa katika kudhibiti (Glycemic) kati ya wagonjwa wa aina ya pili ya ugonjwa wa kisukari wanaopokea matibabu katika hospitali ya rufaa ya Mathari kaunti ya Nairobi.**

### **SEHEMU A**

#### **Utangulizi\Utambulisho**

Jina langu ni James Ngoyo, mwanafunzi wa shahda ya uzamili katika kitivo cha sayansi ya afya chuo kikuu cha Kilimo na teknolojia cha Jomo Kenyatta. Ninaendeleza utafiti kuhusu vipengele vinavyohusishwa katika kudhibiti (Glycemic) kati ya wagonjwa wa aina ya pili ya ugonjwa wa kisukari wanaopokea matibabu katika hospitali ya rufaa ya Mathari kaunti ya Nairobi

#### **Lengo la Utafiti**

Lengo la utafiti huu nikutathmini vipengele vinavyohusishwa na udhibiti wa (glycemic) kati ya wagonjwa wa aina ya pili ya ugonjwa wa kisukari wanaopokea matibabu katika hospitali ya rufaa ya Mathari kaunti ya Nairobi. Utafiti huu unalenga kupata taarifa muhimu kuhusu mzigo unaowakabili wagonjwa wa kisukari na jinis unavyo waathiri wenyewe na jamii kwa jumla; huku ukitoa taratibu za udhibiti wa vipimo vya (glycemic). Aidha matokeo ya utafiti huu yatasaidia katika uundaji wa sera na miradi ya kusaidia katika udhiiti wa wagonjwa wa kisukari na pia utekelezaji wa sera zenyewe

#### **Utaratibu wa utafiti**

Ukikubali kushiriki utafiti huu, utahojiwa kuhusiana na masuala kadhaa kama masuala ya kijamii na uchumi, tabia za kidemografia, matibabu, mzigo wa ugonjwa wa kisukari

kwa wagonjwa, hali ya maisha miongoni mwa masuala mengine. Ili kuweza kupata matokeo sahihi ya vipimo vyako vya damu, ni muhimu sana usile chochote, tafadhali usitumie dawa wala au sindano aina ya insulin asubuhi siku hiyo ya vipimo vya damu. Tafadhali hakikisha kuwa huli kitu chochote au kunywa kwa angalau masaa 8 kabla hujatolewa damu. Ikiwa unatumia dawa zingine zozote unaweza kumeza kama kawaida ukitumia maji kidogo. Tafadhali usubiri kumeza dawa zinazomezwa na chakula mpaka umemaliza kupimwa damu.

### **Madhara, Dhiki au Kero**

Hakuna madhara yoyote ambayo tunatarajia yatatokana na utafiti huu ila tu kero la kuchukua sampuli ya damu kutoka mwilini mwako kusaidia kupima viwango vyako vya sukari mwilini katika kipindi cha miezi mitatu iliyopita na kupata vipimo vya sasa.

### **Manufaa**

Kuna uwezekano hutapata manufaa yoyote wewe binafsi iwapo utashiriki utafiti huu bali utasaidia kutoa taarifa muhimu zitakazosaidia jamii kwa jumla kuendeleza juhudi za kujikinga kutokana na ugonjwa wa kisukari tofauti na matibabu na katika uundaji wa sera

### **Hiari**

Ushirikiano wako ni wa hiari. Uko radhi kuuliza watafiti maswali kabla ya kukubali kushiriki na hata hapo baadaye.

### **Uaminifu (Confidentiality)**

Data pamoja na fomu hojaji na faili zozote zinazohusiana na utafiti zitahifadhiwa kwenye sefu zinazofungwa wakati wa utafiri huu. Data yako itatambulishwa kwa kodi wala sio jina lako. Hatutakutambulisha.



## **Ada**

Hakuna ada za kushiriki utafiti huu.

Una swali lolote?

Unakubali kushiriki utafiti huu?

## **Uhiari wa utafiti huu**

Kushiriki utafiti huu ni kwa hiari yako mwenyewe na una haki ya kukataa kushiriki au kutojibu swali unalohisi linahujumu hali yako ya kawaida. Iwapo utabadili nia ya kushiriki una haki ya kujiondoa wakati wowote na kama kuna kitu ambacho hukielewi au unahitaji taarifa zaidi tutakupa. Uamuzi wako wa kushiriki au kutoshiriki utafiti huu huataathiri uhusiano wako wa sasa na wa hapo baadaye na kituo hiki au vituo vingine vinavyhusika. Ukiamua kushiriki una haki ya kujiondoa bila kudhuru uhusiano huo.

## **Mawasiliano na Maswali**

Anayeendesha utafiti huu ni James Nduati. Uko radhi kumuuliza swali lolote wakati wowote kupitia kwa nambari yake ya simu: 0721258854, Barua pepe jamngoyo@yahoo.com au kupitia kwa watu wafuatao:

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### **Dr. Eva Njenga**

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+254726119729

Maswali yoyote yanayohusiana na haki yako kama mmoja wa washiriki wa utafiti yaelekezwe kwa: **Mwenyikiti, Hospitali Kuu ya Rufaa ya Kenyatta/ Chuo Kikuu cha Nairobi Research and Ethics Committee, Prof. A.N Guantai Nambari ya simu 2726300 ext. 44355/44102.**

**Utapewa nakala ya fomu hii uweke katika hifadhi zako**

**SEHEMU B: FOMU YA IDHINI**

**Ungamo la Mshirika**

Mimi \_\_\_\_\_(mshirika wa utafiti) Nimesoma / nimesomewa maelezo ya utafiti huu na nimepewa nafasi ya kuhoji na kutaka ufafanuzi kwa lolote linalohusiana na utafiti huu, nimehoji, na nimeridhika kwa jawabu nilizopata. Naelewa fika kuwa wakati wowote nitakapotaka kujiondoa kutoka kwa utafiti naweza fanya hivyo bila kutoa sababu zozote na bila kuadhiri kazi yangu. Naelewa kuwa nitahojiwa mara moja na nakubali kwa hiari yangu kushiriki utafiti huu

Sahihi au alama ya kidole: \_\_\_\_\_ Tarehe: \_\_\_\_\_

Jina la mtafiti / msimamizi / mfanyakazi wa uwanja: \_\_\_\_\_

Sahihi: \_\_\_\_\_ Tarehe \_\_\_\_\_

**Appendix 2: Questionnaire**

**This questionnaire will be used to collect data for Type II Diabetes patients at the study site. The information (data) from the respondent will be handled confidentially without discrimination of any participants.**

**Participant Code...../2015 Venue:** Mathari National Teaching and Referral Hospital, Nairobi County

**Date.....Time.....**

<b>A. Social Demographics and Social Economic</b>		
<b>Variables</b>	<b>Response</b>	<b>Code</b>
1.Age (years)		
2.Gender	Males	1
	Females	2
3. Region of residence		
4. Marital status	Single	1
	Married	2
	Widowed/	3
	Divorced/Separated	4
5. No of people in the household		
a) Among them how many are below 18 years of age?		
b) How many are above 18years of age		
6.Religion	Muslim	1
	Christian	2
	Others (Specify).....	
7.Residence	Urban	1
	Rural	2

8. Formal Education Level (choose one from the categories)	Informal Primary school Secondary school Tertiary	1 2 3 4
9. Which of these best describe your main work status (choose one from the categories)	Formal employed Self-employed Casual Unemployed	1 2 3 4
10. Level of income per month (Kshs) (choose one from the categories).	<5,000 5,001 – 10,000 10,001 – 15,000 15,001 – 20,000 > 20,000	1 2 3 4 5
11. House in regard to ownership	Housed Rented House Self owned	1 2 3
12. What type of a house do you live in?	Permanent Semi Permanent Temporarily	1 2 3
<i>Main material of the house floor</i>	Cement Ceramic tiles Others (specify).....	1 2 3
<i>Main material of the house roof</i>	Concrete Iron sheets Asbestos sheet Roofing Tiles	1 2 3 4
<i>Main material of the house walls</i>	Wood /Timber Plywood/Cardboard Stone /Brick walls	1 2 3

	Cement blocks	4
	Ironsheets	5
	Others (specify).....	6
13. Number of rooms excluding toilet/ bathroom?	One room	1
	Two room	2
	Three rooms	3
	More than 3 rooms	4
14 (a). What is your source of water?	Borehole	1
	Tap water	2
	Vendors	3
	Wells	4
b)How much is a 20 litres container of water( <i>shillings if you buy</i> )	Below 50	1
	51- 100	2
	Above 100	3
15.What is your main source of light	Electricity	1
	Kerosene	2
	Solar	3
16.What do you mostly use for cooking	Electricity	1
	Gas	2
	Firewood	3
	Charcoal	4
	Kerosene	5
<b>B. Knowledge and practice - Profile Indicator Levels</b>		
17. When were you diagnosed with diabetes? (state year and month)		
<b>18.</b> What do you think are the risk factors of diabetes mellitus ( <i>more than one choice is allowed</i> )	Hereditary	1
	Stress	2
	Unhealthy diet	3

	Overweight/obesity	4
	Lack of exercise	5
	Excessive alcohol consumption	6
	Taking a lot of sugar	7
	Curse	8
	Over smoking	9
19. How would you tell that someone has diabetes? ( <i>more than one choice is allowed</i> )	Excessive urination	1
	Excessive thirst	2
	Blurred vision	3
	Fatigue	4
	Loss of weight	5
	Numbness	6
	Recurrent boils	7
	Don't know	8
20. Which of the following best describes complications associated with diabetes ( <i>more than one choice is allowed</i> )	Kidney failure	1
	Blindness	2
	Stroke	3
	Erectile dysfunction	4
	Amputation	5
	Heart attack	6
	Don't know	7
21. Which of the following do you know and practice?	No	1
a) Exercise for at least 30 minutes every day.	Yes	2
	Don't Know	3
b) Detect low blood sugar levels through signs and symptoms and manage	Yes	1
	Yes	2
	Don't Know	3
c) Follow the recommended diet?	No	1

	Yes	2
	Don't Know	3
d) Have a hotline number in case of an emergency?	No	1
	Yes	2
	Don't Know	3
e) Keep appointments days per doctors' advice?	Yes	1
	No	2
	Don't Know	3
f) Adhering to the prescribed medication	Yes	1
	No	2
	Don't Know	3
<b>Medication</b>		
22(a) Are you taking any prescription drugs for diabetes?	Yes	1
	No	2
b) If yes what drugs do you use?	Glucose lowering Agents	1
	Insulin	2
	Both	3
	Others (specify).....	
23(a). Are you on any other medications?	Yes	1
	No	2
b) If yes what are other condition are you managing	Hypertension	1
	High Cholesterol	2
	Infection	3
	Others (Specify).....	
24)Can you estimate your monthly diabetes expenses(Kshs)	Below 1000	1
	1001 – 5000	2
	Above 5000	3
25(a) Are there times you skip/miss	Yes	1

your medicines?	No	2
b) If yes why?	Lack of money	1
	Distance to the hospital	2
	Lack of drug in the hospital	3
	Forget	4
	Don't like taking drugs	5
	Others	
	(specify).....	
<b>Diet</b>		
26. Has your health care provider advised you on diet management?	Yes	1
	No	2
<b>Blood glucose monitoring -Awareness and Practices</b>		
27(a) Do you have a glucometer	Yes	1
	No	2
b) Have you been adviced on self glucose monitoring	Yes	1
	No	2
If yes how often do you test Daily	Once	1
	Two times	2
	Three times	3
	Four times	4
	More than four times	5
	Never	6
Weekly	Once	1
	Two times	2
	Three times	3
	Four times	4
	More than four times	5
	Never	6
Monthly	Once	1



	Two times	2
	Three times	3
	Four times	4
	More than four times	5
	Never	6
c)If you don't have a glucometer where do you monitor your blood glucose from?	During clinic, days	1
	During diabetes support group	2
	Chemist/ private clinics	3
<b>Practice on Exercise</b>		
28(a). Are you involved in any exercises	Yes	1
	No	2
b) If yes what is the nature of your exercises?	Walking	1
	Swimming	2
	Cycling	3
	House work	4
	Climbing stairs	5
	Gardening	6
	Others (Specify).....	
29. For the last 7 days, how many days did you do at least 30 minutes of physical activity (Total minutes of accumulative activity including walking, gardening, swimming, climbing stairs, housework)	One day	1
	Two – three days	2
	Four – five days	3
	Six - seven days	4

**Thanks for participation**

**Kiambatisho 2: Fomu Hojaji (Questionnaire in Swahili)**

**Fomu hojaji hii itatumika kukusanya data kuhusu wagonjwa wa aina ya pili ya ugonjwa wa kisukari katika eneo la utafiti. Taarifa kutoka kwa mwenye kujibu fomu hojaji hii itawekwa kwa usiri na washirika hawakubaguliwa.**

**Tarehe.....Eneo la utafiti:** Mathari National Teaching and Referral Hospital, Nairobi County

**Kodi.....**

<b>A. Maelezo ya Demografia</b>		
<b>Maswali</b>	<b>Jibu</b>	<b>Kodi</b>
1. Umri (Miaka)		
2. County		
3. Jinsia	Kike	1
	Kiume	2
4. Hali ya ndoa	Sijaoa\olewa	1
	Nimeoa\olewa	2
	Mjane	3
	Tumetalikiana/Tumeachana	4
5. Dini	Mkristo	1
	Muislamu	2
	N\yinginezo (fafanua).....	
6. Makaazi	Mjini	1
	Vijijini	2
7. Kiwango chako cha elimu ni kipi?	Sijasoma	1
	Shule ya msingi	2
	Shule ya upili	3
	Elimu ya juu	4
.Jibu gani ifutayo inaeleza	Nimeajiliwa	1

bora kazi unayoifanya	Amejiajiri mwenyewe	2
	Kazi bila malipo	3
	Hana ajira	4
9. Kiwango cha mapato ya kila mwezi (Kshs)	< 5,000	1
	5,001 – 10,000	2
	10,000 – 15,000	3
	15,001 – 20,000	4
	> 20,000	5
10.Nyumba unayoishi	Nafasi ya kulala	1
	Kukondisha	2
	Nyumba yangu binafsi	3
11. Nyumba iko na vyumba vingapi isipokua bafu na choo?	Chumba Kimoja	1
	Vyumba viwili	2
	Vyumba vitatu	3
	Zaidi ya vyumba vitatu	4
12. What type of a house do you live in?	Permanent	1
	Semi Parmanent	2
	Temporary	3
13.Njia gani yenye huwa unapata maji ya kunywa	Maji ya mfereji	1
	Mtoni	2
	Kisima	3
	Kununua	4
14.Huwa unanuua mtungi wa lita 20 shillingi		
15. Unatumia mwangaza wa ai ana gani?	Nguvu ya umeme	1
	Mafuta ya taa	2
	Sola	3
16.Unatumia nini kupika	Nguvu ya umeme	1
	Gesi	2
	Kuni	3

	Makaa	4
<b>B. Ufahamu na mazoea</b>		
17. Ulipatikana na ugonjwa wa kisukari mwaka gani		
18. Unaelewa vipi kuhusu visabambishi vya ugonywa wa kisukari	Uzito kuzidi	1
	Utumiaji wa pombe kupita kiasi	2
	Kisukari kwa uko	3
	Kutofanya Mazoezi	4
	Uvutaji sigara	5
	Kutokula chakula bora	6
	Mawazo mingi	7
	Kula sukari kwa wingi	8
	Laana	9
19. Unawezaje kufahamu dalili za kisukari?	Kupoteza mizani	1
	Kutoona vizuri	2
	Kukojoa saana	3
	Kunywa maji mingi	4
	Kufa ganzi	5
	Kupata jivu kila mara	6
	Kuchoka saana	7
	Sijui	8
20. Ni gani kati ya haya huelewa madhara ya kisukari?	Kuharibika kwa figo	1
	Kupotea kwa macho	2
	Kupooza	3
	Kupungukiwa na nguvu za kiume	4
	Kukatwa viongo za mwili	5
	Mshtuko wa moyo	6
	Sijui	7
21. Ni gani kati ya hizi		

unafahamu na kutimiza?		
a) Kufanya mazoezi angalau kwa dakika 30 kila siku	Ndio La Sijui	1 2 3
b. kugundua na kutibu sikari ikishuka	Ndio La Sijui	1 2 3
c) Kufuata maagizo ya chukula?	Ndio La Sijui	1 2 3
d) Kuwa na nambari ya simu wakati wa hatari?	Ndio La Sijui	1 2 3
e) Kafuata siku za kliniki?	Ndio La Sijui	1 2 3
f) Kufuata magizo ya dawa	Ndio La Sijui	1 2 3
<b>Matibabu</b>		
22(a) Unatumia dawa zozote za kisukari?	Ndio La	1 2
b) Kama ndio ni dawa zipi?	Tembe za kupunguza sukari Insulini Zote mbili	1 2 3
23(a). Huwa unatumia dawa zingine isipokua za kisukari?	Ndio La	1 2
b) Kama ndio ni za kutibu ugonjwa gani?	Msukumo wa damu Mafuta ya damu	1 2

	Mengine (taja).....	
24. Unaweza kujua matumizi ya matibabu yako kwa muda wa mwezi mmoja?	<1000	1
	1001 – 5000	2
	> 5000	3
25(a) Kuna wakati hupita mbila kutumia dawa zako?	Ndio	1
	La	2
b) Kama ndio sababu ni zipi?	Kukosa pesa	1
	Safari ya mbali kufika hospitali	2
	Kusahau	3
	Sipendi kutumia dawa	4
<b>Vyakula</b>		
26. Ushawahi elekezwa juu ya lishe mbola?	Ndio	1
	La	2
<b>Kupima sukari kwa damu</b>		
27(a). Uko na machine ya kujipima sukari kwa damu	Ndio	1
	La	2
b) Ushawahi elekezwa umuhimu wa kujipima sukari	Ndio	1
	La	2
Kama ndio unapima mara ngapi Kwa siku	Moja	1
	Mbili	2
	Tatu	3
	Nne	4
	Zaidi ya mara nne	5
	Sijawahi pima	6
Kwa Wiki	Moja	1
	Mbili	2
	Tatu	3
	Nne	4
	Zaidi ya mara nne	5

	Sijawahi pima	6
Mwezi	Moja	1
	Mbili	2
	Tatu	3
	Nne	4
	Zaidi ya mara nne	5
	Sijawahi pima	6
<b>Mazoezi</b>		
28(a). Unafanya mazoezi yoyote	Ndio	1
	La	2
b) Kama ndio unafanya mazoezi ya aina gani?	Kutembea	1
	Kuogelea	2
	Kuendesha basikeli	3
	Kazi za nyumba	4
	Kupanda ngazi	5
	Gardening (Mengine (taja).....)	6
29. Kwa muda wa siku saba zenye zimeisha, ni siku ngapi ulifanya mazoezi kwa wastani dakika 30 (muda wa kufuatanisha zoezi kama Kutembea, Kuogelea, kulima, kupanda ngazi ama kazi za nyumbani)	Siku moja	1
	Siku mbili – siku tatu	2
	Siku nne –siku tano	3
	Siku sita -Siku saba	4

**Ahsante Sana kwa ushirikiano wako.**

### **Appendix 3: Focus Group Discussion guide**

#### **Introduction**

Good morning/ afternoon. My name is James Nduati from Jomo Kenyatta university of Agriculture and Technology. I'm doing a study on factors associated with the glycemic control and thanks for accepting to participate in this discussion. First, I want to thank you all for taking the time to be with us today. With me is my assistant \_\_\_\_\_. Who will be take notes and be here to assist me if I need any help if you have any specific questions about diabetes or the health department.

#### **I. Diabetes Knowledge /Awareness**

How do you get it?

Can a diabetes patient live a normal active life? What are some of the long and short term effects?

#### **II. Management of diabetes**

Probe- Diet, physical activities, glucose monitoring, medication, self discipline, behavioral changes, joining a diabetes support group and family involvement, annual check and keeping my clinic days. At what point, should you seek medical attention?

#### **III. Prevention**

How can diabetes be prevented?

What would you suggest your children do to prevent getting diabetes?

What are things you can do to prevent complications from diabetes?

#### **IV. Control**

What are the challenges that you face putting into practice the advice you were given?

Family



Finances

Social support / social situations

**HbA1c and Cholesterol test**

Do you know about the above tests and what this they tell you?

When did you had this test done?

**V. Communication**

Where do you go incase you are unwell and the clinic is closed

What do you think your doctor should do best to assist control glucose levels?

Are you in a diabetes support group?

Where do you get diabetes information from?

**Closing**

Thank you all for taking the time to participate today. The information you provided is extremely helpful and will be used to help clinic provide better care in the clinic and programs for you and others like you in the future.

### **Kiambatisho cha 3: Fomu ya uhojaji kwa kikundi**

#### **Utangulizi**

Naomba niwasalimie Hamjambo. Kwa majina ni James Nduati kutoka chuo kikuu cha kiliko na teknolojia cha Jomo Kenyatta. Nafanya utafita kuhusu vitu ambazo huzabambisi kudhibiti kwa sukari kwa damu, nachukua hii nafasi kuwapongeza kwa kujihushisha na hiki kikao. Nika msaidizi wangu atakaye nisaidia kuandika yale mabo muhimbu tutakapo jadiliana na kasha atachukua maswali kuhusu yale tutaongea.

#### **I. Maelezo ya kisukari**

1. Ningependa tungee kuhusu kisukari. Tuseme Mimi rafiki yako na sifahamu kisukari ni nini, Utanielekezaje kuhusu?

Vyenye mtu hupata kisukari?

Kana kwamba mtu wakisukari anaweza kuishi maisha ya kawaida?

Madhara ya kisukari?

#### **II. Kujimudu kwa kisukari**

Kwamfano nimegunduliwa na kisukari utanisaidiaje nijikudu kiafya?

Chakula, mazoezi, kupima sukari, kutumia dawa, kuwa na nidhamu, kubadiri mienendo, kujiunga na kikundi cha watu wa kisukari na pia kutekeleza familia, vipimo za kila mwaka and kwenda hospitali kulingana na maagizo ya daktari.

Na pia ni katika wakati gani napaswa kuona daktari ata kama siku ya clinic haijafika?

#### **III. Kuzuia**

Kwa kawaida mtu anawezaje kujizuia kupata kisukari?

Unaweza kuhimiza watoto wako wafanye nini kujizuia kisukari?

Ni madhara gani huketwa na kisukari na huzuiwa namna gani?

#### **IV. Control**

Kwa kawaida ni vitu gani hukusaidia kufanya haya mambo?

i) Familia      ii) Pesa                      ii) Jamii ama marafikia

Maana na kuwa na sukari imedhimitiwa ni gani?

Huwa unatimiza haya mambo namna gani?

Ni nini huwa unafanya kuhakikisha sukari yako iko kwa hari ya kawaida?

Unajuaje kenye unapaswa kufanya?

#### **3. Kipimo cha HbA1c**

Hiki kipimo kinatufahamisha nini?

Ulipimwa hiki kipimo lini mwisho?

#### **V. Mawasiliano**

Huwa untimbiwa wapi wakati unaumwa na kliniki imefungwa?

Ungelipenda vipi kusaidiwa na madaktari wako ili uweze kujimudu kiafya?

Ni kipi ungependelea serikali ifanyie wagonjwa wa kisukari?

Huwa mko kwa kikundi cha wagonjwa wa kisukari?

Ni wapi na ni vipi ungependelea kupata mawasiliano kuhusu kisukari?

#### **Kufunga**

- Tunapokaribia kufunga ningepomba mwenye swali jambo lolote aulize?
- Nawashukuru nyote kwa muda wenu na kuwa watulifu. Hu ujumbe ni wamaana na utatumika na madaktari kuangalia baadhi ya njia mwafaka kuwahudumia wagonjwa wa kisukari.

#### **Appendix 4: Key Informat Interview Guide English/Swahili**

##### **HEALTHCARE WORKER**

Good morning/ afternoon. My name is James Nduati from Jomo Kenyatta university of Agriculture and Technology. Im doing a study on factors associated with the glyceimic control and thanks for accepting to participate in this discussion. I will be take notes for assisting me in my research findings.

What are the key challenges that you face as you learn the clinic?

What is the number of staffs you have at the clinic and their designations?

In a clinic day, how many patients do you see in a day?

According to your experience what should be done to improve the quality of diabetes care by the patient/ health care worker/ facility and the government?

Thank you all for taking the time to participate today. The findings will be shared with you so as to identify areas that need to be improved.

##### **Kiambatisho 4: Fomu ya usajili kwa afisa wa afya**

###### **Utangulizi**

Naomba niwasalimie Hamjambo. Kwa majina ni James Nduati kutoka chuo kikuu cha kiliko na teknolojia cha Jomo Kenyatta. Nafanya utafita kuhusu vitu ambazo huzabambisi kudhibiti kwa sukari kwa damu, nachukua hii nafasi kuwapongeza kwa kujihushisha na hiki kikao. Ningeomba kuuliza maswali inayuhusu huduma ya wagonjwa wa kisukari.

Ni changamoto zipi wewe hukumbana nazo katita shughuli za kuwahudumia wagonjwa wa kisukali?

Kliniki yenu iko na wafanyi kazi wangapi? Wanatosha ama hawatoshi?

Kwa siku moja huwa mnahundumia wagonjwa wangapi?

Wagonjwa wakipewa siku za clinic huwa wanakuja ama hawaji? Na nini hufanya wasije?

**Ahsante Kwa muda waka na nitawapa majibu ya utafiti wangu.**

## Appendix 5: Glycemic Control Indicators and Anthropometric measurements

### Examination Form

Date and time of sample collection..... Code.....

Age..... Sex.....

### **BLOOD TESTS**

**Weight..... Height..... BMI.....**

**1. FBS..... (Mmols/l)**

**2. HbA1c..... (%)**

**3. Blood pressure (mm/Hg)**

**4. Lipid Profile.....**

**5. Urine for Microalbumin.....**

## Appendix 6: Approval Letter by Ethics and Research Committee committee, KNH/ UON-ERC



UNIVERSITY OF NAIROBI  
COLLEGE OF HEALTH SCIENCES  
P O BOX 19676 Code 00202  
Telegrams: varsity  
(254-020) 2726300 Ext 44355



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Website: <http://erc.uonbi.ac.ke>  
Facebook: <https://www.facebook.com/uonknh.erc>  
Twitter: @UONKNH\_ERC [https://twitter.com/UONKNH\\_ERC](https://twitter.com/UONKNH_ERC)



KENYATTA NATIONAL HOSPITAL  
P O BOX 20723 Code 00202  
Tel: 726300-9  
Fax: 725272  
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/303

9<sup>th</sup> July 2015

Ngoyo James Nduati  
Reg. No. TM310-2875/2014  
JKUAT

Dear James

### Research proposal – Factors associated with Glycemic control among Type 2 Diabetes patients attending Mathari National Teaching and Referral Hospital, Nairobi county (P340/05/2015)

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 9<sup>th</sup> July 2015 8<sup>th</sup> July 2016.

This approval is subject to compliance with the following requirements:

- a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN ERC before implementation.
- c) Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN ERC within 72 hours of notification.
- d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN ERC within 72 hours.
- e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
- g) Submission of an *executive summary* report within 90 days upon completion of the study  
This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN ERC website [www.erc.uonbi.ac.ke](http://www.erc.uonbi.ac.ke)

Protect to discover

Yours sincerely,



**PROF. M. L. CHINDIA**  
**SECRETARY, KNH/UON-ERC**

c.c. The Principal, College of Health Sciences, UoN  
The Deputy Director CS, KNH  
The Chair, KNH/UoN-ERC  
The Assistant Director, Health Information, KNH  
Supervisors: Prof. Simon Karanja, Mr. Lawrence Muthami, Dr. Eva Njenga

Return to director



**Appendix 7: Clearance Letter by Mathari National Teaching and Referral Hospital Administration**

**MATHARI HOSPITAL**

**CLEARANCE TO UNDERTAKE RESEARCH IN MATHARI HOSPITAL**

TO: 1/6, DIABETIC CLINIC Dates 20/7/15

This is to inform you that (name/no. of students)

JAMES NDUATI NGIYO

TM 310-2875/2014

From (Name of training institution)

JKUAT JOMO KENYATTA

UNIVERSITY OF AGRICULTURE & TECHNOLOGY

Has/have been cleared by the office of the Medical Superintendent to undertake research at Mathari hospital

from 20/7/15 to August 2015

Please accord them/him/her the necessary support.



In-Charge C.M.E.D

## Appendix 8: Manuscript Publication



www.symbiosisonline.org  
www.symbiosisonlinepublishing.com

Research Article

Journal of Endocrinology and Diabetes

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### Factors Associated With Glycemic Control among Type 2 Diabetes Patients Attending Mathari National Teaching Hospital, Nairobi Kenya

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#### Abstract

**Introduction:** Type 2 Diabetes mellitus is chronic metabolic disorder characterized by hyperglycemia resulting from insulin secretion, insulin action, or both and accounts for over 95% cases globally. Uncontrolled diabetes may result to complications (retinopathy, nephropathy, neuropathy leading to amputations, stroke, heart attack and sexual dysfunction), glycated hemoglobin below 7.0% is recommended for good prognosis. The study determined factors associated with glycemic control, among T2DM patient attending Mathari National and Referral Hospital Nairobi, Kenya.

**Method:** A descriptive cross-sectional study design was used systematic random sampling technique to select 149 study subjects T2DM patients. Quantitative data was collected using a structured questionnaire for socioeconomic and patients practice. Key informants interviews and Focus group discussions collected qualitative data.

Blood samples were drawn for HbA1c, lipid profiles, blood sugar and urine for microalbumin Creatinine Ratio analysis. Data was analyzed using Statistical Package for Social Sciences version 20 (SPSS). Descriptive analysis was used to summarize the data. Associations between variables were tested using Chi Square statistics. Qualitative data was analyzed thematically after translation and transcription. Difference between parameter estimates were deemed statistically significant at  $p < 0.05$ .

**Results:** The mean age of study participants was 54 years and a total of 122(81.6%) out of 149 participants had poor glycemic control with a mean HbA1c of 9.1 (0.8), having elevated FBS, 37.6% with elevated T-Chol and 60.4% having high LDL levels. Twenty four percent had moderately increased UACR while 11.4% had severely increased UACR. Gender (OR3.029, 95%CI: 1.287-7.129,  $p=0.010$ ), FBS (OR=8.14, 95%CI: 2.541-26.3710,  $p=0.001$ ) and using drugs for other co-morbidities (OR=2.519, 95%CI: 1.009-6.288,  $p=0.035$ ) were associated with glycemic control.

**Conclusions:** There is a high burden of poor glycemic control among T2DM patients in Mathari National Teaching and Referral Hospital especially women. With the burden of diabetes increasing, emphasis on diabetes awareness and education to fill in the practice gap in glycemic control. Managing FBS and detecting other co-morbidities like hypertension, kidney problems and dyslipidemia to be done routinely to prevent development of complications.

**Keywords:** Glycemic Control, Type Two Diabetes, HbA1c

#### Abbreviations

FBS: Fasting Blood Sugar; T-Chol: Total Cholesterol; HDL: High Density Lipoproteins; LDL: Low Density Lipoproteins; TGS: Triglycerides; SBP: Systolic blood Pressure; DBP: Diastolic blood pressure; BMI: Body Mass Index; UACR: Urine for Albumin Creatinine Ratio; Kes: Kenya Shillings; OR: Odds Ratio; CI: Confidence Interval; %: Percentage; MNH: Kenyatta National Hospital; DON: University of Nairobi; ERC: Ethical Review Committee; FGD: Focus Group Discussion

#### Units of Measurements

Mmol/L, Kgs/m<sup>2</sup>, Mg/dm<sup>3</sup>, mmol/Lg %.

#### Introduction

Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Prolonged hyperglycemia due to diabetes may result to long-term irreversible organ damage like dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels [1].

In the start of 20th century the disease was not considered a medical priority in Africa unlike today where the world is facing a fast growing number of people living with diabetes with a big number coming from low resource settings regions. Studies done have demonstrated increased incidences in diabetes mellitus [2].

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