NON-ADHERENCE TO MEDICATION AND INFLUENCING FACTORS IN TYPE II DIABETES MELLITUS PATIENTS AT GATUNDU LEVEL 5 HOSPITAL IN KIAMBU COUNTY

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Non-Adherence to Medication and Influencing Factors in Type II Diabetes Mellitus Patients at Gatundu Level 5 Hospital in Kiambu County

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DECLARATION

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

Signature……..Date…….

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This thesis has been submitted for examination with our approval as University Supervisors

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DEDICATION

I want to dedicate this thesis to my loving husband, Charles and our children Jaden, Ariella and Atarah. Thank you for your support and cheering me on as I pursued this achievement.

To my parents and parent-in-laws, thank you for your constant prayers and encouragement as well as stepping in to support with the children as I focused on completion of my studies. I thank God for you always.

I dedicate this to my brothers and sisters who are ever by my side, for their encouragement in the completion of my studies.

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ABBREVIATIONS AND ACRONYMS

ADA	American Diabetes Association
DM	Diabetes Mellitus
FBS	Fasting Blood Sugar
HbA1C	Glycated Haemoglobin
IDF	International Diabetes Federation
MOH	Ministry of Health
MOPC	Medical Outpatient Clinic
NCDs	Non-Communicable Diseases
OGLAs	Oral Glucose Lowering Agents
OGTT	Oral Glucose Tolerance Test
RBS	Random Blood Sugar
T2DM	Type 2 Diabetes Mellitus
WHO	World Health Organization

DEFINITION OF TERMS

Adherence is the degree to which a person's medication taking behaviour, commitment to a diet and /or the execution of lifestyle changes aligns with the approved recommendations as suggested by a healthcare provider

Glycemic Control refers to the typical blood glucose levels in a person living with diabetes mellitus

Medication Adherence refers to the extent to which a person takes medication as agreed upon and advised by a healthcare provider

Non-Adherence refers to the state where a patient does not initiate or continue care as advised by the health practitioner.

Non-Communicable Diseases refers to a disease that is not transmissible directly from one person to another. They could be acute or chronic.

Self-care is the inclusion of activities undertaken at the individual, family and community levels intended to enhance general health, prevent diseases, limit illnesses and restore health

ABSTRACT

Type-2 diabetes mellitus is recognized as a key non-communicable disease affecting over 425 million people globally, with only half of them currently diagnosed. One key indicator of mortality associated with type-2 diabetes is poor adherence to the prescribed medication. The aim of this study was to assess the burden of non-adherence to medication and its associated factors among Type 2 diabetes mellitus patients seeking care in Gatundu Level 5 hospital targeting men and women attending the medical outpatient clinics for diabetes management. The study used a cross-sectional study design. Convenience sampling technique was employed for participant selection and inclusion into the study. A random blood sugar (RBS) measurement - was taken at the beginning of the study and adherence to medication was tracked using an adherence card and pill counts for a month. The results showed that 31 (31.6%) of the participants were between 60-69 years, 70 (71.4%) were married and 66 (67.3%) were female. In addition, 37 (37.8%) had diabetes for more than 8 years, 70.6% had hypertension and 83.7% were prescribed tablets as initial treatment. Majority of the respondents constituting 80.7% had high adherence to prescribed diabetes medication regimen, knowledge on diabetes treatment (p=0.009). Participants ability to detect low blood sugar levels through signs and symptoms and to self-manage it had significantly higher adherence to antidiabetic (p=0.001). The level of education was associated with medication non-adherence. However, this association did not reach statistical significance. There was a positive correlation between knowledge on shaking and fast heart rate and effect of exercise on blood sugar level (r = 0.246, p-value=0.014), (r = 0.607) as well as keeping appointment days and detecting low blood sugar levels through signs and symptoms and manage (r =0.283; p-value 0.011). The current study revealed the need for healthcare managers and providers to introduce a sensitization program on diabetic medication adherence to prevent diabetic complications.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Diabetes Mellitus is considered a key public health problem globally due to its incidence and prevalence and the complications therein. Globally, diabetes affects 425 million people at a prevalence of 8.8% and will rise to approximately 700 million people by the year 2040 (IDF, 2017). Currently, one in every 11 adults worldwide is living with the condition with 90% of these being type II diabetes patients. The past three decades have recorded a distressing rise in the cases of diabetes mellitus, resulting in quadrupling of the cases. In 2015, it was estimated that diabetes caused an approximate 1.6 million deaths globally while in 2017 an approximate 2.2 million fatalities are linked to high blood glucose. In 2018, it was ranked the 7th leading causes of death globally (WHO, 2019).

Upon accessing treatment services, adherence to the prescribed treatment is key in ensuring good health outcomes and a substantial reduction in the risk of complications arising from diabetes. The cornerstone for type 2 diabetes mellitus patients is weight control through change of diet as well as increasing physical activity. However, more often, patients are put on oral medication or insulin to control the blood sugar levels (Yach, 2018). Adherence to the medication in addition to the dietary and lifestyle changes is key to ensure good glycemic control and reduced occurrence of microvascular and macrovascular complications impacting on good health outcomes.

The World Health Organization in its landmark report on non-adherence globally estimated that adherence to medication among patients with chronic diseases including diabetes was 50%; it further stated that adherence levels were likely to lower in developing countries owing to resource limitations (WHO, 2019). In the United States, 33 to 69 per cent of medication related hospital admissions are due to poor adherence

and these have been reported to account for about $100 billion a year. Generally, patients with chronic conditions (especially after the first six months of therapy) have been reported to present with lower adherence rates when compared to those with acute conditions (Osterberg et al, 2016). Previous studies conducted between 1999 and 2002 in Mexico, and Jamaica, indicated that adherence to diabetes treatment is generally below recommended practice, ranging from 23 to 77% (Rwegerera, 2014). Type two diabetic patients in UK (33.0%), Sweden (22.5%), Thailand (44.0%), and Nepal (40.1%) reported to be non-adherence to medication (Alshahrani, 2018; Hao et al., 2019; Koinis et al., 2015; Mårtensson, et al., 2014).

In Africa, particularly in Sub-Saharan Africa, studies have indicated non-adherence to medication ranges from 45.5% in Chad, 47.3% South Sudan, 49.9% Central African Republic, 53.8% in Botswana, 55.9% in Senegal and 40.3% in Nigeria (Barnes, 2017; Dickens, et al., 2019; Morris, 2015). In the Eastern Africa region, a medication adherence study done in Uganda among Type 2 diabetic patients found that adherence to diabetic medication was 28.9 % (Kalyango et al., 2018). Further studies in Ethiopia among diabetic patients found only 45.9% of patients fully adhering to treatment (Abebe et al., 2014). In Tanzania, a study using self-reported questionnaires revealed only 17.5% of patient were fully adhering to medication (Kamuhabwa et al., 2014).

An array of variables has been explored to have an influence on the poor adherence to treatment and self-management practices. They include cost of medication, presence of a comorbidity and/ or a complication associated with T2DM, complex treatment regime, side effects of medications, advanced age, gender associations' e.g., female gender, as well as length of duration of the disease (Rwegerera, 2014). Poor adherence to prescribed medication and treatment regimen in T2D is often linked to inadequate glycemic control. This results in increased morbidity which in turn results in augmented costs of access to outpatient care, increased visits to the emergency room and subsequent hospitalization, developing complications of diabetes and eventually increased mortality (Polonsky & Henry, 2016). Poor glycemic control impacts on health systems due to increased referral to higher facilities for specialized care.

Non-adherence to treatment has been one of the major obstacles to treatment management and important challenge of blood sugar control. Inability to complete prescribed regimen is an important reason for treatment failure and relapse, and complications. There are numerous factors for non-adherence to anti-diabetes treatment particularly in developing countries, such as poverty, lack of family support, social stigma, treatment side effects, subsequent hospitalization, behaviour of health service providers, education level, relieved symptoms, worry of danger of drugs, co-morbid condition and financial burden. Therefore, overcoming the causes for non-adherence to treatment will significantly help in planning and implementing the future strategies for the control of the disease (Bhagavathula et al., 2016).

Many of the factors affecting adherence are due to patients lack of understanding of diabetes and its treatment, health seeking behaviours and self-perceived beliefs on diabetes mellitus and antidiabetics medication (Okoro, 2017; Olowookere et al., 2015). Research has shown that forgetfulness and long-term side effects are the major factors affecting adherence to antihypertensive medication (Ramli et al., 2018; Atinga et al., 2018). This study was planned on the assumption that patient and health system factors affect adherence and a better articulation of the magnitude of adherence in rural Kenya as well as patient-level influencers is important in the design of T2DM service delivery within the health system. This is important in informing the scaling up of population-level solutions geared towards the promotion of proper management of the disease and to reverse its prevalent effects.

1.2 Statement of the problem

Type II diabetes mellitus is a high-impact public health problem that poses substantial challenges on the economy of most developing nations and their already stretched healthcare systems. The effectiveness of adherence and proper self-management practices is well known. According to the Kenya STEPwise Survey for NCDs Risk Factors (MOH, KNBS and WHO, 2015), with almost 750,000 people in Kenya living with type 2 diabetes and the disease being a direct cause of 20,000 annual deaths (MOH,

KNBS and WHO, 2015), among those diagnosed with diabetes mellitus, only 40% were taking medication at the time of the survey.

Diabetes demands long-term follow up through regular access to specialized services and medication. Health workers lacking specialized training are charged with the duty of managing T2DM patients and exposing them to suboptimal management (Roglic et al., 2016). There is also a lack of routine screening for complications during management of care due to high costs of tests as well as lack of access to the same (Jones, LE. 2017). A report by Norvatis Access (2017) showed that there still exist low knowledge levels (under 30%) on NCDs in Africa at community level. The report reveals that in the public sector, chronic medicines were available around 17% of the time, which has an impact on access to and adherence to medication.

Routine data shows that there has been a noteworthy growth in the uptake of services to manage chronic illnesses in health facilities. However, despite advances made in the health system on improving access to care for chronic illnesses, only 68% of known diabetics are on treatment, with approximately 30% of those able to achieve HbA1C levels of less than 7% (Yonga, 2016). Data concerning magnitude of adherence in rural areas are still scarce. This can explain the low prioritization of T2DM management in low-income and middle-income countries whose rural population constitutes the majority of their population.

A study to quantitatively estimate the burden of non-adherence among T2DM patients as well as correlate the adherence to influencing factors is key for effective interventions to be put in place to enhance better disease management and promote improvement approaches aimed at strengthening community and self-management practices.

1.3 Justification/significance of the study

With Kenya undergoing an epidemiological transition such as rapid population growth, urbanization and adoption of unhealthy lifestyles, all of which pose a risk to the

population, data-driven approaches revealing the magnitude of adherence to type 2 diabetes mellitus medication is crucial to advocate for policies to strengthen effective interventions. This in turn will drive uptake of T2DM services and sustained adherence to treatment. Adherence to recommended medication generally in chronic illnesses is influenced by various factors including socioeconomic, health system-related, therapy-related as well as patient factors (WHO, 2018). This increases patients' mortality rate if they have sub-optimal adherence to their medication. It is, therefore, important to understand these unique patterns as well as influencing factors from T2DM patients living with or without a known complication. This study, was carried out in Gatundu health facilities and was aimed at providing findings that will assist the facility as well as other County health facilities in strengthening Type II diabetes mellitus management. Understanding the level of adherence as well as factors influencing adherence to prescribed treatment is essential in ensuring good health outcomes and a healthier population. The aim was to also provide feedback to the county and national government on the specific gaps in self-management practices which may require a change in policy and/or enhancement of community level programs targeting these patients and their families to raise awareness on type II diabetes mellitus and localize management based on the unique socioeconomic and cultural influencers. These study findings will also provide crucial data to the Ministry of Health departments at both the county government and national government level to prioritize management of type II diabetes mellitus and understand the role their partners (donors and NGOs) can play in designing effective adherence strategies. At the level of the individual patient, the findings of the study are aimed at improving adherence to medication for T2DM patients to ensure they live a healthier and productive life as they manage the chronic condition.

1.4 Research Objectives

1.4.1 Main Objective

To assess the burden of non-adherence to medication and its associated factors among Type 2 diabetes mellitus patients seeking care in Gatundu Level 5 hospital.

1.4.2 Specific Objectives

i). To determine the prevalence of non-adherence to prescribed diabetes medication regimen among Type 2 Diabetes Mellitus patients.
ii). To determine the level of knowledge and self-management practices among T2DM patients
iii). To evaluate patient-level factors influencing adherence to medication among T2DM patients in rural settings

1.5 Research Questions

i). What is the level of adherence to prescribed diabetes medication among Type II Diabetes mellitus patients?
ii). What is the level of knowledge and self-management practices among T2DM patients?
iii). What is the patient-level factors influencing adherence to medication among T2DM patients in rural settings?

1.6 Scope of study

The study targeted all adults, both male and females, who have been attending the medical outpatient clinic for type 2 diabetes management at Gatundu Level 5 Hospital. The study included all T2DM patients, including those living with a comorbidity like hypertension and /or a diabetes related complication such as cardiovascular complications, retinopathy, neuropathy and nephropathy including foot complications and amputations. Gatundu town is in Kiambu County and is approximately 20 kilometers away from Kiambu town and 26 kilometers west of Thika. It is considered to be a rural area due to the economic activities but it is becoming more urbanized due to the good road network and its close proximity to Kiambu and Thika towns. The services at Gatundu Level 5 hospital MOPC clinics are offered five days a week and is said to be

managing one of the highest numbers of NCDs outpatients in the County. Also, T2DM patients are managed at surrounding private health facilities.

1.7 Limitations of the Study

All research studies are faced with various challenges. One of such limitations is the strain of time. The researcher maximized on the time available by minimizing the data collection breaks. The researcher anticipated that the respondents might deliberately provide false data or even withhold information given the sensitivity of the information being sought.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Diabetes mellitus is a chronic disease that could be inherited or could be linked to an acquired deficiency in the pancreatic production of insulin, or when the insulin produced is ineffective (WHO, 2018). This group of metabolic disorders common manifestation is hyperglycaemia, which when chronic, is related with the long-term damage, failure or even dysfunction, of various body organs (ADA, 2020).

2.2 Epidemiology of Type II Diabetes Mellitus

Type 1 diabetes results from a deficiency in the production of insulin whereas Type 2 diabetes results from the body's inability to effectively utilize insulin (Alberti, & Zimmet, 2018). Both conditions result in hyperglycaemia. Type I diabetes mellitus represents an approximate 5-10% of those living with diabetes globally whereas type 2 diabetes represents an approximate 90-95% of those diagnosed with diabetes (ADA, 2020). Another form of diabetes becoming more common is gestational diabetes which is observed in pregnant women who previously did not have diabetes but present with high blood glucose levels during pregnancy. It is normally diagnosed during either the second or the third trimester of pregnancy (ADA, 2015). Though this form of diabetes goes away once the baby is born, it predisposes the mother to the risk of getting gestational diabetes in the successive pregnancies, in addition to the increased future development of Type 2 Diabetes mellitus. The prevalence is said to be getting higher. Other forms of diabetes account for the remaining 1-2% cases.

The pervasiveness of diabetes mellitus has been on a steady increase, having quadrupled in the last 30 years, with Type II diabetes mellitus accounting for about 90% of the cases. Globally, approximately 425 million people have the condition with over a half of them undiagnosed (IDF, 2017). The IDF Diabetes Atlas estimates that 15.5milion adults

lived with diabetes in the IDF Africa region, mainly sub-Saharan Africa, in 2017. This represented a regional prevalence of 3.3%. While this is seemingly high, two-thirds (69.2%) of them are unaware of their condition. Half of those with the condition in Africa hail from urban areas, with estimates likely to double by 2025. While countries currently categorized as high-income countries by World Bank have most of their diabetics over the ages of 60 years, the low-income and the middle-income countries have diabetics in the working age ranging between 40 to 60 years. This shows that, with the current trends on population rise as well as increased urbanization in the Africa region, the estimates will increase and may exceed that of high-income countries in the near future (Whiting et al., 2017). 85% of cases in region still undiagnosed (DLFA, 2020).

The pervasiveness of diabetes in Kenya is 6%, with one in every 17 Kenyans having diabetes. In 2014, 12,890 fatalities were reported linked directly to elevated glucose levels and diabetes (Merab, 2015), with many more going undiagnosed. There were 498,500 known cases of diabetes reported in Kenya in 2017 (IDF, 2017). The rise in diabetes cases in Kenya is occasioned by changes in social and demographic situation in the Country, with people adopting lifestyles such as an unhealthy diet and physical inactivity that negatively impact on their health

2.2.1 Risk factors of Type 2 Diabetes Mellitus

Type 2 diabetes mellitus develops due to a combination of lifestyle issues and genetic factors which can be modified while others are non-modifiable in nature. Some of the non-modifiable risks include a strong genetic history of diabetes, age where the older you are (>40 years) the higher the risk of acquiring diabetes, ethnic background as well as a history of gestational diabetes pre-disposes one to developing a late-onset type 2 diabetes. In this type of diabetes, the modifiable risk factors include general physical inactivity, obesity, consuming unhealthy diets, alcohol abuse and active smoking, hypertension as well as dyslipidaemia (heart.org, 2015). Changes in diet and physical

inactivity due to rapid development brought about by urbanization has occasioned a sharp surge in the number of type 2 diabetes patients (IDF, 2018).

2.2.2 Prevention and Diagnosis of Type 2 Diabetes Mellitus

Reports available suggests that T2DM can be prevented by identifying populations at risk, screening and addressing the risk factors especially modifiable factors early in life. This can be achieved through lifestyle modifications, which include being physical activity, healthy diet, stop smoking and weight loss which proved to be more operative than drugs in preventing or delaying the onset of DM in high-risk populations (Mbanya et al., 2020).

Majority of people with Type 2 Diabetes mellitus remain undiagnosed for an extended period of time, usually years because the slow development nature of hyperglycaemia, with its earlier years not severe enough for one to notice. Key symptoms of marked hyperglycaemia as is the case with Type 2 Diabetes mellitus include polyuria, polydipsia (increased thirst) as well as drastic weight loss and sometimes increased hunger, tiredness, blurry vision and wounds that take long to heal (Feinglos & Bethel, 2018). These often come slowly and develop gradually with time. When the patient presents with these symptoms, several tests are done to screen and diagnose. This is done biochemically prior to initiation of any therapy. These confirmatory tests include Fasting blood Sugar (FBS) levels of volumes equal to or greater than 7.0mmol/l or Random Blood sugar (RBS) equal to or greater than 11.1 mmol/l as well as Oral Glucose Tolerance test (OGTT)whose 2-hr plasma glucose is equal to or greater than 11.1mmol/l. Once the first tests are done, further tests should be repeated on another day to confirm the diagnosis and commence the treatment and management plan. Glycated haemoglobin, commonly known as HbA1C, is a recommended test as a substitute for fasting blood sugar for the diagnosis of diabetes. The target HbA1C for individuals living with diabetes should not exceed 7%. HbA1C test provides confirms average glucose levels for 2-3 months and is endorsed as a standard of care in the monitoring of diabetes, especially Type 2 Diabetes patients.

2.3 Kenya national guidelines for treatment and management of Type 2 Diabetes Mellitus

The Ministry of Health has enforced guidelines on the management of diabetes mellitus. These guidelines are adopted from the WHO framework and customized to the national context. In the national clinical guidelines, there exists four key components to be addressed to achieve good glycemic control. The treatment of hyperglycaemias involves education of the patient, changes in diet and physical activity, administering oral hypoglycaemic agents or insulin or both, the treatment of hypertension and dyslipidaemias involves education of the patient on best management practices, changes in diet and introducing physical activity in addition to the administration of drugs, and management of Type 2 diabetes also focuses on the prevention and treatment of microvascular complication as well as macrovascular complications.

It is recommended that various clinical and laboratory methods are employed to monitor individual glycaemic levels to ensure targets are attained. This can be done by checking HbA1C levels at least twice a year, though in its, absence fasting and post prandial blood glucose is recommended at the facility level. Patients are advised to engage in an incessant monitoring of their glucose levels in the blood and urine and the record results in a logbook for review during the regular follow-up visits.

The recommended non-pharmacological management therapies for type 2 diabetes include diabetes education, dietary modification as well as regular physical activity. Pharmacologically, Oral Glucose Lowering Agents (OGLAs) are recommended when good glycemic targets are not achieved regardless of the recommended dietary and exercise regimens or even at the first presentation of diabetes as a way of controlling hyperglycaemia. It is recommended that one should prescribe low cost proven generic drugs which are readily available and easy to access. Also, monotherapy is recommended at first but in case of failure, combination therapy is recommended with different OGLAs. The three-drug therapy could be utilized in the event that the two-drug therapy fails to realize the target glycemic levels. When the oral combination therapy

fails, then it is advised that the OGLAs be replaced and/ or insulin be added to the formulated treatment plan. Type 2 Diabetes is primarily a self-management condition that requires proper daily management through the recommended medication as well as lifestyle modifications or one to achieve good glycemic control. The glycemic levels are impacted on by the adherence levels to the prescribed oral hypoglycaemic agents or insulin as well as dietary and physical activity changes which are self-administered and require consistent adherence.

2.4 Adherence to diabetes medication and self-management practices

Adherence is the degree to which a person's medication taking behaviour, commitment to a diet and /or the execution of lifestyle changes aligns with the approved recommendations as suggested by a healthcare provider (WHO). T2DM treatment and management is for long periods of time, sometimes a lifetime. This calls for proper follow-through by the patient on the recommended medication regimen as well as diet and lifestyle changes, basically self-care practices. WHO defines self-care as the inclusion of activities undertaken at the individual, family and community levels intended to enhance general health, prevent diseases, limit illnesses and restore health. At the individual level, the daily regimen tasks performed by the individual in diabetes management is regarded as self-care (Weinger et al., 2016)

In the developed countries, long term-therapies adherence for chronic illnesses averages about 50%, with even lower rates experienced in the developing countries hence posing a great risk in management of chronic illnesses as it impacts on the patient's perceived quality of life as well as increases their healthcare expenditure due to increased hospital admissions. A number of variables are considered when correlating various adherence behaviors in type 2 diabetes management. These include treatment and disease characteristics such as the disease duration, the intricacy of the treatment as well as the delivery of care, Demographic factors (both intra- and inter-personal) as well as environmental factors (Yach, 2018).

Previous studies show that developed countries with high access to healthcare services still demonstrate sub-optimal adherence to the recommended treatment in the management of patients with type 2 diabetes. A national survey conducted in France showed that only 39% of clients reported good adherence (Tiv et al. (2016). Globally, studies show that adherence levels to diabetes treatment regimen and self-management practices vary from between 38.5% to 93% based on the methodological approach used (Krass, Schieback, Dhippayom 2015). Different studies have investigated levels of adherence to dietary and lifestyle modifications. In South Africa, one such study showed that only 35% of respondents participated in physical exercise (Umeh & Nkombua, 2018). In Nepal, a study showed that upto 87.5% of diabetes mellitus patients were non adherent to dietary modifications recommended for their management (Parajuli J. et al. 2014). A similar study in Yemen also showed similar results, with approximately 36% adhered to recommended levels of physical activity (Alhariri, Daud, & Saghir, 2017). In India, specified diets and exercises were regularly succeeded by only 35% and 37% of the total number of patients (Peyrot et al., 2015). Another study in the US established that 52% of diabetics adhered to the dietary advice (Anderson & Gustafson, 2018). In Botswana, a study revealed low observance to exercise and diet at 52% and 37% respectively (Adewale et al., 2017).

Routine data from the health system show that there has been a steady rise in the number of patients visiting facilities due to diabetes in the last decade (MOH, 2015). Upon interacting with the health system, the clients are advised on self-management practices which include an array of activities, ranging from taking prescribed medication to dietary and lifestyle modifications, all of which require high levels of adherence for them to be effective. A study in Kenya at the Kenyatta National referral hospital revealed that only 45.5% of patients with Type 2 diabetes adhered to the medication (Waari, Mutai & Gikunju, 2018) and this is comparable to other studies within the East African region (Abebe, Berhane, Worku, 2014 and Kamuhabwa &, Charles, 2014). According to the Kenya STEPwise Survey for NCDs Risk Factors (2015), respondents in the highest wealth quantiles as well as having formal education were more likely to be

screened for elevated blood sugar periodically. Also, among those diagnosed with diabetes mellitus, only 40% were taking medication at the time of the survey. Variation in medication use was observed between women (57%) and men (17%) while those aged 30-44 years reported the highest current use of medication, at 67%. A higher percentage of patients on treatment resided in urban areas (54%) compared to those in rural areas at 28%. This could infer that patients' health practices are affected by their health literacy, and these beliefs are also contributors to (non) adherence.

2.5 Public health importance

Good adherence is generally associated with better glycemic control and lower utilization of healthcare and costs (Schauerhamer, & McAdam-Marx, 2018). Medication adherence incorporates complex and driving behaviours such as socio-economic status, healthcare human resources and commodities, patient-level influencers as well as treatment therapy (Pages-Puigdemont, 2016).

It is evident that reasons for non-adherence to recommended treatment regimen are complex and multifactorial, differing from one patient to the next. Diabetes management in Kenya is met with obstacles around access to specialized health services, adherence to prescribed therapy as well as access, availability and affordability of medication (Mcferran, 2018). There exists insufficient funding in the country, geared at reducing the non-communicable disease burden, with an allocation of less than one percent of the curative health budget (Omboki, 2018).

Poor adherence to prescribed medication and treatment regimen in T2D is associated with inadequate glycemic control and increases risk of developing diabetes complications. These complications can cause irreparable impact on major organs resulting in the rise of catastrophic complications. Acute complications of diabetes mellitus include diabetic ketoacidosis, hypoglycaemia, and hyperglycaemia. One of the key chronic complications is cardiovascular disease, presently the foremost cause of mortality globally. Diabetes patients are 2 to 4 times at higher risk of heart disease.

Diabetes also results in kidney diseases, with up to 20% of patients with this complication dying. Diabetes retinopathy occurs in patients with inadequate glycemic control over an extended time, resulting in the harm to the retina of the eye. Diabetic neuropathy is also rising in global prevalence resulting in nerve damage which numbs feet, arms and causes other challenges including erectile dysfunction. It is a key cause of foot complications which when left untreated can result in foot damage and even amputations (Adapa & Sarangi, 2015). All these conditions result in increased morbidity, increased access costs to outpatient services, a rise in emergency room visits and subsequent hospitalization as a result of managing complications of diabetes as well as rise in mortality (Polonsky & Henry, 2016). 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). It is vital to understand the patient's practice towards the illness as well as various treatment factors that influence medication regimen adherence as these impacts on the overall health of the patient.

2.5 Conceptual framework

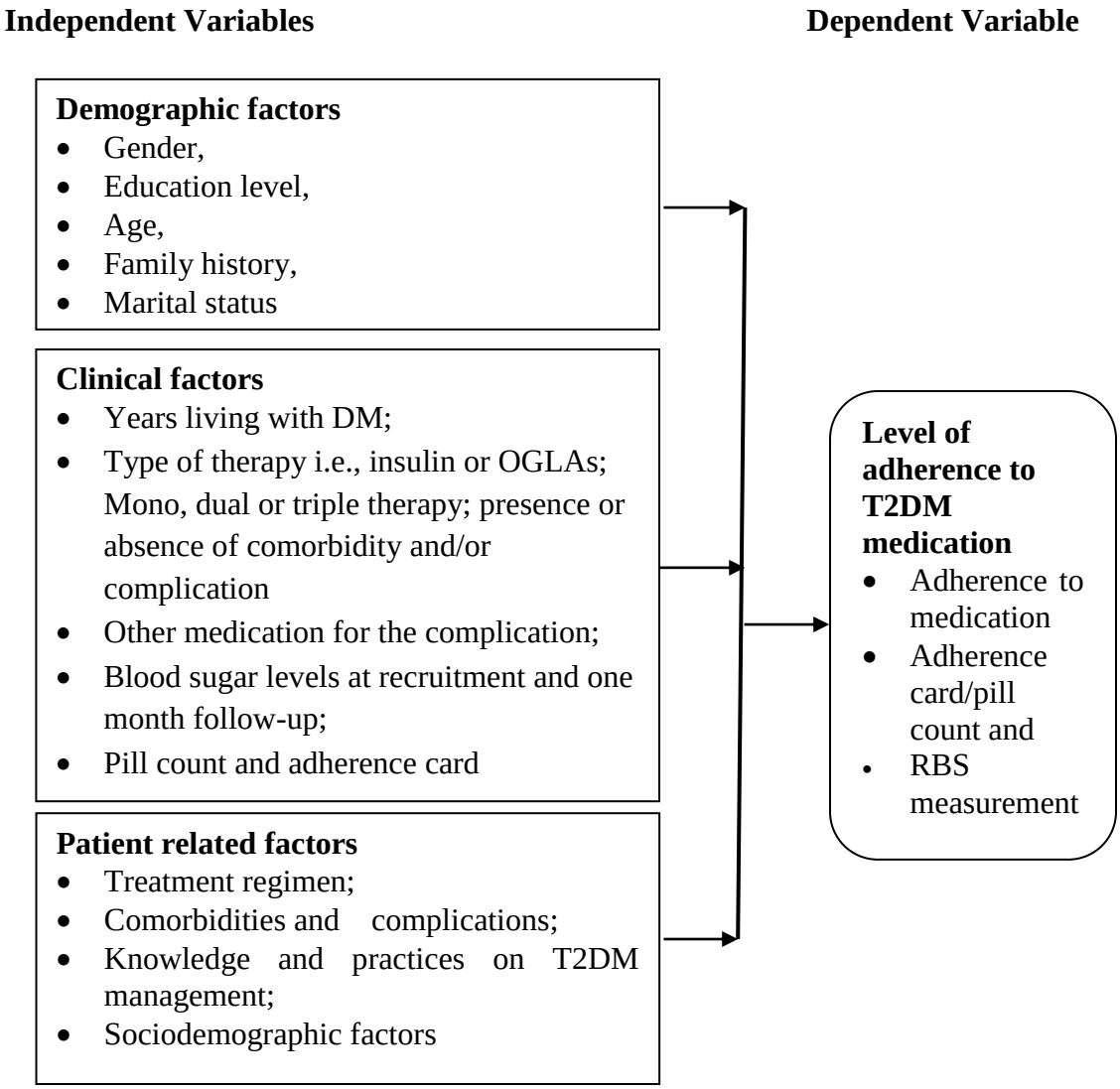

Figure 2.1: Conceptual framework

CHAPTER THREE

STUDY METHODOLOGY

3.1 Study site

The study was conducted at Gatundu Level 5 Hospital. According to the Kenya MOH HRH strategy report 2016, Kiambu County follows closely after Nairobi in the number of NCDs reported (MOH, 2014). Gatundu Level 5 hospital is at the heart of Gatundu town whose approximate populace of 20,000 individuals residing and working within proximity to the town. Gatundu is predominantly rural but experiencing a rise in urbanization due to good road network and infrastructure as well as close proximity to Nairobi, Kiambu and Thika. Gatundu Level 5 hospital serves nearly all the healthcare needs of the area and attracts people from areas along Thika road due to the good road network. It runs a Medical Outpatient clinic (MOPC) daily from Monday to Friday which caters to both Diabetic and hypertension patients. The clinic attends to approximately 40 diabetes patients daily, with 90% of them being managed for Type 2 Diabetes mellitus. There are surrounding private facilities which manage T2DM patients as well. The chief commercial activity in the area is trade which has contributed to the growing urbanization of the area as well as changes in lifestyle due to increased use of minibuses, vans and motorbikes for movement within the area.

3.2 Study design

The study adopted a cross-sectional study design. A structured questionnaire was administered to the Type II diabetes mellitus patients at the recruiting phase to collect demographic information, clinical characteristics of the patient and patient experiences in diabetes management. The patients were then be followed up for a month from the recruitment date to track their adherence to the prescribed diabetes medication. This was done using an adherence card to be filed in by the patient as well as pill counts. Random blood sugar measurements were taken on recruitment.

3.3 Study population

The study population was people aged above 18 years and known to have Type II Diabetes Mellitus who were seeking health services at Gatundu Level 5 Hospital in Gatundu town.

3.3.1 Inclusion criteria

i). People above 18 years, diagnosed with T2DM and on prescription treatment
ii). Patients who give consent to participate
iii). Patients living within a 10-kilomeetre radius from Gatundu town for ease of follow-up

3.3.2 Exclusion criteria

i). Patients with Type 1 diabetes or Gestational diabetes
ii). Patients who are being managed with exercise and diet/lifestyle change only.
iii). Patients who live beyond a ten-kilometer radius from Gatundu town, for ease of follow up during the one-month follow-up period.

3.4 Sample Size Determination

Type 2 diabetes prevalence in rural Kenya is estimated to be 6% (WHO, 2014). Therefore, Cochran's formula (Cochran's, 1977) was applied in the determination of the sample size.

$$\mathbf{N = Z^2PQ /D^2}$$

Where:

N = minimum sample size required

Z =standard normal deviation set at 1.96 corresponding to a 95% confidence interval

P = proportion (assumed) of population with diabetes in Kenya which is 6% (0.06)

Q = 1-P

D= the absolute precision (acceptable error of margin of 0.075)

$$N = \frac{1.96^2 x\, 0.06\ (1 - 0.06)}{0.05^2}$$

N= 86.6 which, on rounding off gives **87 patients**

To allow for withdrawal rate of 10%

N= 87x1.10

= 96 participants

3.5 Sampling procedure

The study recruited participants through convenient sampling procedure at the Medical Outpatient clinic (MOPC). The study sample consisted of patients previously diagnosed with Type 2 Diabetes and on medication. For patients who report a complication, the same was verified from the medical records.

3.6 Data Collection

The collection of data utilized a pre-designed and piloted structured questionnaire. The questionnaire adopted, in part, the Morisky Medication Adherence Scale (Morisky et al., 1986) and was administered to the patients. It covered demographics, clinical information as well as practices on T2DM management. The patient questionnaire was translated from English to Swahili for ease of understanding and communication. The participants approached was required to give consent before administering of the questionnaire. Those who consent was then be taken through the questionnaire by the

principal investigator or her research assistant. Confidentiality and privacy of the information the participants provide is assured. Once the questionnaire was filled, the participants were issued with an adherence card which they used to track the way they take their medication over a period of one month. The researcher counted the number of the tablets at the time of recruitment before the patients start filling in the card and the number of tablets at the end of the one month as a tallying verification method to the filling in of the adherence card. The researcher also took the random blood sugar readings from the patient on the day of recruitment. For qualitative data the adherence card was used to for records of pill count during the day and evening for a period of 30 days

3.7 Pre-testing

A pretest study was done at Kiambu Level 5 Hospital on adults diagnosed with type 2 diabetes and currently being managed at the MOPC clinic to assess the ease of understanding of the questionnaire as well as test the accuracy of the research and assist in resource planning. Subsequent amendments were done before actual data collection.

3.8 Data Management and Analysis

Any data collected was strictly used for this research, and its confidentiality was guaranteed. The questionnaires were coded to ease of traceability. Once filled in, the collected data was cleaned, coded and keyed into STATA version 13 and analyzed using the same.

Descriptive statistical analysis was employed to describe patient demographics and study variables. Percentages and frequencies were computed for age, gender, level of education, presence of a complication and/or comorbidity and diabetes knowledge which form the predictor variables. Correlation between the total count of the remaining diabetic medication and the blood sugar after one month follow-up was assessed. Univariate logistic regression was conducted in assessing the association between each

of the predictor variables and the two main outcome variables (adherence to medication and glycemic control). Two multiple logistic regression models were constructed. The first model had diabetes medication adherence (0=adherent; 1=not adherent) as the outcome variable and the second model had blood sugar (normal=0; abnormal=1) as the outcome variable. Multiple logistic analyses were then conducted to determine whether any combination of predictor variables is associated with glycemic control and treatment adherence amongst Gatundu patients living with Type 2 Diabetes mellitus.

3.9 Ethical Considerations

Ethical approval and prior consent for this study was sought from the University of Eastern Africa-Baraton review committee. Once received, a NACOSTI license was sought as required. Subsequently, further clearance was sought from the Kiambu County Health Department and Gatundu Level 5 Hospital for approval to begin the data collection process.

CHAPTER FOUR

RESULTS

4.1 Demographic characteristics of the respondents

4.1.1 Socio-Demographic Characteristics

The respondents mean age was 62.3 ± 15.28, the mode was 70 years, and median 62.5 years with age ranging from 21 years to 98 years. The findings showed that 31(31.6%) were between 60-69 years, 4(4.1%) between 20-29 years, additionally, 66 (67.3%) were females. The majority of the respondents 70(71.4%) were married as shown in Table 4.1.

Table 4.1: Socio-demographic characteristics of the respondents

Characteristics		Frequency	Percent
Age group	20-29 years	4	4.1
	30-39 years	3	3.1
	40-49 years	14	14.3
	50-59 years	13	13.3
	60-69 years	31	31.6
	70-79 years	21	21.4
	≥ 80 years	12	12.2
Sex	Male	32	32.7
	Female	66	67.3
Marital Status	Single	8	8.2
	Married	70	71.4
	Widowed	20	20.4

4.1.2 Socio-Economic Characteristics of Respondents

Slightly less than half 43(43.9%) of respondents had primary level of education with at least 5% of respondents having tertiary education. Approximately 60% were small scale

farmers with more three-quarter 86 (87.8%) residing in rural areas and 41(41.8%) travelled less than 10 km to the health facility as shown in Table 4.2.

Table 4.2: Respondents Socio-Economic Characteristics

Characteristics		Frequency	Percent
Level of educational	Informal Education	22	22.4
	Primary	43	43.9
	Secondary	28	28.6
	Tertiary	5	5.1
Work status	Work around the homestead	11	11.2
	Small-scale farmer	59	60.2
	Self-employed but not as a farmer	18	18.4
	Formal employment	4	4.1
Residence	Urban	12	12.2
	Rural	86	87.8
Distance to health facility	Less than 10 km	41	41.8
	10-19 km	7	7.1
	20-29 km	4	4.1
	30-39 km	14	14.3
	≥ 40 km	32	32.7

4.1.3 History of Diabetes

Most of the respondents 52(53.1%) had diabetes for more than 5 years with 11(11.2%) were newly diagnosed with diabetes. In addition, 70.6% had hypertension and 2.0% had CVD. Initial treatment and advice given to patients were tablets (83.7%), change of diet (75.5%) and 58.2% were advised to and loss weight as shown in Table 4.3

.

Table 4.3: History of Diabetes

Characteristics		Frequency	Percent
Duration with diabetes	Below one year	11	11.2
	1-5 years	35	35.7
	6-10 years	15	15.3
	More than 10 years	37	37.8
Co-morbidities	None	26	25.5
	Hypertension	72	70.6
	Tuberculosis	1	1.0
	Arthritis	1	1.0
	CVD	2	2.0
Patient on medication	Yes	97	99.0
	No	1	1.0
Initial treatment and advice given	None	1	1.0
	Insulin injection	28	28.6
	Tablets	82	83.7
	Change of Diet	74	75.5
	Exercise and weight loss	57	58.2

4.2 Medication Adherence

4.2.1 Prescribed Drugs for Diabetes Management

Majority of respondents 72(73.5%) were prescribed oral glucose lowering agents while 11.2% were on insulin only whilst 15.3% were on both oral hypoglycemic agents and insulin as shown in Figure 4.1.

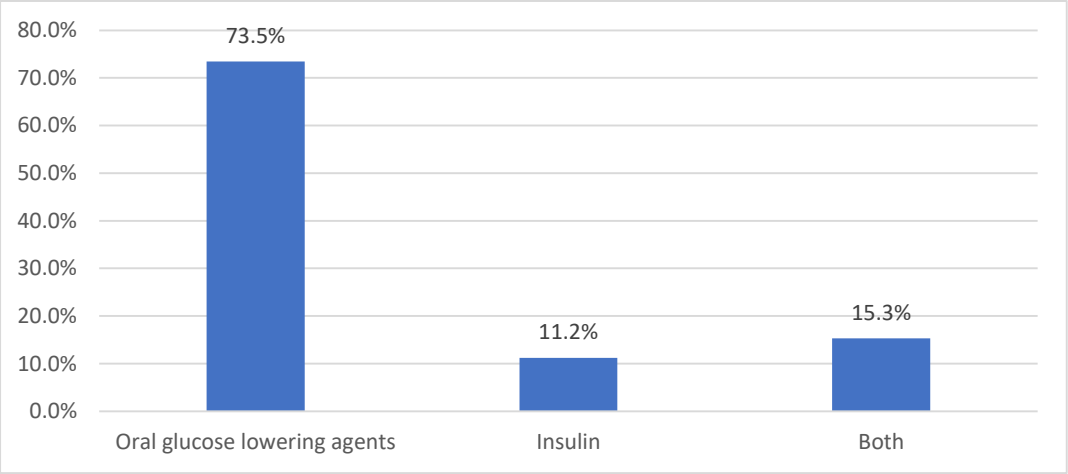

Figure 4.1: Prescribed Drugs for Diabetes Management

4.2.2 Hypoglycemia Dosage

More than half (57.1%) of respondents were taking two tablets per day with 88.8% of these taking medicine in the morning and evening as shown in table 4.4.

Table 4.4: Hypoglycaemia Dosage

Characteristics		Frequency	Percent
Number of tablets	None	12	12.2
	One	29	29.6
	Two	56	57.1
	Three	1	1.0
Time for medication	Morning	4	4.1
	Afternoon	3	3.1
	Evening	4	4.1
	Morning & Evening	87	88.8

4.2.3 Missed Diabetes Medication

Out of 98 respondents, slightly more than half 52(53.1%) had missed their antidiabetic medication in the last 7 days preceding the study with 36.7%, 12.2% and 4.1% missing for 1-3 days, 4-6 days and 7 days respectively as shown in Table 4.5.

Table 4.5: Missed Diabetes Medication

Characteristics		Frequency	Percent
Missed medication	No	46	46.9
	Yes	52	53.1
Duration missed medication	None	46	46.9
	1-3 days	36	36.7
	4-6 days	12	12.2
	7 days	4	4.1

4.2.4 Reasons for Missing Antidiabetics

Out of 48 respondents, forgetfulness (31.1%), lack of money (29.7%) and lack of drugs in the hospital (16.2%) were common reasons for missing antidiabetics respectively as shown in Table 4.6.

Table 4.6: Reasons for Missing Antidiabetics

Reasons	Frequency	Percent
Lack of money	22	29.7
Lack of drugs in the hospital	12	16.2
Distance to the hospital	2	2.7
I forget	23	31.1
I don't like taking drugs	2	2.7
Pain when administering insulin	1	1.4
None	3	4.1
Felt sugars were controlled	4	5.4
Eye problems	1	1.4
Reacting to drugs	1	1.4
Due to drug intolerance causing vomiting	2	2.7
Lack of consistent prescription	1	1.4

4.2.5 Glucose Self-Monitoring Practice

Most of respondents, 40(40.8%) monitor their sugar on a weekly basis with 25.5%, 13.3%, and 1.0% monitor sugar on a monthly basis, quarterly and when not feeling well respectively as shown in Figure 4.2.

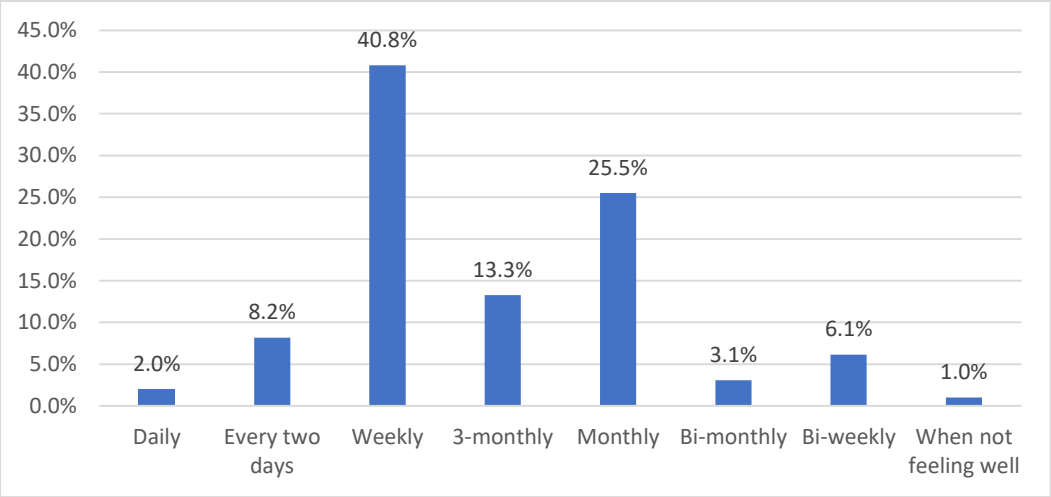

Figure 4.2: Glucose Self-Monitoring Practice

4.2.6 Places for Monitoring Sugar

More than half of respondents (56.1%) check their blood sugar at a chemist or private clinic with 20.4% and 22.4% at home and only during clinic days respectively during the study period as shown in Figure 4.3.

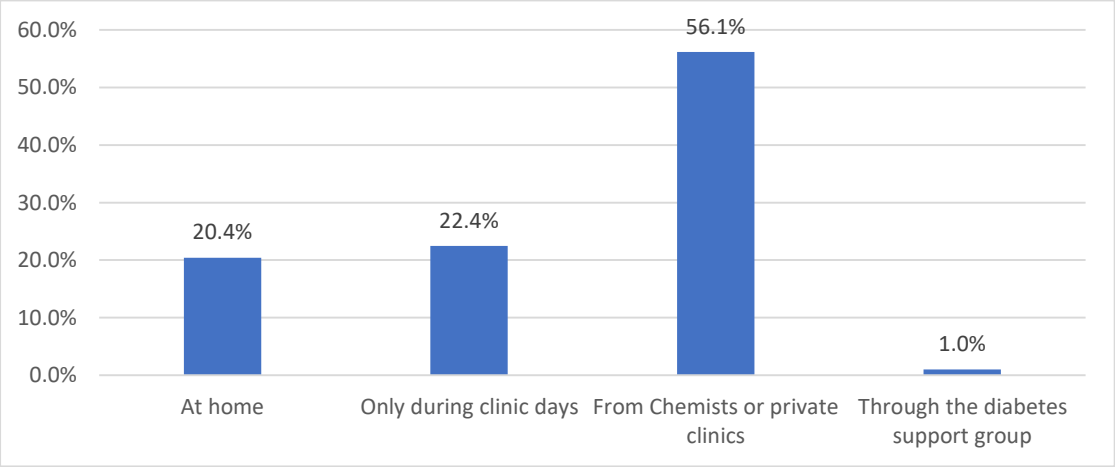

Figure 4.3: Places for Monitoring Sugar

4.2.7 Blood Sugar Measurements

More than half of respondents 66.3% and 59.2% had initial blood sugar and after one month of more than 7.8mmol/l respectively as shown in Figure 4.4.

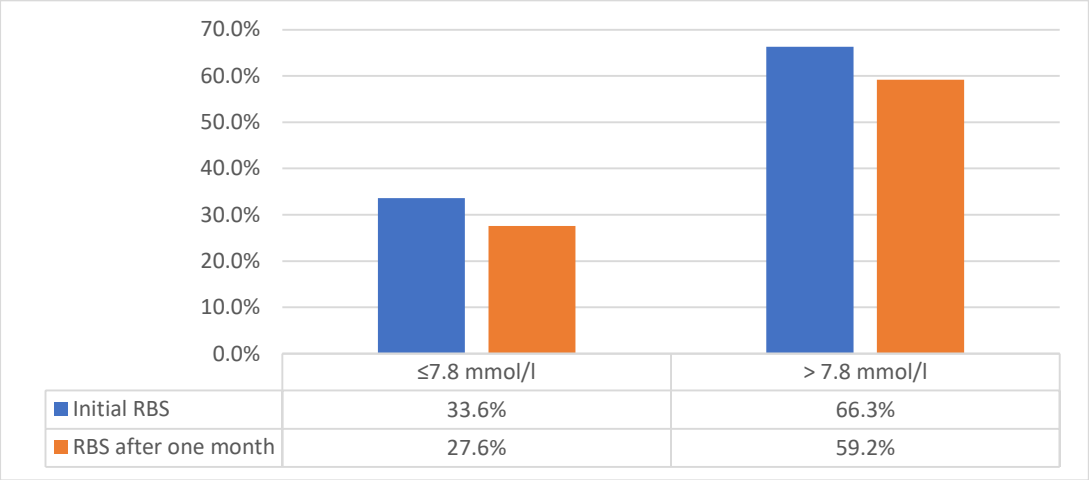

Figure 4.4: Blood Sugar Measurements

4.2.8 Prescribed Diabetes Medication Regimen

Majority of respondents (90.8%) were prescribed glucomet 500mg and 6.1% with insulin as shown in Figure 4.5.

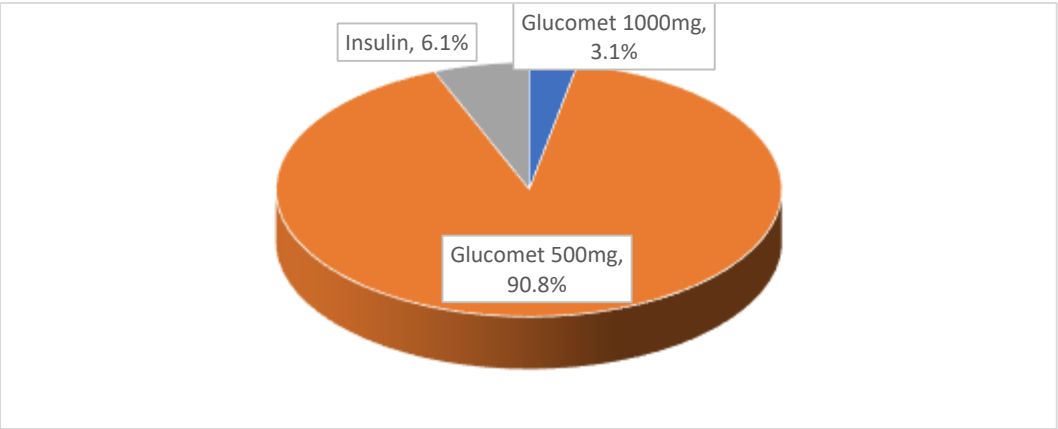

Figure 4.5: Prescribed Diabetes Medication Regimen

4.2.9 Prevalence of Non-Adherence to Prescribed Diabetes Medication Regimen

Using the Morisky Medication Adherence scale to determine adherence level among respondents, it was observed that majority of the respondents constituting 80.7% had high and medium adherence to prescribed diabetes medication regimen as shown in Figure 4.6.

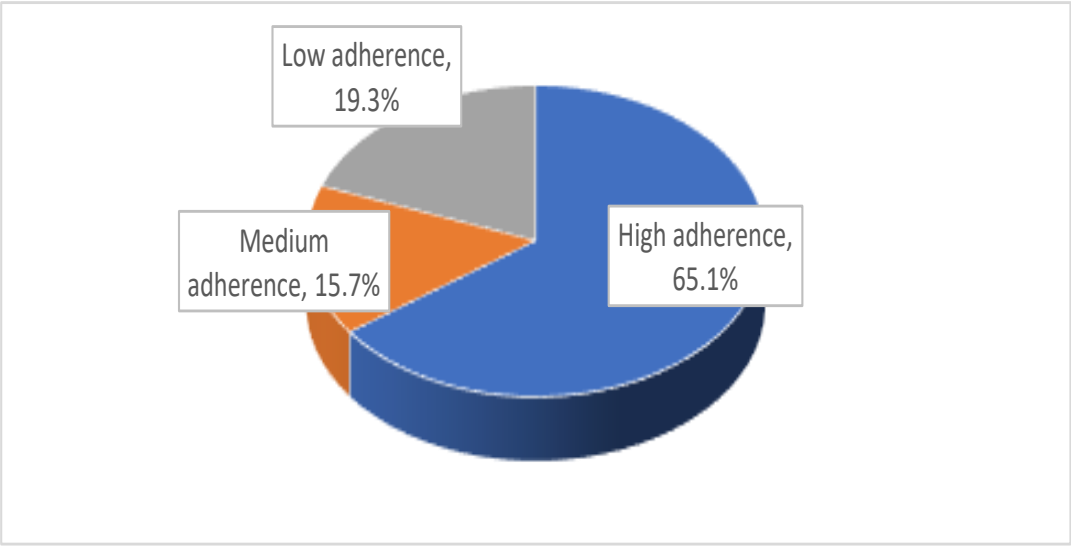

Figure 4.6: Prevalence of Non-Adherence to Prescribed Diabetes Medication Regimen

4.3 Knowledge and Self-Management Practices

4.3.1 Management of Diabetes

The Table 4.7 shows that among the respondents who adhered to antidiabetics, 90.0% said diabetes can be cured, 87.5% said they don't stop taking drugs when sugar is controlled, further, 90.2% would detect low blood sugar levels through signs and symptoms and manage. Knowledge on diabetes treatment (p=0.009) and detecting low blood sugar levels through signs and symptoms and manage (p=0.001) had significant association with self-management of diabetes.

Table 4.7: Knowledge on Management of Diabetes

Variables		High Adherence (%)	Low adherencen (%)	Statistics
DM can be cured	No	17(73.9%)	6(26.1%)	χ^2 =9.517;
	Yes	45(90.0%)	5(10.0%)	df 2;
	I don't know	5(50.0%)	5(50.0%)	p=0.009
Stop taking drugs when sugar is controlled	No	42(87.5%)	6(12.5%)	χ^2 =4.660;
				df 2;
	Yes	17(77.3%)	5(22.7%)	p=0.097
	I don't know	8(61.5%)	5(38.5%)	
Detect low blood sugar levels through signs and symptoms and manage	No	7(58.3%)	5(41.7%)	χ^2 =13.426;
				df 2;
	Yes	55(90.2%)	6(9.8%)	p=0.001
	I don't know	5(50.0%)	5(50.0%)	
Beneficial to stop smoking or taking alcohol	No	7(58.3%)	5(41.7%)	χ^2 =12.028;
				df 2;
	Yes	54(90.0%)	6(10.0%)	p=0.002
	I don't know	6(54.5%)	5(45.5%)	
Checking blood pressure while being DM	No	5(50.0%)	5(50.0%)	χ^2 =15.983;
				df 2;
	Yes	57(90.5%)	6(9.5%)	p=0.0001
	I don't know	5(50.0%)	5(50.0%)	
Shaking and fast heartrate	Low blood sugar	14(73.7%)	5(26.3%)	χ^2 =1.446;
				df 2;
	High blood sugar	36(85.7%)	6(14.3%)	p=0.485
	I don't know	17(77.3%)	5(22.7%)	

4.3.2 Feeling Shaky, Nervous or Hungry

Most of the respondents 92.9% said they eat some form of sugar when suddenly feel shaky, nervous or hungry with 6.1% and 2.0% take water and lie down and rest respectively as shown in Figure 4.7.

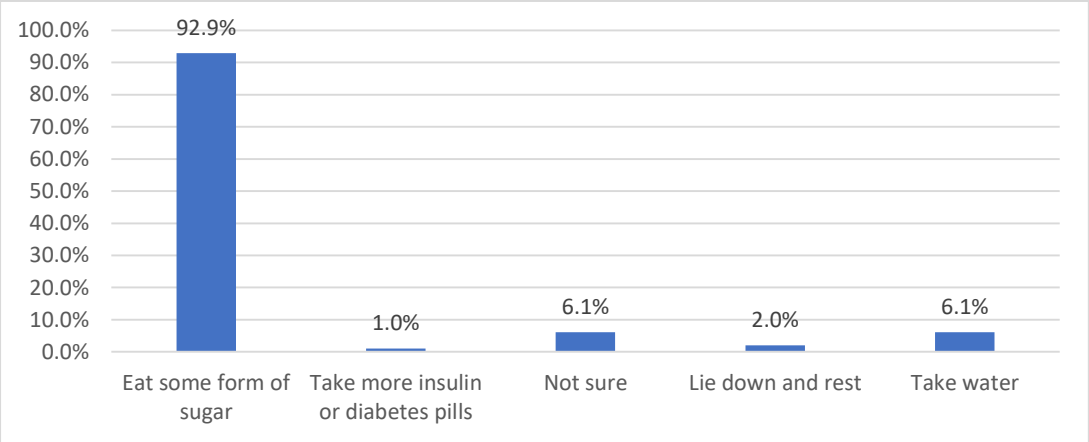

Figure 4.7: Feeling Shaky, Nervous or Hungry

4.3.3 Effect of Exercise on Blood Sugar Levels

Almost three-quarter of respondents (73.5%) said exercise lowers blood sugar level and 19.4% said blood sugar level doesn't change when doing exercise as shown in Figure 4.8.

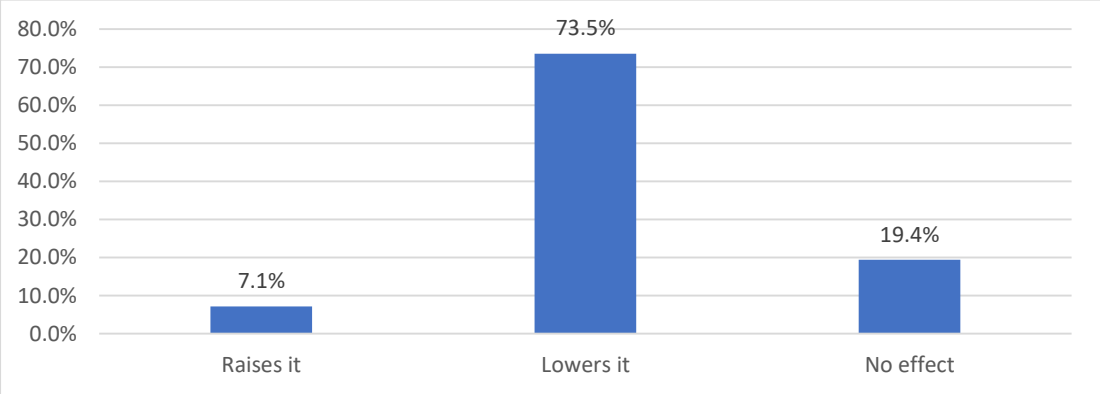

Figure 4.8: Effect of Exercise on Blood Sugar Levels

4.3.4 Appoinments Schedules

Out of 98 respondents, more than three-quarter of respondents 88(89.8%) keep their appointment days with half (50.0%) having appointments once every 3 months. Majority (91.8%) said blood testing is the best to monitor sugar level as shown in Table 4.8.

Table 4.8: Appoinments Schedules

Characteristics		Frequency	Percent
Keep appointment days	No	8	8.2
	Yes	88	89.8
	I don't know	2	2.0
Frequency of appointments	Once per month	24	24.5
	Once every 2 months	23	23.5
	Once every 3 months	49	50.0
	Once every 6 months	2	2.0
Best test for sugar	Urine testing	4	4.1
	Blood testing	90	91.8
	Both are equally high	4	4.1

4.4 Patient-Level Factors Influencing Adherence to Medication

4.4.1 Socio-Demographic Factors

Table 4.9 shows logistic regression analysis of factors associated with medication non-adherence, the finding shows that respondents between 70-79 years, 60-69 years, 40-49 years, and 20-29 years were more likely to be non-adherence to antidiabetics, however, these variables were not significantly associated with non-adherence to medication. Slightly more than quarter 6(26.1%) of single respondents were non-adherence to antidiabetic. Single respondents were 3 times likely to be non-adherence and marital status was not significantly associated with non-adherence (p=0.358). In addition, respondents with informal education, primary and secondary level of education were 6.5, 5.4 and 5.3 times likely to have low-adherence to antidiabetic, however, level of education wasn't significant associated with adherence to medication.

Table 4.9: Logistic Regression Analysis of Factors Associated with Medication Non-Adherence

		Low adherence	High adherence	OR (95% CI)	p-value
Age group	20-29 years	1(25.0%)	3(75.0%)	0.6(0.01-31.05)	0.780
	30-39 years	2(66.7%)	1(33.3%)	0.05(0.01-2.8)	0.142
	40-49 years	2(14.3%)	12(85.7%)	0.7(0.25-17.1)	0.797
	50-59 years	3(23.1%)	10(76.9%)	0.4(0.2-9.6)	0.596
	60-69 years	3(12.0%)	22(88.0%)	0.8(0.4-14.6)	0.893
	70-79 years	3(20.0%)	12(80.0%)	0.6(0.4-7.8)	0.659
	≥ 80 years	2(22.2%)	7(77.8%)	Reference	
Marital Status	Single	6(26.1%)	17(73.9%)	2.8(0.09-1.16)	0.358
	Married	10(16.7%)	50(83.3%)	Reference	
Education level	Informal education	3(23.1%)	10(76.9%)	6.5(0.101-2.132)	0.379
	Primary	7(17.9%)	32(82.1%)	5.4(0.143-5.904)	0.362
	Secondary	5(19.2%)	21(80.8%)	5.3(0.151-6.25)	0.358
	Tertiary	1(20.0%)	4(80.0%)	Reference	
Area of residence	Urban	3(27.3%)	8(72.7%)	1.8(0.154-11.84)	0.788
	Rural	13(18.1%)	59(81.9%)	Reference	
Years range with DM	Below one year	2(20.0%)	8(80.0%)	0.4(0.032-5.955)	0.532
	1-5 years	7(23.3%)	23(76.7%)	0.8(0.165-4.287)	0.836
	6-10 years	2(18.2%)	9(81.8%)	0.7(0.090-5.816)	0.761
	> 10 years	5(15.6%)	27(84.4%)	Reference	
Distance to health facility	< 10 km	4(11.1%)	32(88.9%)	4.4(0.87-22.30)	0.071
	10-19 km	2(28.6%)	5(71.4%)	1.4(0.14-14.15)	0.758
	20-29 km	0(0.0%)	2(100.0%)	1.5(1.43-5.23)	0.124
	30-39 km	2(15.4%)	11(84.6%)	4.5(0.54-37.93)	0.163
	≥ 40 km	8(32.0%)	17(68.0%)	Reference	

4.4.2 Effect of Non- Adherence on Glycemic Control among T2DM Patients

Among those with normal blood glucose only 2 (7.4%) had low adherence to medication compared to 14 (25%) among those who had high glucose levels (Table 4.10). However, there was no statistically significant difference between blood glucose levels and non-adherence to medication on glycemic control (p value 0.076).

Table 4.10: Effect of Non- Adherence on Glycemic Control among T2DM Patients

	Low adherence	High adherence	OR (95%CI)	p-value
Normal	2 (7.4%)	25 (92.6%)	Reference	0.076
High	14 (25.0%)	42 (75.0%)	4.2(0.874-19.871)	

4.4.3 Correlation Between Knowledge and Non-Adherence to Medication

From the analysis of Table 4.11, there is a statistically significant relationship between knowledge on shaking and fast heart rate and effect of exercise on blood sugar level, as indicated by correlation coefficients of (r = 0.246, p-value=0.014). This indicates that the patients who exercise keep a keen eye on the changes of their body to take precautions of shaking and fast heart rate. Analysis has also revealed that there is a significant positive relationship between keeping appointment days and detecting low blood sugar levels through signs and symptoms and manage, as indicated by correlation coefficients of (r =0.283; p-value 0.011). this indicate that patients with regular appointments gain knowledge on detecting sugar levels and managing the symptoms.

Table 4.11: Correlation between Knowledge and Low Adherence to Medication

		1	2	3	4	5	6	7	8
DM can be cured	r	1	0.102	0.123	0.056	0.065	-0.074	-0.014	0.011
	Sig. (2-tailed)		0.317	0.228	0.586	0.526	0.469	0.889	0.911
	N	98	98	98	98	98	98	98	98
Shaking and fast heartrate	r	0.102	1	-0.080	0.067	0.032	-0.032	0.246*	-0.124
	Sig. (2-tailed)	0.317		0.434	0.515	0.753	0.755	0.014	0.223
	N	98	98	98	98	98	98	98	98
Stop taking drugs when sugar is controlled	r	0.123	-0.080	1	0.018	0.100	-0.030	0.185	0.102
	Sig. (2-tailed)	0.228	0.434		0.864	0.328	0.769	0.068	0.318
	N	98	98	98	98	98	98	98	98
Detect low blood sugar levels	r	0.056	0.067	0.018	1	-0.001	0.085	0.015	0.283*
	Sig. (2-tailed)	0.586	0.515	0.864		0.990	0.403	0.885	0.011
	N	98	98	98	98	98	98	98	98
Beneficial to stop smoking or taking alcohol	r	0.065	0.032	0.100	-0.001	1	-0.128	0.126	-0.068
	Sig. (2-tailed)	0.526	0.753	0.328	0.990		0.209	0.216	0.503
	N	98	98	98	98	98	98	98	98
Checking sugar while being DM	r	-0.074	-0.032	-0.030	0.085	-0.128	1	-0.086	0.069
	Sig. (2-tailed)	0.469	0.755	0.769	0.403	0.209		0.399	0.502
	N	98	98	98	98	98	98	98	98
Effect of exercise on blood sugar level	r	-0.014	**0.246***	0.185	0.015	0.126	-0.086	1	-0.147
	Sig. (2-tailed)	0.889	**0.014**	0.068	0.885	0.216	0.399		0.148
	N	98	98	98	98	98	98	98	98
Keep appointment days	r	0.011	-0.124	0.102	**0.283***	-0.068	0.069	-0.147	1
	Sig. (2-tailed)	0.911	0.223	0.318	**0.011**	0.503	0.502	0.148	
	N	98	98	98	98	98	98	98	98

*. Correlation is significant at the 0.05 level (2-tailed).

4.4.4 Association between Selected Variables and Non-adherence to Medication

As shown in Table 4.12, There was no significant difference between the participants with non- adherence to medication who had informal education (p=0.034), had DM between 6-10 year (p=0.040), had DM for more than 10 years (p=0.026), unable to detect low blood sugar through signs and symptoms (p=0.037), don't know the benefits of stopping alcohol and smoking (p=0.025), don't check blood pressure (p=0.001) and don't keep appointments (p=0.012). The proportion of participants who had only primary education were twice as likely to be non-adherent to medication (OR=1.93; 95%

CI= 0.72-5.18, p value= 0.014), and after adjusting for the other variables, there was 39% increase in the odds (OR= 2.3; 95% CI= 0.48-4.07, p value= 0.029) of being non-adherence to medication compared to those who had secondary education

Table 4.12: Association between Selected Variables and Non-adherence to Medication

	Crude		Adjusted	
	OR (95%CI)	**p-value**	**OR (95%CI)**	**p-value**
Education level				
Informal education	Ref			
Primary	1.93 (0.72-5.18)	0.014	1.39 (0.48-4.07)	0.029
Secondary	0.87 (0.42-1.80)	0.712	1.01(0.09-1.90)	0.167
Tertiary	0.35 (0.14-0.86)	0.393	1.68(1.08-2.22)	0.525
Years range with DM				
Below one year	Ref			
1-5 years	0.98 (0.17-5.48)	0.150	1.24 (0.42-3.68)	0.534
6-10 years	1.5 (0.44-8.65)	0.023	3.15 (0.79-12.37)	0.040
> 10 years	4.5 (0.35-8.90)	0.004	5.99 (0.21-11.65)	0.026
DM can be cured				
No	1.57 (0.25-9.00)	0.194	2.42 (0.99-4.88)	0.199
Yes	0.43 (0.01-2.57)	0.342	1.46 (0.42-5.12)	0.288
I don't know	Ref			
Detect low blood sugar levels through signs and symptoms and manage				
No	2.71 (1.86-3.75)	0.031	2.88(1.99-2.54)	0.037
Yes	1.22 (2.73-6.79)	0.046	2.25(1.16-7.29)	0.078
I don't know	Ref			
Beneficial to stop smoking or taking alcohol				
No	2.23 (0.38-1.99)	0.002	2.8(060-6.73)	0.025
Yes	0.62 (1.08-3.27)	0.068	1.8(0.44-7.52)	0.367
I don't know	Ref			
Checking blood pressure while being DM				
No	2.66 (1.02-4.31)	0.001	5.1(0.01-2.80)	0.001
Yes	1.74 (2.14-5.88)	0.047	3.7(0.20-2.55)	0.170
I don't know	Ref			
Effect of exercise on blood sugar level	0.65 (0.22-1.62)	0.352	0.79 (0.30-2.74)	0.657
Keep appointment days	1.95 (2.19-7.09)	0.001	2.54 (1.16-6.57)	0.012

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Prevalence of Non-Adherence to Prescribed Diabetes Medication Regimen

This study revealed that majority of the respondents, constituting 65.1% had high adherence level. This was followed by low adherence and medium level with proportions of 19.3% and 15.7% respectively. The prevalence of low adherence (19.3%) in this study is consistent with similar studies conducted at France and Brazil where the prevalence was 19%, and 18.3% respectively (Tiv et al. 2016; Schauerhamer, & McAdam-Marx, 2018). The findings are also in line with those of a study carried out in Yemen where poor adherence was 22% (Parajuli et al. 2014). The rate of low adherence found in this study was higher compared to a similar study conducted in Ghana, where the prevalence was 8.5% (Mateo, et al. 2016). The low adherence level found in this study was also greater than other studies conducted in Egypt where the adherence rate was 8.9% (Delamater, et al. 2001) and in Mexico the adherence rate was 11 % (Harris 2021).

The low adherence in this study was lower than findings done in Ethiopia by Aboe & Bush, (2017) that found 26.3% of patients with diabetes had low utilization of antidiabetics for a study period of 210 days. Similarly, the finding of the study was lower than another study by Antwi-Adjei, (2017) in Cape town, South Africa that found 29.6% of low adherence to medication among T2DM. A study in Kenya at the Kenyatta National referral hospital reported that only 45.5% of patients with Type 2 diabetes adhered to the medication (Waari, Mutai & Gikunju, 2018) and this is comparable to other studies within the East African region (Abebe, Berhane, Worku, 2014 and Kamuhabwa &, Charles, 2014). According to the Kenya STEPwise Survey for NCDs Risk Factors (2015), respondents in the highest wealth quantiles as well as having

formal education were more likely to be screened for elevated blood sugar periodically. Also, among those diagnosed with diabetes mellitus, only 40% were taking medication at the time of the survey. Variation in medication use was observed between women (57%) and men (17%) while those aged 30-44 years reported the highest current use of medication, at 67%. A higher percentage of patients on treatment resided in urban areas (54%) compared to those in rural areas at 28%. This could infer that patients' health practices are affected by their health literacy, and these beliefs are also contributors to (non) adherence. A study in Dangila city of Amhara region and Kersa district of Oromia region by Nyamwaro, (2016) found coverage of 32%, whilst a report by IDF (2016) found the low adherence in Guinea (30%), Namibia (37%), Chad (38%), Central Africa Republic (38%), and Tanzania (32%). However, a study conducted in India found the incidence of non-adherence to diabetes management to be 75% (Brownlee-Duffeck, et al, 2016), with this study also using self-reports. This difference observed in these studies might be because respondents in this study obtained free health education and this could have influenced their good adherence behavior. Also, might be because of the criteria they use to define non-adherence. There might be studies where if you fail to take mediation for one day you are considered non-adherent and other studies which might consider say missing 10% of your medications. T2DM treatment and management is for long periods of time, sometimes a lifetime. This calls for proper follow-through by the patient on the recommended medication regimen as well as diet and lifestyle changes, basically self-care practices. Poor medication adherence is a significant barrier to attainment of positive clinical outcome among diabetic patients.

5.1.2 Knowledge and Self-Management Practices

Results of this study also showed that 87.5% and 90.2% of the participants who adhered to medication were knowledgeable about continuing to take antidiabetic drugs even when sugar is controlled and how to detect low blood sugar levels through signs and symptoms and manage. These variables were significantly associated with adherence to medication. In Brazil, a study conducted found that increase in the level of knowledge of respondent to be associated to improve in anti-diabetic medication adherence, and this

finding is consistent to this study. There was a positive relationship between knowledge on shaking and fast heart rate and effect of exercise on blood sugar level. This was consistent with other studies by Tiv et al. (2016) and Krass, Schieback, Dhippayom (2015). Educated patients are more knowledgeable about the consequences of diabetes and the complications associated with diabetes and as such tend to adhere to their medications better. Another study by Rajak *et al.*, (2017) on knowledge, attitude and practices regarding diabetes medication adherence in parts of India found that poor knowledge affected medication adherence.

5.1.3 Patient-Level Factors Influencing Adherence to Medication

This study identified that respondents 70-79 years, 60-69 years, 40-49 years, and 20-29 years were more likely to have low-adherence to antidiabetics. This concurs with Chandrashekar *et al* (2014), in a study on utilization and barriers to diabetes medication in rural South India found that the reason for low adherence among the rural population was the age of respondents. Majority of participants who had low adherence level were between 30-39 years. This finding is consistent with the result done at Mulago hospital in Uganda, a study conducted found almost one third of respondents (31.3%) between the ages of 30 to 40 years not adherent to their prescribed treatment regimens

This study also found that respondents with informal education, primary and secondary level of education were 6.5, 5.4 and 5.3 times likely to be low adherent to antidiabetic medication. Also, in the studies reported by Delamater, et al. (2001) and Harris, (2001), non-adherence to a treatment regimen was higher and more likely to be among respondent with low level of education. T2DM patients with lower grade level of schooling were 8 times likely to miss the medication for between 14- 21 days in a month. In addition, illiterates were unable to read effectively or understand the instruction provided by the health professionals and as such were not able to take their medications optimally. In this era of increase in the complexity of diabetes drug therapy, patients need to be educated to understand the condition diabetes and its management. Educational level and the economic status can impact positively or negatively on the

quality of life of the diabetic patient, as a result, on the level of metabolic control. Educating the patient on the disease condition helps improve adherence to therapy and health outcomes. Majority of patients enrolled in this study were females and 20.4% of the females had low adherence whiles 17.2% males had low adherence. This low adherence level among the female participants could be due to their high enrollment for this study. The difference between females and males with low adherence is statistically insignificant; however low adherence to anti-diabetic medication was found to be associated with the female gender as was cited in other studies. The study revealed that urban dwellers were almost twice likely to be non-adherent to diabetes medication. However, in this study, there is no evidence of association between where the patient stays with and level of adherence.

The duration that a patient has been diagnosed of diabetes plays an important role in medication adherence. The findings from this study are consistent with a report by the World Health Organization (WHO). However, in this study higher level of low adherence were among the patients with less duration of being diagnosed with diabetes. This is inconsistent with a study by Abebe, Berhane, Worku, (2014) and Kamuhabwa &, Charles, (2014) that points to the fact that respondent's medication adherence is inversely proportional to the duration of being diagnosed with diabetes. Those patients with longer disease duration tend to be less adherent to treatment. Diabetes is a progressive silent disease, and due to this fact lower rates of medication adherence is a matter of concern to health providers and worldwide and complications due to poor glucose control are likely to increase with time (Schauerhamer, & McAdam-Marx, 2018). There was a significant association between how long the participant have been diagnosed with diabetes and adherence levels. From the results of this study, participants who had been diagnosed of diabetes for 4 years or less were found to adhere poorly to their antidiabetic medications than those who had been diagnosed for more than 4 years, hence adherence increased with increased duration of disease diagnosis. This finding was inconsistent with findings of a study by Alhariri et al, (2017) in Yemen, which reported that patients were less likely to adhere to their medication with time, but

consistent with the findings of Mbanya et al., (2020) which revealed that longer duration of the diseases resulted in good adherence. The finding of this study indicates that adherence is compromised with less duration of diabetes because patient's attitude coping with the disease is reduced and failure to accept that they are having the condition.

5.2 Conclusions

1. The study revealed that a fifth of the respondents constituting 19.3% had low level of adherence to prescribed diabetes medication regimen.
2. Patients with knowledge on taking drugs when sugar is controlled, detecting low blood sugar levels through signs and symptoms and able to manage, stop smoking or taking alcohol and Checking blood pressure while being diabetic are more likely to adhere to their antidiabetic medications.
3. The study revealed that level of education has an influence on medication adherence. Respondents with informal education, primary and secondary level of education were 6.5, 5.4 and 5.3 times likely to be low-adherent to antidiabetics.
4. Interventions that focus on helping patients with low levels of education to understand the benefits of adherence to medication can help improve adherence to medication and prevent related complication.

5.3 Recommendations

Based on the findings of this study it is generally recommended that: -

1. Healthcare providers should generate a systematic sensitization program on what is involved in the diabetes treatment process and the need for adherence to medication so as to address some low adherence cases. This may increase adherence level especially with the preference for hospital healthcare talks. There is also a need to train and deploy patients living with diabetes and Community health volunteers on house-to-house campaign and awareness creation activities.

Peer support and community-level engagement will enhance awareness and improve adherence to medication.

2. Both Central and County governments in collaboration with their stakeholders, should implement targeted community health strategies such as outreaches, community mobilizations and medical camps to educate and provide services to the patients at their localities. Community pharmacists should be trained to support management of T2DM patients at the community level through patient education, medication adherence counseling as well as continuous blood sugar monitoring.
3. Information, education and communication (IEC) activities regarding medication adherence should be strengthened by the MOH and regional health boards through mass media messages and encouraging and broadening the activities of health workers in the rural area.
4. Utilization of Digital Health solutions like mobile messaging and applications, can be embedded in the care management plan to enhance collaboration with care providers, to educate patients on T2DM self-management, as well as remind patients to take their medication and attend to their clinic appointments.
5. Stakeholders such as Ministry of Health, World Health Organization and International Diabetes Federation should play a role in liaising with companies for subsidized medication and glucometers provision on behalf of the patients. Hospitals administration can also approach manufacturers and distributors to enter in preferential pricing agreements for diabetes medication and commodity owing to the large patient volumes handled within their clinics. This would enhance continuous monitoring of blood sugar levels at home, improve medication adherence and consequently impact on health outcomes

5.4 Further Research

In this study, the small sample size (98 participants) and short follow-up period restricts generalizability of the study findings to the general population of persons living with T2DM. There is a need to implement large scale and longer-term prospective studies to

further study the level of adherence, the relationship that exist between the rate of adherence and frequency of patient clinic visits as well as access to and affordability of the prescribed drugs among patients living with T2DM. These studies should involve large number of respondents so that the numbers in the various strata can be sufficient.

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APPENDICES

Appendix I: Consent Form

PART A: Participant Consent Information Form

Title of the Study: The Burden of Non-Adherence to Medication in Type II Diabetes Mellitus Patients: A Prospective Study in Gatundu Town In Rural Kiambu County

My name is Caroline Kyalo and I am a Masters student in Public Health from JKUAT. You are invited to take part in research on diabetes management which is quite common in Kiambu County. In this study, you are a potential participant because you have been attending the diabetes clinic at Gatundu Level 4 Hospital. I would like to ask you to read through the attached form prior to consenting to take part in the research. If you cannot read, you can request the researcher or her assistant to read it to you.

Purpose

The purpose of this research is to evaluate your adherence to medication through a one-time questionnaire to assess current practices and influencing factors as well as follow-up after one month of filling-in an adherence card. The study will offer important information on the burden of non-adherence as well as its key influencers among patients in similar settings in the Country and region, with the findings aimed at informing policies and programs for better design in managing type 2 Diabetes.

Study Procedures

Upon agreement to be part of the study participants and signing this form, I will interview you on a number of factors, mainly demographic and socioeconomic characteristics, medication adherence and self-management practice among other factors. The questions should take around 30minutes of your time. You will then be

directed to an identified room for sample collection to test for Random blood sugar levels

Risk and Benefit

There are no predicted risks linked with this study. You will however benefit in knowing your Random blood sugar levels and the results will be put in your patient file. You will receive a copy of the result.

Confidentiality

All responses and records received in the course of conducting the study will be treated with strict confidentiality. In any report of emanating from the findings of the study, no identifiable information will be published. In addition, the information collected will not include the names, addresses, contact information of the participants, neither will the said information be included in the study. The filled in questionnaires will be safely secured in a locked file, with access granted only to the researchers for the purpose of analysis.

Voluntary nature of the study

Taking part in the study is completely voluntary, with the additional option of withdrawal from the study at any such time as deemed fit by the individual without any penalty. In addition, any decision to partake or not be involved in the study does not have any bearing influence on the individuals current or even future relations with the hospital or other institutions involved. Should you have any questions or queries about any aspect of the study, an explanation shall be provided upon request.

Contacts

The researchers conducting this study are Caroline Kyalo and her assistant. Feel free to contact the researchers at any time. Her contact is 0725 673071 and her mail address is

katungehutchin@gmail.com. Any queries and questions regarding the rights of research subjects, should be addressed to the Ethical Committee at JKUAT. You can direct the questions to:

The Director;

Institute of Tropical Medicine and Infectious Diseases

Jomo Kenyatta University of Agriculture and Technology

P.O. Box 62200-00200; Nairobi

Tel: 067-52711

Email: itromid@kemri.org

OR

The Chairperson,

Ethics Review Committee

University of Eastern Africa Baraton

P.O BOX 2500-30100, Eldoret

Tel: +254 (20) 802-3084/6/7

Email: ueabrec@gmail.com

Part B: Consent Form

I have read/been read to the information in PART A and my concerns were well addressed. I understand that this survey is voluntary and I may stop at any time. I agree to voluntarily participate in the study.

_____

Signature of participant Date:

_____

Signature of researcher/ research assistant Date:

Appendix II: Questionnaire

Serial No.	
Date of Interview	

Part 1: Background information		
Variable	Response	Code
1. Age		
2. Gender	Male Female	1 2
3. Region of residence		
4. Marital Status	Single Married Widowed Divorced/Separated	1 2 3 4
5. Education level	Informal Education Primary Secondary Tertiary	1 2 3 4
6. Residence	Urban Rural	1 2
7. Religion	Christian Muslim Traditional Other (Specify)……..	1 2 3 4
8. Which of these describes your main work status (Choose one only)	I work only around the homestead I am a small-scale farmer I am self-employed but not as a farmer I am in formal employment I am retired or a pensioner	1 2 3 4 5
9. For how long have you lived with diabetes?	Below one year 1-5 years 6-10 years More than 10 years	1 2 3 4
10. When you first diagnosed, what treatment and advice were you given? (*more than one choice allowed*)	None Insulin injection Tablets Change of Diet Exercise and weight loss	1 2 3 4 5

11. Are you taking any medication for it?	Yes No	1 2
Part 2: **Knowledge/Awareness levels on T2DM Management**		
12. Can diabetes be cured?	No Yes I don't know	1 2 3
13. What does it mean when a person with diabetes is shaking and the heart rate is fast:	Low blood sugar High blood sugar I don't know	1 2 3
14. If you suddenly feel shaky, nervous or hungry, what should you do?	Lie down and rest Eat some form of sugar Take more insulin or diabetes pills Not sure Other …….	1 2 3 4
15. Once your blood sugar has been controlled, should you stop taking the drugs?	No Yes I don't know	1 2 3
16. Can you detect low blood sugar levels through signs and symptoms and manage?	No Yes I don't know	1 2 3
17. If you are a smoker or take alcohol, is it beneficial to stop?	No Yes I don't know	1 2 3
18. Should on ehave their blood pressure checked if they have diabetes?	No Yes I don't know	1 2 3
19. How does exercise affect blood sugar level?	Raises it Lowers it No effect	1 2 3
Part C: Practices on T2DM Management		
20. Do you keep appointment days as given by the doctor?	No Yes I don't know	1 2 3
21. How frequent are your doctor's appointments in a year?	Once per month Once every 2 months Once every 3 months Once every 6 months Other (specify)…….	1 2 3 4
22. What is the best method of testing blood glucose levels?	Urine testing Blood testing Both are equally high I don't know	1 2 3 4
Part B: Medication Adherence		

23. What prescribed drugs are you taking for diabetes?	Oral glucose lowering agents Insulin Both	1 2 3
24. If on glucose lowering agents, how many tablets do you take?	1 2 3 More (specify)……..	1 2 3 4
25. What time do you take your medication? (*Indicate dosage*)	Morning Afternoon Evening Morning & Evening	1 2 3 4
26. Are there times you have skipped/missed taking your diabetes medication in the last 7 days?	No Yes	1 2
27. How many days in the last week has that happened?	……..	
28. If yes, why?	Lack of money Lack of drugs in the hospital Distance to the hospital I forget I don't like taking drugs Pain when administering insulin Other (specify)……..	1 2 3 4 5 6
29. Is there any other treatment you take for treating your blood sugar other than the medication you receive from the clinic?	No Yes	1 2
30. If yes, what treatment? (specify)	…….	
Glucose self-monitoring practice		
31. How often do you check your blood sugar?	Daily Every two days Weekly Monthly Other (specify)……..	1 2 3 4
32. Do you have a glucometer?	No Yes	1 2
33. If you do not have a glucometer, where do you go to have your blood glucose level checked?	Only during clinic days From Chemists or private clinics Through the diabetes support group	1 2 3

Appendix III: Adherence Card

Patient Name: …… Serial No: ……

Number of Tablets per day: …… Insulin Injections (Yes/No) ……

Tablets Count at beginning: ……. Tablets Count after 1 month: ……

Day of Week	Morning	Evening
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
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Appendix IV: Translated Questionnaire and Adherence Card

HOJAJI

Nambari ya mfululizo	
Siku ya usaili	

Sehemu 1: Ha≥bari za ziada		
Vibadiliki	Jibu	Ishara
1. Umri		
2. Jinsia	Kiume Kike	1 2
3. Makao		
4. Hali ya ndoa	Mseja Ndani ya ndoa Mjane Aliyetalakiana	1 2 3 4
5. Kiwango cha elimu	Elimu isiyo rasmi Shule ya msingi Elimu ya sekondari Elimu ya juu	1 2 3 4
6. Makao	Mjini Vijijini	1 2
7. Dini	Mkristo Mwislamu Dini za kitamaduni Nyingine (fafanua)……..	1 2 3 4
8. Ipi kati ya hizi inayo ashiria hali yako ya kikazi (Chagua moja pekee)	Nawajibika ndani ya boma Mimi ni mkulima mdogo Nimejiajiri lakini sio kwa ukulima Nafanya ajira rasmi Nimestaafu ama napokea pensheni (malipo ya uzeeni)	1 2 3 4 5
9. Umeugua kisukari kwa muda upi?	Chini ya mwaka mmoja Miaka 1-5 Miaka 6-10 Zaidi ya miaka 10	1 2 3 4
10. Ilipogunduliwa kwa mara ya	Hakuna	1

kwanza, ulipewa matibabu gani na ushauri upi? (*waeza chagua zaidi ya moja*)	Sindano za insiluni Matembe Kubadili mulo ama kula vyakula maalum Zoezi na kupunguza uzani	2 3 4 5
11. Watumia matibabu yoyote?	Ndio La	1 2
Part 2: **Kiwango cha elimu/Maarifa juu ya udhibiti wa T2DM**		
12. Je, kisukari ina tiba?	La Ndio Sijui	1 2 3
13. Wakati mtu mwenye kisukari anahisi kuongezeka kwa mpigo wa moyo, kutiririkwa na jasho ama kutetemeka, nini kinacho mdhuru?	Kupunguka kwa kiwango cha sukari kwenye damu Kuongezeka kwa kiwango cha sukari kwenye damu Sijui	1 2 3
14. Ukihisi kutetemeka, kutukuta, ama njaa, wafaa kufanya kitu kipi?	Kulala ili kupumzika Kula aina fulani ya sukari Kumeza tembe zaidi za insulini ama kisukari Sijui Nyingine ……	1 2 3 4
15. Mara kiwango cha sukari kwenye damu imedhibitika, ni vyema kuacha kuzingatia matibabu uliyopewa?	La Ndio Sijui	1 2 3
16. Je, waeza chunguza kupungua kwa kiwango cha sukari kwenye damu kupitia ishara na dalili za aina na kuidhibiti?	La Ndio Sijui	1 2 3
17. Kama wavuta sigara ama kutumia vileo, kuna manufaa yoyote kuacha?	La Ndio Sijui	1 2 3
18. Je, kuna umuhimu wa kupima shinikizo la damu mara mtu anapochunguzwa ikiwa ana ugonjwa wa kisukari?	La Ndio Sijui	1 2 3
19. Mazoezi yana athari gani kwa kiwango cha sukari kwenye damu kwa mtu mwenye kisukari?	Inaongeza Inapunguza Haina athari	1 2 3
Sehemu C: Mazoea ya kudhibiti T2DM		

20. Wazingatia siku zilizo teuziwa kuona daktari?	La Ndio Sijui	1 2 3
21. Una siku ngapi zilizo teuziwa kuona daktari kwa mwaka?	Mara moja kwa mwezi Mara moja kila miezi miwili Mara moja kila miezi tatu Mara moja kila miezi sita Nyingine (fafanua)…….	1 2 3 4
22. Ipi njia mwafaka ya kupima kiwango cha glukosi kwenye damu?	Kupima mkojo Kupima damu Zote zina usawa Sijui	1 2 3 4
Kuzingatia Matibabu		
23. Ilipendekezwa kutimia dawa gani kudhibiti kisukari?	Kutumia ajenti zinazo punguza glukosi mdomoni Insulini Zote	1 2 3
24. Tembe ngapi zinazo hitajiwa kumeza iwapo unatumia ajenti za kupunguza glukosi?	1 2 3 Zaidi (fafanua)……..	1 2 3 4
25. Wameza dawa nyakati gani kwa siku?	Asubuhi Mchana Jioni Moja asubuhi na moja jioni	1 2 3 4
26. Kuna siku ambazo haukuzingatia ama ulikosa kutumia matibabu kwa siku saba zilizo pita?	La Ndio	1 2
27. Tukio kama hilo limefanyika mara ngapi wiki iliyopita?	……..	
28. Iwapo jibu ni ndio, mbona?	Kukosa hela Kukosa madawa hospitalini Umbali wa hospitali Nilisahau Sipendi madawa niliyo shauriwa kutumia Kuhisi uchungu wakati wa kujidunga na insulini Nyingine (fafanua)……..	1 2 3 4 5 6
29. Kuna matibabu mengine unayo zingatia kwa minajili ya	La Ndio	1 2

kudhibiti kiwango cha sukari kwenye damu kando na iliyopendekezwa kwenye kliniki?		
30. Kama ndio, ni matibabu gani? (fafanua)	…….	
Mazoea ya kufuatilia binafsi kiwango cha glukosi		
31. Ni mara ngapi wapima binafsi kiwango cha sukari kwenye damu?	Kila siku Kila siku mbili Kila wiki Kila mwezi Nyingine (fafanua)……..	1 2 3 4
32. Uko na kifaa cha glucometer?	La Ndio	1 2
33. Kama hauna kifaa cha glucometer, unatumia mbinu gani ama waenda kwa kituo kipi kupima kiwango cha glukosi kwenye damu?	Siku za kliniki pekee Kwenye duka la dawa ama kliniki za kibinafsi Kupitia vikundi vya usaidizi vinavyo jihusisha na kisukari	1 2 3

Appendix V: Kadi Ya Uzingatiaji

Jina la mgonjwa: ……

Nambari ya mfululizo: ……..

Nambari ya tembe kwa siku: ……

Sindano za insulini (Ndio/La)……

Nambari ya tembe mwanzoni: ……

Nambari ya tembe baada ya mwezi……

Siku ya wiki	Asubuhi	Jioni
01		
02		
03		
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Appendix VI: Graduate School Approval

KENYA MEDICAL RESEARCH INSTITUTE

GRADUATE SCHOOL OF HEALTH SCIENCES
P.O. BOX 54840-00200, NAIROBI, KENYA
Tel: (254) (020) 2722541, 0713 112853, 0202711255 or 0713 112854 Fax: (254) (020) 2720030
E-mail: graduateschool@kemri.org Website: www.kemri.org

20th May, 2019

KEMRI/ITROMID/ HSH 311-0022/2017

TO WHOM IT MAY CONCERN

RE: CAROLINE KATUNGE KYALO HSH 311-0022/2017

This is to confirm that the above-named student is pursuing a Msc Programme in **Public Health** at the **KEMRI Graduate School of Health Sciences** formerly **Institute of Tropical Medicine and Infectious Diseases (ITROMID)** a joint programme between **Kenya Medical Research Institute (KEMRI)** and **Jomo Kenyatta University of Agriculture and Technology (JKUAT).**

The student is seeking for permission for data collection to back up her proposal titled **"The burden of non-adherence to medication in type II Diabetes Mellitus patients: A prospective study in Gatundu town in Rural Kiambu County".**

Kindly accord her the necessary assistance.

DEPUTY DIRECTOR
KEMRI GRADUATE SCHOOL

Elizabeth Echoka, PhD
Ag. Assistant Director, Academic Affairs
KEMRI GRADUATE SCHOOL

Appendix VII: Ethical Review Committee Approval

OFFICE OF THE DIRECTOR OF GRADUATE STUDIES AND RESEARCH

UNIVERSITY OF EASTERN AFRICA, BARATON

P. O. Box 2500-30100, Eldoret, Kenya, East Africa

25th April, 2019

Caroline Katunge Kyalo
School Of Public Health
Jomo Kenyatta University of science and Agriculture (JKUAT)

Dear Caroline

Re: ETHICS CLEARANCEFOR RESEARCH PROPOSAL (REC: UEAB/25/042019)

Your Master thesis entitled ***"The burden of Non-adherence to medication in type II diabetes mellitus patients: A prospective study in Gatundu town in Rural Kiambu County-Kenya"*** was discussed by the Research Ethics Committee (REC) of the University and your request for ethics clearance was granted.

This approval is for one year effective 25th April 2019 until 25th April 2020. For any extension beyond this time period, you will need to apply to this committee one month prior to expiry date.
Note that you will need a research permit from the National Commission for Science, Technology and innovation (NACOSTI) and clearance from the study site before you start gathering your data.

We wish you success in your research.

Sincerely yours,

University of Eastern Africa, Baraton
25 APR 2019
P.O.Box 2500-30100, ELDORET
Research Ethics Committee

Prof. Jackie Chege
Chairperson, Research Ethics Committee

A SEVENTH-DAY ADVENTIST INSTITUTION OF H IGHER LEARNING
CHARTERED 1991

Appendix VIII: NACOSTI Permit

THIS IS TO CERTIFY THAT:
MS. CAROLINE KATUNGE KYALO
of JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY (KEMRI CAMPUS), 79998-200 Nairobi,has been permitted to conduct research in *Kiambu County*

on the topic: *THE BURDEN OF NON-ADHERENCE TO MEDICATION IN TYPE II DIABETES MELLITUS PATIENTS: A PROSPECTIVE STUDY IN GATUNDU TOWN IN KIAMBU COUNTY*

for the period ending:
5th July,2020

.....
Applicant's Signature

Permit No : NACOSTI/P/19/61023/30734
Date Of Issue : 8th July,2019
Fee Recieved :Ksh 1000

.....
Director General
National Commission for Science.

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
TEL: 020 400 7000, 0713 788787, 0735 404245
Email: dg@nacosti.go.ke, registry@nacosti.go.ke
Website: www.nacosti.go.ke

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 25772

CONDITIONS: see back page

Appendix IX: NACOSTI Authorization

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/61023/30734**

Date: **8th July 2019**

Caroline Katunge Kyalo
Jomo Kenyatta University of
Agriculture and Technology
P.O. Box 62000-00200
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"The burden of non-adherence to medication in Type II Diabetes mellitus patients: A prospective study in Gatundu Town in Kiambu County."*** I am pleased to inform you that you have been authorized to undertake research in **Kiambu County** for the period ending **5th July, 2020.**

You are advised to report to **the County Commissioner, the County Director of Health Services, and the County Director of Education, Kiambu County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

DR. MOSES RUGUTT, PhD, OGW.
DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kiambu County.

The County Director of Education
Kiambu County.

Appendix X: Gatundu Level 5 Hospital Authorization

COUNTY GOVERNMENT OF KIAMBU
DEPARTMENT OF HEALTH SERVICES
GATUNDU LEVEL 5 HOSPITAL

Telegram:"MEDICAL"Gatundu
Telephone:0786916894
When replying please quote
Email Adress

GATUNDU LEVEL 5 HOSPITAL
P.O. BOX 84 - 01030
GATUNDU
gatundul4h@gmail.com

Ref:GTD/GEN/37/VOL.1/103

24TH JULY 2019

CAROLINE KATUNGE KYALO
KEMRI/ITROMID/HSH 311-0022/2017

RE: AUTHORITY TO COLLECT DATA

Your application to conduct research on *"The burden of non – adherence to medication in type II diabetes mellitus patient"* in this institution has been granted.

During the entire period of your research, you will be reporting to the Medical Officer Incharge Diabetic Clinic, who will be the key Hospital Co-ordinator during the data collection. He will support you access any information that may be relevant for the successful undertaking of the research.

Finally, you are expected to adhere to all the regulations relating to confidentiality of patient information, ethics in research as well as all norms regarding conduct in a Public Health Institution.

Wishing you a successful research.

THE MEDICAL SUPERINTENDENT
Sign
24 JUL. 2019
P. O. Box 84 - 01030,
GATUNDU
GATUNDU LEVEL 5 HOSPITAL

KARIUKI J G
HEALTH ADMINISTRATIVE OFFICER
GATUNDU LEVEL 5 HOSPITAL

Appendix XI: Publication

International Journal of Community Medicine and Public Health
Kyalo CK et al. Int J Community Med Public Health. 2022 Jan;9(1):27-32
http://www.ijcmph.com
pISSN2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20214976

Original Research Article

Knowledge and self-management practices among type II diabetes patients: a study in Gatundu town in Kiambu, Kenya

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[3]Centre for Microbiology Research, Kenya Medical Research Institute, Kenya

Received: 24 September 2021
Revised: 05 November 2021
Accepted: 18 November 2021

***Correspondence:**
Caroline Katunge Kyalo,
E-mail: katungehutchin@gmail.com

ABSTRACT

Background: Type-2 diabetes mellitus is recognized as a key non-communicable disease affecting over 425 million world-wide, with only half of them currently diagnosed. The most crucial risk factor for mortality associated with type-2 diabetes is poor adherence to the prescribed medication.
Methods: A cohort study design was used to study 98 type 2 diabetes patients in Kiambu County. Consecutive sampling method was used. The collection of data utilized a pre-designed and piloted structured questionnaire. Quantitative data analysis was conducted using SPSS version 26.0 and correlation between the total count of the remaining diabetic medication and the blood sugar after one month follow-up was assessed. Univariate logistic regression was conducted in assessing the association between each of the predictor variables and the two main outcome variables (adherence to medication and glycemic control). A multiple logistic regression model was constructed for each of the two outcome variables.
Results: 31 (31.6%) of the study subjects were between 60-69 years, 70 (71.4%) were married and 66 (67.3%) were female. In addition, 37 (37.8%) had diabetes for more than 8 years, 70.6% had hypertension and 83.7% were prescribed oral hypoglycaemic agents as initial treatment. Majority of the respondents constituting 80.7% had high adherence to prescribed diabetes medication regimen, knowledge on diabetes treatment (p=0.009) and detecting low blood sugar levels through signs and symptoms and manage (p=0.001) had significantly association with adherence to antidiabetic.
Conclusions: Diabetic patients who have knowledge on diabetes and its management, those who stop alcohol and cigarette smoking and those who understand hypertension are more likely to adhere to diabetic treatment.

Keywords: Type 2 diabetes mellitus, Medication adherence, Self-management practices

INTRODUCTION

Globally, diabetes affects 425 million people at a prevalence of 8.8% and will rise to approximately 700 million people by the year 2040.[1] Currently, one in every 11 adults worldwide is living with the condition with 90% of these being type II diabetes patients[1]. The past three decades has recorded a distressing rise in the cases of diabetes mellitus, resulting in quadrupling of the cases. In 2015, it was estimated that diabetes caused an approximate 1.6 million deaths globally while in 2017 an approximate 2.2 million fatalities are linked to high blood glucose.[2] In 2018, it was ranked the 7th leading causes of death globally.[2] Currently, Kenya experiences a high disease burden, with NCDs contributing to 20.3%.[3] More than 50% of the total adult admissions to hospitals and

deaths therein in Kenya are as a result of non-communicable diseases, with diabetes ranked among the top three causes. Its prevalence in Kenya is 6%, with one in every 17 Kenyans having diabetes. There were 498,500 known cases of diabetes reported in Kenya in 2017.[1-3] This rise is significantly higher compared to 3.3% in 2011. This is occasioned by changes in social and demographic situation in the country, with people adopting lifestyles that negatively impact on their health. Community studies have established that the prevalence of diabetes mellitus stands at 4.2% in the general population with variations between rural and urban communities (2.2% in the rural and 12.2% in urban.[4] However, these estimates are likely higher due to under diagnoses and missed opportunities at screening. It is also reported that approximately 20% of Kenya's populace have impaired glucose tolerance. In Kenya, T2DM affects a younger and productive population compared to developed countries. Kenyans' peculiar health-seeking behaviours leads to delayed diagnosis, resulting in advanced disease at diagnosis. This poses a high risk for life-threatening complications.[5] Diabetes demands long-term follow up through regular access to specialized services and medication. Health workers who lack specialized training are charged with managing T2DM patients and exposing them to suboptimal management[19]. There is also a lack of routine screening for complications during management of care due to high costs of tests as well as lack of access to the same.[6] Globally, studies show that adherence levels to diabetes treatment regimen ranges from 38.5% to 93% based on the methodological approach. Adherence to prescribed medication is key in ensuring glycemic control and lowering risk of developing complications as well as reduced hospitalization and mortality. WHO reports that in developed countries, adherence to long term-therapies for chronic illnesses, including medication, averages about 50%, with even lower rates experienced in the developing countries.[1] This poses a great risk in management of chronic illnesses like T2DM while impacting on the patient's perceived quality of life and increases their healthcare expenditure due to increased hospital admissions. It is important to understand the status of non-adherence to type II diabetes medication in Kenya, to qualify strategies that will enhance adherence among patients. The purpose of the study is to determine the prevalence of non-adherence to type II Diabetes medication and evaluate the level of knowledge as well as patient-level factors influencing adherence to medication in T2DM patients in Kenya.

METHODS

This study adopted a cohort study design. The study was conducted at Gatundu level 5 Hospital in Kiambu County between August and September 2020.The study recruited participants through consecutive sampling method at the hospital's medical outpatient clinic (MOPC). The study sample consisted of patients previously diagnosed with type 2 diabetes and on medication. For patients who reported a complication, the same was verified from the medical records. The collection of data utilized a structured questionnaire. The questionnaire adopted, in part, the Morisky medication adherence scale.[8] It covered demographics, clinical information as well as management practices on T2DM. The structured questionnaire was administered to the type II diabetes mellitus patients at baseline to collect demographic information, clinical characteristics of the patient and patient experiences in diabetes management. The patients were then followed up for one month from the recruitment date to track their adherence to the prescribed diabetes medication. This was done using an adherence card to be filed in by the patient as well as a pill count. Random blood sugar measurements were taken on recruitment and after one month of follow-up. Data was analysed using statistical package for social science (SPSS) version 26.0. Descriptive data was presented using frequencies, percentages, means and standard deviation while inferential statistics used chi-square test to measure associations, p values equal to or less than 0.05 were considered statistically significant.

RESULTS

Socio-demographic characteristics of study respondents

The respondents mean age was 62.3±15.28 with age ranging from 21 years to 98 years. The findings showed that 31 (31.6%) were between 60-69 years, 21(21.4%) between 70-79 years, 14 (14.3%) 40-49 years and 4 (4.1%) were between 20-29 years. The majority of the respondents 70 (71.4%) were married (Table 1).

Table 1: Socio-demographic characteristics of study respondents.

Characteristics		N	%
Age group (years)	20-29	4	4.1
	30-39	3	3.1
	40-49	14	14.3
	50-59	13	13.3
	60-69	31	31.6
	70-79	21	21.4
	≥80	12	12.2
Sex	Male	32	32.7
	Female	66	67.3
Marital Status	Single	8	8.2
	Married	70	71.4
	Widowed	20	20.4

Socio-economic characteristics of study respondents

Slightly less than half 43 (43.9%) of respondents had primary level of education with at least 5% of respondents having tertiary education. Approximately 60% were small scale farmers with more three-quarter 86

(87.8%) residing in rural areas and 41 (41.8%) travelled less than 10 km to the health facility (Table 2).

Table 2: Socio-economic characteristics of respondents.

Characteristics		N	%
Level of educational	Informal Education	22	22.4
	Primary	43	43.9
	Secondary	28	28.6
	Tertiary	5	5.1
Work status	Work around the homestead	11	11.2
	Small-scale farmer	59	60.2
	Self-employed but not as a farmer	18	18.4
	Formal employment	4	4.1
Residence	Urban	12	12.2
	Rural	86	87.8
Distance to health facility (km)	Less than 10	41	41.8
	10-19	7	7.1
	20-29	4	4.1
	30-39	14	14.3
	≥40	32	32.7

Adherence to prescribed diabetes medication regimen

Using the Morisky medication adherence scale to determine adherence level among respondents, it was observed that majority of the respondents constituting80.7% had high and medium adherence to prescribed diabetes medication regimen as shown in (Figure 1).

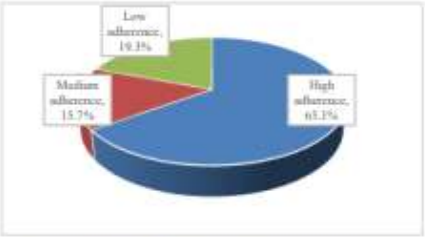

Figure 1: Adherence to prescribed diabetes medication regimen.

Knowledge of management of diabetes

Among the respondents who on adherence to diabetic management, 90.0% of the respondents said diabetes can be cured knowledge, 87.5% said they don't stop taking drugs when sugar is controlled, further, 90.2% would detect low blood sugar levels through signs and symptoms and manage. Knowledge on diabetes treatment (p=0.009) and detecting low blood sugar levels through signs and symptoms and manage (p=0.001) had significant association with self-management of diabetes (Table 3).

Correlation between knowledge and non-adherence to medication

From the analysis of (Table 4), there is a statistically significant relationship between knowledge on shaking and fast heart rate and effect of exercise on blood sugar level, as indicated by correlation coefficients of (r=0.246, p value=0.014). This indicates that the patients who exercise keep a keen eye on the changes of their body to take precautions of shaking and fast heart rate. Analysis has also revealed that there is a significant positive relationship between keeping appointment days and detecting low blood sugar levels through signs and symptoms and manage, as indicated by correlation coefficients of (r=0.283; p value 0.011). This indicates that patients with regular appointments gain knowledge on detecting sugar levels and managing the symptoms.

DISCUSSION

Evidence shows that adherence to medication in management of type II diabetes mellitus impacts on long-term health outcomes for patients and results in improved quality of life. Adherence lies heavily on the patient's self-management practices. Studies in both developed and developing markets use varied methods to determine the level of and factors influencing medication adherence. The current study, using in part Morisky medication scale together with pill count and consecutive random blood sugar readings revealed that majority of the respondents, constituting 65.1% had high adherence level to prescribed medication. This was followed by low adherence and medium level with proportions of 19.3% and 15.7% respectively. The prevalence of low adherence (19.3%) in this study is consistent with similar studies conducted at France and Brazil where the prevalence was 19%, and 18.3% respectively.[9,10] he findings are also in line with those of a study carried out in Yemen where poor adherence was 22%.[11] The rate of low adherence found in this study was higher compared to a similar study conducted in Ghana, where the prevalence was 8.5%.[12] The low adherence level found in this study was also greater than other studies conducted in Egypt where the rate was 8.9%and in Mexico the adherence rate was 11%.[13,14] Medication adherence is, however, not a limited responsibility of the patient. Health system inputs including trained healthcare personnel, access to correct treatment and management information, drugs as well as monitoring through laboratory tests can influence the level of adherence to medication. The study showed that 87.5% and 90.2% of the participants who adhered to medication were knowledgeable about continuing to take antidiabetic drugs even when sugar is controlled and how to detect low blood sugar levels through signs and symptoms and manage.

Table 3: Knowledge of management of diabetes.

Variables		High adherence N (%)	Low adherence N (%)	Statistics
Diabetes mellitus can be cured	No	17 (73.9)	6 (26.1)	C^2=9.517; df 2; p=0.009
	Yes	45 (90.0)	5 (10.0)	
	I don't know	5 (50.0)	5 (50.0)	
Stop taking drugs when sugar is controlled	No	42 (87.5)	6 (12.5)	C^2=4.660; df 2; p=0.097
	Yes	17 (77.3)	5 (22.7)	
	I don't know	8 (61.5)	5 (38.5)	
Detect low blood sugar levels through signs and symptoms and manage	No	7 (58.3)	5 (41.7)	C^2=13.426; df 2; p=0.001
	Yes	55 (90.2)	6 (9.8)	
	I don't know	5 (50.0)	5 (50.0)	
Beneficial to stop smoking or taking alcohol	No	7 (58.3)	5 (41.7)	C^2=12.028; df 2; p=0.002
	Yes	54 (90.0)	6 (10.0)	
	I don't know	6 (54.5)	5 (45.5)	
Checking blood pressure while being diabetes mellitus	No	5 (50.0)	5 (50.0)	C^2=15.983; df 2; p=0.0001
	Yes	57 (90.5)	6 (9.5)	
	I don't know	5 (50.0)	5 (50.0)	
Shaking and fast heartrate	Low blood sugar	14 (73.7)	5 (26.3)	C^2=1.446; df 2; p=0.485
	High blood sugar	36 (85.7)	6 (14.3)	
	I don't know	17 (77.3)	5 (22.7)	

Table 4: Correlation between knowledge and low adherence to medication.

Parameters		1	2	3	4	5	6	7	8
DM can be cured	r	1	0.102	0.123	0.056	0.065	-0.074	-0.014	0.011
	2-tailed-S		0.317	0.228	0.586	0.526	0.469	0.889	0.911
	N	98	98	98	98	98	98	98	98
Shaking and fast heart rate	r	0.102	1	-0.080	0.067	0.032	-0.032	0.246*	-0.124
	2-tailed-S	0.317		0.434	0.515	0.753	0.755	0.014	0.223
	N	98	98	98	98	98	98	98	98
Stop drugs when sugar is controlled	r	0.123	-0.080	1	0.018	0.100	-0.030	0.185	0.102
	2-tailed-S	0.228	0.434		0.864	0.328	0.769	0.068	0.318
	N	98	98	98	98	98	98	98	98
Detect low blood sugar levels	r	0.056	0.067	0.018	1	-0.001	0.085	0.015	0.283*
	2-tailed-S	0.586	0.515	0.864		0.990	0.403	0.885	0.011
	N	98	98	98	98	98	98	98	98
Benefits of avoiding smoking/ alcohol	r	0.065	0.032	0.100	-0.001	1	-0.128	0.126	-0.068
	2-tailed-S	0.526	0.753	0.328	0.990		0.209	0.216	0.503
	N	98	98	98	98	98	98	98	98
Checking sugar while being DM	r	-0.074	-0.032	-0.030	0.085	-0.128	1	-0.086	0.069
	2-tailed-S	0.469	0.755	0.769	0.403	0.209		0.399	0.502
	N	98	98	98	98	98	98	98	98
Effect of exercise on sugar level	r	-0.014	0.246*	0.185	0.015	0.126	-0.086	1	-0.147
	2-tailed-S	0.889	0.014	0.068	0.885	0.216	0.399		0.148
	N	98	98	98	98	98	98	98	98
Keep appointment days	r	0.011	-0.124	0.102	0.283*	-0.068	0.069	-0.147	1
	2-tailed-S	0.911	0.223	0.318	0.011	0.503	0.502	0.148	
	N	98	98	98	98	98	98	98	98

*Correlation is significant at the 0.05 level (2-tailed); S-significance.

These variables were significantly associated with adherence to medication. When patients have access to the right information and knowledge on self-management through their health worker son their appointment clinic days, they are more likely to adhere to medication and detect any changes in their physical symptoms. In Brazil, a study conducted found that increase in the level of knowledge of respondent to be associated to improve in anti-diabetic medication adherence, and this finding is consistent to this study. There was a positive relationship between knowledge on shaking and fast heart rate and effect of exercise on blood sugar level. This was consistent with other studies by Tiv et al and Krass, Schieback, Dhippayom.[15] Educated patients are more knowledgeable about the consequences of diabetes and the complications associated with diabetes and as such tend to adhere to their medications better. Another study by Rajak et al on knowledge, attitude and practices regarding diabetes medication adherence in parts of India found that poor knowledge affected medication adherence.[16] These findings underscore the critical role that increased awareness and knowledge has on adherence to antidiabetic medication. Efforts to reinforce the knowledge levels among type II diabetes mellitus patients are key in enhancing adherence to medication. It will encourage T2DM patients to understand the chronic condition better and be able to appropriately care for themselves by taking their medication as prescribed. Improved medication adherence will result in improved glycemic control and consequently improved quality of life for the T2DM patient.

Limitation of the study

While the study was able to achieve its objectives, the small sample size as well as short follow-up duration restricts transferability of the study findings to the general population of persons living with T2DM in similar areas.

CONCLUSION

The study results revealed that almost a quarter of the respondents constituting 19.3% had low level of adherence to prescribed diabetes medication regimen. Patients with knowledge on taking drugs when sugar is controlled, detecting low blood sugar levels through signs and symptoms and able to manage, stop smoking or taking alcohol and checking blood pressure while being diabetic are more likely to adhere to their antidiabetic medications. Education and information empowerment for T2DM patients is critical in enhancing medication adherence. Educational programs that adopt a wide range of learning strategies should be implemented to reach various population groups. This can be achieved through use of and distribution of information, education and communication materials. With the penetration and use of mobile phones for communication, there is an opportunity to use digital health tools like messaging and applications to educate and check on patients and improve adherence to medication. The National and County governments should enhance training of the health personnel to ensure access to quality care and dissemination of correct management information to T2DM patients during their facility consultation visit.

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