

**DETERMINANTS OF DIABETIC RELATED
COMPLICATIONS AMONG TYPE 2 DIABETIC PATIENTS
VISITING MAMA LUCY KIBAKI HOSPITAL**

EVANS OCHOKI AYIENG'A

**MASTERS OF SCIENCE
(Medical Epidemiology)**

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Determinants of diabetic related complications among type 2 diabetic patients visiting Mama Lucy Kibaki hospital

Evans Ochoki Ayieng'a

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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:

Evans Ochoki Ayieng'a

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

Signature.....Date:

Dr Daniel Nyamongo, PhD
JKUAT, Kenya

Signature.....Date:

Dr Joseph Mutai, PhD
KEMRI, Kenya

DEDICATION

Special thanks go to my beloved wife who endured a lot throughout my whole life just for me, and my supportive parents. I would have never reached this point of my life without them being by my side. No words can describe my gratitude towards them and what they have done to get me where I am. I must especially thank my daughters Megan and Miran who have endured a lot of my absence to pursue my dreams!

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ABBREVIATIONS AND ACRONYMS

ADA:	American Diabetes Association
AMP:	Amputation
CHD:	Coronary Heart Disease
CVD:	Cerebrovascular Disease
DM:	Diabetes Mellitus
ERC:	Ethical Review Committee
ESRD:	End-Stage Renal Disease
FGD's:	Focus Group Discussions
IDF:	International Diabetes Federation
IFG:	Impaired Fasting Glucose
IGT:	Impaired Glucose Tolerance
JKUAT:	Jomo Kenyatta University of Agriculture and Technology
KEMRI:	Kenya Medical Research Institute
KII:	Key Informant Interview
KNH:	Kenyatta National Hospital
PPG:	Postprandial Plasma Glucose
T2DM:	Type 2 Diabetes Mellitus

TIA:	Transient Ischemic Attack
UKPDS:	United Kingdom Prospective Diabetes Study
UON:	University of Nairobi
USD:	United States Dollars
UTIs:	Urinary Tract Infections
WHO:	World Health Organization

ABSTRACT

Diabetes mellitus is a major public health concern globally. In Kenya, 2019 estimates by the WHO indicated a prevalence of 3.3%, equivalent to 1.5 million people. The prevalence is expected to increase by 4.5% by the year 2030 in the absence of effective preventive measures. Research done at KNH, indicated that hypertension was by far the most commonly diagnosed disease (63.3%), with eye (43.5%) and foot (41.1%) being the most common lengthy complications. This study sought to establish determinants of chronic complications of type 2 diabetes mellitus amongst patients visiting Mama Lucy Kibaki hospital in Nairobi, Kenya. The target population was diabetes patients at Mama Lucy Kibaki Referral Hospital in Nairobi, Kenya. Primary data was collected by the use of semi-structured questionnaire and an interview guides for both Focus group discussions and key informant interviews. Three focus group discussions were conducted and key informant interviews were done. All participants were provided their consent prior to their accepting to joining the study. This study was presented to Kenyatta National Hospital/University of Nairobi Ethical Research Committee for ethical approval. Chi-square test was used to explore associations between various variables. Correlation analysis was used to establish the association between continuous variables. FGD's and Key informant interviews in form of notes were manually coded and analyzed based on themes (thematic analysis) which were developed from responses (scripts) in line with study objectives. Results showed that the proportion of type 2 diabetes mellitus complications among patients attending the hospital was estimated at 58.3 % (95% confidence interval, C.I., 52.3% - 64.2%). Three factors were significantly associated with complication status at 5% level of significance; age-group ($P < 0.001$), occupation ($P < 0.001$) and herbal medicine use ($P < 0.001$). Age above 70 years vs 18-35 years (prevalence ratio, PR, 1.72, CI 1.15-2.58), age 56-70 years vs 18-35 years (PR 1.59, CI 1.14-2.23), and herbal medicine use (PR 1.62, CI 1.36-1.94) were significantly associated with complication status. A majority of the respondents also noted that insulin therapy is critical in the regulation of blood sugar in the body. The study concludes that there was a higher proportion of patients who developed complications than those who had no complications with a majority of them developing hypertension, eye disease, kidney problems and nerve damage, respectively, as the most occurring type of complications. It is therefore recommended that the Ministry of Health to include herbal medicine practitioners in patient management programs to ensure their practices support rather than interfere with treatment.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Type 2 diabetes mellitus (T2DM) is now one of the most serious chronic public health issues in the world. In 2014, the worldwide prevalence of diabetes among individuals aged 18 and above was predicted to be 9%. (WHO, 2014). In 2011, an estimated 4.6 million deaths were directly caused by Type 2 diabetes mellitus. In every nation, the number of persons with type 2 diabetes is rising, with 80 percent of people with diabetes living in low- and middle-income countries (Islam et al., 2015). Diabetes mellitus caused 4.6 million deaths in 2011, according to the World Health Organization (2014), and 439 million people are expected to have type 2 diabetes by 2030. The world estimates indicate that 6.28% of population is affected from available data up to 2017 (Khan *et al.*, 2020). According to Kibachio *et al.*, (2013), diabetes is one of Africa's most serious health concerns, with a projected 12.1 million cases (3.2 percent of the adult population) and only 15% of those identified in 2010. Urban regions have witnessed the most growth. The key factors of the rising prevalence of diabetes in Africa are assumed to be evolving dietary habits, physical exercise, and an aging society (Ngalyuka, 2008). Obesity is becoming more popular due to the inexpensive access to high-fat, high-energy foods combined with decreased physical activity (Chan, 2017). Obesity can lead to reduced glucose tolerance, which might make you more susceptible to diabetic problems (Smith-Palmer *et al.*, 2014).

Type 2 diabetes chronic complications have led to an upsurge in morbidity and mortality across the world (Rawshani et al., 2018). Type 2 diabetes mellitus, according to Elgart *et al.*, (2014), is a rising cause of disability and early mortality, mostly due to cardiovascular disease and other chronic consequences. Diabetes patients are at a significant risk of developing microvascular and macrovascular problems, according to previous research (Climie *et al.*, 2019; Legese *et al.*, 2022). Type 2 diabetes complications affect 28–55 percent of diabetic patients, according to epidemiological

research from Europe and North America (Tesfaye & Gill, 2011). In Saudi Arabia, Khan *et al.*, (2014) indicated that 24.1% of Type 2 diabetic patients were suffering from chronic complications. In Ethiopia, Abejew *et al.*, (2015) established that the prevalence of chronic complications of Type 2 Diabetes varies from 52.0% to 74.2%. In Tanzania, Tesfaye and Gill (2011) found that treatment of diabetic complications accounted for approximately 31% of total outpatient.

According to World Health Organization (2014), approximately 1.5 million people in Kenya are currently living with diabetes and this is expected to rise to 2 million (4.5%) by 2030 if there are no preventive measures placed. According to the report published by the Kenya national diabetes strategy (KNDS) 2010-2015 a number of Kenyans amounting to 60% diagnosed to having diabetes present with different complains. In this report, the prevalence of diabetes is between 2.7% in rural centers to 10.7 % in urban centers with a national prevalence of 3.3%. Just like other countries around the world, the complications of Type 2 diabetes have been increasing over the years. Therefore, the KNDS proposed to come up with different health programs and strategies like re-evaluation of wellness programs, treatment methods to reduce the disease burden. In a study conducted in Kenyatta National Hospital, Kainga (2011) found that hypertension was the most typical comorbid condition (63.3%) while eye (43.5%) and foot (41.1%) diseases were the most identified long-term complications. In addition, Ungaya (2011) found that diabetes has been linked to sexual dysfunction in male and female outpatients in Kenyatta National Hospital, impaired ejaculation, reduced libido and Impotence in males and decreased libido, vaginal lubrication and orgasmic dysfunction in women have all been linked to neuropathy, vascular insufficiency, and psychological issues (Otiento, 2007).

Hyperglycemia and failure to meet treatment objectives are linked to type 2 diabetes - related complications, particularly in outpatient settings (Kibachio *et al.*, 2013). Outpatient users are more likely to have poor adherence to medications, poor supervision, and bias or incorrect laboratory findings. Patients with type 2 diabetes who have chronic problems are more likely to be admitted to the hospital (Ungaya, 2011). A

greater need for hospital treatment to handle chronic consequences such as acute stroke, acute heart attack, severe renal failure, and diabetic foot issues may be the reason of this development. Approximately 60% of medical expenses, according to Liu et al., (2010), have indeed been spent on different diabetes comorbidities. An audit indicated high expenditure in Ethiopia in treatment of diabetes melitus (Legese *et al.*, 2022) .

Chronic problems are categorized as macrovascular and microvascular complications (Shera *et al.*, 2004). Coronary heart disease (CHD), peripheral artery disease (PAD), and cerebrovascular disease (CVD) or stroke are types of macrovascular problems. Diabetic nephropathy, diabetic retinopathy, and diabetic neuropathy are all microvascular problems (Rangel *et al.*, 2019). Coronary heart disease and stroke are the most frequent chronic consequences, accounting for around 65 percent of all deaths. Nevertheless, diabetic complications include retinopathy, stroke, and diabetic foot remain the leading causes of disability. In average, complications from Type 2 diabetes increase death, illness, disabilities, and cost (Kainga, 2011).

Diabetes management in Kenya includes various methods, diabetes education where patients are introduced to small talk on diet and proper use of medication including self-testing. Most government facilities have clinics where this education is offered to patients who attend these clinics monthly. These patients are also given drugs to manage the sugar level and are observed by the clinicians over a period of time. The government of Kenya has introduced cheaper medicines for patients to access however the drugs are not sufficient enough thus a steady increase in a number of complications (Mohamed *et al.*, 2018; Waari *et al.*, 2018).

1.2 Problem Statement

Chronic non-communicable diseases account for a considerable portion of the global disease burden and are the leading cause of death worldwide (Heron, 2018). Diabetes is one of the most common noncommunicable diseases in the world, and it and other NCDs are responsible for a considerable and growing percentage of burden of diseases.

Diabetes is the fifth leading cause of death in most developed countries, and evidence shows that it is rampant in many developing and newly industrialized nations. Diabetes was responsible for 332,584 fatalities in Sub-Saharan Africa alone in 2010, according to WHO (2014).

Diabetes complications include greater disability, decreased life expectancy, and significant health expenses in practically every country. Cardiovascular disease is a key consequence of diabetes and the primary cause of early mortality among diabetics. Diabetes is a major cause of end-stage renal disease (ESRD), with diabetic adults 2-4 times likely to develop heart disease or have a stroke than persons without diabetes (World Health Organization, 2014). Furthermore, diabetic retinopathy is the main cause of new blindness in those aged 25 to 74 in the United States, accounting for 12% of all blindness occurrences. Amputations performed worldwide, 70% are done on people with diabetes who have foot ulceration being the main risk factor in the developing nations. At the national level of health service delivery, diabetes chronic complications increase the mortality rates and aggravate the meagre health budgets of governments thus denying equity of health provision. Indeed, a good number of patients die from lack of access to stroke care units, specialized coronary care units, kidney dialysis centres, and specialized limb-saving by-pass surgical procedures. In 2010, diabetes healthcare costs accounted for 11.6% (USD 376) of the total healthcare expenditure worldwide and by 2030, this number will surpass some USD 490 billion (IOF 2009). In Tanzania, Tesfaye and Gill (2011) indicate that diabetic complications were responsible for 31% of total outpatient costs in the major hospitals in Dar-es-Salaam, with annual costs of \$138 per person; 19 times the national average.

The Kenya national diabetes strategy 2010-2015 statistics shows that the current diabetes national prevalence stands at 3.3% and with an urban prevalence of 10.7%, though the majority of people with diabetes are not aware (Kibachio *et al.*, 2013). Due to the increasing prevalence of Type 2 Diabetes in Kenya, it is important to understand the risks involved in the development of chronic complications of type 2 diabetes mellitus so as to develop policies and strategies to prevent their occurrence. According to WHO

data of 2014, it is noted that approximately 1% of deaths in Kenya were directly attributed to diabetes. Roglic (2010) noted that most people in Kenya, therefore, don't die of causes related to diabetes, but associated cardiovascular complications like heart attack. Therefore, the purpose of this study was to identify the indicators linked to the emergence of type 2 diabetes mellitus chronic complications in outpatients at Mama Lucy Kibaki Hospital in Nairobi.

1.3 Research Questions

- 1 What is the proportion of patients who develop diabetic related complications?
- 2 What are the most common types of diabetic related complications occurring amongst Type 2 diabetic patients visiting the hospital?
- 3 What are the key factors influencing knowledge, attitude and practices of patients around the disease?

1.4 Objectives of the Study

1.4.1 General Objective

To determine diabetic related complications (co-morbidities) among type 2 diabetic patients visiting Mama Lucy Kibaki Hospital.

1.4.2 Specific Objectives

The specific objectives of this study were;

- 1 To determine the proportion of type 2 diabetic patients who developed complications/co-morbidities.
- 2 To determine the diabetic related complications among type 2 diabetic patients.
- 3 To determine the factors influencing knowledge, attitude and practices of patients regarding type 2 diabetic disease and its related complications/co-morbidities.

1.5 Justification of the Study

The management of diabetes entails significant, well-known high expenses; yet, macrovascular and microvascular complications are the primary drivers of healthcare spending. The occurrence of these complications will increase the expenditure of healthcare costs of chronic complications that the country's health care systems are ill-prepared for, both in recurrent expenditure and facilities (Oyando *et al.*, 2020). The fundamental objective of successful diabetes care is to prevent those diabetic-related long-term consequences that contribute significantly to the expense of diabetes. Complications significantly raise not just the financial burden on healthcare systems, but also the risk of disability, mortality, and reduced quality of life for patients. The study's goal is to determine the factors involved in development of these complications of type 2 diabetes in outpatients to assist guide for policy and practice.

Communicable diseases such as diabetes have become emerging public health priorities in the emerging middle-class economy like Kenya. Ministry of health in Kenya spends a lot of money collected from recurring expenditure within health facilities to run diabetic clinics which forms just part of the problem in the healthcare system. The program, CDiC (Changing diabetes in children) launched to support and provide free services to children with diabetes in Mama Lucy Kibaki hospital as the main county referral hospital offering the diabetic service has been scaled to supporting adults is an intensely donor funded program. To provide for educational material and conduct trainings for healthcare workers on best practices in reducing the emerging public health problems related to non-communicable diseases such as diabetes, a lot of research is required to inform for targeted solutions. The findings of this study may go a long way to inform the ministry of health in Kenya on best approaches to reduce the incidences of comorbidities associated with diabetes to alleviate the already overburdened healthcare system. This will be achieved by pointing out the real issues that are responsible for such comorbidities associated with diabetes and best approaches to control more incidences.

The findings of this study will be of great importance to the government of Kenya and other researchers. To the Ministry of Health, the study will provide information on the impact of type 2 diabetes complications on the cost of treating patients. This will help the government to make decisions when it comes to resource allocation in diabetes management and treatment centres. The study will also add to the body of knowledge on the most common types of complications affecting type 2 diabetes mellitus outpatients with the highest commonly type of complication informing for newer approaches to reduce the incidences. This might potentially be utilized by healthcare providers to create an education package for diabetic patients to help them prevent and/or minimize complications. It will also help diabetic patients maintain a long-term risk factor-reduction lifestyle. Patients with type 2 diabetes will have their morbidity, disability, and death caused by these problems reduced, postponed, or avoided, resulting in an enhanced quality of life. The findings of this study will help shape legislation and give evidence for a stronger focus on preventative healthcare, as well as serve as a model for treating other chronic diseases. The findings of the study will also help training institutes enhance their curricula to include the necessary preclinical training in managing diabetes and other chronic illnesses. The research will also serve as a foundation for future research. There isn't nearly sufficient research on diabetes - related complications in Kenya, leaving a significant void for future research.

1.6 Conceptual framework

The figure 1 below shows the conceptual framework indicating how the outcome is linked to both the independent and dependent variables

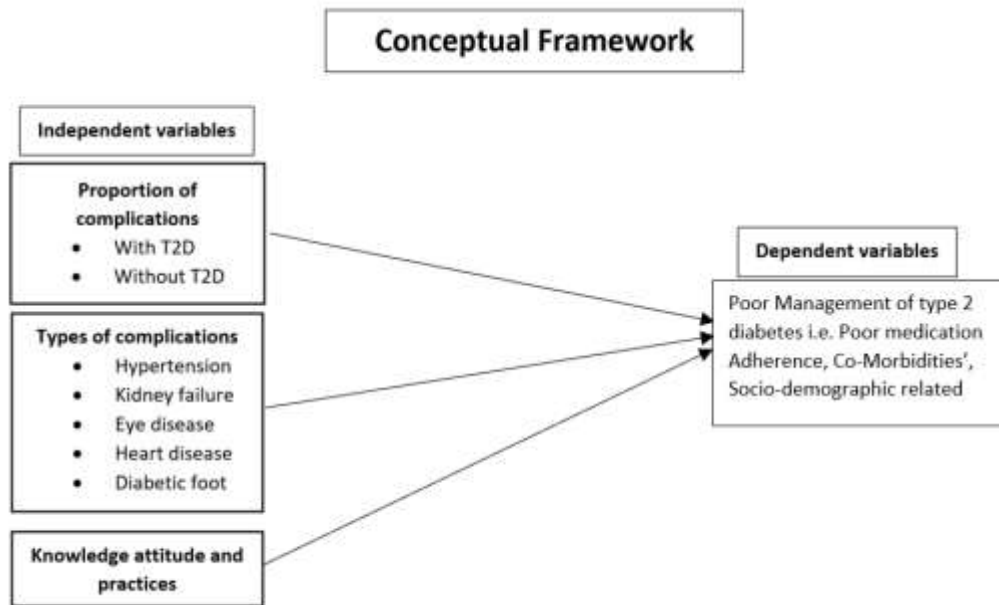


Figure 1.1: Conceptual framework

CHAPTER TWO

LITERATURE REVIEW

2.1 Type 2 Diabetes Mellitus

Diabetes is a chronic, non-communicable disease, associated with high levels of glucose in the blood. Type 1 diabetes develops when the pancreas ceases generating the hormone insulin, whereas Type 2 diabetes occurs when the pancreas' capacity to generate insulin is hampered by the body's resistance to its activity (Nasseri *et al.*, 2015). Impaired fasting glucose (IFG) and impaired glucose tolerance (IGT), often known as prediabetes, are intermediate phases in the development from normal glucose tolerance (NGT) to type 2 diabetes. The pathophysiology underpinning the development of these glucose metabolic changes is complex, but the most critical element in the development of type 2 diabetes is a change in the balance between insulin sensitivity and insulin production. Type 2 diabetes mellitus (T2DM) is becoming more common across the world, and it is becoming a worldwide health crisis that is anticipated to reach pandemic proportions by 2030 (Bahia *et al.*, 2011). T2DM is expected to affect 439 million individuals worldwide by 2030. This rise will be most visible in developing nations, where the number of persons with T2DM is predicted to rise from 84 million to 228 million, accounting for more than 75% of the global population (Ruhembe *et al.*, 2014).

The Asia-Pacific area is at the epicenter of the present diabetes epidemic. In the Western Pacific area alone, there are more than 30 million individuals living with diabetes (Sosale *et al.*, 2014). By 2025, the World Health Organization anticipates that this number would have risen considerably, with India and China each facing a challenge of coping with 50 million afflicted people. A combination of enormous population size and fast-growing prevalence rates, notably of type 2 diabetes mellitus, has created an issue in the region (Farshchi *et al.*, 2014). Diabetes prevalence in rural Bangladeshi communities grew from 3.8 percent in 1999–2000 to 8.5 percent in 2004–2005. Enough research has been conducted in India to determine the prevalence of diabetes, with some estimates

varied greatly between geographical areas and between urban and rural populations. For all adults, men, and females, the Prevalence of Diabetes in India Study (PODIS) revealed an age-standardized prevalence of 4.3 percent, 4.4 percent, and 4.5 percent, respectively. However, more recent research focusing on urban populations or fast-growing areas have revealed a greater incidence of diabetes (10.1%), while rural Indian groups have shown an even higher frequency (12.5–13.2%) (Shera *et al.*, 2010). According to Mohamed *et al.*, (2014), T2DM prevalence in Malaysia was 11.6 percent in 2006 and 15.2 percent in 2011.

South Asia, which comprises of India, Pakistan, Bangladesh, Nepal, Sri Lanka, Bhutan and Maldives, has shown to have an increased predisposition for Type 2 diabetes. Between 2000 and 2030, the prevalence of diabetes is expected to rise by more than 151 percent. When compared to the native white Caucasian population in the UK, immigrants from Pakistan and Bangladesh have a five-fold greater risk of diabetes, while Indian immigrants have a three-fold higher risk of complications, morbidity, and death (Aboobakur *et al.*, 2010).

Due to factors such as rapid urbanization, acceptance of unhealthy diets, poor exercise patterns, and ageing population, the number of people with diabetes in Africa is predicted to rise dramatically over the next two decades (Weibing *et al.*, 2009). There are significant unknowns concerning the incidence, prevalence, and management patterns of diabetes in older persons throughout Africa's different nations (Werfalli *et al.*, 2014).

Diabetes is predicted to be 1% in rural regions, 7% in urban Sub-Saharan Africa, and 8-13 percent in more developed nations such as South Africa and people of Indian ancestry. The prevalence of diabetes in Nigeria ranges from 0.65% in rural 3 Mangu (North) to 11% in metropolitan Lagos (South), according to WHO data. Nigeria has the greatest number of diabetics in Africa. (Chinenye & Young, 2011).

2.2 Chronic Complications of Type 2 Diabetes Mellitus

Diabetes mellitus is linked to an increased risk in number of serious and life-threatening macro- and microvascular complications. In patients with diabetes, macrovascular disease, which comprises of coronary heart disease (CHD), cerebrovascular disease, and peripheral vascular disease, is the main cause of death (Pinhas-Hamiel & Zeitler, 2007). Diabetes patients are two to four times more likely to have a heart attack, stroke, or other issues associated to impaired circulation, and they rely on the ADA. CHD is the major cause of mortality.

Diabetic individuals, according to Abougambou *et al.*, (2013), are much more inclined to produce micro- and macrovascular issues than non-diabetic patients. Many individuals already have metabolic disorders, such as dyslipidemia, before they acquire diabetes, which promotes the development of complications. At the time of T2DM diagnosis, around half of the UKPDS individuals exhibited extensive macro- or microvascular defects. Chronic issues are a well-known side consequence of T2DM development, reducing patient quality of life, taxing the health sector, and increasing diabetes deaths.

Zhaolan *et al.*, (2010) investigated the prevalence of type 2 diabetes mellitus chronic complications among outpatients in urban China. The study discovered that type 2 diabetes mellitus outpatients had a significant prevalence of cardiovascular and cerebrovascular disorders, neuropathy, nephropathy, ocular abnormalities, and foot illness. Chronic problems, on the other hand, varied by city and increased considerably with age and time of diabetes diagnosis. Chronic problems are common among type 2 diabetes outpatients, according to the study, and diabetic patients with chronic difficulties had poor glucose control.

Dart *et al.*, (2013) found that the type 2 diabetes cohort in Canada had a diagnosis of renal and neurologic impairments which occurred within 5 years of diagnosis. Nephropathy, retinopathy, and neuropathy are instances of microvascular complications,

whereas cardiac, cerebrovascular, and peripheral vascular illnesses are examples of macrovascular complications.

2.2.1 Hypertension (High Blood Pressure) and Heart Disease

Persons with Type 2 Diabetes virtually always have hypertension. As blood glucose levels increase, our systems use a variety of methods to reduce glucose levels to "normal" levels. The body does this by retaining extra fluid in the blood vessels. (Ofori & Unachukwu, 2014). The pressure in blood vessels rises as a result of the increased fluid. Blood pressure that is too high causes the circulatory system to weaken all throughout. In certain extreme circumstances (e.g., vascular stroke), this can lead to the bursting of blood vessels or the formation of persistent blood flow difficulties in the limbs and other peripheral parts of the human body (Böhm *et al.*, 2019). Chronically high insulin levels are also associated with the early formation of atherosclerotic plaques inside blood vessel walls, increasing the risk of aneurysm, hypertension, stroke, and heart attack. (Pinhas-Hamiel & Zeitler, 2007).

2.2.2 Eye Disease

Diabetes can cause a number of eye issues, including blindness and impairment of vision if left untreated. In those under the age of 65, diabetes is the major cause of acquired blindness, and it is also one of the main leading causes in older adults (Zou *et al.*, 2018). Diabetes damages the blood vessels and nerves in the retina, which is located in the rear of the eye (Weibing *et al.*, 2009). Diabetic Retinopathy develops as a result of this. Diabetes, according to Farshchi *et al.*, (2014), can produce aberrant new capillary development inside the retina, which reduces blood flow and weakens eyesight. Vision damage is irreversible once it happens. Many visual impairments connected with diabetes can be fixed or prevented if caught early enough. Diabetes patients should get their eyes evaluated by an eye doctor once a year. People with diabetes can avoid eye issues by controlling their blood glucose levels, decreasing their blood pressure, and lowering their cholesterol.

2.2.3 Kidney Disease (Nephropathy)

Waste products are filtered from the circulation and excreted in the urine by the kidneys. Whenever the kidneys' delicate filtration systems and blood vessels are impaired, they are unable to operate normally, and renal failure can occur (Weibing *et al.*, 2009). Diabetic nephropathy is the term given to this condition whenever it is caused by diabetes. In New Zealand, diabetes is one of the primary causes of renal failure. Hemodialysis and, in rare situations, a kidney transplant may be expected to treat acute renal failure (sometimes combined with a pancreas transplant). Over 40% of all patients in New Zealand who require renal replacement treatment (dialysis or a kidney transplant) do so due to the damaging consequences of diabetes. The kidneys are also engaged in blood pressure regulation (Sosale *et al.*, 2014). Diabetes-related impairment can lead to high blood pressure (hypertension), which can exacerbate kidney disease. High blood pressure can be treated with medications and/or a low-salt diet. Diabetes patients are also much more prone to get urinary tract infections (UTIs). If the infection reaches the kidneys, it might cause serious damage to them (Akash *et al.*, 2020).

2.2.4 Nerve Damage (Neuropathy)

Diabetes could harm nerves, notably some in the lower legs and, in certain cases, the hands. Reduced feeling, numbness, stinging, tingling, and aching in the afflicted region are all indications of nerve injury (Sloan *et al.*, 2021). Diabetic neuropathy is the term that describes neurological damage induced by diabetes (Nasseri *et al.*, 2015). Treatments could be administered to assist reduce the discomfort produced by diabetic neuropathy. Medicines that are routinely often used to treat seizures and depression can also be utilized for this purpose. Reduced feeling in the lower legs might make it harder to recognize whether an injury has occurred. It is critical for persons with diabetes to inspect their own feet often, keep them clean, and protect them from harm in order to avoid the problems of diabetic neuropathy (Andayani *et al.*, 2010).

2.2.5 Joint and Foot Problems

When poor blood moves within the limbs is paired with nerve loss and diminished or deadened feeling, the extremities (foot, hands) become more vulnerable to injury and disease. Joint damage (because to a lack of capacity to perceive pain adequately) and foot ulcers are prevalent. (Zhuo *et al.*, 2013). Diabetes-related foot and limb issues may typically be alleviated with correct therapy. However, if the injury is not addressed, it might get septic and necessitate removal (Graz *et al.*, 2018). Diabetes forced 71,000 Americans to have a foot or limb amputated in 2004 alone (Mohamed *et al.*, 2014). Individuals with diabetes should undertake daily self-foot checks and get their feet examined by a health professional once a year.

2.2.6 Infections of the Skin

Fungal (yeast) and bacterial infections, skin spotting (diabetic dermopathy), and a variety of spots, rashes, and bumpy or strangely textured skin patches can all be caused by diabetes (Naik & Farrukh, 2020). The majority of these illnesses are caused by persistently high blood sugar levels, which become less of an issue after blood sugar levels are lowered (Werfalli *et al.*, 2014). Because of their weakened immune, people with diabetes are more susceptible to infections of all kinds (ability to fight infection). As a result, patients with diabetes should obtain yearly influenza vaccines as well as a pneumococcal vaccine every five years (Werfalli *et al.*, 2014).

2.3 Risk factors of Type 2 Diabetes Mellitus Chronic Complications

According to Harney *et al.*, (2006), some prevalent risk factors for diabetic complications include longer duration of diabetes, hypertension, poor metabolic control, smoking, obesity, and hyperlipidemia. T2DM doubles the risk of coronary events in males and quadruples the risk in women. The prevalence of related cardiovascular risk factors such as hypertension, dyslipidemia, and clotting disorders is contributing to this rise. Adults with diabetes plus hypertension have almost double the risk of

cardiovascular disease as nondiabetic people with hypertension, according to observational studies (Petrie *et al.*, 2018). Klag *et al.*, (1996) discovered that blood pressure increases are a strong independent risk factor for end-stage renal disease, and that treatments to prevent the illness should focus on the prevention and control of both high-normal and high blood pressure.

In another study on risk factors of complications of type 2 diabetes in Asians, Yadav, Tiwari and Dhanaraj (2008), found that common risk factors of type 2 diabetes complications include time of diagnosis, greater duration of diabetes, hypertension, poor metabolic control, glycaemic control, smoking, obesity and dyslipidemia. The authors also classified cardiovascular risk factors in Type 2 diabetes into four categories non-modifiable risk factors, newer risk factors, modifiable risk factors and protective risk factors. The non-modifiable risk factors included age, sex and family history while modifiable risk factors included cigarette smoking, obesity, diabetes, elevated cholesterol and behavioural risk factors (Borgnakke, 2016).

Dipika *et al.*, (2014) discovered that male sex and increased triglyceride levels were risk factors for the development of any of the microvascular problems in a comparable research. Females may have a decreased incidence rate of nephropathy due to estrogen's reno-protective effect. However, current research has shown that estrogen's reno-protective properties are reduced in T2DM females due to an imbalance in sex hormone control. Previous research has found that diabetic nephropathy patients had increased triglyceride levels (Shen *et al.*, 2009). Thus, lipid-induced renal injury may be caused by TGF- (transforming growth factor-beta) stimulation, which causes the generation of reactive oxygen species, which damages the glomeruli and glomerular glycocalyx (Wasserman *et al.*, 2018).

Microvascular problems grow with ageing, according to various study findings (Gomez *et al.*, 2011. Kumar *et al.*, (2012) identified a link between triglycerides and the occurrence of microvascular problems in cross-sectional studies. Triglyceride levels and age were found to be independent risk factors for neuropathy. Wiggin *et al.*, (2009)

showed a similar link between triglycerides and neuropathy in a randomized control clinical trial, as did a few cross-sectional investigations.

A study linking triglycerides with neuropathy was published (Bansal *et al.*, 2014) since then, only a few researches have established a favorable association between the two. The specific mechanism underlying the evolution of neuropathy in connection to high triglycerides is unknown, however it might be related to lipid metabolic dysregulation in sensory and motor neurons.

In a study in São Paulo city, Ferreira and Pinto (2006) found that hypertension by the time of the Diabetes Mellitus diagnosis produced a 1.4-fold higher risk of end-stage renal failure. In addition, smoking and alcohol consumption increased the risk of diabetic end-stage renal failure. Also, a 2.4-fold higher risk of end-stage renal failure was shown in patients with multiple hospital admission due to DM decompensation, which concluded poor metabolic control. Photocoagulation and neuropathy were also found to be highly associated with end-stage renal failure but not with the macrovascular disease.

In the Asian community, Zhonghua and Zhi (2009) found that the main risk factors of T2DM chronic complications were also likely to be related to high C-reactive protein, dyslipidemia, high blood urea nitrogen, time of hospitalization, lack of physical exercise after the development of DM, mental stress and high low-density lipoprotein-cholesterol. Insulin injections, good blood fat and blood glucose management, and good sleep quality were the most important protective variables, while high LDL-C and mental stress appeared to be the only risk factors for cardiovascular disease. Lack of exercise after acquiring DM and the amount of sugary food consumed were two distinct risk factors for neuropathy. Insulin injection found to be the similar protective measure against those three problems, while the length of DM seemed to be the common risk factor.

2.4 Knowledge, attitude and practices among type 2 diabetic patients

The value of foot care awareness in minimizing diabetic foot ulcers (DFU) is generally acknowledged; nonetheless, more than half of diabetes patients admit they have never received foot care education. Patients with DFU and those without DFU had comparable levels of foot care expertise. This inadequacy can be explained in part by a lack of awareness of diabetic foot among health care practitioners, a scarcity of personnel, and clinic overcrowding (Chiwanga & Njelekela, 2015). Low health literacy has been linked to poor care, poor health consequences, while also being a social predictor in low- and middle-income countries, according to previous research. Diabetic patients' knowledge, attitude, and practices are linked to successful disease management, risk factor control, diagnosis, and preventative awareness.

According to previous research, people with strong knowledge and education take better care of their diabetes (Demaio *et al.*, 2013; Gautam *et al.*, 2015). According to (Abdulghani *et al.*, 2018) a third of individuals had poorly managed diabetes and half have additional comorbidities. Despite this, just a third of patients said their feet had been inspected in clinics or that their doctor gave them continuous foot care recommendations. On the other hand, while the majority of patients were aware of diabetic foot care and other comorbidities, only a small percentage really performed it. As a result, further efforts for diabetes patients and their physicians for frequent checks and encouraging adequate treatment among patients are urgently needed (Abdulghani *et al.*, 2018).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Design

This was a cross-sectional study which utilized questionnaires to patients and conducting interviews to key informants.

3.2 Study Site

The study was conducted at Mama Lucy Kibaki Hospital, Nairobi County which is a public county referral hospital in Nairobi. The hospital is situated in Komarock ward in the Embakasi central sub-county. It is approximately 8km east of Nairobi central business district. It conducts a diabetic clinic once a week with an estimated 80 diabetic patients visiting every week and a total number of diabetic patients in the register estimated to be approximately 700 (information from records department Mama Lucy Kibaki Hospital). It is also placed in a location where approximately 1.44million Nairobi residents are found (KNBS, 2019).

3.3 Study Population

The target population was type 2 diabetes patients aged over 18 years old attending Mama Lucy Kibaki Referral Hospital diabetic outpatient clinic.

3.3.1 Inclusion Criteria

This study included all type 2 diabetes mellitus outpatients.

- T2DM diagnosed in accordance with international standards (WHO), that is, fasting plasma glucose (FPG) ≥ 7.0 mmol/L and/or 2 hours postprandial plasma glucose (PPG) or casual plasma glucose ≥ 11.1 mmol/L.

- Under regular anti-diabetic drug treatment for at least 1 year
- Above 18 years in age

3.3.2 Exclusion Criteria

- The study excluded patients critically ill and unable to communicate.
- Patients who refused to give consent.
- Patients whose guardians insisted to talk on behalf of the patients (older patients accompanied but would allow their family member to talk on their behalf)
- Patients who could not read or write.

3.4 Sample size determination

The sample size was determined using Fisher's (2003) formula.

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

Where,

- n = the desired sample size (if the target population is > 10,000).
- Z = is the standard normal deviate at the required confidence level.
- p = is the proportion in the target population estimated to have characteristics being studied. According to Kibachio *et al.*, (2013) the prevalence of Type 2 diabetes mellitus complications among outpatients is approximately 60%
- q = 1-0.6 = 0.4.
- d = the level of statistical significance set = 0.05
- Z = Assuming 95% confidence interval Z = 1.96

$$n = \frac{1.96^2 \times 0.6 \times 0.4}{0.05^2} = 368 \text{ type two Diabetes Patients}$$

According to Fisher (2003), for a population that is less than 10,000 and adjustment must be done using the formula;

$$nf = \frac{n}{1 + (\frac{n}{N})}$$

nf = the final sample size when the population is less than 10,000

n = the sample for populations of 10,000 or more

N = the size of the total population from which the sample is drawn

$$nf = \frac{368}{1 + (\frac{368}{900})}$$

nf = 261 type 2 diabetes patients

3.5 Sampling Technique

Consecutive sampling technique was used to select 261 clients from the possible 900 in the month of August 2017. Consecutive sampling is a sampling technique in which every subject meeting the criteria of inclusion is selected until the required sample size is achieved. Consecutive sampling technique involves selecting all individuals who agree to participate, provided they meet pre-established criteria until the number of subjects desired has been recruited (Kothari, 2004). Consecutive sampling was necessary in the study because the number of patients registered were few. Due to different line of specialization offered by different facilities, Mama Lucy Kibaki Hospital was selected on the basis that it offered diabetic clinic services supported by donors and ministry of health Kenya. The other two county referrals, Mbagathi hospital and Mathare hospital had a line of specialization that they primarily addressed. Mbagathi

specialized on chest and lung infections while Mathare specialized on mental health. Volunteer response sampling was used to select participants of the focus group discussion (Murairwa & Sciences, 2015). Patients who attended the clinic were approached and requested to voluntarily participate in the discussion. They were given information about the study and its impact and allowed to decide to participate. Additionally, purposive sampling technique was employed in selection of key informants where the detailed knowledge expertise of the informant was used as a basis of participant selection (Campbell *et al.*, 2020). The Interviewer selected informants who attended the clinics more frequently and interacted with patients more often as best candidates to provide information.

3.6 Data Collection

Primary data was collected by the use of semi-structured questionnaires and an interview guide. The questionnaires were administered to the type 2 diabetes mellitus outpatients in Mama Lucy Kibaki Referral Hospital. The questionnaires encompassed both closed-ended or open-ended questions so as to enable the respondent to express their view without being influenced by the researcher. It addressed issues such as type of comorbidity the patients had developed, their knowledge in management of the disease, their routinely practices such as exercise, diet. Questionnaires were utilized in this research since the component of anonymity as some of the information needed is sensitive. The researcher was assisted by two trained field assistants (nurses) to administer the questionnaire.

Guides for focus group discussions (FGD's) and Key informant interviews were developed and used amongst patients and key personalities at the facility (3 doctors, a nurse in charge of the patients at the hospital or clinics and a medical superintendent or administrator), respectively. Informed by the saturation point, a minimum of FGD's comprising between 8-12 patients were conducted (2 female, 2 male, and 2 mixed). To conduct both FGD's and key informant interviews, a guide focusing on issues such as types of complications and establishing knowledge attitude and practices regarding

complications was developed and used (Appendix V-X). The researcher moderated discussions and interviews with the assistance of one field assistant (nurse) who took notes.

3.6.1 Recruiting and Consenting Process

After obtaining permission from the hospital authorities, the principal investigator introduced the study to the participants that had to meet the inclusion criteria requirements. He then proceeded to explain the details of the study so as to enlighten the participants more. This included the complications that arose as a result of diabetes type 2, their awareness of the disease, some of the challenges they faced in accessing medical services among other details.

The principal investigator then went ahead and explained how this particular study would benefit the participants and other diabetic patients. The particular data collected will be used for this study and nowhere else but the analyzed data may be presented to the relevant stakeholders in an effort to improve the health sector. In case of the presence of rewards of any kind whether monetary or otherwise, the principal investigator was to inform the participants prior to the study. Consent forms were provided afterwards for the participants who voluntarily took part in the study. The principal interviewer used consecutive sampling in which every subject meeting the criteria of inclusion was selected until the required sample size was achieved. It involved selecting all individuals who agreed to participate, provided they met pre-established criteria, until the number of subjects desired had been recruited (Kothari, 2004). The participant were assured of confidentiality and no names were used.

3.7 Data management and Analysis

Data from questionnaire was sorted by inserting serial numbers to them. The data was checked for errors like missing data and codes. It was then followed by data editing, which sought to correct illegible, incomplete, inconsistent and ambiguous answers. The

third step in data management was data coding. A codebook for the different variables was prepared on the basis of the numbering structure of the questionnaires and facility assessment tool. All the questionnaires and interview guides were numbered from 1 continuously to the last participating number prior to data collection to make the referencing easier. All the categorical variables were chronologically set to make sure that the accurate code was filled in for each variable. By making use of the coded variable number and the questionnaire/interview schedule number, it was easy to discover and correct mistakes during data entry. The fourth step was data entry. Data entry is the act of transcribing data, often into a computer program. The fifth step was data cleaning, which reviews data for consistencies. Inconsistencies may have arisen from faulty logic, extreme values among others (Field, 2009).

After confirming that all data filled in was accurate, descriptive statistics were utilized to analyze quantitative data with the help of a Statistical Software for Social Sciences (SPSS version 22). Continuous variables were summarized with mean and standard deviation and categorical variables with frequencies and percentages. The study also used χ^2 -tests to explore associations between various variables. Student's *t*-test was used to compare two means in numerical data. Mean, prevalence and bivariate analysis results were presented in form of frequencies, percentages mean and charts. A modified Poisson regression model was fit to obtain the prevalence ratio of complications (have complications vs no complications) across patients' characteristics. Two-tailed tests were performed with the significance level at 0.05. Correlation analysis was also be used to establish the association between continuous variables.

Key informant questionnaires and focus group discussion notes were also separated from each other. Findings from FGD's and Key informant interviews in form of notes were manually coded and analyzed based on themes (thematic analysis) which were developed from responses (scripts) in line with study objectives. Its findings were presented in form of description and supported by verbatims.

3.8 Ethical Considerations

Before data collection, this study was presented to Kenyatta National Hospital/University of Nairobi Ethical Research Committee for approval. Ethical approval number (P525/09/2017) was issued by the committee. In addition, written informed consent was obtained from the outpatients and Key Informants. The researcher also assured the participants of the confidentiality of the information provided and that the information obtained was used for academic purposes only. Confidentiality was ensured by limiting access to the data to the researcher only. This was done by use of passwords in the computer that contained the data as well as the folder that contained the SPSS file. In addition, to ensure the de-identification and anonymity of the respondents, no names were used in the interviews or questionnaires. Before commencing the research, permission was obtained from the hospital administration.

CHAPTER FOUR

RESULTS

4.1 Response Rate

A response rate of 100% was achieved. All the 266 patients interviewed accepted to be respond to the interview.

4.2 Socio-demographic Characteristics of Participants

The table below shows that females formed a majority (56.4%) of the study population. Three-quarters (74.8%) were married while more than half (54.5%) were self-employed (Table 4.1).

Table 4.1: Socio-Demographic characteristics of Participants

Profile	Category	No complications n (%)	Have complications n (%)	Total n (%)
Age-group (years)	18-35	40(36.0)	28(18.1)	68(25.6)
	36-55	56(50.5)	62(40.0)	118(44.4)
	56-70	13(11.7)	51(32.9)	64(24.1)
	Above 70	2(1.8)	14(9.0)	16(6.0)
Sex	Female	60 (54.1)	90 (58.06)	150 (56.4)
	Male	51 (45.9)	65 (41.9)	116 (43.6)
Marital status	Divorced	1 (0.9)	2 (1.3)	3 (1.1)
	Married	83 (74.8)	116(74.8)	199 (74.8)
	Single	25 (22.5)	28 (18.1)	53 (19.9)
	Widowed	2 (1.8)	9 (5.8)	11 (4.1)
Occupation	Employed	16 (14.4)	19 (12.3)	35 (13.2)
	Retired	1 (0.9)	8 (5.2)	9 (3.4)
	Self-employed	63 (56.8)	82 (52.9)	145 (54.5)
	Student	12 (10.8)	0 (0.0)	12 (4.5)
	Unemployed	19 (17.1)	46 (29.7)	65 (24.4)
Education	None	2 (1.8)	4 (2.6)	6 (2.3)
	Primary	38 (34.2)	72 (46.4)	110 (41.3)
	Secondary	52 (46.9)	62 (40.0)	114 (42.9)
	Tertiary	19 (17.1)	17 (11.0)	36 (13.5)

Age Distribution by Complication Status.

Figure 4.1 illustrates the distribution of age by complication status. Both distributions were tested for normality using Shapiro-Wilk's normality test and were both found to be not normally distributed (No complications group-P=0.0136; a group with complications-P=0.0005). Those with no complications were generally younger as shown by the negatively skewed distribution while those with complications were generally middle-aged to old. There is a significant difference between the median age of the two groups of participants (P-value <0.0001; Mann-Whitney U test at 5% level of significance). The median (IQR) age of those with complications is 52 (38-64) years with the youngest being 22 years and the eldest 81 years. For those with no complications, the median (IQR) age is 40 (33-50) years with the youngest being 18 years and the eldest 72 years.

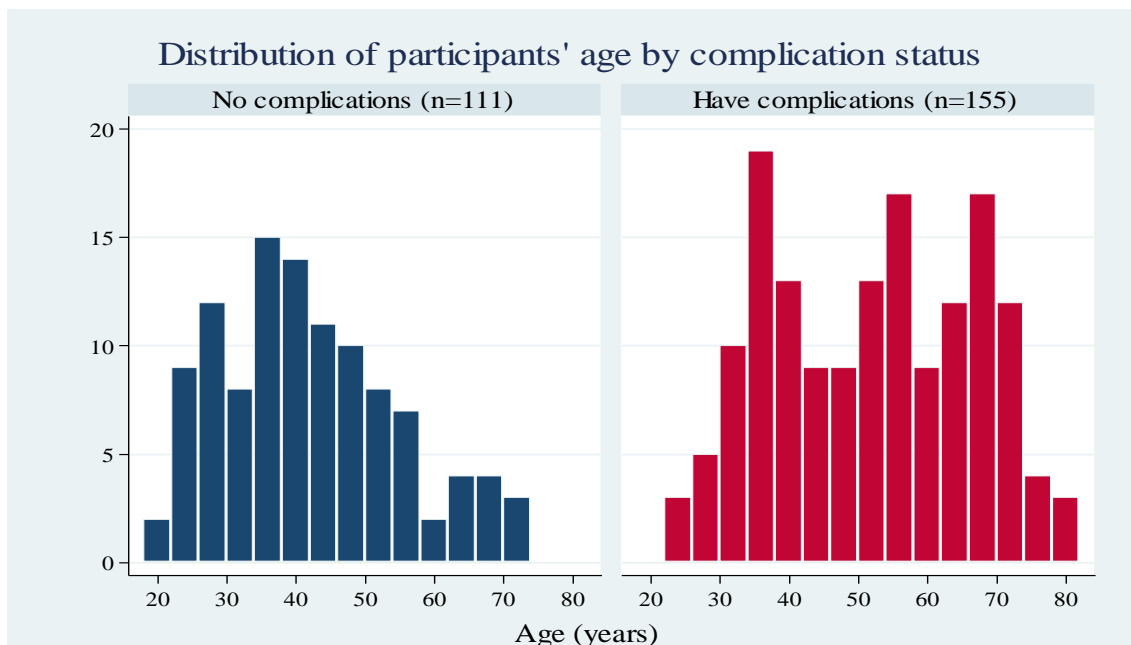


Figure 4.1: Age distribution by complication status (with or without complications)

4.3 Proportion and Types of Complications among Patients Visiting the Hospital

Figure 4.2 shows the proportion of complications in the study population. More than half (58.3%) of the participants had complications. Thus, the proportion of complications among type 2 diabetes mellitus outpatients in the hospital was 58.3% (C.I.: 52.3% - 64.2%). Further, the proportion of participants with complications was statistically significantly higher than that of those with no complications ($P = 0.0038$; two-sample proportion t-test at 5 % level of significance).

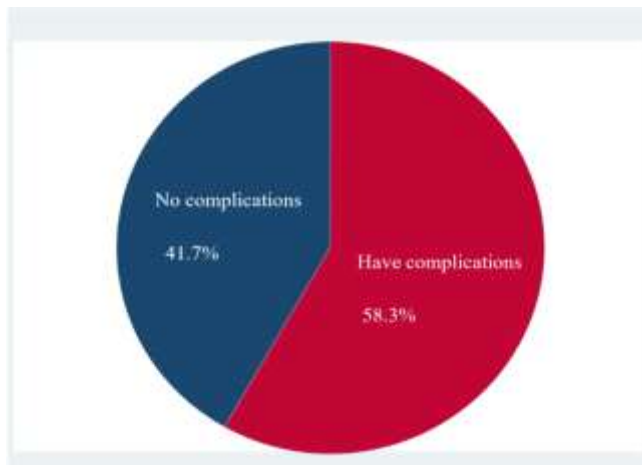


Figure 4.2: Proportion of Complications among Diabetic Patients

Distribution of specific complications among participants (with complications) is shown in figure 4.3 below. This was a multiple response questions, therefore frequencies of occurrence of each complication were reported. The most prevalent complication among participants was hypertension (101/155; 65.2%), followed by eye disease (72/155; 46.5%). The least prevalent complication was heart problem (10/155; 6.5%).

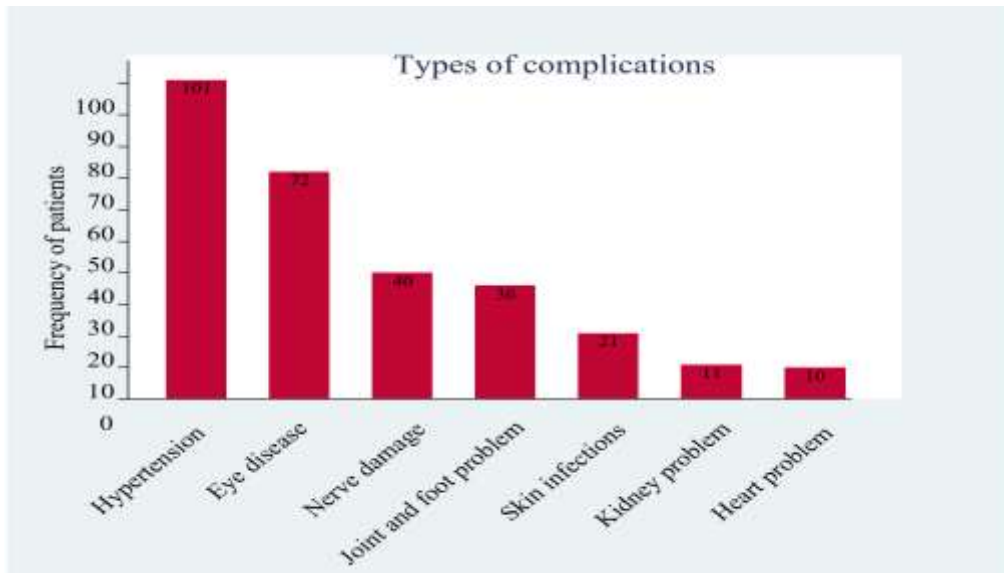


Figure 4.3: The proportion of complications among diabetic patients

4.4 Weight classification of participants by complication status

From figure 4.4, it can be deduced that the study population was largely overweight to obese. A majority (44.5%) of those with complications were overweight, likewise to those without (46.9%). More than a third (35.5%) of those with complications were obese while a quarter (25.3%) of those without were not. Those who were underweight formed the minority in both groups of patients.

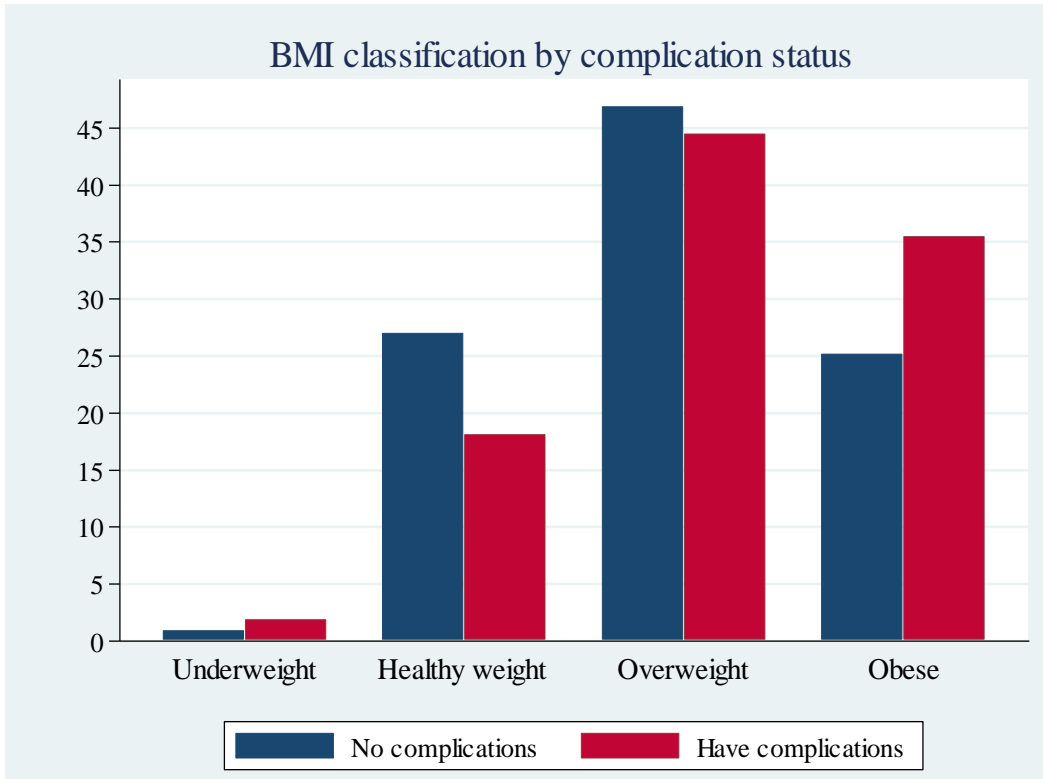


Figure 4.4: The BMI classification of patients with or without diabetic related complications

4.5 Respondent's BMI by complications

Figure 4.5 shows that a small proportion of respondents were of healthy weight across all types of complications. A sizeable proportion was either overweight or obese across all complications. Half (50%) of diabetes patients with hypertension were obese. Similarly, slightly over half (52.4%) of those with skin infection were overweight. Interestingly, none of the patients with either heart problem, joint-and-foot problem or kidney problem were of healthy weight.

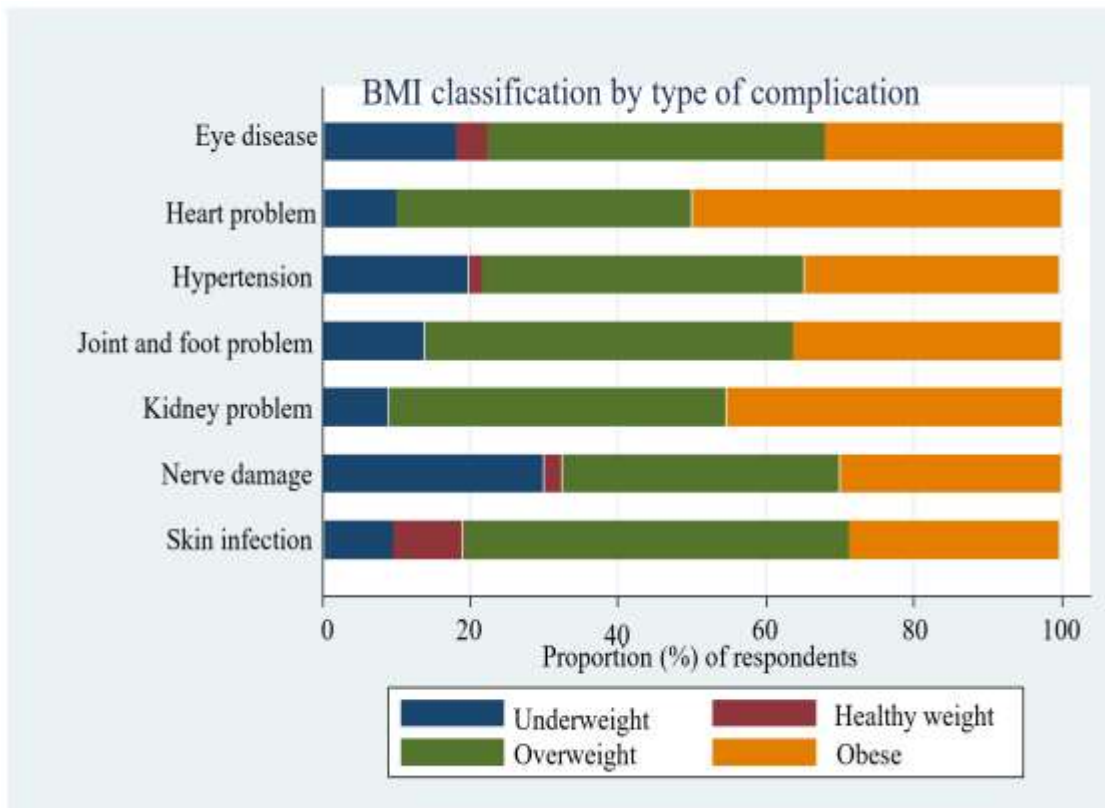


Figure 4.5: The BMI classification of patients based on the type of complication

4.6 Knowledge, Attitude and Practices of Patients regarding Complications

4.6.1 Frequency of complications on patients who practice exercises

From figure 4.6 below, a majority of patients in both categories do some form of exercise on a daily basis i.e., about 60% of those with complications and 70% of those with no complications. However, 6.7% of those with complications and 5.8% of those without never engaged in any form of exercise. The proportion of patients with complications not exercising daily (none, rarely, once a week and more than once a week) is consistently higher than that of those with no complications.

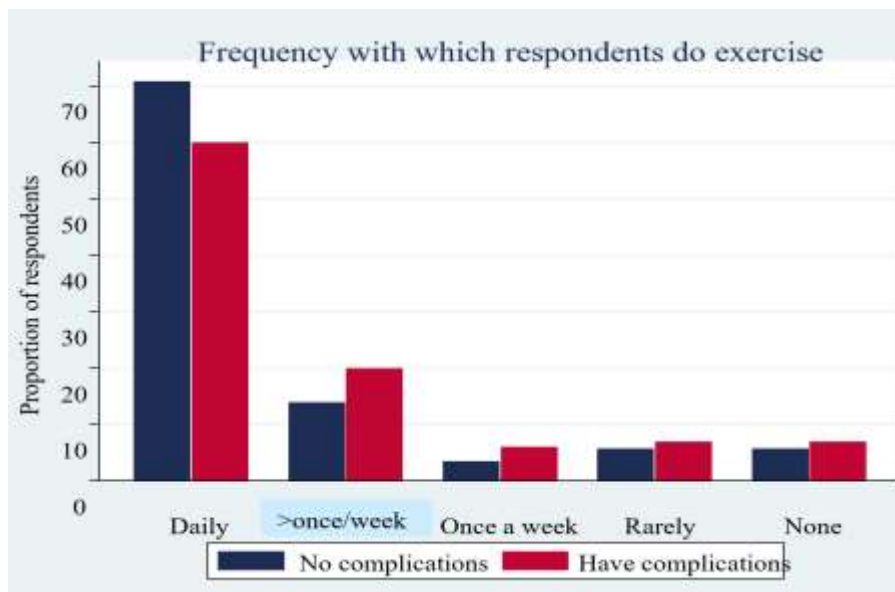


Figure 4.6: Proportion of patients with or without type two diabetes related complications who exercise

4.6.2 Frequency of Exercising vs Type of Complication

When specific complications are considered, it can be seen in figure 4.7 that most patients across all complications do some form of exercise at least daily. Over three-quarters engaged in exercise at least once a week across all complications except nerve damage and heart problem. A sizeable proportion of respondents do not engage in any form of exercise, most notably those with kidney problem (18%) and nerve damage (17%).

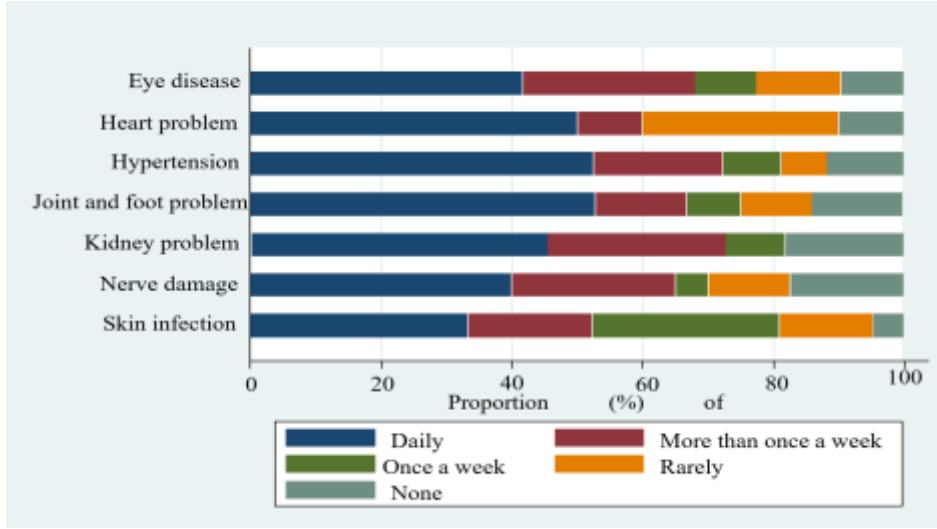


Figure 4.7: Frequency of exercise on patients with complications

A summary of patient’s practices is presented in Table 4.2. Among those with complications, less than half (45.2%) are on insulin therapy while 95.7% are on vegetarian diet. Just above a quarter (27.1%) of those with complications use herbal medicine to treat their disease while only 4.5% of their counterparts do so. Interestingly, none of the study participants use neither *miraa* nor hard drugs.

Table 4.2: Practices of Patients by Complication Status

Practice	Response	No complications n (%)	Have complications n (%)	Total n (%)
Are you on insulin therapy?	No	66 (59.5)	85 (54.8)	151 (56.8)
	Yes	45 (40.5)	70 (45.2)	115 (43.2)
Type of diet adopted	Non-vegetarian	10 (9.0)	13 (8.4)	23 (8.7)
	Vegetarian	101 (91.0)	142 (91.6)	243 (91.3)
Do you smoke?	No	110 (99.1)	152 (98.1)	262 (98.5)
	Yes	1 (0.9)	3 (1.9)	4 (1.5)
Do you take alcohol?	No	106 (95.5)	147 (94.8)	253 (95.1)
	Yes	5 (4.5)	8 (5.2)	13 (4.9)
Do you use <i>miraa</i> ?	No	111 (100)	155 (100)	266 (100)
Do you use hard drugs?	No	111 (100)	155 (100)	266 (100)
Do you use herbal medicine (any plant extract used in its unaltered form) to treat your disease?	No	106 (95.5)	113 (72.9)	219 (82.3)
	Yes	5 (4.5)	42 (27.1)	47 (17.7)

4.6.3 Knowledge and Attitude on the disease and its management.

Patients were asked why they thought they were put on insulin therapy and the results are illustrated in figure 4.8. The most prevalent response across both groups was that it regulates blood sugar. Almost two-thirds (63.3%) of those with complications said insulin therapy helps in regulating blood sugar in the body while 89.2% of those without giving the same response. Another important response as reported by 23.3% of those with complications and 5.4% of those without, was that it helps reduce hyperglycemia.

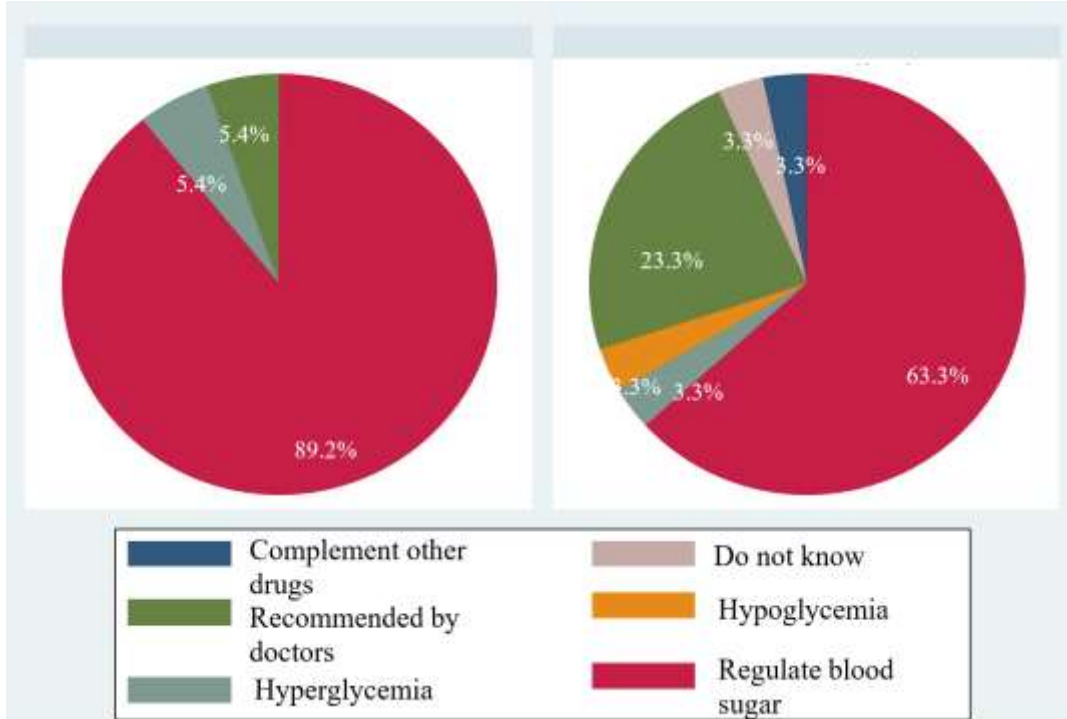


Figure 4.8: Knowledge on insulin management therapy of diabetes

4.6.4 Reasons for being on Insulin therapy across all types of complications

Figure 4.9 shows that at least half of participants across all types of complications said that they were put on insulin therapy to help in regulating blood sugar. Another common response across all complications was hyperglycemia. The least common responses were that insulin therapy “compliments other drugs” and “recommended by a doctor”, both prevalent in three complications only. Despite being on insulin therapy, some patients do not know why they were put on the same, about one-tenth (9.1%) of those with a skin infection, 6.7% of those with the joint-and-foot problem, 5.9% of those with an eye problem and 5.0% of those with hypertension.

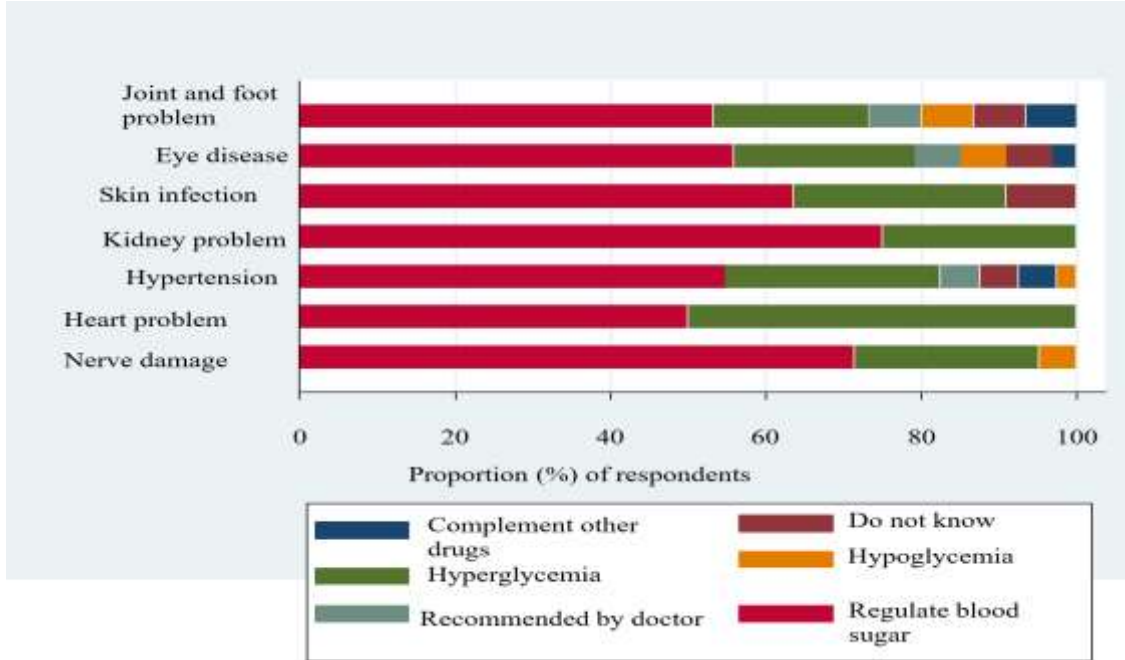


Figure 4.9: Reasons for being on insulin therapy across all types of complications

4.6.5 Patients' knowledge of type 2 Diabetes Mellitus

Patients' perception of type 2 diabetes mellitus was probed and the results are shown in figure 4.10. What stood out most across the two groups of participants is that type 2 diabetes mellitus is a condition where one's body fails to regulate blood sugar. This was reported by a third (33.3%) of those with complications and 40.6% of their counterparts. Surprisingly, a sizeable proportion; 12.5% of those with complications and 16.0% of those without, did not know what diabetes is despite being diagnosed with the disease. Other responses were largely infrequent (<10%).

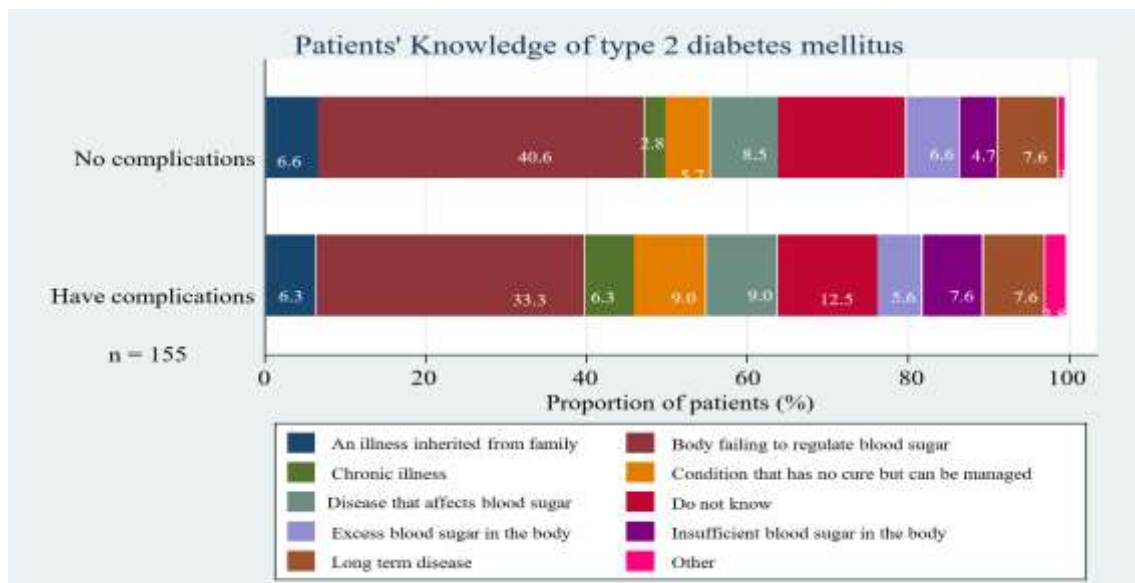


Figure 4.10: Patients with or without complications knowledge on type 2 diabetes mellitus

4.6.6 Patients' understanding of Type 2 Diabetes Mellitus by Type of Complication

From figure 4.11, it can be deduced that a majority of patients across most complications described type 2 diabetes mellitus as a situation where the body fails to regulate blood sugar. Another common description was: type 2 DM is a long-term disease. Other notable though not common descriptions were: “disease that affects blood sugar”, “insufficient blood sugar in the body”. It is also worth noting that some patients across all complications do not know what type 2 DM is, despite being diagnosed with the disease; most notably those with skin infection (15.0%) hypertension (14.0%), and heart problem (11.1%).

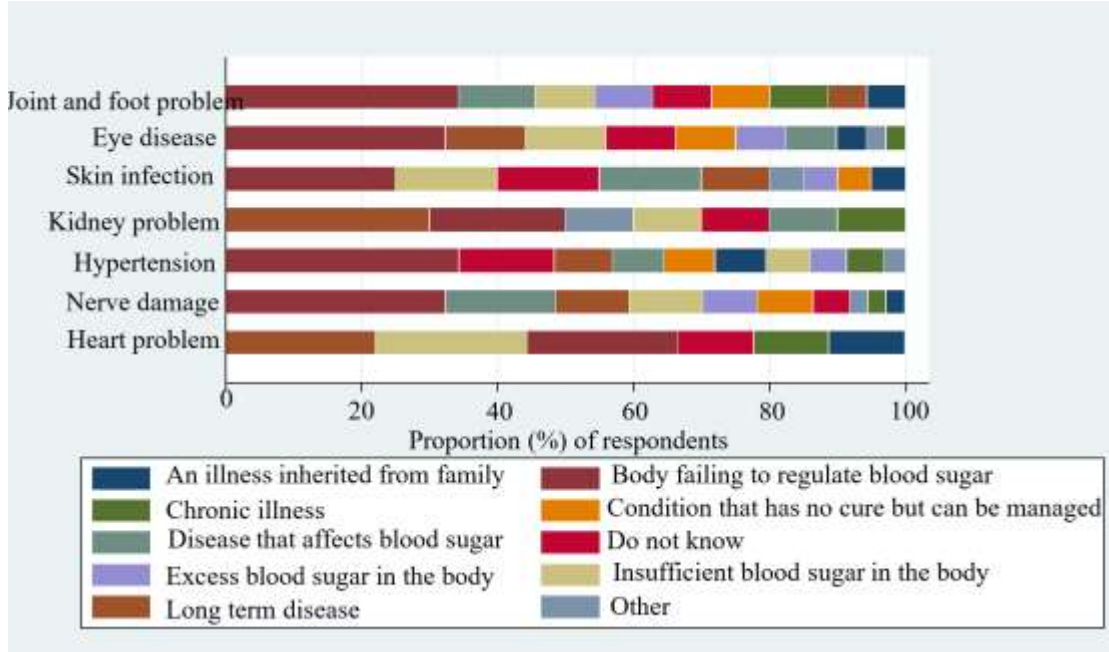


Figure 4.11: Patient understanding of Type 2 Diabetes Mellitus by Type of Complication

4.7 Association between complications and patients' profile/characteristics

Association between complications and patients' profile/characteristics - socio-demographic information and practices regarding diabetes management - were assessed. Initially, crude associations were determined using Chi-square (χ^2) test of association. In each test, we hypothesized that there is no association between a patient factor and complications ($\alpha = 0.05$). Then adjusted associations were obtained using Modified Poisson regression (Poisson regression with robust standard errors) model where the statistic of interest was the prevalence ratio (PR).

4.7.1 Crude Associations

Three factors were significantly crudely associated with complication status at 5% level of significance; age-group ($P < 0.001$), occupation ($P < 0.001$) and herbal medicine use ($P < 0.001$). A closer look at the association between complications and herbal medicine

use shows that a higher proportion (27.1%) of those with complications use herbal medicine to treat their disease than those with no complications (4.5%). Next, adjusted associations of patients' factors with complications are determined. Those whose P-values are at most 0.2 were included in the adjusted model (table 4.3).

Table 4.3: Crude association between complication status and patients' characteristics/factors

Factor	Category	No complications n (%)	Have complications n (%)	χ^2 test P-value
Sex	Female	60 (54.1)	90 (58.06)	0.515
	Male	51 (45.9)	65 (41.9)	
Age-group (years)	18-35	41 (36.9)	28 (18.1)	<0.001
	36-55	55 (49.5)	62 (40.0)	
	56-70	13 (11.7)	51 (32.9)	
	Above 70	2 (1.8)	14 (9.0)	
Marital status	Divorced	1 (0.9)	2 (1.3)	0.356
	Married	83 (74.8)	116(74.8)	
	Single	25 (22.5)	28 (18.1)	
	Widowed	2 (1.8)	9 (5.8)	
Occupation	Unemployed	19 (17.1)	46 (29.7)	<0.001
	Employed	16 (14.4)	19 (12.3)	
	Self-employed	63 (56.8)	82 (52.9)	
	Student	12 (10.8)	0 (0.0)	
	Retired	1 (0.9)	8 (5.2)	
Education	None	2 (1.8)	4 (2.6)	0.170
	Primary	38 (34.2)	72 (46.4)	
	Secondary	52 (46.9)	62 (40.0)	
	Tertiary	19 (17.1)	17 (11.0)	
BMI	Underweight	1 (0.9)	3 (1.9)	0.164
	Healthy weight	30 (27.0)	28 (18.1)	
	Overweight	52 (46.9)	69 (44.5)	
	Obese	28 (25.2)	55 (35.5)	
Frequency of exercising	At most once a week	17 (17.4)	31 (22.3)	0.350
	More than once weekly	81 (82.6)	108 (77.7)	
Type of diet adopted	Non-vegetarian	10 (9.0)	13 (8.4)	0.859
	Vegetarian	101 (91.0)	142 (91.6)	
Are you on insulin therapy?	No	66 (59.5)	85 (54.8)	0.453
	Yes	45 (40.5)	70 (45.2)	
Do you smoke?	No	110 (99.1)	152 (98.1)	0.494
	Yes	1 (0.9)	3 (1.9)	
Do you take alcohol?	No	106 (95.5)	147 (94.8)	0.806
	Yes	5 (4.5)	8 (5.2)	
Do you use herbal medicine? to treat your disease?	No	106 (95.5)	113 (72.9)	<0.001
	Yes	5 (4.5)	42 (27.1)	

4.7.2 Adjusted Associations

Table 4.4 is a summary of results of adjusted associations of complications with patient factors. In this model, the outcome is complication status (reference: no complication). Age-group (above 70 vs 18-35 years; PR = 1.72, CI = (1.15-2.58) and 56-70 vs 18-35 years; PR = 1.59, CI = (1.14-2.23)) and herbal medicine use (PR = 1.62, CI = (1.36-1.94)) were significantly associated with complication status, adjusting for other factors.

Adjusting for employment status, education, BMI, and herbal medicine use, the proportion of patients aged above 70 years who have complications were 72% more than that of those aged between 18 and 35 years with the same condition (P = 0.009). This implies that among type 2 diabetes mellitus patients, a significantly higher proportion of the elderly (above 70 years) have complications compared to the youths (18-35 years). Still under age-group, controlling for employment status, education, BMI, and herbal medicine use, the proportion of patients aged between 56 and 70 with complications is 59% higher than that of those aged between 18 and 35 years with the same condition (P = 0.006).

Finally, adjusting age-group, employment status, education and BMI, the proportion of patients with complications who use herbal medicine to treat their condition is 62% higher than that of patients with complications who do not use herbal medicine (P<0.001). In other words, patients who use herbal medicine as an alternative of conventional modern medicine are more likely to have (or have had) complications compared to those who do not use.

Table 4.4: Adjusted association between complication status and patients' characteristics

Patients' characteristics	Prevalence ratio (PR)	Robust Std. Error	z	P>z	[95% Conf. Interval]	
Age-group (ref: 18-35)						
36-55	1.148915	0.20009	0.8	0.425	0.81667	1.616327
56-70	1.594821	0.271841	2.74	0.006	1.141886	2.227416
Above 70	1.720177	0.356774	2.62	0.009	1.14559	2.582956
Employment (ref: Unemployed)						
Employed	1.004789	0.109694	0.04	0.965	0.811238	1.244519
Education (ref: None)						
Primary	2.33456	1.436693	1.38	0.168	0.698834	7.79895
Secondary	2.153725	1.332936	1.24	0.215	0.640299	7.244314
Tertiary	2.104667	1.358562	1.15	0.249	0.593926	7.458199
BMI (Ref: Healthy weight)						
Underweight	0.762041	0.273292	-0.76	0.449	0.377321	1.539027
Overweight	0.847467	0.292147	-0.48	0.631	0.431209	1.665549
Obese	0.95261	0.339664	-0.14	0.892	0.473598	1.916111
Herbal medicine (Ref: No)						
Yes	1.622715	0.148772	5.28	<0.001	1.355823	1.942144

4.8 Summary of qualitative analysis

4.8.1 Disease Awareness

Most participants were aware of what diabetes is and the impact it caused on their overall health. They described it as a lifetime condition which is mainly associated with the lack of control of blood sugar.

“A disease where the body fails to control its sugar levels and requires constant management by use of drugs and lifestyle changes such as eating an appropriate diet” (FGD 1 male; FGD 2 male; FGD 3 mixed)

In addition, many participants associated diabetes with the body's inability to control blood sugar which in turn results to a lifetime reliance on drugs and lifestyle changes to manage the condition

“A disease where the body cannot control its blood sugar” (FGD 2, male)

“A lifetime condition that is acquired from a patient’s folks” (FGD, 2 female)

“Diabetes can also be hereditary as parents with diabetes are also likely to have children with diabetes (KII, 1)

4.8.2 Community Perceptions Concerning Diabetes

Many of the respondents felt that they were being treated differently or would be treated differently by society if they exposed the severity of the disease. Individuals around them provide extra care and support to help ensure that they are okay e.g., through ensuring that they have eaten the appropriate food and in ensuring that they get medication. However, some of the patients believe that they needed to keep their health information as confidential in order as they did not want to be treated as a burden. The respondents also felt that when seeking health services, they should be given first priority.

“I don’t get any special treatment but I think I deserve to be treated differently especially when seeking medical care. I should be given 1st priority” (FGD 1, male).

Moreover, they felt that patients with chronic illnesses should be given extra care and handed first priority when seeking health services.

“Only my wife knows about my condition. I feel that when other people know about it, it would be a bother” (FGD 2, male)

“The society treats me differently because I have diabetes and hypertension, hence people strive not to upset me” (FGD 2, female).

4.8.3 Challenges in Accessing Medicare

All the respondents noted a number of challenges which were associated with the access to healthcare. These include issues long queues and waiting time, transportation to the hospital, shortage of drugs, expensive drugs and cost of seeking medication in the facility.

“Some of the challenges in accessing healthcare in the facility include long queues at the lab, the high cost of travel, lack of diabetic drugs in the pharmacy and long waiting time before being attended to” (FGD 1, male)

“Lack of drugs at the pharmacy, drugs are expensive and long queues while waiting time on the doctor” (FGD 2, female)

“Shortage of drugs and the drugs are very expensive” (FGD 3 mixed)

“There have been no drugs for the past year” (KII, 1)

4.8.4 Perception of Medical Care

Most of the respondents noted improvements in relation to the provision of health services in the society especially with the introduction of computerized health record storage. Additionally, the doctors were always available even during the strike. However, the facility still faces issues in relation to the shortage of drugs.

“Yes, services have somehow improved, doctors are good and really concerned about the patient following his perception and advising us. But the lack of drugs is a major concern” (FGD 1, male)

“Services have improved since doctors are always present and more than one. Sometimes patients would come and get one doctor but nowadays you will get two or more doctors” (FGD 2, female)

“Yes, services have improved since records have been computerized and it’s easy to access information about the patient. However, long queues and lack of drugs is an issue the government should address” (FGD 3, mixed)

However, some of them pointed out that there were no noticeable improvements noted as shown in the following responses;

“No improvements since drugs are always lacking in the pharmacy however, doctors are always present like when there were strikes” (FGD 3, mixed)

“There have been no improvements since the patients we still take more time in the lab than when the tests are done at the D.O.C and the pharmacy always lacks drugs” (KII, 2)

4.8.5 Government’s Action to Enable Access of Treatment

All respondents noted that it was critical for the government to provide sufficient number of doctors and set up a lab at the D.O.C. The drugs also have to be provided on a regular basis and at subsidized costs. The respondents also noted that the government should be educated and create more awareness about diabetes and establish pharmacies where the NHIF card could be used to purchase medication.

“Provide drugs constantly at the pharmacy, subsidize costs of drugs of diabetes drugs, employ more doctors and set up a lab at the D.O.C.” (FGD 1, male)

“Constantly supply medicine at the hospital pharmacy, employ more doctors, educate and create more awareness about the disease, reduce the cost of drugs and create pharmacies where patients can use NHIF to get drugs if the hospital lacks drugs” (KII, 3)

“Provide drugs at the pharmacy at reduced cost and employ more doctors” (FGD 1, male)

“Add the number of patients in a day” (KII, 3)

4.8.5 Current Services in the Health Facility

All respondents expressed concern that the services at the health facility were generally good but there was need for improvement. They noted that the doctors also offered good advice and follow-up on patients.

“The services are generally good but can be improved. Doctors are really good when advising and following-up on patients” (FGD 1, male)

“There is great improvement i.e., digitization of systems has really helped” (FGD 2, female)

“The services are a bit fast at the diabetic clinic” (FGD 3, mixed)

4.8.6 Society views on the Diabetes

The respondents were asked whether they got any support around them, the individuals who gave the help on a frequent basis, whether they get necessary support from their colleagues at work and school, if they got permission from school and work to visit the health facility and whether there were any special meals prepared for them at home, school and workplace. They noted that they got support from individuals around them who mostly included their family, members, spouses and friends. They also got necessary support at work school and they got permission to visit the health facility but they had to present the proper documents. Lastly, the respondents mostly ate what was available but some mostly ate boiled food.

4.8.7 Other Concerns

All the respondents required individuals who provided supportive care for diabetic patients to be educated and more aware of diabetes. There is a need for health programs to help these individuals and it is critical that all the concerns which the patients report

get to the health management. Additionally, NHIF medication should work in private pharmacies.

“People who help diabetic patients should also be educated more and made aware of the condition. Such a program should be introduced” (FGD 1, male)

“Make sure the reports get to the big people and bosses” (FGD 2, female)

It is critical that the reports which the patients make reach the management of the hospital for better service delivery.

“NHIF should be able to work with private pharmacies.” (FGD 3, mixed)

4.8.8 Number of Patients Diagnosed with Diabetes Mellitus in a month

According to all the respondents, there were at least 10 patients who are diagnosed with diabetes mellitus in the week. This, in turn, translates to a total of 40 patients in a month.

“Ten new Diabetes Mellitus patients weekly” (KII, 1)

“About 10 new patients per clinic day, so 40 in a month” (KII, 2)

“10 per clinic day, 40 patients” (KII, 3)

4.8.9 Challenges faced when Executing Duties

According to all the respondents, the facility faces challenges like lack of diabetes drugs, congestion and delayed appointments from patients. Other issues include the patient workload which causes delayed lab results due to congestion in the lab and patients are usually sent away when they are unable to pay for visitation fee and if they do not have the appropriate documentation. The patients also do not feel that their information is confidential due to the congestion of patients in the hospital. When patients also miss

their appointments, they are usually sent away as the clinic usually closes at around 1 pm.

“Lack of privacy due to congestion hence the patients may sometimes withhold information that is crucial to the physician” (KII, 1)

“Lack of diabetic drugs, congestion and lateness by patients” (KII, 2)

“Plenty of workloads, delayed workload due to congestion at the lab, patients may be sent away if they do not have the documentation and if they are unable to pay for the visitation fee” (KII, 3).

4.8.10 Perception of Patient Adherence to Medication

The respondents reported that most of the patients adhere to the recommended medication however, there is an instance where patients cease to take medication when they begin to feel better. Patients can also cease to adhere to the medication when they ran out of drugs and they do not purchase other drugs in time.

“Yes, most of them do, but there are some patients who do not since they are feeling better or the drug/prescription is over and they did not purchase of top it up” (KII, 1)

4.8.11 Side Effects reported by Patients

Some of the reported side effects include headaches, weight gain, stomach upset, lack or decreased appetite, dizziness and nausea.

“Yes, some of the patients have complained of headaches, weight gain, stomach upset, and lack or reduced appetite among others” (KII, 1)

“Yes, effects such as weight gain, weight loss, dizziness, headaches, lack of appetite and nausea” (FDG 1, male)

4.8.12 Number of Patients that require a Waiver/Exemption

The key informants also indicated that a number of patients still required a waiver but NHIF had been instrumental in helping the patients with their medical expenses.

“A number of patients may require a waiver, but with NHIF it has really helped very many patients in their payment” (KII, 1)

“NHIF has helped with this challenged” (KII, 2)

4.8.13 A major cause of Mortality and Morbidity among Type diabetes patients

Little is known about the major reasons why the patients attending the facility develop diabetes however most of the patients died due to complications like hypertension and kidney damage.

“Complications that arise due to diabetes i.e., hypertension and kidney damage.”
(KII, 3)

4.8.14 Opinion on ways to improve the Provision of Services

In order to improve the provision of the health services in the facility, there is a need to increase the number of days that the patients can visit the diabetic clinic. Medication should also be made readily available, irrelevant policies should be revised and the facility must increase the space in the facility in order to accommodate more patients.

“Increase the number of days in a week that when the diabetic clinic opens and drugs should be readily available at the hospital at all the time. Since diabetic clinic space is small relevant authorities should work on increasing the space so as to accommodate the many patients that attend the clinic” (KII, 2)

“Increase the number of diabetic clinic days or the hours to accommodate more patients and lab tests should be done at the clinic and patients should not be sent

to the lab and back to the clinic, it wastes time. Provide more space at the clinic it is very congested” (KII-3)

4.8.15 Patient Adherence to Lifestyle Changes Education

According to the respondents, most of the patients adhere to the lifestyle education and the changes that they are supposed to implement.

“Yes, most patients practice the lifestyle education given every morning as the clinic opens patients are taught one or the few things regarding their lifestyle and the relevant changes they are to make so as to manage their condition” (KII, 1)

“Yes, most patients adhere to the lifestyle education given to them but a few may be out of ignorance do not” (KII, 2)

4.8.16 Patient Appointments

When asked whether the patients missed their appointments for clinical most respondents reported that some of the patients were always late, or were simply ignorant. Some missing due to unavoidable circumstances like travelling or living further from the county. Others could not make it due to the unavailability of transport.

“Yes. Mostly due to ignorance and lateness and travelling costs” (FGD 2, female)

“Patient comes after the clinic is closed, some simply forgot, some may not be within the county or have travelled and some cannot make it since they have no means i.e., fare or transport money” (KII, 1)

4.8.17 Patients' suggestions to improve the Level of Care in the Health Facility

A number of recommendations were suggested by the respondents to help improve the level of healthcare in the facility. These include improving the supply of drugs in the pharmacy, conducting the lab tests in the facility, to increase the number of doctors and the clinic days should accommodate all the patients in order to reduce the waiting time.

“The laboratory tests should be done at the clinic” (FGD 2, female)

“Increase the number of doctors and clinic days to accommodate all patients and reduce waiting time” (FGD 3, mixed)

“Add the number of Clinic days in a week” (KII, 1)

4.8.18 Suggestions by Healthcare providers on how to improve healthcare services

There were a number of recommendations which were offered to help improve the efficiency of the health department in the country. These include the need to increase the number of doctors, reducing the cost of medication, providing sufficient drugs to the health facility and stop corruption in the health facility.

“To provide more doctors” (KII, 1, KII, 2, KII, 3)

“Provide drugs at the pharmacy. The pharmacy should not lack drugs” (KII, 1, KII, 2, KII, 3)

“Reduce the cost of drugs and stop corruption” (FGD 1, male)

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Proportion of Complications among Patients visiting the Hospital

The study revealed that a majority of the patients with diabetes mellitus were of the age of 40 and above. This relates to a study conducted by Gregg *et al.*, (2016) which revealed that a majority of the patients with diabetes mellitus were of the age 45-65 years. The findings also revealed that at least half of the population with Type II Diabetes Mellitus reported that they had complications which translated to a proportion level of 58.3%. Additionally, the proportion of participants with complications was statistically significantly higher than that of those with no complications. A majority of the patients with Type II Diabetes Mellitus had at least one complication (Zheng *et al.*, 2018). Another study conducted in Sweden captured a prevalence of 4.4% and an incidence rate of 399 per 100,000 population among individuals with type II diabetes. The study also found out that the prevalence had increased over a duration of 7 years and early half of the patients had either cardiovascular diseases or microvascular infarction (Norhammar *et al.*, 2016).

At least half of type 2 diabetes mellitus outpatients visiting a regional referral hospital in Nairobi, Kenya had complications. The most prevalent complication was hypertension, followed by eye disease and heart problem. Older age, and use of herbal medicine were associated with complications. Most patients correctly knew that they were put on insulin therapy in order to regulate blood sugar in the body. The majority reported that they did some form of exercise daily, with a higher proportion among those with complications. A significant proportion of patients did not engage in any form of exercise, with the majority being those with complications.

A total of 72.9% of patients with complications reported use of herbal medicines. A majority of public health institutions have always reported high workload which reduces the quality of patient care and this may explain why patients seek alternative and cheaper methods of treatment like use of herbal medicines. Most patients would know that the disease is incurable and requires prolonged treatment. This may lead them to try herbal medicine to reduce treatment costs. Traditional beliefs in the Kenyan society where health promotion targets natural remedies (Mothupi *et al.*, 2014; Ondicho *et al.*, 2016) as the best and safest ways of treatment has provided for the growth of and use of herbal medicines even where they seem not to work. The society relies on herbalists as an option of treatment and often in most cases these herbalists take advantage of the patients by providing herbs that only provide nutritional benefits and not therapeutic effects thus leading to an increased number of cases of diabetes and its complications. Religious beliefs also play a major role in patient care. Most of the religions in Kenya encourage nutrition and use of natural food herbs as the best ways of promoting health of patients. More often these methods are not practiced in the correct way and therefore the patients suffer the most. Diabetes mellitus complications mainly affect older individuals. These results are consistent with those of a study that revealed that a majority of the individuals who are affected by diabetes are aged 45-65 years (Gregg *et al.*, 2015). Another study also found that the prevalence of diabetes has been on the rise with an estimation of 57.4% (Gautam *et al.*, 2015).

Type 2 diabetes patients with complications were more likely to exercise on a regular basis as compared to patients without complications because they believed regular exercises would reduce the severity of the disease or eliminate the complications they were experiencing. Those without complication exercised less because they did not suffer more from the complications. Other studies indicate that the level of knowledge in relation to diabetes and its impact is still low (Mohammadi *et al.*, 2015). Similarly, a study in India revealed that there is a need to improve the level of knowledge among diabetic patients in order to reduce the level of morbidity associated with the disease (Gautam *et al.*, 2015).

Most patients were aware that insulin therapy was critical in the regulation of blood sugar in the body. A study conducted in India revealed that the level of knowledge of the patient was associated with incurability and poor self-care practices (Dalpatbhai *et al.*, 2017). Another study revealed that with better knowledge scores and high-quality self-care practices, patients were more likely to experience more benefits (Al-Alboudi *et al.*, 2016). Yet another important finding was that most of the patients with diabetic complications were obese. Patients should be encouraged to have healthy weight and engage in some form of physical exercise at least more than once a week (Thuita *et al.*, 2020). It is recommended to encourage nutritional support for patients who require it.

Other socio-demographic factors that were noted was that unemployed people with none or the least education had higher rates of complications than those who were employed and had a higher level of education. Unemployment reduces the chances of accessing better healthcare whereas education empowers the society on best health practices. Since we are not able to increase employment and level of education especially amongst older patients then it is important to increase the level of health promoting programs that target diabetic care thus enabling patients to understand the importance of adherence to medications and not introducing other alternatives like herbal medicines. It is also important to educate the caregivers and other individuals who offer services to patients. Herbal medicine practitioners should be registered and all herbal medicines tested to confirm their therapeutic functions. This information should be shared with the public and only effective herbal medicines should be allowed to circulate by registered members. The cost of treatment should also be reduced to encourage patients to wholly access treatment and seek less of alternative or cheaper treatment.

5.1.2 Common types of Complications among Patients visiting the Hospital

The diabetes mellitus patients noted that the most prevalent complication was hypertension. However, other notable complications that were noted Eye disease, nerve damage, joint and foot problem, skin infections, kidney problems and heart problems. These findings relate to a study conducted by Kautzky-Willer *et al.*, (2016) which

reveals that most patients with diabetes mellitus suffer from cardiovascular complications, myocardial infarction and stroke. Gray *et al.*, (2017) also notes that most patients with diabetes mellitus also report having cardiovascular complications. Another study found out that diabetic kidney disease, arterial stiffness and hypertension are usually common among individuals with diabetes type 2 (Dabelea *et al.*, 2014).

Microvascular problems such diabetic retinopathy (hence the high incidences of eye disease), nephropathy that accounted for the highest number of cases of hypertension observed in this study, and neuropathy, as well as life-threatening macrovascular illnesses like atherosclerosis, stroke, affect a large percentage of individuals with type 1 and type 2 diabetes.

The pathophysiology of diabetes and its consequences has been linked to a number of biochemical pathways and hereditary variables. They have a significant effect on cellular transcription programs in target organs, causing abnormal expression of growth-promoting, proinflammatory, pro-apoptotic, and pro-fibrotic genes (Woroniecka *et al.*, 2011).

Endothelial cells, vascular smooth muscle cells (VSMCs), monocytes, and retinal, neuronal, and renal cells are all affected by diabetes and diabetogenic agents such as excessive glucose, AGEs, angiotensin II (Ang II), TGF-, and oxidized lipids. Numerous signaling pathways and protein kinase stimulated by such substances result in increased expression of growth factors, inflammatory chemokines, and cytokines involved in endothelial dysfunction, vascular cell growth, macrophage infiltration, fibrosis, inflammatory processes, and organ failure thus explaining why most patients developed hypertension in larger proportions followed by eye disease and nerve damage (Reddy *et al.*, 2015).

5.1.3 Knowledge, Attitude and Practices of Patients regarding Complication

According to the findings, a majority of the Type 2 Diabetes patients with complications exercised on a daily basis. The patients were also aware of what diabetes is and the complications associated with the disease. However, according to a study conducted by Mohammadi *et al.*, (2015) there is still a need to improve the level of knowledge in relation to diabetes which is still insufficient despite the attitude being acceptable. A study conducted in India also noted that there was need to improve the level of knowledge among diabetic patients in order to reduce the level of morbidity (Gautam *et al.*, 2015). Secondly, a majority of the respondents also noted that insulin therapy is critical in the regulation of blood sugar in the body. However, in relation to practices, some of the patients missed their appointments and skipped their medication whenever they felt better. In a study conducted in Gujarati, India, researcher found there existed a need to improve the level of knowledge associated with the incurability of the disease, the attitudes towards the complications and self-care practices like more exercises (Dalpatbhai *et al.*, 2017). Studies have also revealed that with better knowledge scores and high-quality self-care practices, patients were more likely to experience more benefits (Al-Aboudi *et al.*, 2016).

5.2 Conclusions

In summary, the study revealed that a higher proportion of all type 2 diabetes patients visiting the hospital had some form of diabetes related complications. Most of these patients who had developed these complications were more obese and performed less exercises when compared to the other proportion of diabetic patients who had no complications.

At least each diabetic patient developed some form of complication as indicated in the results with a majority of them developing hypertension, eye disease and nerve damage, respectively as the most common types of complications.

Despite the patients being aware of the issues associated with diabetes mellitus, some of the patients did not practice the appropriate self-care practices. Additionally, the health facility related concerns also limited the knowledge and self –care practices in relation to diabetes management. The study showed that older persons, obese persons and persons using herbal medicines were more likely to have complications of type 2 diabetes mellitus. Health providers and care givers should be supported to provide health promotion and nutrition programs to their diabetes patients. Attempts should be made to include herbal medicine practitioners in patient management programs to ensure their practices support rather than interfere with treatment.

5.3 Recommendations

The following is a summary of the study's recommendations.

The hospitals should monitor regularly and do follow up and adherence counselling and monitoring to newly diagnosed type 2 diabetic patients to prevent emergence of diabetic related complications. It should facilitate research on type 2 diabetes with adequate reporting to provide enough data to mitigate re-emergence of diabetic related diseases or mortality.

There is need to Increase the level of health promotion programs in the public hospitals such as nutritional campaigns, health leaflets with pictorial illustrations, testing awareness and any beneficial information to the public that is associated with diabetes. This can be done by hospital management where quarterly funds can be allocated for such programs. Therefore, it is important for partners and the ministry of health to educate the caregivers and other individuals who offer aid to diabetes patients

The hospital management committee should ensure that the health facilities have accessible services to patients regularly instead of single clinic days and these facilities are well equipped. This can be done by increasing the number of staffs working on the clinics and thus encouraging doctors and nurses to increase the number of diabetes clinic days in the facility. There is need for the Pharmacy department through the help of the

ministry of health and hospital procurement to increase the supply of diabetes drugs which are affordable through adequate revenue allocation.

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APPENDICES

Appendix I: Informed Consent Form

Informed consent form for type two diabetes patients visiting Mama Lucy Kibaki hospital

Research Title: Factors associated with complications amongst patients visiting Mama Lucy Kibaki hospital

Institution: Jomo Kenyatta University of Agriculture and Technology/Kenya medical Research Institute department of Public Health

Principal Investigator: Evans Ochoki Ayieng'a

Supervisors:

Dr. Daniel Nyamongo, Jomo Kenyatta University of Agriculture and Technology school of public health, Nairobi.

Dr. Joseph Mutai, Kenya Medical Research Institute, Nairobi

Ethical Approval

Kenyatta National Hospital/University of Nairobi Ethical and Research Committee, P.O BOX 20723-00202, Nairobi.

The information in this part is meant to assist you understand this study with a view to enabling you give voluntary and informed consent to your participation. Kindly read it carefully before signing the consent form.

Purpose of the study

Dear participant

You are invited to participate in a study meant to determine factors associated with complications amongst type two diabetic patients visiting Mama Lucy Kibaki hospital. Please read this sheet carefully before you decide to participate.

Permission is requested from you to enroll in this research study. The following are general principles that apply.

- i. Your acceptance to participate in this study is voluntary and will get same medical care whether you participate or not.
- ii. You may withdraw from the study any time without necessarily giving a reason for your withdrawal without consequences to the services you receive from the clinic.
- iii. After reading the explanation you may ask any questions that will enable you understand clearly the nature of the study.

Procedure to be followed

With your permission, I will ask you about the history of your disease (type 2 diabetes) and the medication you have been using from the first time you were diagnosed with the disease. I will also ask what challenges you are facing and types of medications you are using. All information given will be handled with confidentiality and will only be used for the purpose of this study.

Benefits and rewards

You may ask any questions about the type of issues you have with regards to your disease and maybe helped where the institution is able to. I will offer counsel on best practices to manage your disease. There will be no monetary reward for participating in the study.

Discomfort and risks

The study may have some questions that you may not be comfortable answering. If this happens you may refuse to answer if you so choose. You may also stop the interview any time. Participation may take approximately 15 mins before you are attended to in the clinic.

Assurance of Confidentiality

All the information that you shall give will be confidential and your name shall not be mentioned during data handling or any publication. Serial numbers will be used instead.

Should you have any questions concerning this study please contact any of the following?

The Secretary

Kenyatta National Hospital/University of Nairobi Ethics Review Committee

P.O Box 20723 00100

Nairobi

Or

Evans Ochoki Ayieng'a

P.O Box 112 00100

Nairobi

Informed consent

I have read the above information and understood. I willingly agree to participate in this study, the nature and purpose of which have been fully explained to me.

Signature/Thumb_____

Date_____

Investigator Statement

I have explained the research to the participant and answered his/her questions to the best of my ability. I confirm that consent has been given freely

Signature of the Investigator_____ Evans Ochoki

Date_____

Appendix II: Tamko La Ridhaa

Tamko la ridhaa kwa mgonjwa wa kisukari anayehudhuria Hospitali ya Mama Lucy Kibaki

Kichwa cha Tafiti: Visababishi vinavyohusishwa na madhara ya ugonjwa wa kisukari kwa wagonjwa wanaohudhuria hospitali ya Mama Lucy Kibaki

Taasisi Zinazohusika: Chuo Kikuu cha Kilimo na Teknolojia cha Jomo Kenyatta pamoja na Taasisi ya tafiti za afya, kitengo cha Afya ya Jamii (Kenya Medical Research Institute department of Public Health)

Mtafiti Mkuu: Evans Ochoki Ayieng'a

Wasimamizi wa Tafiti:

Dr. Daniel Nyamongo, Chuo Kikuu cha Kilimo na Teknolojia cha Jomo Kenyatta

Dr. Joseph Mutai, Taasisi ya tafiti za afya, kitengo cha Afya ya Jamii (Kenya Medical Research Institute department of Public Health)

Ruhusa ya Maadili

Ruhusa ya maadili ya tafiti hii imetolewa na Hospital ya taifa ya Kenyatta, pamoja na bodi ya tafiti na maadili ya Chuo Kikuu cha Nairobi, S.L.P. 20723-00202, Nairobi.

Maelezo yaliyomo ni ya kukusaidia wewe mhusika kuelewa na kutambua dhumuni la tafiti hii ili uweze kushiriki katika utafiti huu kwa ridhaa yako mwenyewe bila kushurutishwa au kurubuniwa na mtu yoyote yule. Tafadhali isome fomu hii kwa makini sana kabla ya kuweka sahihi yako.

Lengo la Tafiti

Kwako Mhusika,

Unakaribishwa kushiriki katika tafiti hii yenye kutaka kujua visababishi vinavyohusishwa na madhara ya ugonjwa wa kisukari kwa wagonjwa wanaohudhuria hospitali ya Mama Lucy Kibaki. Tafadhali soma kwa makini sana kabla ya kuamua kushiriki katika tafiti hii.

Tunaomba ridhaa yako ya kushiriki katika tafiti hii. Yafuatayo ni maelezo muhimu ya utafiti huu

- I. Ushiriki wako katika tafiti hii unatokana na ridhaa yako mwenyewe na utapata huduma zilezile za matibabu hata kama umeridhia au hukuridhia kushiriki katika tafiti hii.
- II. Unaweza kujitoa katika tafiti hii wakati wowote ule bila kuhitajika kutoa sababu au maelezo ya kwa nini umesitisha ushiriki wako katika utafiti huu. Kujitoa kwako kutoka katika tafiti hii, hakutaathiri huduma za matibabu ulizokuwa unapata katika kliniki ya wagonjwa wa kisukari.
- III. Baada ya kusoma maelezo ya tafiti hii, unaruhusiwa kuuliza swali lolote lile iwapo unahitaji kueleweshwa zaidi kuhusu tafiti husika

Kanuni za Kufuatwa

Kwa ridhaa yako, nitakuuliza historia ya ugonjwa wako wa kisukari na dawa ambazo unatumia kutokea kipindi ulichogundulika kuugua ugonjwa wa kisukari. Pia, nitakuuliza kuhusu changamoto unazokumbana nazo na aina ya dawa unazotumia. Taarifa zako zote hizi zitahifadhiwa kwa usiri mkubwa na kutumika tu kwa malengo ya tafiti hii.

Malipo na Faida

Unaweza kuuliza swali lolote lile linalohusu ugonjwa wako wa kisukari na taasisi itakusaidia kulingana na uwezo na kasma ya taasisi. Nitatoa ushauri nasaha kwako kadri ya uwezo wangu kuhusiana na ugonjwa wako.

Maudhi na Madhara

Baadhi ya maswali ya kwenye tafiti yanaweza yakawa ya kuudhi kwako mhusika, hivyo kama utakuwa haujapendezwa nayo unaruhusiwa kukataa kuyajibu. Pia unaweza kusitisha kuhojiwa wakati wowote ule. Uhusika wako katika tafiti utachukua dakika 15 kabla ya kuhudhuria kliniki ya ugonjwa wa kisukari.

Uhakikisho wa Kutunza Siri

Taarifa zote ambazo tutazipata kutoka kwako zitakuwa za siri na majina halisi ya mhusika hayatawekwa wazi wakati wa kuhifadhi kumbukumbu au wakati wa kuchapisha utafiti huu. Kila mhusika atapewa namba maalum badala ya kutumia majina yao halisi.

Kama una swali lolote kuhusu utafiti huu, tafadhali usisite kuwasiliana na wafuatao;

Katibu,

Hospitali ya Taifa ya Kenyatta/Bodi ya Tafiti na Maadili ya Chuo Kikuu cha Nairobi

S.L.P. 2073 00100

Nairobi

Au

Evans Ochoki Ayieng'a

S.L.P 112 00100

Ridhaa

Napenda kuthibitisha ya kwamba nimesoma na kuelewa maelezo ya tafiti hii. Hivyo basi, kwa ridhaa yangu mwenyewe bila kushurutishwa au kurubuniwa na mtu yoyote yule,

nipo tayari kushiriki katika tafiti hii kwani dhumuni na malengo ya tafiti hii yameelezwa vizuri kwangu na nimeyaelewa.

Sahihi/Dole

Gumba.....

Tarehe.....

Tamko la Mtafiti

Napenda kukiri ya kwamba, nimemueleza kwa kina mhusika wa tafiti hii malengo na madhumuni ya tafiti yetu na nimejibu maswali yake yote kwa kadri ya uwezo wangu. Nathibitisha ya kwamba mhusika ametoa ridhaa mwenyewe ya kushiriki katika tafiti hii bila kushurutishwa au kurubuniwa na mtu yoyote yule.

Sahihi ya Mtafiti.....

Evans Ochoki

Tarehe.....

Appendix III: Questionnaire

Factors associated with complications amongst patients visiting Mama Lucy Kibaki hospital

Serial number..... Date.....

Clients Biodata

Client number.....

Date of birth.....

Age.....

Marital Status.....

Occupation.....

Residence.....

Highest level of education.....

Date or age first detected with type 2 diabetes.....

Baseline Parameters

Date of visit	
Height (cm)	
Weight (Kgs)	
Blood sugar level on day of visit (mmol/dl)	
Blood pressure on day of visit (Hgmm)	
BMI on day of visit	
Complain or other disease on day of visit	

Comorbidities

Present? YES..... NO.....

If yes, specify.....

Drug history

Date of first ever use of Antihypoglaecemics.....

Age at the time.....

Drugs used.....start date..... age.....

Stop date/switch..... age.....

Duration of use.....

Reason for switch of drug.....

Adverse effect.....

Other drugs used.....

Reason for use of these drugs.....

Side effects experienced.....

Patient has used insulin injection,
YES.....NO.....

If YES reason.....

Patient has been admitted in hospital,
YES.....NO.....

If YES Reason.....

Socio-demographic characteristics

1. Age:

2. Sex:

male female

3. Marital Status:

4. Highest Education level:

5. Employment status:

6. Number of children:

7. Number of years you have had diabetes.....

8. Comorbidities Yes No

Which ones?

9. Medication history

History of treatment

10. Current drugs in use.....

11. When did you start taking the drugs.....

12. Blood sugar levels after taking these drugs.....

Are the drugs helping you reduce the sugar level?.....

13. How often do you exercise.....

14. Type of diet adopted

vegetarian diet Non vegetarian diet

Specify duration above.....

15. Are you on Insulin therapy? Yes No

Reasons.....

16. Do you smoke Yes No

17. Do you take Alcohol Yes No

18. Do you use khat (Miraa) Yes No

19. Do you use any other hard drugs Yes No

If yes which one

How long have you used it?

20. What is your Understanding about type 2 diabetes mellitus?

18. Do you sometimes use herbal medicine to treat your disease?

Management of blood glucose level

Method	Average blood sugar level	comments
Diet		
Exercise		
Drugs		

Diet and Exercise		
Diet and drugs		
Drugs and exercise		

Presence of comorbidity

Type present	Tick where appropriate
Hypertension	
Eye disease	
Joint and Foot problem	
Kidney damage	
Nerve damage	
Heart problems	
Infections of the skin	

Appendix IV: ORODHA YA MASWALI YA UCHUNGUZI

Maswali kuhusu sababu zinazohusihwa na matatizo kwa wagonjwa wanaohudhuria hospital ya Mama Lucy Kibaki hospitali

Nambari ya simu Tarehe.....

Wateja Biodata

Nambari ya mteja

Tarehe ya kuzaliwa.....

Umri

Hali ya ndoa.....

Kazi

Makazi

Kiwango cha juu cha elimu

Tarehe au umri kwanza wa kugunduliwa na ugonjwa wa kisukari wa aina 2

Tarehe ya ziara	
Urefu (cm)	
Uzito (Kgs)	
Kiwango cha sukari ya damu siku ya ziara (mmol/dl)	
Shinikizo la damu siku ya ziara (Hgmm)	

BMI siku ya ziara	
Kulalamika au ugonjwa mwingine siku ya ziara	

Vidokezo

Sasa? NDIYO HAPANA.....

Ikiwa ndio, taja

Historia ya madawa

Tarehe ya kwanza ya matumizi ya Antihypoglaecemics Umri wakati huo

Madawa amabayo umetumia tarehe ya kuanza umri

Tarehe ya kuacha / kubadili umri Muda wa matumizi

Sababu ya kubadili dawa

Athari mbovu

Dawa nyingine uliotumia

Sababu ya matumizi ya madawa haya

Madhara uliyopata

Mgonjwa ametumia sindano ya insulini,NDIYO LA

Ikiwa ndiyo sababu

Mgonjwa amelazwa hospitalini, NDIYO HAPA

Ikiwa NDIYO Sababu

Tabia za hali ya kijamii

1. Umri

.....

2. Jinsia

Mume kike

3. Hali ya ndoa

.....

4. Kiwango cha juu cha elimu

.....

5. Hali ya ajira

.....

6. Idadi ya watoto

.....

7. Vidokezo Ndiyo Hapana

Zipi?

8. Historia ya dawa zilizotumika

Historia ya matibabu

9. Madawa ya sasa ya matumizi

10. Ulianza lini kutumia madawa ya kulevya

11. Viwango vya sukari ya damu baada ya kuchukua madawa haya

Je! Madawa ya kulevya husaidia kupunguza kiwango cha sukari?

12. Ni mara ngapi unavyofanya

13. Aina ya chakula iliyopitishwa

mlo wa mboga Mlo usio mboga

Taja muda juu

14. Je, wewe ni kwenye tiba ya insulini?

Ndio la

Sababu

15. Je! Mgonjwa huvuta moshi

Ndio Hapana

16. Je, unachukua Pombe

Ndiyo Hapana

17. Uelewaji wako kuhusu aina ya ugonjwa wa kisukari ya aina 2 ni nini?

18. Je! Wakati mwingine hutumia dawa za dawa za kutibu ugonjwa wako?

Usimamizi wa kiwango cha damu ya glucose

Njia	Wastani kiwango cha sukari ya damu	maoni
Mlo		
Zoezi		
Madawa		
Chakula na Zoezi		
Mlo na madawa ya kulevya		
Dawa na zoezi		

Uwepo wa magonjwa mengine

Aina	Weka alama mahali panapofaa
Shinikizo la damu	
Ugonjwa wa jicho	
Tatizo la viungo na Mguu	
Uharibifu wa figo	
Uharibifu wa nerve	
Matatizo ya moyo	
Magonjwa ya ngozi	

Appendix V: Informed Consent Form for Focus Group Discussion

Research Title: Factors associated with complications amongst patients visiting Mama Lucy Kibaki hospital

Institution: Jomo Kenyatta University of Agriculture and Technology/Kenya medical Research Institute department of Public Health

Principal Investigator: Evans Ochoki Ayieng'a

Supervisors:

Dr. Daniel Nyamongo, Jomo Kenyatta University of Agriculture and Technology school of public health, Nairobi.

Dr. Joseph Mutai, Kenya Medical Research Institute, Nairobi

Ethical Approval

Kenyatta National Hospital/University of Nairobi Ethical and Research Committee, P.O BOX 20723-00202, Nairobi.

The information in this part is meant to assist you understand this study with a view to enabling you give voluntary and informed consent to your participation. Kindly read it carefully before signing the consent form.

Purpose of the study

Dear participant

You are invited to participate in a study meant to determine factors associated with complications amongst type two diabetic patients visiting Mama Lucy Kibaki hospital. Please read this sheet carefully before you decide to participate.

Permission is requested from you to enroll in this research study. The following are general principles that apply.

- iv. Your acceptance to participate in this study is voluntary and will get same medical care whether you participate or not.
- v. You may withdraw from the study any time without necessarily giving a reason for your withdrawal without consequences to the services you receive from the clinic.
- vi. After reading the explanation you may ask any questions that will enable you understand clearly the nature of the study.

Procedure to be followed

With your permission, I will ask you about the history of your disease (type 2 diabetes) and the medication you have been using from the first time you were diagnosed with the disease. I will also ask what challenges you are facing and types of medications you are using. All information given will be handled with confidentiality and will only be used for the purpose of this study.

Benefits and rewards

You may ask any questions about the type of issues you have with regards to your disease and maybe helped where the institution is able to. I will offer counsel on best practices to manage your disease. There will be no monetary reward for participating in the study.

Discomfort and risks

The study may have some questions that you may not be comfortable answering. If this happens you may refuse to answer if you so choose. You may also stop the interview any time. Participation may take approximately 15 minutes before you are attended to in the clinic.

Assurance of Confidentiality

All the information that you shall give will be confidential and your name shall not be mentioned during data handling or any publication. Serial numbers will be used instead.

Should you have any questions concerning this study please contact any of the following?

The Secretary

Kenyatta National Hospital/University of Nairobi Ethics Review Committee

P.O Box 20723 00100

Nairobi

Or

Evans Ochoki Ayieng'a

P.O Box 112 00100

Nairobi

Informed consent

I have read the above information and understood. I willingly agree to participate in this study, the nature and purpose of which have been fully explained to me.

Signature/Thumb_____

Date_____

Group interviewed_____

Participant no _____

Investigator Statement

I have explained the research to the participant and answered his/her questions to the best of my ability. I confirm that consent has been given freely

Signature of the Investigator _____ Evans Ochoki

Date _____

Appendix IVI: Tamko La Ridhaa

Tamko la ridhaa kwa mgonjwa wa kisukari anayehudhuria Hospitali ya Mama Lucy Kibaki

Kichwa cha Tafiti: Visababishi vinavyohusishwa na madhara ya ugonjwa wa kisukari kwa wagonjwa wanaohudhuria hospitali ya Mama Lucy Kibaki

Taasisi Zinazohusika: Chuo Kikuu cha Kilimo na Teknolojia cha Jomo Kenyatta pamoja na Taasisi ya tafiti za afya, kitengo cha Afya ya Jamii (Kenya Medical Research Institute department of Public Health)

Mtafiti Mkuu: Evans Ochoki Ayieng'a

Wasimamizi wa Tafiti:

Dr. Daniel Nyamongo, Chuo Kikuu cha Kilimo na Teknolojia cha Jomo Kenyatta

Dr. Joseph Mutai, Taasisi ya tafiti za afya, kitengo cha Afya ya Jamii (Kenya Medical Research Institute department of Public Health)

Ruhusa ya Maadili

Ruhusa ya maadili ya tafiti hii imetolewa na Hospital ya taifa ya Kenyatta, pamoja na bodi ya tafiti na maadili ya Chuo Kikuu cha Nairobi, S.L.P. 20723-00202, Nairobi.

Maelezo yaliyomo ni ya kukusaidia wewe mhusika kuelewa na kutambua dhumuni la tafiti hii ili uweze kushiriki katika utafiti huu kwa ridhaa yako mwenyewe bila kushurutishwa au kurubuniwa na mtu yoyote yule. Tafadhali isome fomulama hii kwa makini sana kabla ya kuweka sahihi yako.

Lengo la Tafiti

Kwako Mhusika,

Unakaribishwa kushiriki katika tafiti hii yenye kutaka kujua visababishi vinavyohusishwa na madhara ya ugonjwa wa kisukari kwa wagonjwa wanaohudhuria hospitali ya Mama Lucy Kibaki. Tafadhali soma kwa makini sana kabla ya kuamua kushiriki katika tafiti hii.

Tunaomba ridhaa yako ya kushiriki katika tafiti hii. Yafuatayo ni maelezo muhimu ya utafiti huu

- IV. Ushiriki wako katika tafiti hii unatokana na ridhaa yako mwenyewe na utapata huduma zilezile za matibabu hata kama umeridhia au hukuridhia kushiriki katika tafiti hii.
- V. Unaweza kujitoa katika tafiti hii wakati wowote ule bila kuhitajika kutoa sababu au maelezo ya kwa nini umesitisha ushiriki wako katika utafiti huu. Kujitoa kwako kutoka katika tafiti hii, hakutaathiri huduma za matibabu ulizokuwa unapata katika kliniki ya wagonjwa wa kisukari.
- VI. Baada ya kusoma maelezo ya tafiti hii, unaruhusiwa kuuliza swali lolote lile iwapo unahitaji kueleweshwa zaidi kuhusu tafiti husika

Kanuni za Kufuatwa

Kwa ridhaa yako, nitakuuliza historia ya ugonjwa wako wa kisukari na dawa ambazo unatumia kutokea kipindi ulichogundulika kuugua ugonjwa wa kisukari. Pia, nitakuuliza kuhusu changamoto unazokumbana nazo na aina ya dawa unazotumia. Taarifa zako zote hizi zitahifadhiwa kwa usiri mkubwa na kutumika tu kwa malengo ya tafiti hii.

Malipo na Faida

Unaweza kuuliza swali lolote lile linalohusu ugonjwa wako wa kisukari na taasisi itakusaidia kulingana na uwezo na kasma ya taasisi. Nitatoa ushauri nasaha kwako kadri ya uwezo wangu kuhusiana na ugonjwa wako.

Maudhi na Madhara

Baadhi ya maswali ya kwenye tafiti yanaweza yakawa ya kuudhi kwako mhusika, hivyo kama utakuwa haujapendezwa nayo unaruhusiwa kukataa kuyajibu. Pia unaweza kusitisha kuhojiwa wakati wowote ule. Uhusika wako katika tafiti utachukua dakika 15 kabla ya kuhudhuria kliniki ya ugonjwa wa kisukari.

Uhakikisho wa Kutunza Siri

Taarifa zote ambazo tutazipata kutoka kwako zitakuwa za siri na majina halisi ya mhusika hayatawekwa wazi wakati wa kuhifadhi kumbukumbu au wakati wa kuchapisha utafiti huu. Kila mhusika atapewa namba maalum badala ya kutumia majina yao halisi.

Kama una swali lolote kuhusu utafiti huu, tafadhali usisite kuwasiliana na wafuatao;

Katibu,

Hospitali ya Taifa ya Kenyatta/Bodi ya Tafiti na Maadili ya Chuo Kikuu cha Nairobi

S.L.P. 2073 00100

Nairobi

Au

Evans Ochoki Ayieng'a

S.L.L.P 112 00100

Ridhaa

Napenda kuthibitisha ya kwamba nimesoma na kuelewa maelezo ya tafiti hii. Hivyo basi, kwa ridhaa yangu mwenyewe bila kushurutishwa au kurubuniwa na mtu yoyote yule,

nipo tayari kushiriki katika tafiti hii kwani dhumuni na malengo ya tafiti hii yameelezwa vizuri kwangu na nimeyaelewa.

Sahihi/Dole

Gumba.....

Tarehe.....

Tamko la Mtafiti

Napenda kukiri ya kwamba, nimemueleza kwa kina mhusika wa tafiti hii malengo na madhumuni ya tafiti yetu na nimejibu maswali yake yote kwa kadri ya uwezo wangu. Nathibitisha ya kwamba mhusika ametoa ridhaa mwenyewe ya kushiriki katika tafiti hii bila kushurutishwa au kurubuniwa na mtu yoyote yule.

Sahihi ya Mtafiti.....

Evans Ochoki

Tarehe.....

Appendix VII: Patient Focus Group Discussion Guide

Date_____

Group interviewed_____

Interview completed by_____

You have been invited to take part in this meeting today so as to share your thoughts, feelings and experiences about diabetes type two and the challenges you generally face in accessing treatment or improving your health. For this discussion you are invited to share as much or as little as you feel comfortable to share. Your insights will help the institution improve their health services and provide you with better health care.

I guarantee you that anything you tell us is confidential. Anything you say will not be personally attributed to you in any reports that result from this focus group. All our reports will be written in a manner that no individual comment can be attributed to a particular participant.

Your participation in this focus group is voluntary. Are you willing to participate in this discussion?

Yes []

No []

If Yes

Date_____

Participant no_____

Signature/thumb_____

Do you have any question before we start?

1. Please introduce yourself and tell us how long you have had diabetes.
2. Please tell us briefly about awareness of the disease?
3. I would like to ask you a question concerning the society, how different have you been treated you because you are diabetic?
4. What challenges do you face while accessing medical care?
5. Looking at a few years back, do you think that medical care has somehow improved?
6. What do you think the government should do to assist in enabling you access treatment more efficiently?
7. What do you like about the services you receive at the hospital facility?
8. What do you think should be done to improve services rendered in the hospital?
9. What is your view on how society generally view those people with the disease?
 - i) Do you get any support from the people around you?
 - ii) Could you mention the people that help you frequently when you need to access medical care?
 - iii) Do you get the necessary support from your colleagues at work or school?
 - iv) Do you easily get permission either at school or at work when you need to attend the health facility?
 - v) Are there any special meals that are prepared either at home, school or work place specifically for you?

10. If you were asked to advise the Country's Health Department on how best they can improve the services they render, what would you suggest?
11. Is there anything else you would like to add?

Thank you so much for your time and willingness to share your experiences with us today. We will include your comments in our data to describe how care patients with diabetes type 2 may be improved by the relevant stake holders and organizations.

Appendix VIII: Informed Consent Form for Key Informants

Research Title: Factors associated with complications amongst patients visiting Mama Lucy Kibaki hospital

Institution: Jomo Kenyatta University of Agriculture and Technology/Kenya medical Research Institute department of Public Health

Principal Investigator: Evans Ochoki Ayieng'a

Supervisors:

Dr. Daniel Nyamongo, Jomo Kenyatta University of Agriculture and Technology school of public health, Nairobi.

Dr. Joseph Mutai, Kenya Medical Research Institute, Nairobi

Ethical Approval

Kenyatta National Hospital/University of Nairobi Ethical and Research Committee, P.O BOX 20723-00202, Nairobi.

The information in this part is meant to assist you understand this study with a view to enabling you give voluntary and informed consent to your participation. Kindly read it carefully before signing the consent form.

I agree to participate in this study, whose conditions are as follows;

- The aim of this study is to identify complications, factors associated with complications and prevalence of complications among patients with type two diabetes.
- Each interview will last at least [] minutes.

- Questions will focus on gaining information about complications encountered in patients with type two diabetes at Mama Lucy Kibaki Hospital.
- The information I give and the information will be used solely for the purposes defined by the project.
- At any point, I can refrain to answer certain questions, discuss certain topics or cease to participate in the interview without prejudice to myself.
- The interview will be recorded to make the interviewer's job easier. However, the recording will be destroyed as soon as it has been transcribed.
- All the interviews will be conducted and handled in a professional way so as to protect the confidentiality of the sources. Each of the participants will be given a unique identifier thus names will not appear in any documentation.
- For security purposes all the data will be kept in a password protected computer and will be destroyed at the end of the project.
- For more information on the study or questions that arise you can contact the following persons: -

The secretary;

Kenyatta National Hospital/University of Nairobi Ethics Review Committee,

P.O Box 20723 00100,

Nairobi.

Or

Evans Ochoki Ayieng'a,

P.O Box 112 00100,

Nairobi.

Informed consent

I have read the above information and understood. I willingly agree to participate in this study, the nature and purpose of which have been fully explained to me.

Respondent's

Signature/Thumb_____

Date_____

Investigator Statement

I have explained the details of the research to the participant and answered his/her questions to the best of my ability. I confirm that consent has been given freely

Signature of the Investigator_____ Evans Ochoki

Date_____

Appendix VIX: Fomu Ya Idhini

Fomu ya idhini ya mtoa taarifa muhimu na muhudumu wa hospitali ya Mama Lucy Kibaki.

Kichwa cha Tafiti: Visababishi vinavyohusishwa na madhara ya ugonjwa wa kisukari aina ya pili kwa wagonjwa wanaohudhuria hospitali ya Mama Lucy Kibaki

Taasisi Zinazohusika: Chuo Kikuu cha Kilimo na Teknolojia cha Jomo Kenyatta pamoja na Taasisi ya tafiti za afya, kitengo cha Afya ya Jamii (Kenya Medical Research Institute department of Public Health)

Mtafiti Mkuu: Dr. Evans Ochoki Ayieng'a

Wasimamizi wa Tafiti:

Dr. Daniel Nyamongo, Chuo Kikuu cha Kilimo na Teknolojia cha Jomo Kenyatta

Dr. Joseph Mutai, Taasisi ya tafiti za afya, kitengo cha Afya ya Jamii (Kenya Medical Research Institute department of Public Health)

Ruhusa ya Maadili

Ruhusa ya maadili ya utafiti huu imetolewa na Hospital ya taifa ya Kenyatta, pamoja na bodi ya tafiti na maadili ya Chuo Kikuu cha Nairobi, S.L.P. 20723-00202, Nairobi.

Maelezo katika sehemu hii ni ya kukusaidia kuelewa utafiti huu kwa lengo la kukuwezesha kutoa idhini ya hiari na taarifa kwa ushiriki wako. Tafadhali soma kwa makini kabla ya kuweka sahihi kwenye fomu ya kibali.

Nakubali kuhusika katika utafiti huu, kwa masharti yafuatayo;

- Lengo la utafiti huu ni kutambua matatizo, mambo yanayo changia matatizo na kiwangocha matatizo yanayo sababishwa na ugonjwa wa kisukari.

- Kila mahojiana yatakuwa kwa muuda wa dakika []
- Maswali yatahusiana na matatizo yanayo sababishwa na ugonjwa wa kisukari kwa wgomjwa wanaohudhuria hospitali ya Mama Lucy Kibaki.
- Mahojiano ninayotoa na habari zozote zitakazo tokana na mahojiano haya zitatumika kwa utafiti huu pekee yake.
- Wakati wowote ninaakubalika kukatiza mahojiana kukosa kujibu maswali ninayoulizwa ama hoja tunazozungumzia. Jambo hili halitaniletea shida yoyote.
- Mahojiana haya yatarekodiwa ili kurahisisha kazi ya mtafiti.
- Ili kuhakikisha usiri, ujumbe huu utawekwa kwenye tarakilish yenye nambari ya nenusiri. Kila mshiriki atapewa nambari ya utafiti na majina hayatatumika kwa utafiti huu.
- Ujumbe kutokana na utafiti huu utaharibwa badaa ya utafiti kukamilika.
- Kwa habari yoyote au maswali kuhusiana na utafiti huu, unaweza kuwasiliana nasi kupitia;

Katibu,

Kenyatta National Hospital/University of Nairobi Ethics Review Committee

P.O Box 20723 00100

Nairobi

AU

Evans Ochoki Ayieng'a

P.O Box 112 00100

Nairobi

Ridhaa

Napenda kuthibitisha ya kwamba nimesoma na kuelewa maelezo ya tafiti hii.Hivyo basi, kwa hiari yangu mwenyewe bila kushurutishwa au kurubuniwa na mtu yoyote yule, nipo tayari kushiriki katika tafiti hii kwani dhumuni na malengo ya tafiti hii yameelezwa vizuri kwangu na nimeyaelewa.

Sahihi/Dole Gumba ya mhojiwa

Tarehe.....

Tamko la Mtafiti

Napenda kukiri ya kwamba, nimemueleza kwa kina mshiriki wa utafiti huu malengo na madhumuni ya tafiti yetu na nimejibu maswali yake yote kwa kadri ya uwezo wangu.Nathibitisha ya kwamba mhusika ametoa ridhaa mwenyewe ya kushiriki katika utafiti huu bila kushurutishwa au kurubuniwa na mtu yoyote yule.

Sahihi ya Mtafiti.....

Evans Ochoki

Tarehe.....

Appendix X: Key Informant Interview Guide

Clinical evaluation on type 2 diabetes mellitus

Caregiver Interview

Date _____ Facility _____

Time _____

Designation _____

The focus of this evaluation is to be in a better understanding on the challenges patients face in your facility and the challenges you as a care provider face while offering services to the same patients.

The purpose of this is to make understand your thoughts, feeling on what might be a cause of increasing morbidity and mortality amongst patients who attend the diabetic clinic in your facility.

Anything you tell me will not be personally attributed to you in any reports that results from evaluation. All reports will be written in a manner that no individual comment can be attributed to a particular person.

Your participation in this interview is completely voluntary. Are you willing to participate?

Do you have any questions before we begin?

1. How many new patients are diagnosed with diabetes mellitus every month?
2. What challenges do you face when executing your duties to patients?
3. Do you feel that patients adhere to treatment given?

4. Have patients reported with any side effects from drugs given?
5. How many patients roughly require to access a waiver or exemption system in your facility?
6. What is the major cause of mortality and morbidity among patients suffering from type two diabetes?
7. What is the average age of patients affected most by morbidity amongst diabetes type 2 patients?
8. What is your opinion on ways to improve services offered to patients in your facility?
9. Do patients adhere to lifestyle changes education given to them?
10. Do you have a nutrition support program in your facility?
11. Do patients miss their appointment for clinical review and what reason do they give on their subsequent appointment?

Appendix XI: Research Publication

The findings of this research were published in the Pharmaceutical Journal of Kenya, Vol. 24, No 3/2020. pjk@psk.or.ke, www.psk.or.ke. Hurlingham, Jabavu Road PCEA Foundation, Block C Rm. 22 P.O. Box 44290-00100 GPO Nairobi, Kenya, +254202738364/18, +254722817264/723310942.

ORIGINAL RESEARCH

Factors associated with complications among type 2 diabetes patients visiting a regional referral hospital in Nairobi, Kenya

Ochoki Evans^{1*}, Mutai Joseph², Nyamongo Daniel³

¹Institute of Tropical Medicine and Infectious Diseases, College of Health Science, Jomo Kenyatta University of Agriculture and Technology, P.O Box 112 00100 Nairobi, Kenya.

²Kenya Medical Research Institute, Email: joemutai@yahoo.com.

³College of Health Sciences, Jomo Kenyatta University of Agriculture and Technology Email: dnyamongo@jkuat.ac.ke.

*Corresponding Author. Email: ochokie@gmail.com

Abstract

Background: Diabetes mellitus is a major public health concern globally. In Kenya, 2019 estimates by the World Health Organization indicated a prevalence of 3.3%, equivalent to 1.5 million people. The prevalence is expected to increase by 4.5% by the year 2030 in the absence of effective preventive measures.

Objective: This study sought to investigate the risks involved in the development of chronic complications of type 2 diabetes mellitus amongst patients visiting a regional referral hospital in Nairobi, Kenya.

Methods: A cross-sectional approach was used. The target population was diabetes patients aged 18 years and over at Mama Lucy Kibaki Referral Hospital in Nairobi, Kenya. Consecutive sampling technique was used to select patients. Primary data was collected by the use of semi-structured questionnaires and an interview guide. Three focus group discussions were conducted and key informant interviews done with doctors, nurses and the medical superintendent of the hospital. Chi-square test was used to explore associations between various variables.

Results: The prevalence of type 2 diabetes mellitus complications among patients attending the hospital was estimated at 58.3 % (95% confidence interval, C.I, 52.3% - 64.2%). In bivariate analysis, three factors were significantly associated with complication status at 5% level of significance: age-group ($P < 0.001$), occupation ($P < 0.001$) and herbal medicine use ($P < 0.001$). In multivariate analysis, age above 70 years vs 18-35 years (prevalence ratio, PR, 1.72, CI 1.15-2.58), age 56-70 years vs 18-35 years (PR 1.59, CI 1.14-2.23), and herbal medicine use (PR 1.62, CI 1.36-1.94) were significantly associated with complication status.

Conclusion: We found that older persons, obese persons and persons using herbal medicines were more likely to have complications of type 2 diabetes mellitus. Health providers and care givers should be supported to provide health promotion and nutrition programs to their diabetes patients. Attempts should be made to include herbal medicine practitioners in patient management programs to

ensure their practices support rather than interfere with treatment.

Introduction

Diabetes mellitus is a major public health concern globally. It is estimated that the condition affects at least 9% of adults in the world who are 18 years and older [1]. Additionally, at least 4.6 million deaths in the world are attributed to type 2 diabetes and at least 80% of these cases occur in low and middle income countries [2]. The World Health Organization also estimates that at least 439 million individuals will be affected by type 2 diabetes by the year 2030 [3].

In Kenya, the prevalence of diabetes is steadily increasing. In 2019, the World Health Organization estimated a prevalence of 3.3%, equivalent to 1.5 million people. The prevalence is expected to increase by 4.5% by the year 2030 in the absence of effective preventive measures. This prevalence may be attributed to the fact that only approximately 15% of the population has been diagnosed and documented. Prevalence is higher in urban areas (10.7%) compared to rural areas (2.7%) [4]. The rapid increase in prevalence is associated with the availability of cheap high-fat and high-energy foods which in combination increases the cases of diabetes. Obesity has been associated with glucose tolerance which results in an increased susceptibility to diabetes [5].

Type 2 diabetes is associated with an increased morbidity and mortality around the world [6]. A study conducted in Ethiopia estimated the prevalence of chronic complications associated with type 2 diabetes to be between 52-74.2% [7], while another study conducted in Tanzania revealed the prevalence of diabetic complications to be 31% [8]. In Kenya, the most prevalent comorbid condition is hypertension [9]. Other studies have linked diabetes type 2 to impotence, neuropathy, psychological problems and vascular insufficiency [10].

Methodology

A cross-sectional survey was conducted in May to October 2018. The study received ethical approval from the Kenyatta