CLINICAL INERTIA TO INITIATION OF INSULIN THERAPY AMONG PATIENTS WITH TYPE TWO DIABETES IN MOI TEACHING AND REFERRAL HOSPITAL, ELDORET KENYA

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DECLARATION

Declaration by Candidate

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DISCLOSURE

No benefits in any form were received by the researcher from a commercial party related directly or indirectly to the subject of this dissertation. Neither has a member of the researcher's immediate family received payments or other benefits or commitment or any agreement to provide such benefits from a commercial company.

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DEDICATION

I dedicate this dissertation to my parents Charles and Purity Mwaniki and to my late brother

Stephen Ndegwa Mwaniki.

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LIST OF ABBREVIATIONS

ADA   American Diabetes Association

DAWN study   Diabetes Attitudes, Wishes, and Needs study

DOPC   Diabetes Outpatient Clinic

GDM   Gestational Diabetes Mellitus

GUIDANCE   Guideline Adherence to Enhance Care

HbA1C   Glycosylated Hemoglobin A1c

IDF   International Diabetes Federation

IFG   Impaired Fasting Glucose

IGT   Impaired Glucose Tolerance

ITAS questionnaire   The Insulin Treatment Appraisal Scale questionnaire

KNH   Kenyatta National Hospital

MODY   Mature Onset Diabetes of the Young

MTRH   Moi Teaching and Referral Hospital

NGSP   National Glycohemoglobin Standardization Program

NIDDM   Non-insulin-dependent diabetes mellitus

OGTT   Oral Glucose Tolerance Test

OHAs   Oral Hypoglycemic Agents

PHQ-9   Patients Health Questionnaire-9

PIR   Psychological Insulin Resistance

SKILLD questionnaire The Spoken Knowledge in Low Literacy in Diabetes Scale

questionnaire

SOLVE™   Study of Once Daily Levemir

T2DM   Type 2 Diabetes Mellitus

OPERATIONAL DEFINITIONS

➢ T2DM patients: patients with age at diabetes diagnosis ≥ 25 years and on OHAs without routine insulin therapy

➢ Clinical inertia: lack of intensification of antidiabetic treatment with exogenous insulin in T2DM patients with HbA1c ≥ 9% despite being on regular clinic follow-up for at least 3 months

➢ Regular clinic follow-up: no missed clinic days

➢ Clinicians: qualified healthcare workers in direct contact with patients at the DOPC who diagnose, treat or otherwise offer patient care

➢ Clinical depression: PHQ-9 score of ≥ 10

➢ Adequate patient DM self-care knowledge: SKILLD score ≥ 50%

ABSTRACT

Background: The prevalence of diabetes among the Kenyan adult population is 3%, with Type 2 Diabetes (T2DM) contributing to over 90% of all cases. Despite insulin being a major component in T2DM management, it is not used enough partly due to a phenomenon known as clinical inertia (CI). In diabetology, CI is defined as failure to escalate antidiabetic treatment despite failing to achieve glycemic targets. It has been shown to be a significant contributor to poor glycemic control but has yet to be explored in Kenya. This study defined CI as failure to use exogenous insulin as part of antidiabetic management for patients with T2DM and glycated hemoglobin (HbA1c) levels of 9% or more despite being on oral hypoglycemic agents (OHAs) and regular clinic follow-up for at least 3 months.

Objectives: The broad objective was to determine the prevalence of CI among patients with T2DM at Moi Teaching and Referral Hospital (MTRH) Diabetes out Patient Clinic (DOPC). Specific objectives were to: identify associations between CI and patient factors (demographic and clinical characteristics, clinical depression, attitudes towards insulin therapy, level of DM self-care literacy) and to explore factors contributing to CI as considered by clinicians working at DOPC.

Methods: This was a mixed methods study. Quantitative study: a total of 480 patients were recruited into the study. Interviewer administered patient questionnaires were used to record patients biodata, HbA1c levels, attitudes towards insulin as assessed by the Insulin Treatment Appraisal Scale (ITAS), presence of clinical depression indicated by PHQ-9 scores, and levels of diabetes self-care knowledge indicated by Spoken Knowledge in Low Literacy in Diabetes (SKILLD) scores. Statistical analysis was done using R software at 95% confidence and p value 0.05. Chi squares were used to determine significance of associations while Odds Ratios (ORs) and multiple linear regression were used to interconnect dependent and independent variables. Qualitative study: 15 clinicians were recruited using purposive sampling. Phenomenology was employed with key informant interviews used to collect data. Data were analyzed by thematic content using Nvivo version 12.

Results: Out of 480 patients, 259 had HbA1C levels of 9% or more and the prevalence of CI was 54%. Majority of the patients were female (61%) and were married (71%) Single marital status seemed to increase risk of CI (OR 2.1; p value 0.047) while male gender seemed to be protective (OR 0.65; p value 0.041). No associations were found between CI and clinical depression, patients' attitudes towards insulin therapy or level of DM self-care literacy. Clinicians believed insulin was important in T2DM management but withheld prescribing it due to their knowledge gaps on insulin prescription, workplace resource constraints, perceived patient resistance to insulin therapy and perceived negative impact of insulin on patient quality of life.

Conclusion: The prevalence of CI was high in MTRH. Single marital status increased the risk of CI while male gender was protective. Clinician factors were found to be the key drivers of CI.

Recommendation:

There is need to address the negative attitudes towards insulin therapy among clinicians at the DOPC with an aim of reducing CI. Prospective implementation research as a follow-up to this study will assess the effectiveness of various existing strategies targeted to reduce CI.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Diabetes Mellitus has been defined in literature as "a metabolic disorder caused by different factors characterized by a chronic hyperglycemia with disturbances to carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both" (Azevedo & Alla, 2008).

According to the ADA, the following general categories can be used to classify diabetes (2020):

- Type 1 diabetes which results from an autoimmune response leading to pancreatic beta-cell destruction. This eventually leads to an absolute deficiency of insulin when more than 80% of the pancreatic beta cells have been destroyed. It has a weak genetic link and HLA predisposition, and its typical onset is during childhood (before the age of 19 years).

- Type 2 diabetes (T2DM) which results from progressive insulin resistance with an accompanying deficiency in insulin secretion by pancreatic beta cells. The insulin deficiency develops in the setting of decreased insulin sensitivity at receptor sites with resultant hyperglycemia. Its etiopathogenesis is diverse with no known single cause. It possesses a strong genetic concordance and is typically associated with obesity.

- Gestational diabetes mellitus (GDM) is a condition that develops during pregnancy and resolves with childbirth. It is commonly diagnosed in the second and third trimesters and has the potential to transform into T2DM.

- Diabetes due to other specific causes, i.e., chemical- or drug-induced diabetes (such as after organ transplantation, in the HIV/AIDS treatment, or with use of glucocorticoids, diseases of the exocrine pancreas (including pancreatitis and cystic fibrosis), and monogenic diabetes syndromes (e.g., Maturity Onset Diabetes of the Young (MODY) and neonatal diabetes).
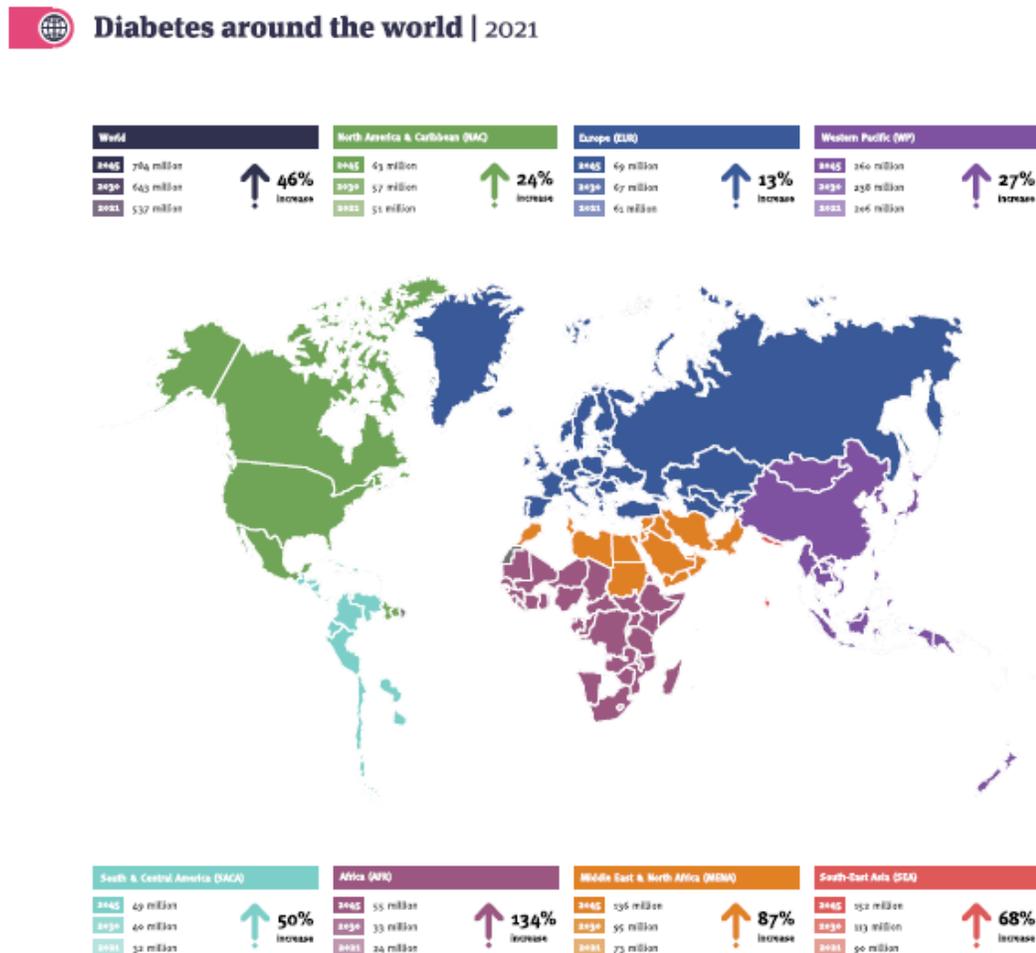
Figure 1: Global projections for the diabetes epidemic 2021
Diabetes is currently the most common metabolic disorder worldwide, with 476 million people living with the disease globally. The International Diabetes Federation (IDF)

regards diabetes as among the largest global health emergencies in the twenty-first century. The global prevalence of diabetes is one in eleven adults, while the prevalence of glucose intolerance stands at one in fifteen adults. Research has shown that the global health expenditure on diabetes is approximately 12% per annum (Azevedo & Alla, 2008). T2DM currently accounts for approximately 90-95% of all cases of diabetes (Hameed et al., 2015). The disease is now a serious and common global health emergency and has evolved, in most counties, in association with rapid social and cultural changes, dietary alterations, aging populations, reduction in physical activity, urbanization increase and other unhealthy behavioral and lifestyle patterns that have contributed to the global obesity epidemic.

Diabetes is among the top ten causes of mortality worldwide and accounts for over eighty percent of all premature deaths due to non-communicable diseases alongside cancer, cardiovascular disease, and respiratory disease. The presence of diabetes accounts for increased mortality from stroke, chronic liver disease, infections, chronic kidney disease, and cancer (Glovaci et al., 2019). The disease remains as the second biggest negative total effect on the reduction of global health adjusted life expectancy, despite the current progress made in the extension of life expectancy and promotion of population health (Bhupathiraju & Hu, 2016). In Kenya, diabetes contributes to the overall national disease burden and consequent reduction in life expectancy to the current average of 56 years. This has in turn contributed to the country's slow progress towards achieving the Millennium Development Goals (Aya et al., 2013).

According to the IDF 2021 atlas, the prevalence of diabetes among the adult population in Kenya was estimated at 3% (821, 500 individuals), and deaths attributable to diabetes

among the adult Kenyan population aged 20 to 79 years stood at about 8000 (IDF). However, these projections were likely underestimated because most people diagnosed with diabetes in Kenya usually present to health facilities with what seem to be unrelated medical complaints (K & Summary). The population that is mostly affected by diabetes is mainly between forty to fifty-nine years, with the peak being in the productive age range. In more recent years, T2DM has been shown to be on the rise among the under-30 age set. In the US, 5.7 percent of all new cases of T2DM occur in people between 18 and 29 years (Centers for Disease Control and Prevention. National Center for Health Statistics. Underlying Cause of Death 1999–2017 on CDC WONDER Online Database, 2018. Accessed at http://wonder.cdc.gov/ucd-icd10.html on Oct 10, 2019).

The development of complications among these individuals have been noted to set in as early as two years into their diagnosis, with the cardiovascular disease risk burden being the highest in this population.

Generally, diabetes complications are divided into acute and chronic complications. Acute complications may include diabetic ketoacidosis, hyperosmolar hyperglycemic state, and hypoglycemia (Blair, 2016). Among the chronic complications are macrovascular and microvascular complications, which have similar etiologic characteristics. The initiation of these vascular complications results from chronic hyperglycemia, which causes several structural and metabolic derangements, including abnormal signaling cascade activation (such as protein kinase C), advanced glycation end product (AGE) production, abnormal stimulation of hemodynamic regulating systems (including the renin-angiotensin-aldosterone system) and increased reactive oxygen species production.

Macrovascular complications include cardiomyopathies, coronary heart disease, cerebrovascular disease or transient ischemic attacks, arrhythmias and peripheral arterial disease (Kharroubi & Darwish, 2015). Diabetic patients possess a four-fold higher risk of developing cardiovascular disease than the general population, and research also depicts diabetes as an independent risk factor for cardiovascular disease. Besides, diabetes confers a two-fold increased risk for a recurrent myocardial infarction and a five-fold increased risk for a first acute myocardial infarction, compared to individuals without diabetes and with a previous history of myocardial infarction (Bin Rasheed & Chenoweth, 2017). The central pathogenic mechanism under these complications is fat deposition along blood vessels, resulting in atherosclerosis and progressive narrowing of arterial walls. Atherosclerosis is proposed to result from injury and chronic inflammation of arterial walls in the coronary or peripheral vascular systems, with the subsequent oxidation of lipids and their accumulation in the endothelial walls (Kharroubi & Darwish, 2015). Angiotensin II may be a promoting factor to the oxidation, and there is a characteristic monocyte infiltration and differentiation into macrophages, which then take up the oxidized lipids to form foam cells. These cells result in the downstream T-cell chemotaxis, smooth muscle stimulation, collagen synthesis, and atheroma formation (Goyal & Jialal, 2018).

Studies depict coronary heart disease, one of the macrovascular complications, as the major complication under this class (Deshmukh & Jain, 2015). Further studies elucidate that the risk of a first acute myocardial infarction in people with T2DM is equivalent to nondiabetics harboring a previous history of myocardial infarction. Diabetes is also depicted as a strong independent predictor of cerebrovascular disease and stroke risk with

T2DM patients being at a much higher risk of stroke than type one diabetic patients (increased risk of 150% to 400%) (DeFronzo et al., 2015).

Microvascular complications are observed to pose a much more significant threat in the clinical setting and are much more commonly responsible for diabetes-related mortality. There are three major microvascular complications, including diabetic nephropathy, neuropathy, and retinopathy (Asmat et al., 2016). Diabetic retinopathy is proposed to be the most common of the three and is responsible for a significant incidence rate of blindness among people with diabetes as it is the leading cause of blindness among individuals with diabetes. It can affect the macula, peripheral retina, or both. The severity and duration of hyperglycemia is the one important factor that determines the risk of developing retinopathy and other microvascular complications (DeFronzo et al., 2015). Retinopathy may develop as early as seven years prior to the clinical diagnosis of diabetes, especially in those with T2DM. Its severity ranges from pre-proliferative and non-proliferative to more severely proliferative diabetic retinopathy characterized by an abnormal growth of new blood vessels (Saleem, Masood, & Khan, 2016). The prevalence of retinopathy increases with the prolonged diabetes duration, and its occurrence has associations with other factors, including the presence of hypertension, younger age of diabetes onset, abnormal blood lipid levels, renal disease, high-fat diet, insulin treatment, tobacco use, and elevated homocysteine levels (Home et al., 2011).

On the other hand, diabetic nephropathy is regarded as the leading cause of kidney failure and is defined by proteinuria of above 500mg per day in the setting of diabetes, with preceding microalbuminuria (albumin excretion of between 30mg to 300mg over 24 hours)

(Cole & Florez, 2020). This is seen in both type 1 and 2 diabetes. The pathological changes in nephropathy include microaneurysm formation, an increase in the thickness of the glomerular basement membrane, and Kimmelstiel-Wilson bodies (mesangial nodule formation), among other changes (DeFronzo et al., 2015). About a quarter of type 2 diabetic patients have either microalbuminuria or a more advanced diabetic nephropathy stage, with a worsening rate of two to three percent per year. The risk factors for diabetic nephropathy development are similar to those of diabetic retinopathy and include the age of diabetic onset, dyslipidemia, obesity, duration of diabetes, hyperglycemia, and hypertension.

The risk of developing diabetic neuropathy is also mainly determined by glycemic control besides genetic factors that may come into play. Other risk factors may include diabetes duration, dyslipidemia, age, hypertension, increased height, severe ketoacidosis, presence of cardiovascular disease, and microalbuminuria. It is recognized as the presence of signs and symptoms of peripheral nerve dysfunction in diabetic patients, with other possible causes excluded (Cole & Florez, 2020). The precise nature of peripheral nerve injury from hyperglycemia is not well elucidated, but likely mechanisms are described, including oxidative stress, injury from AGEs, and polyol accumulation. The injury could result in autonomic, sensory, focal or multifocal neuropathies. The most commonly seen result of neuropathies is foot ulceration or injury, which is responsible for over 80% of amputations among diabetic patients (Tilg et al., 2017). One frequently under-diagnosed complication of diabetic neuropathy is diabetes-related cardiac autonomic neuropathy, which can result in resting heart rate variability, resting tachycardia, orthostasis, slow heart rate recovery post-exertion, exercise intolerance, and silent myocardial infarction. Its prevalence ranges

from one percent to ninety percent depending on the outcome variable, though the definite prevalence is still unclear (Mbanya et al., 2010).

One significant adverse effect not directly linked to the disease that may occur among diabetic patients is depression. This is mostly experienced due to the chronicity of the disease and the lifetime dependence on medication. Studies show that people with diabetes mellitus have two to three times increased risk of developing depression, and the majority of the cases of depression among such patients remain under-diagnosed (Darwish et al., 2018). Depression is regarded as a very serious and common medical condition with a lifetime prevalence of about 15% in high-income countries and about eleven percent in low-income countries. The lifetime risk of developing a mental health problem is approximated at about fifty percent, with a resultant drop in productivity, employment, and wages (Ali et al., 2006). The American Psychiatric Association (APA) Diagnostic and Statistical Manual of Mental Disorders (DSM-5) defines depression as a mood disorder reuniting several symptoms with the ability to alter an individual's functionality (Sartorius, 2018). Depression disturbs cognition, emotions, and behaviors and could be mild, moderate, or severe, without or with psychotic features. Studies have indicated that undiagnosed diabetic patients and pre-diabetic patients have a moderately increased depression prevalence, while those previously diagnosed with diabetes have a marked increase in prevalence compared to individuals with normal glucose metabolism. The prevalence rates of depression could be twice higher in type 2 diabetes and three times higher in type 1 diabetes than in the general population (Mendes, Martins, & Fernandes, 2019).

The presence of anxiety and depression in a diabetic patient is associated with worsened prognosis, decreased quality of life, increased medical therapy non-adherence, and increased mortality. Generally, there is bidirectional diabetes and depression association, and depression has the potential to increase the risk of type 2 diabetes by sixty percent (Yakaryılmaz & Öztürk, 2017). Epigenetic factors may activate common pathways for depression and type 2 diabetes. These may include low socioeconomic status, lack of physical exercise, poor sleep, and diet, and may do so through disturbance and activation of the stress system. Stress (through the chronic activation of the sympathetic nervous system and hypothalamus-pituitary-adrenal axis) and inflammation promote T2DM and depression, forming the common pathway (Mendes, Martins, & Fernandes, 2019).

Furthermore, depression increases the risk of the development of both macrovascular and microvascular complications of diabetes, hyperglycemia, and the resultant greater mortality. One important macrovascular complication with a bidirectional association with depression and an especially poor prognosis in elderly patients is coronary heart disease (Kim et al., 2019). Patients with coronary heart disease may be diagnosed with depression or may report symptoms suggestive of depression (Kim et al., 2019). Therefore, early recognition and treatment of depression in diabetes could significantly decrease the emergence of diabetic complications such as coronary heart disease.

The current management guidelines for diabetes recommend a structured approach to diabetes treatment, beginning with dietary and lifestyle modifications, followed by metformin monotherapy, and eventual combination therapies, including insulin therapy and other oral hypoglycemic agents. Patients who do not have adequate glycemic control have a significantly increased risk for developing long-term macrovascular and

microvascular complications (Ishizawa et al., 2016). The progressive nature of T2DM may necessitate regimen intensification and these transition points in management are characterized by the need for sufficient patient understanding of the treatment goals and adequate physician-to-patient communication to foster adherence to therapy (Chen et al., 2019). In this regard, there is a dire need for holistic collaboration for efficient, standardized management of type 2 diabetic patients to prevent the occurrence of diabetic complications and downstream mortality.

Type 2 diabetes mellitus is a growing pandemic and a leading cause of morbidity and mortality. After the DCCT (Diabetes Control and Complications Trial) found that tight glycemic control–a glycohemoglobin A1c (HbA1c) <7% (53 mmol/mol)–could prevent or slow the progression of nephropathy, retinopathy, and neuropathy in patients with type 1 diabetes mellitus, a consensus, extended to patients with type 1 and type 2 diabetes mellitus, emerged: normalizing glycemia prevents diabetes mellitus complications. Guidelines, quality improvement interventions, quality-of-care measures, and patient-directed marketing have since focused on achieving tight glycemic control. Experts labeled clinicians' failure to intensify therapy to achieve this target as clinical inertia and a quality gap. (Rodríguez-Gutiérrez & Montori, 2016)

Clinical inertia can lead to poor glycemic control among type 2 diabetes patients. However, there is paucity of information on clinical inertia in low- and middle-income countries including Kenya.

1.2 Problem Statement

Despite current management guidelines stipulating tight glycemic control for patients with T2DM, a significant proportion of patients fail to reach their glycemic targets due to delayed treatment intensification, also known as clinical inertia.

Clinical inertia has led to patients living with persistent hyperglycemia thus increasing their risk of T2DM associated morbidity and mortality. The increasing number of patients presenting with poorly controlled T2DM and its complications has also led to increased healthcare related burdens on both patients and health care systems.

1.3 Study Justification

Insulin is a major component in current treatment guidelines for the management of T2DM. It is readily available, relatively cheap, and easy to titrate. Studies have shown that's timely initiation and up-titration of insulin therapy results in better patient outcomes with reduced morbidity and mortality related to T2DM. In our setup, studies have shown evidence of suboptimal glycemic control among patients with T2DM. However, clinical inertia to insulin as a possible contributor is yet to be explored. Understanding the predictors of clinical inertia in our population will help bridge gaps currently hindering timely insulin initiation among patients. Exploring clinical inertia and explicating its associated factors will inform future research on the subject. Moreover, investigating the contribution of clinicians to clinical inertia will be a step in providing new knowledge on clinicians attitudes towards insulin, will guide provider training, and inform management guidelines on routine use of insulin therapy among patients living with T2DM.

1.4 Research Question

What is the prevalence of clinical inertia to insulin initiation among patients with T2DM and what are its associated factors?

1.5 Objectives

1.5.1 Broad Objective

To establish the prevalence of clinical inertia to insulin initiation among patients with T2DM at MTRH DOPC and to determine its associated factors.

1.5.2 Specific Objectives

- To determine the prevalence of clinical inertia among patients with T2DM attending DOPC in MTRH.
- To determine possible associations between prevalence of clinical inertia and: patient demographic and clinical characteristics, clinical depression, patient attitudes towards insulin therapy and level of patient DM self-care literacy.
- To explore factors that contribute to clinical inertia among clinicians.

<center>**CHAPTER TWO**</center>

2.0 LITERATURE REVIEW

2.1 Natural history and pathogenesis of Type 2 Diabetes

T2DM is a chronic and progressive illness characterized by chronic hyperglycemia, beta cell dysfunction and insulin resistance that may take years to manifest, and as a result, it is often underdiagnosed. People who suffer from T2DM may have a genetic predisposition to the illness and may only present with the condition once lifestyle factors are conducive for disease progression. T2DM is diagnosed more frequently in ethnic minority groups such as American Indians, Hispanics, Pacific Islanders, and African Americans (Ramlo-Halsted & Edelman, 1999), with multigenetic defects postulated to be the most likely cause of this pattern. Other factors including advanced age, high BMI, sedentary lifestyle, and high sugar diets have also been shown to have a positive association with increased incidence of T2DM. Chronic glucotoxicity and high free fatty acid levels associated with the above risk factors eventually cause defects in insulin secretion (Lorenzo et al., 2010). When combined with lifestyle modification, optimal treatment regimens have been found to control symptoms, slow down disease progression, and reduce the number of complications linked with T2DM (Association, 2009).
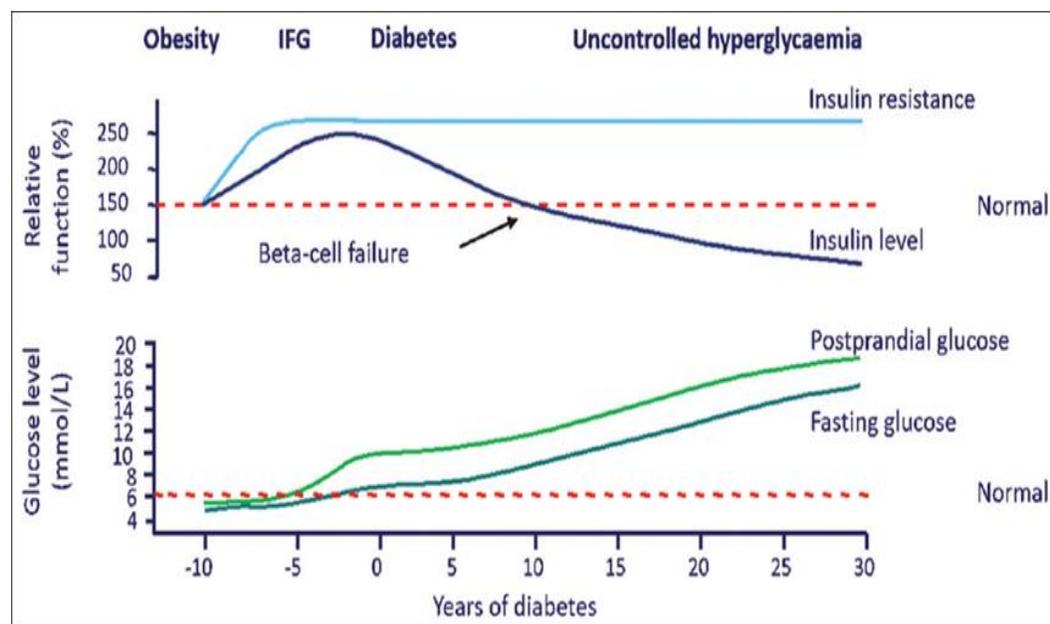
Figure 2: Natural History of Type 2 Diabetes

2.2 Insulin Resistance

The pathogenesis of T2DM generally takes years to occur, with pre-diabetes occurring first in the background of insulin resistance. Pre diabetes encompasses impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) (DeFronzo et al., 1992). IFG has been defined by the American Diabetes Association (ADA) as a fasting blood sugar level from 5.6 to 7.0 mmol/L (Association 2011). IGT is defined as fasting blood glucose levels below 7 mmol/l and plasma glucose of more than 7.8mmol/l but less than 11mmol/l 2 hours after a 75-g oral glucose tolerance test (Barbara et al., 2016). The stage of IGT is regarded as an essential marker in determining at-risk patients of developing overt T2DM. The progression of insulin resistance combined with the defective secretion of insulin by pancreatic beta cells leads to an upsurge of hepatic gluconeogenesis. Because of this, there is a rise in fasting blood glucose. Lifestyle factors and genetic factors combined with the presence of pre-diabetes often progress into overt T2DM over time. Initially, pancreatic

beta cells compensate for insulin resistance by producing more insulin, leading to hyperinsulinemia. This initially keeps glucose levels within normal, but IGT eventually develops and at first manifests as mild postprandial hyperglycemia (Nathan et al., 2009).

Patients with type 2 diabetes mellitus have varying degrees of the condition, with varying amounts of insulin resistance and beta-cell abnormalities. Insulin resistance, increased hepatic gluconeogenesis, and impaired insulin production (non-immune mediated) are common symptoms of type 2 diabetes mellitus (Weir & Bonner-Weir 2020). Because the cause of the metabolic dysfunction is still unknown, the exact cause of type 2 diabetes mellitus is not clearly defined. Nevertheless, the disease is linked to a vital genetic component. There is a link between genetic and environmental factors such as age, sedentary lifestyle, and obesity in the pathogenesis of diabetes mellitus. While insulin sensitivity progressively decreases with age, obesity and a sedentary lifestyle contribute to insulin resistance. However, no specific genes have been identified so far; thus, the pathogenesis of diabetes mellitus is currently considered to be due to multi genetic dysfunction (Weir & Bonner-Weir 2020).

Although more common among the obese population, non-obese people who have more adipose tissue concentrated in the trunk are at a higher risk of diabetes mellitus. Increased central adiposity and reduced level of activity attributed to aging are predominant risk factors for diabetes mellitus. However, with the adoption of a more sedentary lifestyle, there is an emergence of the disease among the younger population, including those in their 20s (Weir & Bonner-Weir 2020).

As occurs in diabetes mellitus, hyperglycemia worsens ß-cell dysfunction and insulin resistance. The result is a vicious cycle that leads to hyperglycemia aggravation, a phenomenon called glucose toxicity. This effect explains why initial glycemic control is usually difficult compared to subsequent maintenance of such control. Hyperglycemia develops slowly and initially; the classic symptoms of diabetes mellitus are generally not present because the hyperglycemia is mild. In addition, before developing overt diabetes, there is normally a long incubation period referred to as the pre-diabetic state characterized only by mild abnormalities in plasma glucose levels that manifest as impaired glucose tolerance as defined by the criteria mentioned above (Weir & Bonner-Weir 2020).

There is adequate insulin secretion in the initial stages of disease progression and thus no need for insulin therapy in the initial management plan. This is the non-insulin-dependent phase. However, as the disease progresses, there is a need for exogenous insulin for sufficient glycemic control.

As aforementioned, the triad of metabolic disorders in diabetes mellitus includes beta-cell dysfunction, insulin resistance, and decreased hepatic gluconeogenesis. The consensus is that the critical defect in type 2 diabetes mellitus is insulin resistance. However, whether insulin resistance or reduced insulin secretion occurs first remains a matter of debate (Weir & Bonner-Weir 2020).

Insulin resistance has been defined as the hindrance of insulin action in promoting the uptake of glucose by skeletal muscles and fat cells (Harris et al., 1987). Insulin resistance also refers to reduced sensitivity to specific insulin concentration, assessed indirectly using fasting insulin levels. Hence, the greater levels of insulin produced, the higher the degree of insulin resistance. This resistance is characterized by a reduced response to certain levels

of endogenous insulin. Fasting insulin levels can be used to determine levels of insulin resistance. That is, higher insulin levels are indicative of greater degrees of insulin resistance. At molecular level, insulin resistance involves a reduction in the number of insulin receptors and a decrease in the activity of insulin receptor kinase leading to declines in translocation of glucose transporter-4 (GLUT4), decreased concentration and phosphorylation of the insulin receptor substrates IRS- 1 and IRS-2, decreased phosphatidylinositol-3-0H kinase (PI[3]K) activity and alteration in intracellular enzyme activity (Weir & Bonner-Weir 2020).

The pathogenesis of type 2 diabetes is generally multifactorial, and various organs in the body are implicated in the disease development. They either contribute to insulin resistance or decreased insulin secretion. The adipose tissue plays a fundamental role in this etiopathogenesis. The existence of obesity is associated with an increase in leptin secretion, a hormone that controls the rate of fat deposition in the adipose tissue. This hormone is increased in overweight or obese individuals (DeFronzo et al., 2015). It stimulates the hypothalamus to increase lipolysis in the adipose tissue, leading to increased production of free fatty acids. These FFAs directly contribute to insulin resistance at the storage sites or promote the production of tumor necrosis factor-alpha (TNF-alpha), which has a dual action of inhibiting insulin production and promoting insulin resistance (DeFronzo et al., 2015). Secondly, amylin is a hormone co-secreted with insulin in the pancreatic beta cells. Research depicts that in individuals with obesity, the secretion of amylin is impaired and this appears to be associated with inhibition of insulin production, hence contributing to insulin deficiency (Galicia-Garcia et al., 2020).

The implication of the gastrointestinal system in the pathogenesis is through the production of amylin. In normal non-diabetic individuals, there is the production of amylin hormones, including glucose-dependent insulinotropic polypeptide (GIP) and glucagon-like peptide 1 (GLP-1) (Zaccardi et al., 2016). GLP-1 serves the most important function and is found in the pancreas, liver, kidneys, brain, and intestines. It increases insulin production, decreases glucagon production in islet alpha cells, and decreases glucose production in the liver cells. In obesity and pre-diabetic patients, amylin production is downgraded, hence rendering such individual's glucose intolerant (Zaccardi et al., 2016).

The natural history of insulin resistance progresses from impaired glucose tolerance to overt type 2 diabetes (Kalra et al., 2019).

IFG and IGT are primarily asymptomatic stages in the development of T2DM but have been found to be potentially pathological due to the presence of persistent postprandial or fasting hyperglycemia (Ramlo-Halsted & Edelman, 1999).

In addition to genetic risk factors, T2DM is commonly present in the background of dyslipidemia, acromegaly, hypertension, pregnancy, use of estrogens or glucocorticoids with some of these leading to metabolic syndrome. The term metabolic syndrome was used to define a cluster of diseases, namely dyslipidemia, diabetes mellitus, and hypertension. Insulin resistance is thought to be the glue that links these three components together (Weir & Bonner-Weir 2020).

Initially, pancreatic beta cells try to correct hyperglycemia caused by IGT by producing greater amounts of insulin. During this phase of the disease, measures like lifestyle modification and use of single agent OHAs are the hallmark of management. However, as the beta-cell function becomes refractory to hyperglycemia, relative insulin deficiency

develops. At this phase of T2DM management, beta cells eventually become unresponsive to monotherapies geared at improving their function. Patients may benefit from multiple oral agents and may also need exogenous insulin therapy in order to achieve optimal glycemic control (DeFronzo et al., 1992). Failure of a treatment intervention that was initially effective despite good adherence indicates disease progression and that treatment must be modified in order to achieve optimal glycemic control (Ramlo-Halsted & Edelman, 1999).

2.3 Impaired Beta-cell Function

Initially, in the setting of insulin resistance, compensatory hyperinsulinemia follows due to beta-cell mass expansion and increased enzymes involved in glucose metabolism. However, disease progression results in failure of the compensatory mechanism causing inadequate compensatory hyperinsulinemia. Manifestations of impaired ß-cell dysfunction include absent first phase of the response to glucose; thus, there is a failure in prompt postprandial glycemic control; decreased sensitivity of tissues to insulin; insulin hyposecretion due to amyloid accumulation in the islet cells (Weir & Bonner-Weir 2020).

2.4 Glucose Toxicity

Insulin hyposecretion and insulin resistance are dynamic and are aggravated by chronic hyperglycemia. Glucose toxicity refers to the components of insulin hyposecretion and dysfunction that can be reversed by controlling hyperglycemia. Chronic hyperglycemia in type 2 diabetes mellitus causes corresponding insulin hyposecretion and worsening insulin resistance—correction of the hyperglycemia causes some reversal of the defects (Weir & Bonner-Weir 2020).

2.5 Genetics

The genetics in diabetes mellitus are not well known or understood. However, the disease is said to be polygenic, with polymorphisms noted in multiple genes. The overall effect is impaired insulin secretion, inhibited insulin pathway signaling, and defective metabolic pathways. Three gene markers have been identified to be closely linked to diabetes mellitus: a polymorphism in peroxisome proliferator-activated receptor (PPAR'). The second is a polymorphism involving the gene encoding calpain-lO, which is a cysteine protease causing ß-cell dysfunction and insulin resistance in peripheral tissues such as muscle and fat. The third is a susceptibility locus to chromosome 3 in a region close to the adiponectin gene (Weir & Bonner-Weir 2020).

2.6 Impaired Glucose Tolerance

Years or even decades before the onset of hyperglycemia, the metabolic pathways that progress to type 2 diabetes are set in motion. The initial metabolic defect is insulin resistance, causing decreased uptake of glucose by adipose tissue and skeletal muscles. Initially, the ß-cells compensate by increasing insulin concentration, causing hyperinsulinemia, maintaining plasma glucose levels to relatively normal levels for some time. Eventually, impaired glucose tolerance develops, accompanied by mild postprandial hyperglycemia. With worsening insulin resistance, insulin hyposecretion results in increased hepatic gluconeogenesis, further increasing plasma glucose levels. This stage is termed impaired fasting glucose (IFG), defined as fasting blood glucose level of ≥ 110 mg/dl but <126.mg/dl (6.1-7 mmol/L). Thus, impaired glucose tolerance and impaired fasting glucose are common points in the continuum of disease progression between

standard glucose tolerance and overt diabetes mellitus. In addition, they serve as markers for identifying the at-risk group (Weir & Bonner-Weir 2020).

2.7 Disease Progression and principles of management of Type 2 Diabetes

Disease progression to frank diabetes mellitus from impaired glucose tolerance is characterized by a decrease in beta-cell Function and insulin hyposecretion. The inability of the beta cells to compensate for insulin resistance through increased insulin secretion indicates the start of type 2 diabetes mellitus. Normal glucose plasma levels will be maintained as long as beta cells can compensate through increased insulin concentration. Progressive beta cell failure thus decreases insulin secretion; therefore, hyperglycemia ensues. Hyperglycemia worsens, leading to symptoms and an increased risk of microvascular complications (Weir & Bonner-Weir 2020).

Although insulin resistance is the initial pathologic defect underlying type 2 diabetes mellitus, beta-cell dysfunction is the determining factor in the progression of the disease to its overt form. Initial compensatory hyperinsulinemia following insulin resistance is over time overridden by the beta cells becoming refractory to glucose. Despite the abnormally high level of insulin secretion, relative insulin deficiency develops coupled with worsened hyperglycemia leading to overt diabetes mellitus. Consequently, the beta cells' secretory capacity declines drastically, resulting in a state of absolute insulin deficiency. Beta cells become unresponsive to pharmacological regimens aimed at increasing insulin secretion, such as insulin secretagogues (Weir & Bonner-Weir 2020).

In Kenya, the National Clinic Guidelines for the management of T2DM have identified metformin as the first drug of choice, in combination with lifestyle modification, for the

initial management of T2DM (Sanitation, 2010). As the natural progression of T2DM occurs, monotherapy with metformin may be ineffective. Multidrug combinations may be required after failed monotherapy. They may also be initiated upfront in patients presenting with more severe hyperglycemia and/or complications. These drug combinations include the addition of another OHA, addition of exogenous insulin, or both (Nathan et al., 2009). Averagely, it takes 3-6 months for newly diagnosed diabetic patients on ideal therapeutic regimens to get to target HbA1C of 7% or less, with a reduction of 0.25% to 3% in 6 months ("6. Glycemic Targets: & Standards of Medical Care in Diabetes—2018).

2.8 Criteria for the diagnosis of diabetes

- A hemoglobin A1C (HbA1C) level of 6.5% or higher; the test method used in the lab should be certified by the NGSP and should be standardized to the Diabetes Control and Complications Trial (DCCT) reference assay, or

- Random plasma glucose of 11.1mmom/L (200 mg/dL) or higher in a patient with classic symptoms of hyperglycemia (i.e., polyuria, polydipsia, polyphagia, weight loss) or hyperglycemic crisis, or

- A 2-hour post prandial plasma glucose level of 11.1 mmol/L (200 mg/dL) or higher during a 75-g OGTT, or

- A fasting plasma glucose level of 7 mmol/L (126 mg/dL) or higher; fasting is defined as no caloric intake for at least 8 hours."

Source: Criteria for the diagnosis of diabetes (ADA, 2010)

The primary goal when it comes to the management of T2DM is to prevent long-term complications of the disease. This can only be achieved by maintaining ideal glycemic control. This, however, is not straightforward because T2DM is a progressive illness.

Research has shown that there is increased risk of severe diabetic retinopathy and chronic kidney disease in patients with HbA1C levels above 8.6% and therefore early treatment optimization is crucial to avoid this (Lind, M., Pivodic, A., Svensson, A. M., Ólafsdóttir, A. F., Wedel, H., & Ludvigsson, J. (2019). HbA1c level as a risk factor for retinopathy and nephropathy in children and adults with type 1 diabetes: Swedish population-based cohort study. BMJ (Clinical research ed.), 366, l4894. https://doi.org/10.1136/bmj.l4894).

OHAs become less effective with the progression of beta-cell dysfunction. In patients who have persistent hyperglycemia despite lifestyle modification and metformin therapy, the addition of a second oral agent or an injectable agent like insulin should be considered. Insulin is the preferred second-line medication for patients with HbA1C >9 percent or persistent hyperglycemia symptoms despite metformin titration (ADA 2020).

Historically, management of T2DM with insulin was primarily dictated by the physicians' judgment and patients' attitudes towards the use of insulin (Home et al., 2014). However, recent studies have shown that insulin is superior to oral diabetes medication in terms of tolerability, cost-effectiveness, and glycemic control (Swinnen et al., 2009). Studies have shown and now advocate for initiation of insulin therapy when glycemic goals have not been reached after 2-3 months of maximally dosed oral therapy (Swinnen, Hoekstra, & DeVries, 2009). Since insulin has been shown to be the most effective treatment for achieving glycemic control (Dalal et al., 2016), it would be expected that it would be simple to initiate and maintain insulin therapy. However, clinical inertia continues to be a great obstacle to the timely initiation of insulin therapy among patients with T2DM.

Beta-cell dysfunction and insulin resistance demands treatment intensification for adequate glycemic control (Reach et al., 2017). Current guideline recommendations are lifestyle

and diet modification as a first step if baseline HbA1c is mildly elevated. These changes are either combined with or followed by metformin monotherapy coupled with an array of additional oral and injectable pharmacological components. According to this algorithm, intensification of therapy in a patient with type 2 diabetes mellitus should be delayed for 2-3 months of treatment and should commence using the appropriate agent when the patient does not achieve proper glycemic control on their current regimen (Reach et al., 2017). However, there is usually a delay in intensifying therapy even for years, predisposing the patient to long-term diabetes mellitus (Reach et al., 2017).
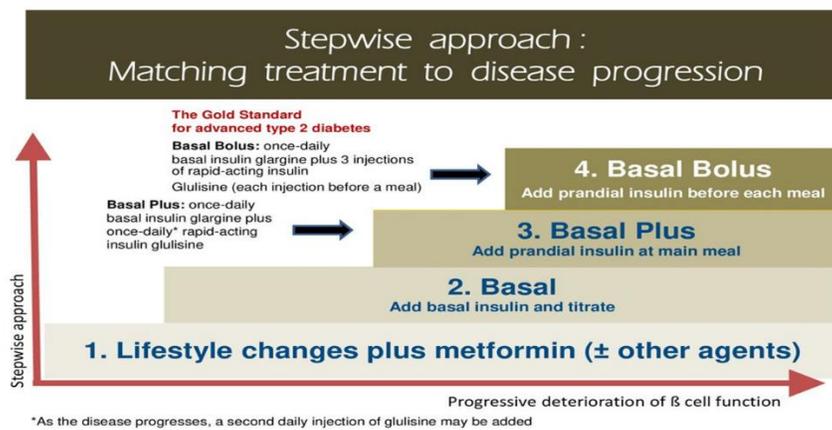
Adapted from Raccah D, et al. Diabetes Metab Res Rev 2007;23:257–64

Figure 3: Management algorithm for T2DM

2.9 What is clinical inertia?

Clinical inertia in diabetology is defined as failure to establish optimal glycemic targets due to delayed or failed escalation of therapy which ultimately leads to failure in optimizing glycemic control. It can also be defined as the failure of a healthcare provider to intensify therapy when there is a reason to do so in a patient who has not met clinically-based goals of care. (Reach et al., 2017). It significantly increases morbidity among patients with

T2DM and compounds the financial burden of managing the disease. Clinical inertia particularly to insulin is a challenge faced more so when the decision to start patients on insulin is being entertained (Polonsky & Jackson, 2004). Clinical inertia has three key sources: the health care provider, the patient, and health system-related factors (Ruiz-Negrón et al., 2019).

It is a multi-faceted term that represents complex attitudes, beliefs, and perceptions about insulin therapy (Allen et al., 2016). Previous experiences with insulin, lack of knowledge on diabetes and its management, cultural beliefs, and societal attitudes can influence the above factors. It is, however, not a psychological disorder (Polonsky & Jackson, 2004). It has been shown to occur more among patients with T2DM since their need for insulin often develops with time as compared to those with type 1 diabetes, who cannot do without insulin therapy (Saleem et al., 2016).

Part of the reason why clinical inertia has been tolerated is that it is a multifactorial issue with contribution from patients with diabetes, physicians, and the healthcare system (Strain et al., 2014). Not only does it interfere with initiation and compliance to insulin therapy, but it may also influence treatment satisfaction as well as the social, psychological, and physical aspects of a patient's quality of life (Brod et al., 2009). In this way, clinical inertia among patients, health care workers, and systems further compound the complexity of managing T2DM.

Clinical inertia can result in uncontrolled hyperglycemia, complications of diabetes, and reduced quality of life (Larkin et al., 2008). Unfortunately, insulin tends to be initiated when the complications of diabetes have begun to manifest, partly as a result of clinical

inertia. The decision to initiate insulin commonly faces a lot of logistical and emotional resistance due to negative perceptions (Nefs et al., 2012).

Studies in the USA investigating clinical inertia to insulin therapy among patients with T2DM on regular follow up showed that despite 39% of patients having HbA1c exceeding eight percent on initial testing, antidiabetic therapy increases occurred at 9.8 percent of visits only (Berlowitz et al.,) In Spain, studies have shown that therapy intensification is not received by 32.2% to 52.5% of patients with poor glycemic control (Mata et al., 2013).

2.10 Prevalence of clinical inertia

Clinical inertia can be found at any point in the disease's course, from the start of oral hypoglycemic medications until the beginning of insulin therapy. Prior studies have shown that clinical inertia in the background of T2DM began to manifest in the early 2000s (Van et al., 2009). Further research conducted in the USA showed that less than half of the two thousand patients with T2DM and high HBA1c levels had their treatment up-titrated (Andreozzi et al., 2020).

In patients with HbA1c levels of more than 7%, a retrospective cohort study found that switching from one to two oral hypoglycemic medications was required within an average of three years from diagnosis (Khunti & Khunti, 2015). In US clinical practice, Fu and colleagues found that in patients receiving extra antihyperglycaemic medication, it had taken an average of 14 months to intensify their treatment (Fu & Sheehan, 2017).

Inertia was found in 26.2 percent of patients with an HbA1c of 7% and 18.1 percent of patients with an HbA1c of 8% who failed to have their medications intensified after a median follow-up of 4.2 years in a similar study conducted in the United States. In individuals taking one oral antidiabetic medicine, adding another OHA took 2.9 years for

those with an HbA1c of 7%, 1.9 years for those with an HbA1c of 7.5%, and 1.6 years for those with an HbA1c of 8.0%.

In individuals taking two oral antidiabetic drugs, intensification with another OHA took 7.2 years for those with an HbA1c of more than 7% and 6.9 years for those with an HbA1c of less than 7%. (Khunti et al., 2018). Additionally, this study showed the median time to intensify the treatment with insulin was similar, with >7.1, >6.1, or 6.0 years taken to intensify therapy for patients taking one, two, or three oral antidiabetic agents, respectively.

In a retrospective study involving over eighty thousand patients with type two diabetes mellitus in the UK, the median time for initiation of treatment intensification in patients on one to three oral antidiabetics was more than 7.2 years, indicating the prolonged duration of poor glycemic control prior to treatment intensification. Further, an analysis of treatment intensification in patients on basal insulin showed an overall delay in treatment intensification by more than four years, with less than a third of patients with [HbA1c ≥ 7.5% having their treatments intensified (Khunti et al., 2013).

Current clinical guidelines recommend frequent three-monthly monitoring of HBA1c levels coupled with a stepwise intensification of treatment until proper glycemic control is attained. In addition, clinical inertia is quantified in most studies by measuring the proportion of patients with higher than normal HBA1c (Fu & Sheehan, 2017).

The decision to intensify therapy in a patient with type 2 diabetes mellitus is multifactorial and highly complex. There is a need for proper communication between the physician and the patient to ensure adherence to the regimen. The primary health care providers ought to individualize healthcare according to the efficacy of the drug, its side effects, presence of co-morbidities, stage of disease, affordability, patient motivation and compliance, and the

patient's support system (Ruiz-Negrón et al., 2019). Patient adherence is increased when there are fewer side effects and an excellent interpersonal relationship has been established with the primary healthcare provider.

2.11 The burden of clinical inertia

Clinical inertia contributes to approximately 200,000 adverse outcomes per year in people living with T2DM. Therapeutic delays have seen many patients start on treatment when the complications of T2DM have already set in (Strain, Blüher, & Paldánius, 2014).

The American Association of Clinical Endocrinologists and American College of Endocrinology recommend insulin therapy initiation among patients with T2DM and HbA1C levels exceeding 9% despite being on optimal OHA therapy (Jellinger et al., 2007). This is, however, not common practice.

A global multinational survey involving more than 66,000 patients with T2DM showed that the average HbA1C level at the time of initiating insulin was 9.5%. In addition, approximately 90% of the participants already had complications of diabetes (Home et al., 2014).

A study conducted on type 2 diabetes mellitus large cohort of patients who were followed over a twenty-two-year period depicted that a delay of one year in the intensification of treatment among the patients with a persistent HbA1c above seven percent through either initiation of insulin therapy or oral antidiabetic regimens resulted in a significant increase in the risk of stroke, myocardial infarction, cardiovascular events composite, and heart failure (Khunti et al., 2016).

Inadequate sugar control has been shown to result in a significant number of premature deaths and high healthcare costs (Giugliano et al., 2019). In 2012, the global mortality burden for poor glycemic control was estimated at 3.7 million, while the 2011 to 2030 global diabetes financial burden is projected to cost about 1.7 trillion United States dollars (Giugliano et al., 2019).

SOLVE™, a multicenter observational study conducted in ten countries (Asia, Europe, and North America) involving 17,374 patients with T2DM, depicted a general delay in the initiation of insulin until average HbA1c level of 9% (Khunti et al., 2012).

A retrospective cohort study that was conducted in the United Kingdom and enrolled 11,696 patients diagnosed with type 2 diabetes mellitus from the UK Clinical Practice Research Datalink. This study revealed that of the patients who qualified for regimen intensification, only 30.9% had an intensification of their treatment regimens with a glucagon-like peptide-1 receptor agonist (GLP-1 agonist) or a premix or bolus insulin, with the median intensification time being 3.7 years (Khunti & Millar-Jones, 2017).

A similar study conducted in the United States elucidated a failure of treatment intensification within six months in 62.9% of the 7,389 patients with an index HbA1c of equal to or more than 7% and who were on a stable two oral antidiabetic drug regimen for at least six months (Ruiz-Negrón et al., 2019). Another study in the same US clinical setting revealed that from the electronic medical records, the likelihood of achieving the blood glucose control goals of HbA1c 0f less than 7% in T2DM patients initiated on basal insulin after being on oral antidiabetic therapy was considerably significant within twelve months of insulin therapy, if not fully achieved (Meredith et al., 2021).

An observational study conducted in the United States enrolled 3,891 patients with T2DM who were registered with a health maintenance organization. It was found that there was almost a three-year delay in initiating insulin in patients who have been on dual once a day (OAD) therapy (metformin and a sulfonylurea) and have persistently high HbA1C readings (Nichols, Koo, & Shah, 2007).

2.12 Factors associated with clinical inertia

1. **Patient factors**.

These factors contribute approximately thirty percent of the overall contributors of clinical inertia. Patients' willingness to start on insulin is greatly determined by their understanding of their condition as well as engagement with their treatment. Adherence to treatment is greatly influenced by individual and societal attitudes and/or misconceptions about T2DM and its management (Cramer, 2004).

Patients' age plays a major role in clinical inertia in a variety of chronic illnesses, with those of advanced age being at a higher risk of clinical inertia. Fear of the repercussions of treating an aged person's chronic disease may augment the perception of the hazards associated with the underlying disease (Andreozzi et al., 2020). As a result, existing guidelines may not be appropriately adhered to, as is the case in the management of diabetes mellitus.

Approximately twenty-three percent of adults diagnosed with T2DM are aged sixty-five years and older, according to The International Diabetes Foundation (Yakaryılmaz & Öztürk, 2017). Treatment of diabetes among the elderly population aims to minimize

disease progression, prevent further complications, and maintain the individual's overall health. Insulin treatment has been recommended for older people with T2DM who have persistently high blood glucose levels despite adherence to oral hypoglycemic agents, or an HBA1c of 7 or greater with maximum dosage or a combination of oral hypoglycemic agents. Early insulin treatment has been recommended for older patients with T2DM. Clinical inertia has been shown to have a significant impact on older adults, particularly those with other comorbidities, those using multiple medications, and those who lack access to consistent medical care in the clinical set-up (Ajmera et al., 2015).

According to Tunceli et al, obesity is a significant factor influencing clinical inertia, with high body mass index (BMI) being associated with HBA1c levels >7 as well as greater rates of treatment intensification. The study also linked cardiovascular disease to aggressive treatment plans, with dyslipidemia and obesity being associated with proactive management escalation (Tunceli et al., 2015).

Differences in gender have also been shown to contribute to clinical inertia. A study conducted to look at associations between clinical inertia among patients with T2DM and cardiovascular disease reported gender disparities in the prevalence of cardiovascular disease with women being at higher risk (Andreozzi et al., 2020). In a retrospective study exploring clinical inertia carried out in Malaysia among 7646 T2DM patients, 60.5% were found to be female with a mean HBA1c level of 8.1%. Of the total, 70% were obese, 80.4% had co-existing hypertension and 76.6% had dyslipidemia.

In a similar study done in South Africa conducted between October and December 2010 among patients with T2DM, females were found to have had BMI levels and were obese

compared to males who were overweight. The females also showed poor glycemic control in need of treatment intensification (Govender et al., 2017).

In a retrospective study done to explore clinical inertia to insulin use among insulin naive T2DM patients in a Diabetes Center in Sao Paulo, United States over a period of two years, the prevalence of clinical inertia was found to be 65.8%, 61.9% and 58.2% respectively for basal, first and second years after insulin therapy (Alvarenga et al., 2018). Clinical inertia was determined by patients having HbA1c levels above 7%, and clearly demonstrated the high burden of clinical inertia among patients with T2DM. Majority of those with clinical inertia were female patients above the age of 60 years.

Patients' perceptions towards insulin therapy have been shown to contribute to clinical inertia. Analysis of previous literature identifies certain common patient factors which are associated with the occurrence of clinical inertia. Social stigma, need for lifestyle adaptations, restrictions required by insulin use, negative self-perceptions, patients' beliefs/knowledge about diabetes and insulin as well as attitudinal barriers (fear of injections, sense of personal failure or self-blame for the necessity of insulin use, etc.) are some of the factors that have been highlighted. These factors, working independently or in combination, contribute to clinical inertia among patients (Polonsky & Jackson, 2004).

The international multicenter DAWN study further assessed factors related to the quality of diabetes care. These included levels of knowledge on diabetes self-management and depression among patients with T2DM. The report showed that 54.9% of insulin naïve patients are anxious about the possibility of being started on insulin (Reach et al., 2015).

A cross-sectional study conducted in the USA among a low-income and poorly educated racial minority population of insulin-naïve patients with T2DM reported that 48% of the

study population had a complete unwillingness to accept insulin, with lower levels of education predicting higher levels of resistance to insulin therapy (Machinani, Bazargan-Hejazi, & Hsia, 2013).

In Gujarat, research conducted among patients with T2DM showed that 51.2% were reluctant to start insulin therapy with loss of patient autonomy and inadequate knowledge on insulin therapy emerging as the major contributors to negative perceptions (Ali Shah, Butt, & Hussain, 2017). These participants were unwilling to start on insulin therapy despite having an average HbA1C level of 10.92+1.12% (Syed et al., 2017).

In a diabetes education program conducted in the Gulf region that enrolled insulin naïve patients with T2DM, 73% of patients who were eligible for initiation of insulin therapy were at first hesitant to start treatment (García-Pérez et al., 2013). Furthermore, approximately 28% of these patients were totally against starting on insulin if prescribed, while a significant number of the remaining sample expressed various degrees of reluctance (Sorli & Heile, 2014).

A study done in Pakistan showed that 53.29% of patients were unwilling to start insulin therapy, with needle phobia being the commonest factor. This was followed by fear of the side effects of insulin. Other contributing factors included perceptions of peers, difficult and lifelong application, cost, storage issues, seeing insulin as a last resort of treatment, misdirection from "quacks," and patient's reluctance (Saleem et al., 2016).

From a review of previous literature, patients lack of knowledge on insulin and insulin therapy as well as false perceptions of T2DM and its management significantly contribute to clinical inertia. Studies have shown that some patients strongly believe that insulin is the cause of serious complications and chronic health problems such as blindness, heart

attacks, amputations, and even death. The patients do not link these complications to T2DM itself (Funnell, 2007).

A number of patients view the initiation of insulin therapy as a result of their failure to manage their diabetes. This causes them to have feelings of guilt and fear that they may never be able to control their illness despite following prescribed treatment regimens (Peyrot et al., 2005). They also believe that the use of insulin will not have a major or positive impact on the management of their diabetes and on their overall health (Polonsky & Jackson, 2004). Some patients see insulin therapy as a sign that their condition is getting worse since they believe that insulin is a drug for the very sick (Allen et al., 2016). They fail to see insulin therapy as a vital part of their treatment that will prevent complications associated with diabetes and hence improve their quality of life.

Fear of injections is also a major barrier to the initiation of insulin therapy. Patients fear causing self-harm or pain and have overall anxiety due to their dislike for needles (needle phobia). Some patients also believe that self-injection is unnatural (JE, RC, & CG, 2005). Needle resistance has been found to be most common among patients who are self-administering insulin (Hu et al., 2011).

Insulin naïve patients have expressed concern about the impact of insulin therapy on their lifestyles. They commonly feel that insulin therapy would be stressful and burdensome. They do not think that they could effectively handle the day-to-day demands of being on insulin therapy (Morris et al., 2005). Many feel that they would lose their personal freedom once they started on insulin, that their activities of daily living would be restricted and that they would be inconvenienced due to the complexity and time-consuming nature of insulin therapy (R. & Mark, 2001).

Hypoglycemia following insulin injections has been found to be a significant fear among patients. Some studies have shown that patients adjust their prescriptions so as "not to suppress the blood glucose to avoid hypoglycemia," especially when away from home, e.g., during school hours or at work (Ann & Rebecca, 2002). Despite being educated on the danger signs of hypoglycemia, many patients are still fearful of insulin use and believe that insulin causes more severe hypoglycemic episodes than oral diabetes medications.

The Insulin Treatment Appraisal Scale (ITAS), a 20-item scale, is a tool used to assess patients' perceptions of insulin treatment. The scale consists of 4 positively stated items and 16 negatively stated items ranked on a 5-point Likert-type scale. The total score is calculated by adding the scores on the negatively scored items and the reversed scores on the positively stated items. The total score may range from 20 to 80. The ITAS scale has been validated locally in a study on Psychological Insulin Resistance conducted at KNH and has been translated into Kiswahili (Gulam, Otieno, and Omondi Oyoo 2017) (See appendix 4).

The ITAS is a brief, psychometrically sound instrument that can be used in insulin naive and insulin-treated patients to assess positive and negative perceptions regarding insulin treatment and changes therein.

The clinical relevance of the ITAS has been demonstrated. In cross-sectional studies, a difference has been observed between insulin using and non-insulin participants in total ITAS scores of approximately one standard deviation. Longitudinal research indicates that the ITAS is sensitive to treatment change from oral medication to insulin injections. Furthermore, higher ITAS scores (indicating more negative appraisal of insulin) are associated with being hypothetically less 'willing' to begin insulin if recommended.

Previous research has identified associations between ITAS scores and general and diabetes-specific emotional wellbeing among people with T2DM. (Holmes-Truscott et al., 2014)

Despite adequate treatment for diabetes, it is estimated that fifteen to twenty percent of people with diabetes are struggling with a moderate to severe form of depression (Pouwer et al., 2013). Depression is regarded as a clinical state of low mood and aversion, with a resultant persistent apathy and sadness feeling. It can interfere with the daily functioning of an individual, affect their behavior, feelings, thoughts, motivation, and sense of well-being. Its manifestation could be noticed through symptomatology entailing sadness, anorexia, hypersomnia, and difficulty in thinking or concentration (Darwish et al., 2018). Depression is mostly associated with feelings of dejection, suicidal ideations at times, and hopelessness. It can be short or long-term and has anhedonia as the core symptom. Depression can develop as a result of the hardships associated with disease progression or neurohumoral changes related to diabetes (Darwish et al., 2018).

It has been shown to negatively affect treatment outcomes because of its effects on patients' decision-making skills when it comes to compliance to treatment, regular follow-up, and lifestyle modification (Rubin & Peyrot, 2001). T2DM patients with depression seem to lack the self-drive required to manage and keep their blood sugar in check and experience poorer glycemic control compared to non-depressed patients (Nefs et al., 2013). This may be due to less adherence to self-care behaviors, less treatment-related adherence, and lower physical activity levels (Gonzalez et al., 2007). In a cross-sectional study conducted among patients with T2DM in Iran, 73.2% of participants had HbA1c $\geq 9\%$ with an average depression score of $12.15 \pm (4.99)$ out of a possible 30 (Azami et al., 2019).

A study done in Kenya indicated a doubling of the incidence of diabetes and its complications in patients with concomitant depression. In patients with preexisting diabetes, depression is an independent factor for the predisposition of coronary artery disease. Depression opposes the attainment of normoglycemic levels through behavioral and physical changes. Concurrent diabetes and depression are associated with an increased burden of symptoms for both illnesses, poor self-care and management, and decreased adherence to treatment. Conversely, successful treatment of depression is associated with improved glycemic control (Otieno et al., 2017).

Depression is a major concern among the adult population, particularly those with co morbid conditions. Researchers have looked into the link between T2DM and depression, particularly among people aged 65 and up. Concomitant diabetes mellitus has been shown to increase the risk of depression in the elderly than those who do not have diabetes mellitus (Trief, 2007).

A study conducted in the United Kingdom among older persons with diabetes mellitus found a high frequency of depression among the participants. Approximately 30% of people with diabetes mellitus experience a significant increase in depressive symptoms, and 12 to 18% fulfill diagnostic criteria for severe depression. Furthermore, compared to their counterparts of the same age and sex, patients with diabetes mellitus had significantly greater rates of depression (Okemah & Quiñones, 2018). A contextual analysis of ten studies found that the prevalence of depression was considerably higher in diabetic individuals than in those without the disease (17.6 versus 9.8 percent). Furthermore, ladies with diabetes had a higher rate of depression (23.8%) than males (12.8 percent) (Ali et al., 2006).

According to a study done in Japan, age-related physical changes that occur as one grows older worsen both depression and diabetes. Further, complications of diabetes and the impact of hypoglycemia are more significant among are more common in the elderly population (Ishizawa et al., 2016). In addition, concurrent diabetes mellitus and depression decrease cognitive function with an associated increase in cases of dementia, indicating an increase in the level of brain toxicity (Mendes & Fernandes, 2019).

T2DM patients who also suffer from clinical depression are prone to hypoglycemia from taking multiple drugs and drug-drug interactions. They are also less able to recognize when their glucose blood levels are low, and the appetite changes from missing a meal. Their physical changes make it harder for them to exercise, stick to their diet, and adhere to their medication. The two conditions are synergistic, and a combination of the two causes adverse health outcomes. Poor glycemic control worsens depression, and depression causes poor glycemic control (Kim et al., 2019).

 A study done in Japan found manifestations of depressive disorders among patients with T2DM included sleep disturbances, changes in appetite, lack of motivation, decrease in self-care, decreased social interactions, and expressing hopelessness. These symptoms may not be easily recognized and may be thought to be effects of T2DM itself. Most of these patients suffered from chronic depression and have recurrent episodes despite successful treatment (Ishizawa et al., 2016).

A study that was conducted in Western Kenya among 253 patients with T2DM found a prevalence of clinical depression of 20.9%. The average age of the participants was 57.6 years. More women (27 percent% of female and 15% of male participants were found to have clinical depression (Shirey et al., 2015).

Risk factors shown to potentiate the development of depression among patients with T2DM include being elderly, female, unmarried, low socioeconomic status, previous history of depression, presence of a chronic physical illness, alcohol use, existing cognitive impairment, and family history. Having a first-degree relative with the disease increases the risk for depression threefold. Patients with depression who have a robust support system and participate in social activities have a lower chance of negative outcomes (Chen et al., 2019).

The PHQ-9 questionnaire is an instrument used for screening, diagnosing, monitoring and measuring the severity of clinical depression. It incorporates DSM-IV depression diagnostic criteria with other leading major depressive symptoms into a brief self-reported tool. The total sum of the responses suggests varying levels of depression, with scores ranging from 0 to 27. Generally, a total of 10 or above is suggestive of the presence of depression. This tool has successfully been validated and used in several studies in Kenya and has been translated into Kiswahili (Omoro et al. 2006) (See appendix 6).

In addition to making criteria-based diagnoses of depressive disorders, the PHQ-9 is also a reliable and valid measure of depression severity. These characteristics plus its brevity make the PHQ-9 a useful clinical and research tool. (Kroenke et al., 2001)

Self-care in diabetes mellitus is defined by developing the patient's knowledge or awareness and involvement in the collective management of the disease as well as managing their condition in a social context. Done well, it enables the patient to manage the disease on their own effectively. Predictors of good outcomes in patients practicing self-care include healthy eating, blood sugar monitoring, risk reduction behaviors, medication adherence, physical activity (Dedefo et al., 2019).

Diabetes self-care among patients with T2DM is an often-overlooked component of the diabetes care process, despite the fact that T2DM is a multifactorial condition that can often be difficult to manage by pharmacotherapy alone (Phillips et al., 2018). Individuals diagnosed with T2DM are expected to manage their blood glucose, diet, physical activity, medications, foot care, treatment of related conditions, and preventive measures for secondary conditions (Phillips et al., 2018). This can be overwhelming to patients who may have low levels of self-care knowledge on T2DM.

Low literacy levels on T2DM among patients have been positively associated with poor glycemic control. For example, a cross-sectional study conducted in Sao Paulo, Brazil revealed that low scores on diabetes self-care were associated with poor glycemic control evidenced by an average participant HbA1c of 8.5% (Souza et al., 2020).

There is a need to provide educational services to patients with diabetes mellitus by providing self-management training. However, a study showed less than 6.8 percent of patients receive this training, partly due to the unavailability of the programs to begin with (Karam et al., 2020).

The American Association of Clinical Endocrinologists underlines the value of patients being informed and engaged in their treatment (Garber et al., 2016). Furthermore, WHO stresses the necessity of diabetes mellitus patients learning how to actively participate in their own care. Diabetic patients that had not undergone formal teaching about self-care procedures, for example, had a four-fold increase in the condition's complications, according to an American Diabetes Association evaluation of diabetes self-management education guidelines (Powers et al., 2017).

A study of adults in Ethiopia living with type 2 diabetes mellitus on self-management education revealed improved glycemic control at immediate follow-up (Hailu et al., 2019).

Another study in Addis Ababa, Ethiopia identified certain self-care activities, including behavioral changes like avoiding food with high-fat content, self-glucose monitoring, increased physical activity, foot care, and following a diet plan. These self-care practices were shown to improve glycemic control among patients with T2DM (Tewahido & Berhane, 2017).

Although lowering the patient's HBA1c levels is the prime objective of diabetic self-management, it is not the only focus of patient treatment. In diabetic care, self-monitoring of glucose control is critical. It guarantees that the patient is actively involved in meeting and maintaining glycemic goals (Jannoo et al., 2017). The key priority in self-monitoring is to evaluate for proper glycemic control and take the necessary steps to attain optimum control quickly. Self-monitoring also offers insight into current glycemic levels, enabling treatment review and steering dietary, exercise, and pharmacological adjustments to achieve targeted blood glucose control. (Jannoo et al., 2017).

In low-income countries, some sociodemographic and cultural issues have limited self-care activities. Poor patient-provider relationships, high drug, and medical-care costs, the severity of symptoms, lack of pharmaceutical access, patient dissatisfaction with medical therapy, and poor distribution of healthcare providers in different parts of these countries are just a few of them. (Mogre et al., 2019).

The Spoken Knowledge in Low Literacy in Diabetes Scale (SKILLD) questionnaire is used to assess patient knowledge about diabetes self-care, including appropriate lifestyle modifications, glucose monitoring, the recognition and treatment of complications

associated with diabetes, and appropriate activities to prevent long-term consequences of poorly controlled/uncontrolled diabetes. It was designed to enhance comprehension among patients with low literacy. It is a verbally administered questionnaire which helps to alleviate issues associated with reading and comprehension. In order to avoid overwhelming patients, it covers a limited number of components. Responses to questions were designed as open ended to allow patients to explain their responses. Patients are given 10-15 seconds to give their responses and secondary questions are asked if the patient is completely unable to respond. Answers are considered correct if the verbal responses are consistent with the acceptable responses present on the questionnaire with a maximum sore of 100%. This tool has been locally validated and used at the Kenyatta National Hospital to assess levels diabetes knowledge and self-care among patients with type 2 diabetes. It has also been translated into Kiswahili (Omari, 2013) (See appendix 5).

The Spoken Knowledge in Low Literacy Patients with Diabetes has shown to be adequate to evaluate diabetes knowledge in elderly patients with low schooling levels. It presents normal distribution, adequate internal consistency, with no ceiling or floor effect. The tool is easy to be used, can be quickly applied and does not depend on reading skills.(Souza et al., 2016).

2. Physician factors

The barriers to effective patient care by physicians have been found to be related to insulin initiation, its intensification, and titration. A study that aimed to identify the barriers of diabetic self-care from the provider's perspective identified factors such as patient affordability, clinicians' belief that medications cannot heal the patient's disease, and

providers' lack of confidence in their capacity to change patient behavior (Mogere et al., 2019).

Studies conducted among physicians to investigate their attitudes to the initiation of insulin in patients with T2DM demonstrated varied reluctance to starting insulin therapy (Marrett et al., 2012). Some of the reasons given by the interviewed clinicians included risk of hypoglycemia secondary to insulin administration, patients' ability/inability to purchase insulin, patients' negative experiences with insulin, patients' fears about starting insulin therapy, risk profile in patients with comorbidities, excessive weight gain associated with insulin use, reduced quality of life among patients, concerns about patients' abilities to administer insulin, challenges communicating effectively with patients, differences in healthcare facilities that patients' may visit, non-compliance to treatment and their deficiency in knowledge to optimally manage patients on insulin (Currie et al., 2012).

In a cross-sectional study conducted in the USA, 54% of clinicians preferred to individualize glycemic targets based on patient's age, life expectancy, self-management capacity, co morbidities, and willingness to change therapy. 64% of these clinicians cited patient resistance as a barrier to insulin initiation. Many patients were adamant about starting insulin due to fears about what treatment escalation meant about their disease progression. In addition, 43% cited problems with patient self-management, including cognitive or mental health issues and dexterity 80% felt that patient non-adherence would often discourage them from initiating insulin (Ratanawongsa et al., 2012).

Among providers, 43.4% have been shown to prefer holding off medications until they feel that the patient absolutely needs them. General practitioners are more likely to delay insulin

in comparison to specialists. General practitioners have been shown to perceive higher numbers of patients with psychosocial problems associated with the use of insulin as compared to physicians and are more hesitant to initiate insulin therapy. This is evidence that some clinicians underestimate the need for treatment intensification among their patients due to inadequacy in knowledge on the management of T2DM (C., C., C., & M., 2011).

Literature has also shown that clinicians have the tendency to blame poor glycemic control on patient's non-compliance to insulin as opposed to attributing it to the progression of the disease (C., C., C., & M., 2011). Some providers have used the potential initiation of insulin as a threat to "scare" patients into observing ideal lifestyle habits that would help in keeping their T2DM controlled. This has caused both practitioners and patients to develop negative attitudes towards the use of insulin and to brand insulin as therapy for those who have failed to manage their T2DM optimally.

Fear of hypoglycemia has been shown a significant contributor to inertia among physicians. Approximately three-quarters of healthcare providers list hypoglycemia as a substantial barrier to the initiation of insulin therapy. Further, there are concerns of weight gain and the effect of the medication on the patient's overall quality of life, and it is thus used as a last resort. (Ruiz-Negrón et al., 2019).

Most physicians may not have the adequate skills, resources, or experience in initiating insulin therapy or providing patient education on insulin titration and this in turn caused them to delay insulin initiation. This was demonstrated by a study conducted in USA by Ruiz which showed that the median time for initiation of basal insulin by clinicians was

3.7 years. The study population was 3078 with a mean age of 54.4 years. Of the total study population, 36 percent experienced clinical inertia (Ruiz-Negrón et al., 2019).

When it came to patient factors that were of concern to health care workers that contributed to their delay in treatment intensification with insulin, factors such as fear of weight gain, injection, and inconsistent monitoring of blood glucose levels and pain from the injection were some of the concerns raised by physicians which made them hold back on treatment escalation. (Ruiz-Negrón et al., 2019). These factors haved contribute to the failure of physicians to establish appropriate therapeutic targets and to escalate treatment of T2DM to achieve therapeutic goals (Strain, Blüher, & Paldánius, 2014).

3.   Environmental factors

Health system structures that are not structured to support patient-provider communication and multidisciplinary approaches to care have shown poor glycemic control among patients. This has especially been seen in primary health care facilities, particularly in poor resource settings. Inadequate resources, high workload, loss to follow up and time constraints have been shown to be major contributors to clinical inertia (Ratanawongsa et al., 2012).

The lack of clear and standard guidelines on treatment intensification with insulin has brought about confusion among the physicians concerning intensifying medication plans. Finally, the high cost of the medication, together with the difference in formulation depending on disease progression and patient requirements, largely contribute to clinical inertia (Karam et al., 2020).

Time limits on primary care physicians, along with a lack of standardized care organization, may hinder the healthcare system's ability to offer proper and reliable care suited to individual patients' requirements (Karam et al., 2020).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Site

MTRH is the second largest national referral hospital in Kenya, located in Eldoret, Uasin Gishu County. The hospital serves patients from Western Kenya, the Rift Valley, parts of Southern Sudan, and Eastern Uganda.

The MTRH DOPC is a specialist clinic which runs in the Chandaria cancer and chronic disease management center, located within MTRH. Care at the DOPC is aimed at giving patients an opportunity to meet medical experts who give highly specialized advice on how to manage their diabetes. The clinic runs on Mondays, Thursdays, and Fridays from 8.00 a.m. An average of 5 new adult patients are enrolled in the clinic each week, with about 150 patients are seen per week. The clinic caters to patients with both type 1 and T2DM, with the majority of the patients being managed for T2DM.

The clinics are run by a team made up of clinicians and other support staff like peer educators and nutritionists. The records department is responsible for booking patients to the clinic based on return dates recommended by clinicians. Patients are booked on a first come first served basis depending on their last clinic visit and recommended return date. Patient flow is organized to start at the pay point. The patients then visit the nurse triage desk, where vital signs and a blood sugar reading are taken. This is then followed by consultation that's done on a first come first served basis. Clinicians are responsible for taking patients' vital signs and assisting with any emergencies that may arise. They also review patients, request for laboratory investigations, prescribe treatment and make referrals. Review by a nutritionist is done if requested by the clinician, while diabetes

education is provided both on request by the patient and/clinician. Patients may also be referred for diabetic foot care which involves a foot risk assessment, patient education on foot care, and management diabetic foot ulcers if present.

3.2 Study design

A mixed-methods study design was employed.

"Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purpose of breadth and depth of understanding and corroboration" (Anderson, 2010.119).

"Qualitative research involves the collection, analysis, and interpretation of data that are not easily reduced to numbers. These data relate to the social world and the concepts and behaviors of people within it. It looks at X in terms of how X varies in different circumstances rather than how big is X or how many Xs are there?" (Anderson, 2010.119). It allows for the in-depth examination of issues. When in depth interviews are conducted, the interviews are not restricted to specific questions. The researcher is able to guide the interview in real time. This allows for quick revision of the research framework if new issues arise. The data collected is primarily based on personal experiences and this data may sometimes be more convincing than quantitative data. Complex information about the research topic can be obtained from interviews as opposed to more positivistic enquiries (Anderson, 2010). This enables issues to be examined in detail and in depth. Interviews are not restricted to specific questions and can be guided/redirected by the researcher in real time and the research framework/direction can be quickly revised as new information

emerges. The data based on human experience that is obtained is powerful and sometimes more compelling than quantitative data (Anderson, 2010). . Literature has shown that numerous studies looking into clinical inertia among health care providers used key informant interviews to collect data on factors influencing clinical inertia (Ratanawongsa et al., 2012). High quality data has been collected using key informant interviews among clinicians and has yielded high quality results after analysis. Use of key informant interviews allowed each clinician to express their views in their own words and yield a lot of vital data that would inform the study objectives.

In this case, the mixed methods design involved the simultaneous collection and analysis of both qualitative and quantitative data using the convergent parallel mixed methods study design. The quantitative aspect involved data collection and analysis using existing tools to look at prevalence of clinical inertia and its contributing factors. These factors included patients' attitudes towards insulin therapy, presence of clinical depression as well as levels of knowledge on diabetes self-care. The qualitative aspect of the study took a phenomenological approach which involved conducting in depth key informant interviews among clinicians to explore factors contributing to clinical inertia.

3.3 Study population

- Quantitative:
    - Patients with T2DM who are on routine follow up at the MTRH DOPC
- Qualitative:
    - Clinicians attending to patients at MTRH DOPC

3.4 Eligibility Criteria

3.4.1 Inclusion criteria

- **Quantitative study:**

    o Patients attending the DOPC with diagnosis of T2DM

    o Patients attending the DOPC who were able to communicate in English or
      Kiswahili

- **Qualitative study**

    o Clinicians routinely attending to patients at MTRH DOPC

3.4.2 Exclusion criteria

- Patients with type 1 diabetes

- Patients diagnosed with T2DM who had been on follow up for less than three
  months

- Patients who were severely ill at the time of the study and unable to sit through
  the interview

3.5 Sample size determination

GUIDANCE was a cross-sectional study based in Europe which aimed to investigate
potential predictors of meeting target HbA1C levels (7%). 46.4% of patients were found to
have poor glycemic control based on HbA1C levels (Stone et al., 2013).

- Quantitative

Using the Cochran formula (1977) to calculate the sample size

 N=z2 pq/d2 where:

N= required sample size for patients with T2DM

z = confidence level at 95% (standard value of 1.96)

p = Proportion of patients found to have HbA1C levels above target (46.4%)

d = margin of error at 5%

The minimum required patient sample size was 376.

- Qualitative

All clinicians attending to patients at the DOPC were identified as potential participants. Staff registers were used to identify the number of clinicians working at the clinic.

3.6 Sampling procedure

Simple random sampling was employed and recruitment of study participants was done on the DOPC designated days i.e., Mondays, Thursdays and Fridays. Once verified by the records department, patients' files were sorted at the nursing triage station. The list of patients registered for consultation on each clinic day was used as a sampling frame from which samples were drawn. All patients on follow up for T2DM who attended the DOPC were short listed as possible participants. Thereafter, patients were approached and assessed for eligibility. Patients found to be eligible as study participants were then individually informed about the purpose of the study and requested for written consent to recruit them. Those who gave written informed consent were recruited as part of the sample population. Purposive sampling was used to recruit clinicians to the study.

3.7 Data collection

Patient data collection instruments consisted of an interviewer-administered bio-demographic and clinical questionnaire, the ITAS questionnaire assessed patient's

perceptions towards insulin therapy, the PHQ-9 questionnaire assessed for clinical depression and the SKILLD questionnaire assessed patient's level of knowledge on diabetes self-care.

The clinical data questionnaire will include the following:

- Patient information section covering patient's hospital number, preferred interview language and telephone number where available.

- Demographic section covering age, sex, level of education, marital status, level of income and health insurance status.

- Treatment characteristics section covering weight, height, BMI, HbA1C levels, duration of diabetes since diagnosis and duration of using oral diabetes medications (appendix 3).

All questionnaires were counter checked before participants left the interviewing room to give them time to clarify their responses.

HbA1C testing was done after interviewing patient participants using the DCA Vantage™ point of care immununoassay analyzer (see appendix 8). The test results were then communicated to all study participants. Patients with high HbA1c levels were referred to clinicians for treatment optimization.

Qualitative

In-depth, semi-structured and open ended interview questionnaires were used to collect data among clinicians. The questionnaire contained substantial open ended questions with associated question probes which were conducted in English and explored 5 domains

captured through priori coding based on review of previous literature (See appendix 7). Interviews were recorded using an audio recorder and researchers were prepared appropriately before data collection through training on conducting the interviews as well as the operating instructions for the provided recording equipment.

3.8 Data Management

Quantitative: Duly filled consent forms were stored securely in lockable cabinets whose keys were in the custody of the principal investigator. Questionnaires were stored on the REDCap database with the password being available only to the principal investigator and research assistants. Data did not bear patients names and serial numbers were used instead.

Qualitative: Recordings were transferred from the audio recorder to a computer hard disk for transcription. Access to these recordings was limited to the principal investigator and research assistants.

All data was de-identified and did not include participant names or hospital numbers.

3.9 Quantitative Study Variables

Dependent variable
- Clinical inertia

Independent variables
- Age

- Gender

- Level of Education

- Family income

- Insurance cover

- Body Mass Index (BMI)

- Number of years since diabetes diagnosis

- Number of years on OHAs

- Patients attitude scores as assessed by ITAS

- Presence of depression as assessed by PHQ-9

- Level of diabetes self-care knowledge as assessed by SKILLD

The priori domains guiding the clinician key informant interviews were:

- Clinicians opinions on use of prescription of routine insulin therapy in the management of T2DM

- Patient factors and clinical inertia

- Work environment factors and clinical inertia

- Clinician factors and clinical inertia

- Clinicians opinions on the impact of routine insulin therapy on patient quality of life

3.10 Data analysis and display

Quantitative data analysis

Statistical analysis was done using R software. Continuous data i.e., age, BMI, duration of T2DM from time of diagnosis, duration of using oral diabetes medication and patient attitude test scores were presented as means, standard deviations and medians. Categorical data i.e., clinical inertia, depression, and level of patient DM self-care knowledge were presented in form of tables. Chi squares were used to determine significance of associations while odds ratios and multiple linear regression were used to explain the relationship between the dependent and independent variables that were found to be significant

predictors of clinical inertia. All statistical tests were powered at 95% confidence with a p value of 0.05.

Qualitative data analysis

The resulting recorded data was transcribed verbatim with the help of transcribers. Verbal dimensions and involuntary vocalizations, were included in the transcriptions. Transcripts were coded thematically and summarized thematically using Nvivo version 12. Findings were summarized and excerpts used to illustrate the key findings.

3.11 Ethical Considerations

- Approval to conduct the study was sought from the Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee (IREC/2018/336) (See appendix 1).

- Signed informed consent was obtained from all the participants

- Transcribers and research assistants were required to sign a confidentiality agreement to prevent the disclosure of participants' personal information

- All interviews were conducted in private and confidentiality maintained throughout the study

- No drugs were administered to patients recruited to the study

- Participant confidentiality and autonomy was maintained throughout the study

- Any patients diagnosed with depression were referred appropriately for further evaluation and management

- Patients found to require treatment escalation for diabetes were be referred to a consultant for review.

CHAPTER FOUR

4.0 RESULTS

Study Period

The study period ran for a duration of 3 months between April and June 2019.

4.1 Qualitative study response rate and socio demographic characteristics

The qualitative study targeted a sample size of 376 respondents. However, after adjusting

for possible non-response at 20%, the final sample size was 480 patients with T2DM.

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┌─────────────────────────────┐
│ 1722 Patients assessed for  │
│ eligibility based on patients│
│ attending clinic during the │
│ study period                │
└─────────────────────────────┘
              │
              │                      ┌──────────────────────────┐
              │─────────────────────▶│        EXCLUDED          │
              │                      │        18 T1DM           │
              ▼                      │  168 on follow up<3/12   │
┌─────────────────────────────┐     │      4 Severely ill      │
│      1532 Eligible          │     │         (190)            │
│ (n=1532)(k=4)(1532/4=383    │     └──────────────────────────┘
└─────────────────────────────┘
              │
              │                      ┌──────────────────────────┐
              │─────────────────────▶│    8 declined consent    │
              ▼                      └──────────────────────────┘
┌─────────────────────────────┐
│    Sample size = 375        │
│ Adjusted for non-response   │
│         (20%)               │
│      Final Analysis         │
│         N=480               │
└─────────────────────────────┘
```
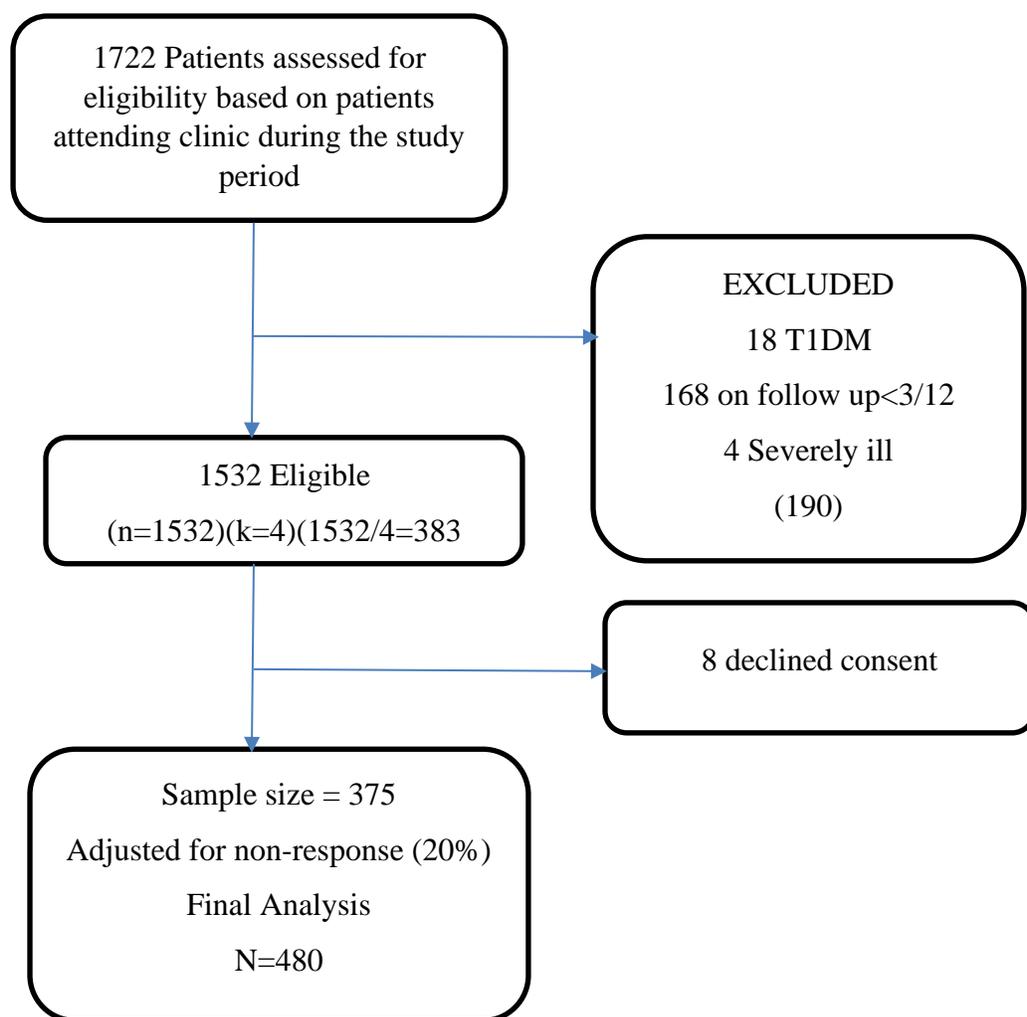
Figure 4: Response Rate

4.2 Socio-Demographic Characteristics

The participants' socio-demographic characteristics are summarized in table 1 below:

Table 1: Sociodemographic Characteristics

	Overall (N=480)
Age (yrs)	
Mean (SD)	**58.579** (13.580)
Age in categories	
25-34 years	20 (4.2%)
35-44 years	58 (12.1%)
45-54 years	95 (19.8%)
55-64 years	**133 (27.7%)**
65-74	122 (25.4%)
>=75 years	52 (10.8%)
Gender	
Female	293 (61.0%)
Male	187 (39.0%)
Education level	
None at all	32 (6.7%)
Primary School	**220 (45.8%)**
High School	167 (34.8%)
College	61 (12.7%)
Marital status	
Single	53 (11.0%)
Married	**341 (71.1%)**
Separated	19 (4.0%)
Divorced	3 (0.6%)
Widowed	64 (13.3%)
Monthly Income	
Less than ksh5,000	1 (0.2%)
Ksh. 5,000 - Ksh19,999	16 (3.3%)
Ksh. 20,000 - Ksh. 49,999	21 (4.4%)
Ksh. 50,000 - Ksh. 99,999	43 (9.0%)
Ksh. 100,000 - Ksh. 149,999	6 (1.2%)
More than Ksh. 150,000	12 (2.5%)
Don't know	**346 (72.1%)**
Chose not to answer	35 (7.3%)

Health Insurance	
Yes	**391 (81.5%)**
No	89 (18.5%)
BMI	
Mean (SD)	**26.697** (5.661)
BMI categories	
Underweight	26 (5.4%)
Normal	162 (33.8%)
Overweight	**178 (37.1%)**
Obese	114 (23.7%)
Number of years since DM Diagnosis	
Less than 5 years	**190 (39.6%)**
5-10 years	151 (31.5%)
>10 years	139 (29.0%)
Number of years on Oral medication	
Less than 5 years	**193 (40.2%)**
5-10 years	155 (32.3%)
>10 years	132 (27.5%)

4.3 Study Objective Results

Specific Objective 1: To determine the prevalence of clinical inertia among patients with T2DM attending DOPC in MTRH.

There was a total of 259 participants with an HbA1C greater than 9%. Thus, the prevalence of clinical inertia was 53.95% (95% CI: 49.38, 58.49).

Specific Objective 2: To determine possible associations between prevalence of clinical inertia, patient demographic and clinical characteristics, clinical depression, patient attitudes towards insulin therapy and level of patient DM self-care literacy.

Table 2 below shows the association between clinical inertia and demographic & clinical characteristics at bivariate level. It was observed that marital status and BMI were significantly associated with clinical inertia with p values of 0.008 and 0.019 respectively.

Table 2: Association between Clinical Inertia and Social Demographic Characteristics

	0 (N=221)	1 (N=259)	p value
Age (yrs)			0.263^1
< 35 years	8 (40.0%)	12 (60.0%)	
>=75 years	24 (46.2%)	28 (53.8%)	
35-44 years	30 (51.7%)	28 (48.3%)	
45-54 years	34 (35.8%)	61 (64.2%)	
55-64 years	68 (51.1%)	65 (48.9%)	
65-74	57 (46.7%)	65 (53.3%)	
Gender			0.063^1
Female	125 (42.7%)	168 (57.3%)	
Male	96 (51.3%)	91 (48.7%)	
Education level			0.673^1
None at all	18 (56.2%)	14 (43.8%)	
Primary School	98 (44.5%)	122 (55.5%)	
High School	77 (46.1%)	90 (53.9%)	
College	28 (45.9%)	33 (54.1%)	
Marital status			**0.008^1**
Married	168 (49.3%)	173 (50.7%)	
Single	14 (26.4%)	39 (73.6%)	
Widowed/Separated/Divorced	39 (45.3%)	47 (54.7%)	
Health Insurance			0.060^1
Yes	188 (48.1%)	203 (51.9%)	
No	33 (37.1%)	56 (62.9%)	

BMI			**0.019[1]**
Underweight	7 (26.9%)	19 (73.1%)	
Normal	64 (39.5%)	98 (60.5%)	
Overweight	88 (49.4%)	90 (50.6%)	
Obese	**62(54.4%)**	**52(45.6%)**	
Number of years since DM Diagnosis			0.510[1]
>=5 years	130 (44.8%)	160 (55.2%)	
Less than 5 years	91 (47.9%)	99 (52.1%)	
Number of years on Oral medication			0.689[1]
>= 5 years	130 (45.3%)	157 (54.7%)	
Less than 5 years	91 (47.2%)	102 (52.8%)	

1. Fisher's Exact Test for Count Data
2. Pearson's Chi-squared test

A multivariate logistic regression was then fit to further assess for any associations. Since the years since DM diagnosis and years on oral medication were highly correlated, we couldn't include both of them in the model and instead chose the one that was highly associated with the outcome of interest which in this case was years since DM diagnosis. The results are as shown in table 3 below:

Table 3: Factors Associated with Clinical Inertia

Characteristic	OR	95% CI	p-value
Age categories			
25-35 years	1		
35-44 years	0.73	0.24, 2.22	0.600
45-54 years	1.71	0.57, 5.03	0.300
55-64 years	0.98	0.33, 2.84	>0.900
65-74	1.25	0.42, 3.67	0.700
>=75 years	1.41	0.44, 4.51	0.600
Gender			
Female	1		
Male	0.65	0.43, 0.98	**0.041**
Education level			
None at all	1		
Primary School	2.03	0.90, 4.73	0.093
High School	2.06	0.88, 4.95	0.100
College	2.09	0.79, 5.61	0.140
Marital status			
Married	1		
Single	2.10	1.03, 4.48	**0.047**
Widowed/Separated/Divorced	1.14	0.67, 1.96	0.600
Health insurance			
Yes	1		
No	1.28	0.76, 2.17	0.400
BMI			
Extreme Obese	1		
Obese2	0.28	0.06, 1.29	0.110
Obese 1	0.60	0.13, 2.41	0.500
Overweight	0.64	0.15, 2.48	0.500
Normal	0.94	0.22, 3.65	>0.900
Underweight	1.43	0.27, 7.27	0.700
Years dm_diagnosis. factor1			
>=5 years	1		
Less than 5 years	0.83	0.56, 1.23	0.400
PHQ-9			
Mild	1		
Moderate	0.87	0.48, 1.59	0.700
Moderately severe	0.91	0.19, 4.95	>0.900
ITAS	0.98	0.95, 1.01	0.130
SKILLD			
Knowledgeable	1		
Not knowledgeable	1.06	0.71, 1.58	0.800

It was observed that single marital status (OR 2.1 p 0.047) and male gender (OR 6.5 p 0.04) were significantly associated with clinical inertia.

Using the PHQ-9 questionnaire, we observed that there were a total of **7 (1.4%)** participants who had depression. The mean attitude scores based on ITAS scores was **22.39**. We observed that a total of **185 (38.5%)** were knowledgeable on diabetes using the SKILLD test. We further assessed whether these factors were associated with clinical inertia. The results are shown in Table 4 below.

Table 4: Association between Depression, Patients Attitudes, Literacy and Clinical Inertia

	0 (N=221)	1 (N=259)	p value
Depression			0.967[1]
Mild	192 (45.9%)	226 (54.1%)	
Moderate	26 (47.3%)	29 (52.7%)	
Moderately severe	3 (42.9%)	4 (57.1%)	
Depression			1.000[1]
Depression	3 (42.9%)	4 (57.1%)	
No depression	218 (46.1%)	255 (53.9%)	
ITAS score			0.780[2]
Mean (SD)	22.778 (7.114)	22.066 (5.748)	
Knowledge			0.595[3]
Knowledgeable	88 (47.6%)	97 (52.4%)	
Not knowledgeable	133 (45.1%)	162 (54.9%)	

1. Fisher's Exact Test for Count Data
2. Kruskal-Wallis rank sum test
3. Pearson's Chi-squared test

The results revealed that there was no association between clinical depression, patients' attitudes, literacy and clinical inertia as evidenced by p values of more than 0.05.

Specific Objective 3: To explore factors among clinicians that contribute to clinical inertia

Out of the 18 potential clinician participants, 15 were available for interviews during the study period. Cadres included nursing, clinical medicine, general medicine, internal medicine registrars and qualified physicians. Two potential participants were away for studies while one was excluded due to their interest in the study.

  a) Clinicians' opinion on insulin therapy

Results from the clinician key informant interviews on attitudes towards insulin therapy revealed clinicians believed insulin therapy was important in management of T2DM. Its prescription should not be delayed if patients are deemed to require it.

"I think insulin has a big role in management of type two diabetes and as such, clinicians should not delay, you know, the initiation of insulin in type two diabetes" **IDI_001**

"I think my opinion would be based on whether or not the patient needs it at the point of initiation, but generally for as long as the patient needs it, I have no bias against insulin therapy compared to oral hypoglycaemics" **IDI_008**

It was also established that clinicians believed that insulin was important in managing persistent hyperglycemia and the prevention of long term complications. Its prescription was noted to be dependent on the physicians' willingness to prescribe it.

"My opinion regarding use of insulin in management of type two diabetes is that it is necessary, especially considering that in some cases, there is a lot of, well, sugars may not

be controlled using oral formulations or other medications, so in this case insulin needs to be initiated to achieve optimal control of blood sugars, so it is necessary to use and I am for the opinion of using insulin in type two diabetics." **IDI_006**

"It is very necessary so that you can prevent the long-term complications" **IDI_002**

"Insulin plays a major role in glycemic control. We unfortunately don't prescribe it enough here" **IDI_014**

b) Patient related factors and clinical inertia

Difficulties in patients' self-administration of insulin would make clinicians hold back on prescribing insulin, with patients' poor injection technique, old age and poor eyesight as associated factors.

"..also for elderly people, especially when it comes to measuring the insulin, they cannot be able to see properly because of their poor eye sight" **IDI 005**

"Others include poor technique in terms of the patient knowing how to inject insulin on themselves. So a lot of reassurance and a lot of discussion with the patients on trying to find ways of helping them, making sure that they optimally use insulin with the proper techniques, proper dosages and all is really key." **IDI_006**

Patients' attitudes were also noted to influence insulin prescription, with patients' unwillingness to start insulin, preferences for oral medications and non-adherence to insulin being identified as contributing factors.

"I think for me, I would put the first one as patient's attitude because if they are not willing to start insulin therapy the compliance wrong and they won't be able to really control the sugars" **IDI_003**

"*Yes because it is hard to prescribe if client is not comfortable because of compliance issues, you know?*" **IDI_010**

"So most of the times it is usually hesitance from the patients themselves, most patients are not willing to shift of course to injections, most patients will usually prefer oral medications." **IDI_007**

Patients' financial capability to purchase insulin was also a concern among clinicians. They would hold back on prescribing insulin because they felt that insulin was expensive and that patients did not have the required facilities to store it appropriately at home.

"The environmental conditions that they live in, are they able to store that insulin in a way that they preserve its effectiveness as far as drug preparation. Yeah, those are some of the factors, so mainly whether they understand how to use it, whether they are able to store it correctly but paramount is whether or not they need it at that point as opposed to oral drugs." **IDI_008**

"Then also the cost, insulin therapy is significantly more expensive than oral hypoglycemic agents" **IDI_009**

Prescription of insulin was also noted to be dependent on the patients' current clinical status with co-morbidities, need for surgery and current glycemic status emerging as factors that would influence clinicians' decisions to prescribe insulin.

"With comorbid conditions, that is enough to start insulin for instance most of the oral glucose lowering agents are contraindicated in for instance chronic kidney disease , so that will make me start insulin as early as possible because insulin, the chances of having optimal glucose control with insulin are higher than on oral glucose lowering agents" **IDI_001**

"It also depends on the conditions of the patients coz I think in some cases, for example if a patient has type two diabetes and also needs some surgical interventions or they are in acute stage, they may need to have insulin used which will help in achieving optimal sugar management, so in such cases patients may need to use insulin as a way of controlling sugars." **IDI_006**

"I think it depends on their sugar control and HbA1C. High levels above 10 would make me prescribe insulin." **IDI_015**

c) Work and clinic environment and prescription of insulin therapy

Regarding their work environment, clinicians reported that they would not prescribe insulin since it was generally unavailable at the clinic. They also reported that in as much as insulin may be available, the subsidization of their costs was not much and this in turn limited patients' ability to purchase insulin.

"Maybe the availability and the cost of the drug may be the one I can think of because sometimes as much as the drug is available, the subsidization of the cost is not as much, I know some people have to go to the county hospital to get the drug at subsidized cost, so maybe that's the one I can pick up on." **IDI _009**

Most of the newer formulations of insulin are not available here so that gives me limited choices when prescribing insulin **IDI_014**

Clinicians also reported that they would hold back on prescribing insulin because they had inadequate consultation time with patients. They also reported that burn out due to understaffing and high number of patients was a major challenge that made them hesitant to prescribe insulin.

"As a clinician, I would say factors that affect me personally would be adequacy in terms of time, maybe being able to, okay I may have the knowledge or even the training but then having enough time to actually communicate with patients, because sometimes you get overcrowded maybe you have to see like thirty patients and you are the only one so you don't get enough time to… that communication is not really… it's not productive, so I would say that, yeah." **IDI _004**

"Understaffing is an issue. As you can see we have so many patients. Many times we just continue with the drugs they have been using. I know it's not the best but what can we do" **IDI_012**

      d) Clinician factors and prescription of insulin therapy

Fear of complications, communication challenges with patients and need for more training on diabetes care emerged as major factors that would make clinicians hold back on insulin prescription. Clinicians voiced the need for more training on diabetes care to build their knowledge on insulin prescription. They also expressed hesitancy to prescribe it due to fear of complications, majorly hypoglycemia particularly among the eldery.

"We are not very well trained to prescribe insulin. I just give what is prescribed. Only in high sugars is when we, I may consider giving soluble insulin" **IDI_010**

"Other things that will cause me to withhold on insulin would be side effects of it, especially hypoglycaemic episodes for people who are elderly" **IDI_007**

    e)   Effects of insulin therapy on patients' quality of life

Clinicians generally felt that insulin therapy had a negative impact on patients' quality of life because of its negative financial impact due to its high cost, and psychological impact due to stigma and low self-esteem.

"Oh let me put it this way, it has a big financial impact on them because they always have to constantly source for this medication for use, so patient will always has to have the financial capability or alternatively good insurance" **IDI_006**

"then also the stigma of using insulin especially in public places where they might need to inject before they feed and so on.

So I think it affects them psychologically that they have to use insulin and they seem to other people like they have this bad diabetes that require using insulin, so I think most of the time it is a psychological issue." **IDI _007**

"*The quality of life, quality of life for insulin users in diabetic patients, I think… quality of life, is changed… okay insulin can lead to lipodystrophy so it might lead to… especially for ladies injecting around the abdominal area can lead to multiple patches, hyperpigmentation but patches basically so it might decrease their self-esteem.*" **IDI 005**

(see appendix 9 and 10 for matrix coding and codebook respectively)

The results from the key infoemant interviews generally indicated that clinicians felt that insulin was important in the management of T2DM but were still unwilling to prescribe it for routine use due to the factors illustrated above.

CHAPTER FIVE

5.0 DISCUSSION

The following chapter discusses study results as reported in chapter five.

Looking at patient demographic characteristics, it was found that the average age of patients attending the MTRH DOPC was 59 years with majority being female (54.9%). This was in keeping with other studies on clinical inertia to insulin therapy which showed similar gender distributions. A study on clinical inertia conducted in the UK in 2013 showed that 56% of the study participants were female with an average patient age of 66.5 years (Khunti et al., 2013). Additionally, a retrospective study by Alvarenga et al. (2017) conducted in Brazil revealed that 60% of the study participants were females, with an average patient age of 64 years. Findings contrasted with those from a retrospective observational study on clinical inertia in poorly controlled T2DM conducted in the United States which depicted 54.9% of the study participants were males, with an average patient age of 65.5 years (Romera et al., 2020).

The prevalence rate of clinical inertia in our population was high at 54% (95% CI: 49.38, 58.49), indicating overall poor glycemic control among patients with T2DM. These patients had HbA1C levels of 9% and above despite being on treatment and regular follow up at the DOPC. A prospective study by Romera et al. (2020) also depicted a high prevalence rate of clinical inertia at 77.8%. The HbA1c levels for these patients remained above 8% for a median of 1.2 to 1.6 years out of the three-year study period. Further, a study by Khunti et al. (2013) also showed a high prevalence rate of clinical inertia to insulin initiation at 46.4%, with HbA1c levels of the participants remaining above 7% despite consistent treatment with OHAs. Another prospective study done by Alvarenga showed a

clinical inertia prevalence of 78.5% at the initiation of the study, 56.2% at one year of follow-up, and 62.2% after two years. Inertia in this case was defined as patients having HbA1c levels above 8.5% (Alvarenga et al., 2018).

Our study revealed that clinical inertia was positively associated with single marital status and negatively associated with male gender. Single patients were found to be twice more likely to have clinical inertia than those who were married (OR 2.1 p 0.047) while male patients were found to be less likely to have clinical inertia than females (OR 0.65 p 0.04). Our study associations differed from those of Alvarenga, whose prospective study conducted in Brazil revealed that the male gender was positively associated with clinical inertia (OR 1.74; p 0.040) (Alvarenga et al., 2018). Findings also differed from those of a study done in Sudan to investigate clinical inertia and barriers to insulin injection, which depicted no significant statistical difference between gender and clinical inertia, with p 0.487 at a 95% confidence level (Mirghani, 2018). In our setup, it is possible that males were found less likely to have CI since our sample size was imbalanced in terms of gender with females representing 60% of the total sample size population.

Results from this study showed low levels of clinical depression with only 1.4% of patients having PHQ-9 scores of 10 or more. These findings were comparable with those from a study done in the United States by Li et al. (2008), which recorded age-adjusted prevalence rate of clinical depression of 8.3% (95% CI 7.3– 9.3) among patients with T2DM using the PHQ-9 tool, with the percentages ranging from only 2% in Connecticut to 28.8% in Alaska. On the contrary, a study done in Webuye County, Kenya depicted a significantly higher prevalence rate of clinical depression at 20.9% among T2DM patients as assessed using

the PHQ-2 tool which is used for screening rather than diagnosing depression. In addition, these patients were not assessed for clinical inertia (Kristen, 2015).

Bivariate and multivariate analysis done to explore for possible associations between CI and clinical depression found no statistically significant associations. These findings contrasted with those by Aujoulat et al. (2014) whose results revealed that clinical inertia was more common among patients with clinical depression (70% versus 51%; P = 0.02). In Aujoulat's study, clinical inertia was associated with the diagnosis of depression in both unadjusted and adjusted multilevel analyses (risk ratio [RR], 1.40; 95% CI, 1.11-1.74; P = 0.004; adjusted risk ratio [ARR], 1.49; 95% CI, 1.06-2.10; P = 0.02).

Results from our study revealed that T2DM patients receiving care at MTRH DOPC generally had positive attitudes towards the use of insulin, indicated by an average ITAS score of 22.39. These findings differed with results by Gulam et al. (2017), in a study conducted at KNH which showed high ITAS scores among patients with poor glycemic control, with 59% of patients scoring above 40 (Gulam, Otieno & Omondi Oyoo, 2017). These findings also differed from those of another study conducted in the United States that showed significantly higher average ITAS scores of 60.7 among patients with T2DM. This study went further to look for possible associations between ITAS scores and clinical inertia. However, on further analysis, these scores were found to have no significant associations with clinical inertia.

Results on diabetes self-care knowledge as assessed by the SKILLD questionnaire revealed only 38.5% of patients attained more than the average score of 50%. These findings compared with those from a study conducted in the United States which showed that 56%

of patients with T2DM had SKILLD scores of less than 50% (Rothman, 2005). However, findings contrasted with study findings by Omari et al., conducted in KNH in 2013, which showed generally good diabetes self-care knowledge with 77.2% of patients scoring above 50 (Omari, 2013). On bivariate and multivariate analysis, no significant associations were made between SKILLD scores and clinical inertia indicated by p values of more than 0.05. Further, according to findings in a study conducted in Iran, it was concluded that level of self-care among T2DM patients with controlled diabetes mellitus (HbA1C <7%) was more than patients with uncontrolled diabetes mellitus (HbA1c ≥9%) (Modaressi, 2020).

Results from the clinician key informant interviews revealed that clinicians believed that insulin played an important role in the management of T2DM and that its use should not be delayed. They believed that insulin therapy was important for the prevention of the long term complications of T2DM and its prescription was determined by the patients' therapeutic needs. These findings were supported those by Kelly et al. (2018), who in a focused discussion group with health care workers found that they believed insulin was important in the management of T2DM and considered it effective in management. In another study conducted in Arabia, qualitative data collected showed that the healthcare workers believed in the benefits of insulin therapy in T2DM management (Naila et al., 2013). In a study conducted in the United States, Ellis et al. (2018) depicted that healthcare workers believed that insulin therapy was important in optimizing glycemic control among diabetic patients. However, findings contrasted with a study conducted in UK which showed that clinicians felt insulin therapy should be delayed until absolutely necessary (Peryot et al., 2005).

In this study, clinicians believed that the decision to prescribe insulin was not an easy one to make. Its prescription was largely clinician dependent and was also significantly determined by the clinicians' therapeutic preferences. These findings were supported of those by Swinnen (2009), who found that making the best therapeutic choice for patients with T2DM was often a difficult task for clinicians.

The clinician interviews further went ahead to explore patient factors that influence their decision to prescribe insulin. Responses indicated that clinicians were very concerned about their patients' ability to administer insulin and felt that patients faced several challenges in the self-administration of insulin. Clinicians believed that fear of self-injection and poor injection technique were major issues and that patients should be given time to acclimatize to the use of insulin before actually starting therapy. Findings by Kelly et al. (2018) also reported that clinicians held back on prescribing insulin because they felt some patients could not bear the thought of having insulin injections every day for the rest of their lives. A study by Ross (2013) depicted patients' inability to adhere to complex insulin regimens would make them hold back on prescribing insulin.

Clinicians also pointed out that the elderly faced challenges in self-administration of insulin due to poor eyesight and that many of these elderly patients were unable to access consistent assistance while administering insulin at home. The findings by Tong et al. (2015) supported this view by pointing out clinicians' perceptions that older patients had difficulty achieving glycemic control due to age-related factors.

Patients' attitudes towards the use of insulin were also found to influence clinicians' decisions to begin insulin therapy. Responses indicated that clinicians felt patients were

unwilling to start on insulin unless they felt that they were very sick. Responses also deduced that clinicians felt that patients had a preference for OHAs as compared to insulin and that patients would first request for a trial on OHAs before they were willing to start on insulin. Other studies have also cited patient reluctance to be a major contributing factor in the decision to initiate insulin therapy. One such study is the study by Naila et al., 2013 conducted in Arabia, which showed that clinicians were hesitant to prescribe insulin due to perceived patient resistance as a result of psychological barriers. Similar findings were also reported in the 2018 study by Ellis et al., conducted in the United States (Ellis et al., 2018). Additionally, a study by Bonafede highlighted that clinician perceived insulin administration as being complex and this negatively influenced their decision to prescribe it (Bonafede et al., 2016).

This study showed that patients' non-adherence to insulin is a big concern for clinicians since they did not see the point of starting insulin for a patient who would not adhere to the treatment prescribed. Results were supported by those of Kelly et al. (2018) who found that healthcare practitioners reported their typical patient did not take their insulin as prescribed, and this negatively influenced their decision to prescribe insulin. The non-adherence factor in the initiation of insulin therapy was also supported by findings from the United States managed care study, which depicted that healthcare providers were more likely to intensify treatment or initiate insulin therapy in adherent than non-adherent patients (Triplitt, 2010). In contrast, a study by Bonafede et al. (2016) highlighted that patient treatment adherence did not influence physician's decisions to initiate insulin treatment or intensify therapy and suggested that better results could be achieved by simultaneously intensifying treatment or initiating insulin therapy while addressing the adherence concerns.

Clinicians' responses also revealed their concerns on the ability of patients to maintain insulin therapy, primarily because the felt that purchasing insulin would be more expensive for patients in comparison to OHAs. A study conducted in New Haven, USA among clinicians showed that participants admitted to cost-related underuse of insulin (Hekert, 2018). Responses also indicated that clinicians were concerned that patients did not have ideal insulin storage facilities at home and that this interfered with the efficacy of the drug. These findings were supported by those of Silva et al. (2019), which pointed out that most diabetic patients in East Africa did not have proper insulin storage facilities and that this negatively influenced the decision by physicians to prescribe it.

As regards the environmental factors influencing the prescription of insulin, interview responses indicated that lack of time, understaffing, unavailability of laboratory tests and medications all negatively influenced clinicians' decisions to prescribe insulin. They felt that they needed more time with individual patients to be able to communicate with them effectively before beginning insulin therapy. These findings were supported by those of Kelly et al. (2018), which showed that health care workers identified the importance of having adequate time to give professional advice to patients on their diabetes management. This was also supported by Okemah et al.'s (2018) findings that lack of time among healthcare practitioners predisposed them to use simple conventional medications at the expense of the patient's benefit from superior regimens. Lack of time and understaffing contributed to poor understanding of the patient's nature of disease, which could have augmented the reluctance to initiate insulin therapy or intensify antidiabetic treatment (Okemah et al., 2018). Ross (2013) noted that staff availability in the development of individual patient care plans and resource constraints limiting time for care could mean

less time for diabetes education and that improper care plans (including medicines use-related instructions) could lead to delay in insulin initiation and therapy intensification in the management of diabetes mellitus.

Clinicians also reported that they primarily prescribed OHAs because they were readily available in the hospital pharmacy as well as peripheral facilities as compared to insulin and that they did so for the convenience of the patient. This was supported by the study findings by Reach et al. (2017), which showed that work environment factors such as inadequacy of drugs and supportive technology, poor insurance cover and the inefficient data coordination, planning, and exchange among healthcare team members had a negative impact on insulin prescription. Besides, Ellis et al. (2018) noted that poor collaboration between primary and secondary care facilities and lack of essential resources negatively impacted the intensification of treatment and initiation of insulin therapy among diabetic patients.

For clinician factors influencing insulin prescription, results indicated that the fear of hypoglycemia associated with insulin use was a major concern to clinicians. Peyot et al. (2012), in a study conducted among health care workers, also identified hypoglycemia as a factor that made clinicians hold back on insulin prescription. Romera et al. (2020) also noted physicians' reluctance in the use of insulin due to the risk of hypoglycemia, alongside other reasons such as weight gain, lack of educational resources, and lack of proper training on self-injection. Ellis et al. (2018) also noted fear of hypoglycemia to be a major setback in insulin therapy initiation among clinicians.

Clinicians also reported that communication barriers also posed challenges when it came to prescribing insulin for patients. Dunning et al. (2017) also depicted the role of language at the core of social perception, attitude change, intergroup bias, personality identity, and stereotyping. The study showed that language barriers could lead to disparaging and negative attitudes, hence contributing to more stress among diabetic patients hence leading to poor health outcomes. Further, it elucidates the important role of communication in fostering diabetic patient engagement, treatment outcomes, the conceptualization of the disease and the management plan, and the patient's psychosocial well-being.

The interviews also revealed that clinicians felt that they needed to enhance their knowledge on T2DM management and that would boost their confidence in prescribing insulin. This was supported by the results of Kelly et al. (2018), which identified the need for consistent professional education on diabetes management among health care workers for better patient care. The results of Okemah et al. (2018), also elucidated healthcare professional's tendency to feel inadequate in knowledge to optimally manage type 2 diabetes mellitus owing to the ever-increasing array of treatment options for diabetes management. The study further found that busy healthcare providers had limited time to equip themselves with the newly emerging data on the currently available treatment options, which together with the lack of education, time, and unfamiliarity with the safety and efficacy of certain medications, resulted in such providers opting for conventional medications (such as sulfonylureas and metformin), while overlooking the new options such as newly developed more efficacious medications and combination agents (Okemah et al., 2018). The inadequacy of knowledge and skills that evidenced the need for consistent training on diabetic guidelines to boost clinicians' confidence in insulin administration was

also supported by several other studies. In their study, Peryot et al. (2005) noted knowledge deficiency among primary care providers to be a fundamental setback to insulin therapy initiation by clinicians, an aspect that was also elucidated by Ellis et al. (2018). An Arabian study also found inadequate experience with anti-diabetic treatment and concerns about risks to be key clinician related factors that negatively influenced insulin therapy initiation (Naila et al., 2013).

Clinicians believed insulin therapy negatively impacted patient quality of life in that it had a negative impact on patients' self-esteem due to associated physical side effects like weight gain, the stigma associated with its use as well as the financial burden of purchasing it. They believed that it was important to take these factors into consideration before starting a patient on insulin. This was consistent with findings by Najla (2013), who in a study assessing physicians' attitudes towards routine use of insulin therapy among patients deduced that physicians' reluctance to initiate insulin therapy was associated with patients' perception of insulin initiation as a personal failure and threat to the quality of life.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The prevalence of CI was high in MTRH. Single marital status increased the risk of CI while male gender was protective. Clinician factors were found to be the key drivers of CI.

6.2 Study Strengths

The current study harbors various desirable strengths. The study has established preliminary evidence on clinical inertia among patients with T2DM for future studies. Using a mixed-methods approach also gave a better and deeper understanding of clinical inertia and its associated factors from both patient and clinician perspectives.

6.3 Study Limitations

This was a cross sectional study. Conducting a follow-up study may have given a better picture of prevalence of clinical inertia in response to continued clinic care.

6.4 Recommendation

There is need for specific training for clinicians at the DOPC to address their negative attitudes towards insulin therapy with an aim of reducing CI. Prospective implementation research as a follow-up to this study will assess the effectiveness of various existing strategies targeted to reduce CI.

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APPENDICES

Appendix 1: IREC Approval

MU/MTRH-INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3
Reference: IREC/2018/336
Approval Number: 0003272

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET
14th March, 2019

Dr. Wairimu Mwaniki,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Dr. Mwaniki,

RE: FORMAL APPROVAL

The MU/MTRH- Institutional Research and Ethics Committee has reviewed your research proposal titled: -

"Clinical Inertia to Initiation of Insulin Therapy among Patients with Type Two Diabetes in Moi Teaching and Referral Hospital".

Your proposal has been granted a Formal Approval Number: *FAN: IREC 3272* on 14th March, 2019. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; hence will expire on 13th March, 2020. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date. You will be required to submit progress report(s) on application for continuation, at the end of the study and any other times as may be recommended by the Committee.

Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. You will also be required to seek further clearance from any other regulatory body/authority that may be appropriate and applicable to the conduct of this study.

Sincerely,

DR. S. NYABERA
DEPUTY-CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
1 4 MAR 2019
APPROVED
P. O. Box 4606-30100 ELDORET

cc	CEO	-	MTRH	Dean	-	SOP	Dean	-	SOM
	Principal	-	CHS	Dean	-	SON	Dean	-	SOD

Appendix 2: MTRH Approval

An ISO 9001:2015 Certified Hospital

MOI TEACHING AND REFERRAL HOSPITAL

Telephone :(+254)053-2033471/2/3/4
Mobile: 722-201277/0722-209795/0734-600461/0734-683361
Fax: 053-2061749
Email: ceo@mtrh.go.ke/directorsofficemtrh@gmail.com

Nandi Road
P.O. Box 3 – 30100
ELDORET, KENYA

Ref: ELD/MTRH/R&P/10/2/V.2/2010

18th March, 2019

Dr. Wairimu Mwaniki,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Clinical Inertia to Initiation of Insulin Therapy among Patients with Type Two Diabetes in Moi Teaching and Referral Hospital".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.
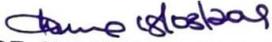
DR. WILSON K. ARUASA, *MBS*
CHIEF EXECUTIVE OFFICER
MOI TEACHING AND REFERRAL HOSPITAL

MOI TEACHING AND REFERRAL HOSPITAL
C E O
APPPOVED
1 8 MAR 2019
SIGN................................
P. O. Box 3 - 30100, ELDORET

cc - Senior Director, (CS)
    - Director of Nursing Services (DNS)
    - HOD, HRISM

All correspondence should be addressed to the Chief Executive Officer
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Appendix 3: Study Explanation

SECTION 1: Study Explanation for Patients (English)

My name is Dr. Wairimu Mwaniki. I am a postgraduate student in the Department of Internal Medicine, Moi University. I am conducting a study on clinical inertia to insulin therapy among patients with type 2 diabetes at the Moi Teaching and Referral Hospital.

What is the study about?

The study is aimed at identifying the prevalence of clinical inertia among patients with type 2 diabetes. The results will help the health care providers to tailor management of diabetic patients according to the patients' needs.

What does the study involve?

It involves answering questions from questionnaires and a blood test for hemoglobin A1C. You are free to accept or decline to participate in the study. If you accept, a small amount of blood will be drawn from your finger under hygienic precautions. Thereafter, a set of questions will be put forward to you. There is a minimal risk of bleeding associated with this procedure, mostly in persons with a known blood clotting problem. This blood will be used to measure the level of hemoglobin A1C in your blood which is a measure of the state of your blood sugar over the past 3 months.

Will I benefit from the study?

Yes. The results of the blood test will be recorded in your file and appropriate advice will be offered in consultation with your primary care provider. Answers provided in the questionnaire will not be disclosed to anybody. They will remain confidential and will be used solely for the purpose of the study. Your personal details such as names and contact details will be separated from the questionnaire.

Are there any dangers involved?

There are no dangers involved.

Can I withdraw from the study?

You are free to withdraw from the study and this shall not compromise your care in any way.

Thank you for your co – operation. In case you have questions related to this study, you can contact me: Dr. Wairimu Mwaniki, Tel. 0722 565954. Department of Internal Medicine, Moi University.

SECTION 2: Study Explanation (Kiswahili)

Jina langu ni Dkt. Wairimu Mwaniki. Mimi ni mwanafunzi wa masomo ya kiwango cha juu katika kitengo cha 'Internal Medicine', katika chuo kikuu cha Moi. Ninaendeleza utafiti wa kuchunguza mtazamo wa wagonjwa wanaougua na ugonjwa wa sukari kuhusu utumizi wa insulini na jinsi kiwango cha sukari kilivyo mwilini.

Je, utafiti huu una lengo gani?

Lengo la utafiti huu ni kubainisha mtazamo wa walio na ugonjwa wa sukari kuhusu utumizi wa insulini. Matokeo ya utafiti huu utawawezesha wahudumu wa afya kuelewa jinsi ya kumsaidia mgonjwa ili aweze kujichunga vyema zaidi.

Je, utafiti huu unahusisha nini?

Utafiti huu unahusisha kujibu maswali kadhaa pamoja na upimaji wa damu kuthibitisha kiwango

cha sukari kutumia kipimo cha hemoglobin A1C. Uko na uhuru wa kukubali au kukataa kushiriki katika utafiti huu. Ukikubali kushiriki utaulizwa maswali kadhaa na kiwango kidogo cha damu, kutolewa kutoka kidole chako kwa njia ya usafi unaostahili. Hakuna kipimo chengine chochote kitakachofanywa kwa damu hiyo.

Je,nitafaidika na utafiti huu?

Ndio. Utapata nasaha inayostahili kulingana na matokeo ya kipimo hicho na baada ya ushariano na mhudumu wako wa kila siku. Majibu utakayotoa kwa maswali utakayoulizwa yatabaki kuwa siri, hayatatobolewa kwa mtu yeyote na yatatumika kwa lengo la utafiti huu peke yake. Majibu yenye sifa ya ubinafsi kama majina na anwani yataekwa kando na majibu mengineo.

Je,kuna hatari inayohusika katika utafiti huu?

La. Hakuna hatari inayohusika.

Je,nitaruhusiwa kutoka katika utafiti huu?

Una uhuru wa kutoka kwenye utafiti huu na hakutaathiri kwa njia yeyote huduma unayopata kila

siku. Asante kwa ushirikiano wako. Kwa maelezo zaidi unaweza kuwasiliana nami kupitia nambari ya simu ifuatayo: Dkt. Wairimu Mwaniki Tel. 0722 565954. Department of Internal Medicine, Moi University.

SECTION 3: Study Explanation for Clinicians

My name is Dr. Wairimu Mwaniki. I am a postgraduate student in the Department of Internal Medicine, Moi University. I am conducting a study on clinical inertia to insulin therapy among patients with type 2 diabetes at the Moi Teaching and Referral Hospital.

What is the study about?

The study is aimed at identifying the prevalence of clinical inertia among patients with type 2 diabetes. The results will help the health care providers to tailor management of diabetic patients according to the patients' needs.

What does the study involve?

It involves you participating in a key informant interview and providing answers to open ended questions during the interview. You are free to accept or decline to participate in the study.

Will my responses remain confidential?

Answers provided during the interview will remain confidential and will be used solely for the purpose of the study. Your personal details such as names and contact details will kept separately.

Are there any dangers involved?

There are no dangers involved.

Can I withdraw from the study?

You are free to withdraw from the study and this shall not compromise your care in any way.

Thank you for your co – operation. In case you have questions related to this study, you can contact me: Dr. Wairimu Mwaniki, Tel. 0722 565954. Department of Internal Medicine, Moi University.

Appendix 4: Consent Form

SECTION 1: Patient Consent Form (English)

Study number: _____

Name: _____

Telephone number: _____

I, above named, consent to participate in the study on clinical inertia to insulin therapy among patients with type 2 diabetes. I do this with the full understanding of the purposes of the study and the procedures involved which include answering questions and a blood test for AIC (HbA1C applicable for patients only). The information provided shall be confidential. I have been explained to the implications of this study. I also understand that I can withdraw from the study any time without my care being compromised. Having agreed on the above I voluntarily agree to participate in this study.

Signature/ Thumbprint of participant_____ Date_____

Signature of witness _____ Date _____

SECTION 2: Patient Consent Form (Kiswahili)

Nambari ya utafiti: _____

Jina: _____

Nambari ya simu: _____

Mimi, niliyetajwa hapo juu naridhia (nakubali) kushiriki katika utafiti wa kuchunguza mtazamo wa wagonjwa wanaougua na ugonjwa wa sukari kuhusu utumizi wa insulini na jinsi kiwango cha sukari kilivyo mwilini.

Nakubali kushiriki nikifahamu malengo na taratibu za utafiti huu ikiwemo kujibu maswali na kipimo cha damu cha A1C (Kipimo cha damu cha A1C ni kwa wagonjwa pekee). Nimeelezwa lengo la utafiti huu na hautanidhuru. Taarifa itakayotolewa itakuwa siri. Ninafahamu ya kwamba naweza kujiondoa kutoka utafiti huu wakati wowote bila kuathiri huduma ninazopata. Baada ya kuelezwa haya yote,ninakubali kwa hiari yangu kushiriki katika huu utafiti.

Sahihi au kidole cha mshiriki _____   Tarehe _____

Sahihi ya shahidi _____

Tarehe_____

SECTION 3: Clinician Consent Form (English)

Study number: _____

Name: _____

Telephone number: _____

I, above named, consent to participate in the study on clinical inertia to insulin therapy among patients with type 2 diabetes. I do this with the full understanding of the purposes of the study and the procedures involved which include answering certain questions. The information provided shall be confidential. I have been explained to the implications of this study. I also understand that I can withdraw from the study at my discretion. Having agreed on the above I voluntarily agree to participate in this study.

Signature of participant_____ Date_____

Signature of witness _____ Date _____

Appendix 5: The Patient Questionnaire

SECTION 1

1. Hospital Number (Nambari ya hospitali) _____

2. Interview language (Lugha ya mahojiano) _____

3. Telephone number where possible (Nambari ya simu ikiwezekana)

_____

SECTION 2: DEMOGRAPHIC CHARACTERISTICS

1. What is your gender? Male ☐   Female   ☐

2. What is your date of birth? ___/____/_____

(siku ya kuzaliwa) Day Month Year

3. What is the highest level of education you received? (kiwango cha juu zaidi cha

masomo

ulichofika ni kipi?)

None at all (hakuna) …………………………………………………

Primary School (shule ya msingi) ………………………………

High School (shule ya upili)

College (chuo kikuu)

4. What is your marital status?

Single ☐   Separated ☐

Married ☐   Divorced ☐

Living as Married ☐   Widowed ☐

5. What is your total combined family income for the past 12 months, before taxes, from

all sources, wages, public assistance/benefits, help from relatives, alimony, and so on?

If you don't know your exact income, please estimate.

(Kiasi cha pesa ambacho mnapata nyumbani kama familia kwa jumla kabla ya kutozwa

ushuru

ni ngapi? Jumuisha fedha kutoka mshahara,usaidizi wa jamaa na menginezo. Kama

haujui kwa

hakika waweza kusema makadirio)

(Pick one option/ chagua jibu moja)

a. Less than (chini ya) ksh5,000 ……………………………………………………

b. Ksh. 5,000 -

Ksh19,999……………………………………………………………..

c. Ksh. 20,000 – Ksh.

49,999…………………………………………………………….

d. Ksh. 50,000 – Ksh.

99,999…………………………………………………………….

e. Ksh. 100,000 – Ksh.

149,999…………………………………………………………

f. More than (zaidi ya) Ksh. 150,000

…………………………………………………………

g. Don't know (sifahamu)……………………………………………………………

h. Chose not to answer

(sitajibu)…………………………………………………………

6. Are you currently using any health insurance cover? (unatumia bima yoyote kulipia

matibabu yako?)

Yes ☐   No   ☐

SECTION 3: DISEASE AND TREATMENT CHARACTERISTICS

Height in meters_____

Weight in kilograms_____

Body Mass Index (BMI)_____

HBAIC_____

How many years has it been since you were diagnosed to have diabetes? (Umekuwa na ugonjwa wa kisukari kwa miaka ngapi?)

Less than 5 years (Chini ya miaka 5)	5-10 years (Miaka 5-10)	>10 years (Zaidi ya miaka 10)

2. For how many years have you been using oral diabetes medications? (Umekuwa ukitumia tembe za ugonjwa wa sukari kwa muda gani?)

Less than 5 years (Chini ya miaka 5)	5-10 years (Miaka 5-10)	>10 years (Zaidi ya miaka 10)

Appendix 6: Insulin Treatment Appraisal (ITAS) scale (English)

Insulin Treatment Appraisal Scale (ITAS)

The following questions are about your perception of taking insulin for your diabetes. If you have not yet initiated insulin therapy, please answer each question from your current knowledge and thoughts about what insulin therapy would be like. Please indicate to what extent you agree or disagree with each of the following statements. Tick one box for each statement that best describes your own opinion.

	strongly disagree	disagree	agree nor disagree	agree	strongly agree
1. Taking insulin means I have failed to manage my diabetes with diet and tablets.	☐	☐	☐	☐	☐
2. Taking insulin means my diabetes has become much worse.	☐	☐	☐	☐	☐
3. Taking insulin helps to prevent complications of diabetes.	☐	☐	☐	☐	☐
4. Taking insulin means other people see me as a sicker person.	☐	☐	☐	☐	☐
5. Taking insulin makes life less flexible.	☐	☐	☐	☐	☐
6. I'm afraid of injecting myself with a needle.	☐	☐	☐	☐	☐
7. Taking insulin increases the risk of low blood glucose levels (hypoglycaemia).	☐	☐	☐	☐	☐
8. Taking insulin helps to improve my health.	☐	☐	☐	☐	☐
9. Insulin causes weight gain.	☐	☐	☐	☐	☐
10. Managing insulin injections takes a lot of time and energy.	☐	☐	☐	☐	☐
11. Taking insulin means I have to give up activities I enjoy.	☐	☐	☐	☐	☐
12. Taking insulin means my health will deteriorate.	☐	☐	☐	☐	☐
13. Injecting insulin is embarrassing.	☐	☐	☐	☐	☐
14. Injecting insulin is painful.	☐	☐	☐	☐	☐
15. It is difficult to inject the right amount of insulin correctly at the right time every day.	☐	☐	☐	☐	☐
16. Taking insulin makes it more difficult to fulfil my responsibilities (at work, at home).	☐	☐	☐	☐	☐
17. Taking insulin helps to maintain good control of blood glucose.	☐	☐	☐	☐	☐
18. Being on insulin causes family and friends to be more concerned about me.	☐	☐	☐	☐	☐
19. Taking insulin helps to improve my energy level.	☐	☐	☐	☐	☐
20. Taking insulin makes me more dependent on my doctor.	☐	☐	☐	☐	☐

Highlighted statements represent the positive attitudes

Appendix 7: SECTION 2: Insulin Treatment Appraisal (ITAS) tool (Kiswahili)

	Nakataa Kabisa	Nakataa	Sikubali na sikatai	Nakubali	Nakubali Kabisa
1. Kuchukua insulin inamaanisha sijafaulu kuchunga ugonjwa wangu wa kisukari kwa chakula na tembe	☐	☐	☐	☐	☐
2. Kuchukua insulin inamaaninisha ugonjwa wangu wa kisukari umekuwa mbaya zaidi.	☐	☐	☐	☐	☐
3. Kuchukuwa insulin inasaidia kukinga maafa ya ugonjwa wa kisukari.	☐	☐	☐	☐	☐
4. Kuchukua insulin inamaanisha watu wengine wananiona mimi kama mtu mgonjwa zaidi.	☐	☐	☐	☐	☐
5. Kuchukua insulin inafanya maisha kuwa magumu zaidi.	☐	☐	☐	☐	☐
6. Naogopa kujidunga mwenyewe na sindano.	☐	☐	☐	☐	☐
7. Kuchukua insulin inaongeza hatari ya kushuka kwa kiwango cha sukari mwilini.	☐	☐	☐	☐	☐
8. Kuchukua insulin inasaidia kuboresha afya yangu.	☐	☐	☐	☐	☐
9. Insulin inasababisha kuongezeka kwa kilo.	☐	☐	☐	☐	☐

10. Kumudu sindano ya insulin inachukua	☐	☐	☐	☐	☐

wakati na nguvu nyingi.

11. Kuchukua insulin inamaanisha lazima niwache	☐	☐	☐	☐	☐

shughuli ninazozifurahia.

12. Kuchukua insulin inamaanisha afya yangu itazorota.	☐	☐	☐	☐	☐
13. Kudunga insulin ni jambo la kuaibisha.	☐	☐	☐	☐	☐
14. Kudunga insulin ni uchungu.	☐	☐	☐	☐	☐
15. Ni vigumu kudunga kiwango kinachotakikana cha	☐	☐	☐	☐	☐

insulin kisawasawa kwa wakati unaofaa kila siku.

16. Kuchukua insulin inafanya kuwa vigumu zaidi	☐	☐	☐	☐	☐

kutekeleza wajibu wangu (kazini, nyumbani).

17. Kuchukua insulin inasaidia kusawazisha kiwango	☐	☐	☐	☐	☐

cha sukari vizuri.

18. Kuwa kwa insulin inasababisha familia na marafiki	☐	☐	☐	☐	☐

kuwa na wasiwasi zaidi kunihusu mimi.

19. Kuchukua insulin inasaidia kuimarisha kiwango changu cha nguvu.	☐	☐	☐	☐	☐
20. Kuchukua insulin inanifanya mimi kutegemea zaidi	☐	☐	☐	☐	☐

daktari wangu.

Appendix 8: Spoken Knowledge in Low-Literacy Diabetes (SKILLD) tool

(English/Kiswahili)

1. What are the signs and symptoms of High Sugar?

How do you feel when your blood sugar is high or when you were diagnosed?

Unahisi vipi wakati kiwango cha sukari mwilini kiko juu,ulikuwa unahisi vipi ulipopatikana kuwa na ugonjwa

wa sukari?

Needs at least 2.

Extreme thirst, frequent urination, drinking or eating, blurred vision and or drowsiness, fatigue.

2. What are the signs and symptoms of low sugar?

How do you feel when your blood sugar is too low?

Unahisi vipi wakati kiwango cha sukari mwilini kiko chini sana?

Needs at least 2.

Hunger, nervousness, jitteriness, mood swings, irritability, confusion, sweaty, fast heart rate.

3. How do you treat low blood sugar? What should you do if your sugar is too low? How can you bring your sugar up if it's too low?

Ni nini unapaswa kufanya nini wakati kiwango cha sukari mwilini kiko chini ili kipande?

Accept very general answer; juice, milk, hard candy, 15 g of carbohydrates.

4. How often should a person with diabetes check his or her feet?

Mtu anayeugua ugonjwa wa sukari anapaswa kuichunguza miguu yake mara ngapi? Mara moja kwa siku, mara moja kwa wiki au mara moja kwa mwezi?

Once a day,once a week or once a month?

Accept daily.

5. Why are feet exams important in someone with diabetes? Why is it important to look at your feet? What are you looking for? Ni kwa nini kuichunguza miguu ni muhimu kwa anayeugua

ugonjwa wa sukari? Mtu huwa anatafuta nini?

Accept very general answer; prevention of morbidity due to neuropathic/immunological consequences of diabetes.

6. How often should you see your eye doctor and why is this important?

 Ni mara ngapi unafaa kumwona daktari wa macho, umuhimu wa kufanya hivyo ni nini?

How often? Why?

Accept; seen at least yearly AND screen/manage retinopathy, glaucoma, blindness.

7. What is a normal fasting blood glucose or blood sugar? When you wake up in the morning and check your sugar before you eat or take medicine, what should it be? What 2 numbers?

Unapoamka asubuhi na kupima sukari kabla ya kula au kumeza dawa, huwa kiwango cha sukari

chafaa kuwa vipi?

Accepted range; 70 to 120 mg/dl or 3.8 to 6.6 mmoles/l.

8. What is a normal HbA1c (haemoglobin A1C) or average blood sugar test?

When they draw blood from your arm and get an average blood sugar reading, what should it be?

Unapotolewa damu mkononi na kupimwa ili kupata kiwango cha sukari kwa muda wa takriban

miezi mitatu ,chafaa kuwa kiwango kipi?

Accept either normal<6 % or target < 7%.

9. How many times per week should someone with diabetes exercise and for how long? How many times a week? How long or how much per day?

Mtu anayeugua ugonjwa wa sukari anapaswa kufanya mazoezi mara ngapi kwa wiki? kwa muda

upi kwa siku?

Accept within 3 -5 times a week for a total of 30 – 45 minutes each. Must include frequency.

10. What are some of the long-term complications of uncontrolled diabetes? Do you know anyone that has diabetes and had bad things happen to them/ what are some of those bad things?

Ni shida zipi za kiafya zinazompata mtu anayeugua ugonjwa wa sukari kwa muda mrefu?

Needs at least 2. Accept blindness/impaired vision, kidney disease/dialysis, amputation, neuropathy, impotence,gastroparesis, cardiovascular disease.

Appendix 9: Section 1: PHQ-9 (English)

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? (Use "✔" to indicate your answer)	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING ___0___ + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Appendix 10: SECTION 2: PHQ-9 (Kiswahili)

KIDODOSI JUU YA AFYA YA MGONJWA -9 (PHQ-9)

Katika kipindi cha <u>wiki mbili zilizopita</u> ni mara ngapi umesumbuliwa na matatizo haya yafuatayo? *(Tumia "✔" ili kuashiria jibu lako)*	Haijatoke zea kabisa	Siku kadhaa	Zaidi ya nusu ya siku hizo	Takriban kila siku
1. Kutokuwa na hamu au raha ya kufanya kitu	0	1	2	3
2. Kujisikia tabu sana au kukata tamaa	0	1	2	3
3. Matatizo ya kupata usingizi au kuweza kulala au kulala sana	0	1	2	3
4. Kujisikia kuchoka au kutokuwa na nguvu	0	1	2	3
5. Kutokuwa na hamu ya kula au kula sana	0	1	2	3
6. Kujisikia vibaya-au kujiona kuwa umeshindwa kabisa au umejiangusha au kuikatisha tama familia yako	0	1	2	3
7. Matatizo ya kuwa makini kwa mfano unaposoma gazeti au kuangalia TV	0	1	2	3
8. Kutembea au kuongea taratibu sana mpaka watu wakawa wameona tofauti? Au kinyume chake kwamba hutulizani na unahangaika sana kuliko ilivyo kawaida	0	1	2	3
9. Mawazo kuwa ni afadhali zaidi ufe au ujidhuru kwa namna fulani	0	1	2	3

Appendix 11: Clinician Question Guide

1. What is your opinion on insulin therapy in the management of type 2 diabetes? Expound. Probe: Is it necessary?

2. What are some of the factors related directly to patients that influence your decision to prescribe/not to prescribe insulin therapy to patients with type 2 diabetes? Probes: risk of hypoglycemia, patient's financial capability to purchase insulin, patient's attitude towards insulin therapy, risk of patient's non-compliance to insulin therapy, presence of other co-morbid conditions.

3. How do work environment factors influence your decision to or not to prescribe/recommend insulin therapy for patients with type 2 diabetes? Probes: time, staffing.

4. What are some of the factors directly affecting you as a clinician that influence your decision to prescribe insulin therapy to patients with type 2 diabetes? Probes: level of training on diabetes care, quality of communication with patients.

5. How do you think use of insulin affects patients' quality of life? Expound. Probe: what is its impact?

Appendix 12: Procedure on Collection of HbA1C Samples

The DCA Vantage™ point analyzer is a point of care immununoassay analyzer that is routinely used to measure HbA1C levels in whole blood. It measures HbA1C levels ranging between 2.5% to 14% (4mmol/mol to 130 mmol/mol) (DCA Vantage HgbA1C Procedure, page 2).

The DCA Vantage™ system consists of 4 functional areas:

1. Reagent cartridge compartment: Test is performed once

cartridge is inserted.

2. Onboard barcode scanner: Used to calibrate the system and

 scan reagent and control cartridges.

3. Display screen: An integrated touch screen.

4. Printer: Internal thermal printer for test results

Below are the steps followed when using the DCA Vantage point analyzer to measure HbA1C levels in peripheral blood:

    i.   **Callibration**

"Before using a new lot of reagent cartridges, scan the calibration card into the analyzer. The values for the calibration parameters are encoded onto the calibration card provided with each lot of reagent cartridges. The reagent cartridge barcode (containing lot number and test name) is scanned before samples are analyzed. This accesses the appropriate calibration parameter values (calibration curve) for the particular lot number of reagent

cartridges in use. If no calibration curve is in the instrument for the particular lot number

of cartridges in use, the instrument prompts the user to scan the calibration card.

The instrument can store two calibrations for the DCA HbA1c Assay. Each of the two

calibrations is for a different lot number.

1. Locate the dot on the instrument next to the barcode track.

2. Hold the card so that the barcode faces to the right. Insert the Calibration card into the

top of the

barcode track above the dot.

3. Hold the Calibration card gently against the right side of the track and smoothly slide

the card down. A

beep sounds to signal a successful scan." (DCA Vantage ™ Analyzer, 2011-4).

ii.   Sample Collection

"Clean the collection site with alcohol and allow it to dry. Thereafter, perform finger stick

and with the capillary holder at an angle, touch only the tip of the capillary to a small drop

of blood on the finger until the capillary fills. Use lint free tissue to wipe the outside of the

glass capillary. Analysis must begin within 5 minutes after filling the glass capillary." (

DCA Vantage ™ Analyzer, 2011-6).

iii.   Test procedure

"Ensure that the system is in the Home screen, which displays the status of the system and

is the starting point for Patient and Control Test Sequences. Insert the capillary holder

containing the sample into the reagent cartridge until the holder snaps into place. The open

side of the capillary holder should face the foil pull tab. To scan the Reagent Cartridge,

hold the reagent cartridge so that the barcode faces to the right. Insert the reagent cartridge above the "dot" located on the side of the instrument barcode track. Quickly and smoothly, slide the reagent cartridge down. A beep sounds to signal a successful scan. With the barcode facing to the right, insert the reagent cartridge into the cartridge compartment until a gentle a snap is heard or felt. Using a slow, continuous motion, pull the flexible pull-tab completely out of the reagent cartridge and discard. Close the door. Five seconds after the door is closed, a beep sounds and the assay begins. The Result screen displays when the system finishes analyzing the sample. Press the "print" button on the screen to print results. Remove the Reagent Cartridge. Open the cartridge compartment door. Locate the button on the right side of the cartridge compartment. Push and hold it down with your right hand. With your left hand, gently push the tab on the cartridge to the right to release the cartridge. Thereafter, discard in biohazard container." (DCA Vantage ™ Analyzer, 2011-8).

Appendix 13: Clinician Interview Matrix coding

Themes/Sub themes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	N
1. Opinion on insulin therapy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**15**
Important in management of type two diabetes	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Depended on patient needs							X						X		X	3
Important in managing persistent hyperglycemia					X	X										2
Physician dependent				X										X		2
Prevent long term complications		X									X	X				3
2. Patient related factors to/not prescribe insulin therapy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**15**
Difficulty in administering injection					X	X	X	X	X				X			6
Fear of the injection needles						X			X							2
Old age and poor eye sight					X			X				X				3
Poor technique of injection						X										1
Patient's attitude towards insulin therapy	X	X	X		X	X	X		X	X				X		8
Non adherence to therapy		X		X	X					X						4
Unwillingness to start insulin therapy			X						X	X						3
Patient preferences for oral medicine							X		X							2
Patient's financial capability to maintain insulin therapy	X	X	X	X	X		X		X							7
Ability to store insulin at home				X				X								2
Affordability		X	X	X	X		X		X		X					6
Patient clinical status	X			X		X		X							X	5
3. Work environment factors to/not prescribe insulin therapy	X	X	X	X	X			X	X	X	X	X	X	X	X	**13**
Medicine availability				X				X						X		3
Understaffing						X					x		X	X		4
Test availability	X							X					X		X	3
Time		X		X								X				3
4. Clinician factors to/not prescribe insulin therapy	X		X	X	X	X	X		X	X	X	X	X	X	X	**13**
Fear of complications						X	X						X			3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Quality of communication with patients			X	X										X	X	4
Training on diabetes care	X		X		X		X		X	X	X					8
5. Effects of insulin on patients' quality of life			**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**12**
Improves quality of life			X		X			X			X		X	X		6
Reduces complications								X			X		X	X		4
Lowers quality of life				X		X	X		X	X		X				6
Negative financial impact					X			X								2
Negative psychological impact						X	X	X	X	X		X				6
Stigma						X	X		X	X						4
Low self esteem				X		X										2

Key

ID	Name
1	001
2	002
3	003
4	004
5	005
6	006
7	007
8	008
9	009
10	101
11	011
12	012
13	013
14	014
15	015

Appendix 14: Clinician Interview Codebook

1. Opinion on insulin therapy		15
Important in management of type II diabetes	*Okay from what I know, is that I know most patients with type two diabetes at some point will eventually require insulin. So it is an important part of the management, something that we should consider in patients with type two diabetes at some point.* **IDI_007**	2
	I think insulin has a big role in management of type two diabetes and as such, clinicians should not delay, you know, the initiation of insulin in type two diabetes. **IDI_001**	
Important in conditions of hyperglycaemia	*Yea it is necessary especially when you are given oral hypoglycaemics and you are not achieving your sugar control, and when other comorbidities are setting in like renal dysfunction, insulin is necessary.* **IDI_005**	2
	My opinion regarding use of insulin in management of type two diabetes is that it is necessary, especially considering that in some cases, there is a lot of, well, sugars may not be controlled using oral formulations or other medications, so in this case insulin needs to be initiated to achieve optimal control of blood sugars, so it is necessary to use and I am for the opinion of using insulin in type two diabetics. **IDI_006**	
Depended on patient needs	*I think my opinion would be based on whether or not the patient needs it at the point of initiation, but generally for as long as the patient needs it, I have no bias against*	3

	insulin therapy compared to oral hypoglycaemics. **IDI_008** *I think it's a very important part of diabetes care especially when oral medications are not offering good control the patient may need insulin* **IDI_013** *It's important based on the status of the patient. Not every patient requires insulin* **IDI_015**	
Important in managing persistent hyperglycemia	*Yea it is necessary especially when you are given oral hypoglycaemics and you are not achieving your sugar control, and when other comorbidities are setting in like renal dysfunction, insulin is necessary.* **IDI_005** *"..in some cases, there is a lot of well, sugars may not be controlled using oral formulations or other medications so in this case insulin needs to be initiated to achieve optimal blood sugars"* **IDI_006**	1
Physician dependent	*okay in my opinion, I feel it is relevant but then most of it I feel it is physician dependent, there are people who would feel they would dwell only on orals, others feel they need to add insulin as part of treatment so maybe it's something that I can't really confidently say am okay with, maybe unless we get clarity on why some people do, some people don't.* **IDI_004** *"Insulin plays a major role in glycemic control. We unfortunately don't prescribe it enough here"* **IDI_014**	2
Prevent long term complications	*"It is very necessary so that you can prevent the long-term complications"* **IDI_002**	3

	"It is a key part of the management guidelines depending on the patients' glycemic status so I believe it's important especially to prevent disease complications" **IDI_011** *"I think insulin is key particularly in emergencies like very high sugars which usually cause other complications, you know."* **IDI_012**	
2. **Patient related factors for prescribe or not to prescribe insulin therapy**		
Difficulty in administering injection		6
Fear of the injection needles	*"Okay, especially when you get young patients, especially teenagers, they are really quite difficult to maintain them on insulin because one, they say that the injections are quite painful, secondly they are not adherent to their diets, they just want to eat anything they feel like eating, then fourthly about a teenage who is being rebellious, that is also another factor, so young patients is quite difficult"* **IDI_005**	2

	"Then also I think most patients are afraid of giving themselves the insulin injections, so having like a period to prepare themselves before they start the insulin therapy is an important consideration as well". **IDI_009**	
Old age/poor eyesight	*"..also for elderly people, especially when it comes to measuring the insulin, they cannot be able to see properly because of their poor eye sight"* **IDI 005** *"We have elderly patients who are not able to self-administer, they have virtually no caretaker support.so usually, will make me hesitant on initiating insulin coz we are not sure that insulin will be administered correctly."* **IDI 007** *"Most of these patients are old. They can't manage with insulin especially if they live alone"* **IDI_012**	3
Poor patient self-injection technique	*Others include poor technique in terms of the patient knowing how to inject insulin on themselves. So a lot of reassurance and a lot of discussion with the patients on trying to find ways of helping them, making sure that they optimally use insulin with the proper techniques, proper dosages and all is really key.* **IDI_006**	1
Patient's attitude towards insulin therapy		7
Unwillingness to start insulin therapy	*"I think for me, I would put the first one as patient's attitude towards insulin therapy because if they are not willing to start insulin therapy the compliance wrong*	2

	and they won't be able to really control the sugars" **IDI_003** *"Oh, for me I think there is the stigma of using insulin. So most clients don't prefer it unless they are so sick and need it"***IDI_010**	
Non-adherence to therapy	*"I would first educate them and teach them on the management of signs and symptoms of hypoglycaemia and then what causes hypoglycaemia and show them the risk of when they are using oral hypoglycaemic reagents and the benefits of using insulin, so the key role is the patient to have full education on how to prevent long-term complications. So it will not hinder me from starting insulin"* **IDI _002** *"..but most importantly is compliance and also ability to purchase insulin"* **IDI_004** "*secondly, they are not adherent to their diets, they just want to eat anything they feel like eating, then fourthly about a teenage who is being rebellious, that is also another factor, so young patients are quite difficult"* **IDI_005** *"Yes because it is hard to prescribe if client is not comfortable because of compliance issues, you know?"* **IDI_010**	4

Patient preferences for oral medicine	*"So most of the times it is usually hesitance from the patients themselves, most patients are not willing to shift of course to injections, most patients will usually prefer oral medications."* **IDI_007** *"I think the acceptability for patients is like the key component, most of the times the patients themselves would request to have a trial of oral agents before transitioning to insulin therapy, I think it is sometimes felt as a failure like if especially for one reason or the other they had not been compliant to the oral hypoglycaemic agents, even though compliance might have not affected how well controlled they are like if they have such high insulin requirements and they do need additional insulin, I think the transition from oral hypoglycaemic agents to insulin therapy is considered like a failure of sort on the patient's side."* **IDI _009**	2
Patient's financial capability to maintain insulin therapy		7
Affordability of purchasing insulin	*"The other thing about starting insulin is cost effective than oral hypoglycemics"* **IDI_002** *"Second is maybe the financial capability, if they are not able to afford it also affects compliance"* **IDI_003** *"I think more will be compliance and also ability to purchase. So maybe if there are other options that can be explored in terms of treatment, as opposed to just starting something that you know would not be consistent, that would be really beneficial."* **IDI_004**	7

	"Okay one, financial aspect of the patient, if a patient cannot really afford insulin, that would affect my decision to prescribe for them insulin, that is the only thing that I can be able to mention for now." **IDI_005** *"On the contrary, I think sometimes insulin tends to be cheaper than other drugs, especially the new medications like SGLT2s and so on, so sometimes we might actually consider insulin for patients who are not able to afford the newer drugs, which if they were to use those drugs they are not able to afford, so also sometimes tend to convince patients to use insulin because sometimes it is more affordable to them."* **IDI_007** *"Then also the cost, insulin therapy is significantly more expensive than oral hypoglycemic agents"* **IDI_009** *"For me cost is a big deal. Insulin like lantus us expensive. Medicines like metformin are pretty affordable so that would influence my decision."* **IDI_011**	
Ability to store insulin	*" If they don't have a way of storing the insulin, yeah, that one is like one of those long reasons on why we wouldn't start insulin on such patients."* **IDI_005** *"The environmental conditions that they live in, are they able to store that insulin in a way that they preserve it, effectiveness as far as drug preparation, yeah, those are some of the factors, so mainly whether they understand how to use it, whether they are able to store it correctly*	2

	but paramount is whether or not they need it at that point as opposed to oral drugs." **IDI_008**	
Patient clinical status	*"With comorbid conditions, that is enough to start insulin for instance most of the oral glucose lowering agents are contraindicated in for instance chronic kidney disease , so that will make me start insulin as early as possible because insulin, the chances of having optimal glucose control with insulin are higher than on oral glucose lowering agents"* **IDI_001** *"Okay, so the first part of the question, for me to prescribe insulin it will depend on the clinical status of the patient. Number one, the sugar control, what is the HBA1C levels? What is the fasting blood sugar? What is the random blood sugar? What is the sugar chart, how it has been, if the sugars have been uncontrolled am going to start the insulin, despite them being on oral hypoglycemics"* **IDI_005** "*It also depends on the conditions of the patients coz I think in some cases, for example if a patient has type two diabetes and also needs some surgical interventions or they are in acute stage, they may need to have insulin used which will help in achieving optimal sugar management, so in such cases patients may need to use insulin as a way of controlling sugars."* **IDI_006** *"I think first of all, like I have said, if it is a patient who has been on management and this is like type two diabetics, if they require the therapy based on the fact that maybe we scaled up on oral hypoglycemic agents as*	5

	far as dosage, as far as add on drugs and they are not responding, then I think that patient would be a candidate for insulin therapy.” **IDI _008** *“I think it depends on their sugar control and HbA1C. High levels above 10 would make me prescribe insulin.”* **IDI_015**	
3. Work environment factors influencing prescription of insulin therapy		
Medicine availability	*“I would say what influences my decision is the availability of the insulin at where I am because some patients prefer getting their medication from the facility as opposed to buying them outside, they feel it’s cheaper from government institutions so I think I would put that first and then of course other things like time and also staffing, yes but not quite, not as serious as the other one.”* **IDI _004** *“Think maybe the availability and the cost of the drug may be the one I can think of because sometimes as much as the drug is available, the subsidization of the cost is not as much, I know some people have to go to the county hospital to get the drug at subsidized cost, so maybe that’s the one I can pick up on.”* **IDI _009** *Most of the newer formulations of insulin are not available here so that gives me limited choices when prescribing insulin* **IDI_014**	3

| Understaffing | "*staffing would influence because insulin, majorly it causes hypoglycaemia ,so we need to monitor the sugars of these patients, so staffing can influence my decision on if I want to start.*" **IDI_005**

 "*It is difficult because we have so many patients and doctors are few. Insulin is a sensitive medication. If we had more doctors maybe we would use it more*" **IDI_010**

 "*Staffing is an issue. As you can see we have so many patients. Many times we just continue with the drugs they have been using. I know it's not the best but what can we do*" **IDI_012**

 "*Also as you can see, I'm the only constant here so staffing is a challenge too*" **IDI_014** | 4 |
| Availability of laboratory test | "*I think we are lucky because we can check glucose, you know, the three month average glucose HP1C to inform us on the level of, you know, glucose control, so by HB1C information we are able to start on insulin or to escalate on the oral glucose lowering agents, again we are able to check for presence of comorbidities, so if the patient is at higher risk of developing complications then we rather switch to insulin so that we attain or aim at achieving optimal glucose control to delay or stop progression of complications in diabetes.*" **IDI_001**

 "*Availability of the laboratories as well for any test we would want to carry out to determine whether or not the patient is doing well on the insulin like HB1Cs and random blood sugars, etcetera. So I think generally the*" | 4 |

	environment is supportive of you know, that ability to prescribe". **IDI_008** *"We are lucky here coz we have a good lab and measuring sugars, even HbA1C is possible. HbA1C will determine if we need insulin."* **IDI_013** *"I think the work environment is good. Coz we are able to monitor sugars well."* **IDI_015**	
Time	*"I wouldn't say time a factor, I put the patient first, I better strain and see that patient does not develop long-term complications."* **IDI_002** *"As a clinician, I would say factors that affect me personally would be adequacy in terms of time, maybe being able to, okay I may have the knowledge or even the training but then having enough time to actually communicate with patients, because sometimes you get overcrowded maybe you have to see like thirty patients and you are the only one so you don't get enough time to… that communication is not really… it's not productive, so I would say that, yeah."* **IDI _004** *"For me I guess the main issue is the files. We should have save on time"* **IDI_011**	3
4. **Clinician factors influencing prescription of insulin therapy**		

| Fear of complications/Side effects | *"One of the factors is the fear of possible complications that may arise from use of insulin. One of the key fears being hypoglycaemia that is something that most people are afraid of, considering also hypoglycaemia has really devastating effects, well, worst case being mortalities."* **IDI_006**

 "Okay so, I'll call it more of a challenge from other health workers especially supporting staff like nurses and so. I think there is a lot of clinician or rather from health care workers hesitance to use insulin. Most people are afraid to administer insulin especially normal blood glucose levels, and it is notable that most, especially nurses feel that it is easier to administer insulin when patients have hyperglycaemia as opposed to normal glycemia. So other things that will cause me to withhold on insulin would be side effects of it, especially hypoglycaemic episodes for people who are elderly, and I think another major thing is home support or caretaker support for patients" **IDI_007**

 "For me, hypoglycemia is a concern especially on clinic days. Patients tend to fast in order to have good sugars when we see them!" **IDI_013** | 3 |
| Quality of communication with patients | *"but in terms of communication, yes that one is okay, but personally especially if I have a queue outside, the communication with the patient quality will be affected, so I prefer to sending them to people who are trained to actually educate these patients on how to take their insulin therapy."* **IDI_003** | 4 |

	"...then actually having time to communicate with patients because sometimes you get overcrowded…communication is not really effective" **IDI_004** *"Being able to communicate with patients is not always easy. Language barrier has forced me to get a translator a number of times. Most patients are old and understand very little English or Kiswahili."* **IDI_014** *"For me it's not being able to get time to counsel patients on insulin all the patients that I manage because I don't see the same patients during clinics. Communication is strained so titrating drugs becomes hard"* **IDI _015**	
Training on diabetes care		8
Effects of insulin on patients' quality of life		2
Improved quality of life		6
Reduces Complications	*"...they have fewer complications, fewer admission rates and generally improved health status so I guess that translates to better quality of life"* **IDI_009** *"Insulin can be good in regulation of sugars. They will have less complications".* **IDI_012** *"Insulin will definitely have value in terms of glycemic control but the patient has to be cooperative in terms of its use. But overall it reduces morbidity so quality of life will be better."* **IDI_014** *"I think it improves quality of life coz it's very effective in managing high sugars. So complications like*	4

	neuropathy will be fewer. That's a major complication of diabetes that I see a lot." **IDI_015**	
Lowers quality of life		
Negative financial impact	*"Oh let me put it this way, it has a big financial impact on them because they always have to constantly source for this medication for use, so patient will always has to have the financial capability or alternatively good insurance that will be able to cater for their expenses, and also if there is proper use or lack of use of the insulin, there is also an impact in terms of the health because complications may arise as a result. So, it also has an impact in terms of their medical status."* **IDI_006** *"For the negative effects on the patients in terms of quality of life is just access to care and financial aspects of treatment need to be considered. A lot of our patients come from lower social economic status and it means like they must sacrifice money that they would otherwise use to improve like family life or like home life to put it in treatment. Then like also I feel that patients who are on insulin therapy tend to have more frequent visits to the clinic so also that cost of coming to the hospital as well as like missing time from work and things like that may impact their lives."* **IDI_009**	2
Negative psychological impact		6
Stigma	*"then also the stigma of using insulin especially in public places where they might need to inject before they feed and so on. So I think it affects them psychologically that they have to use insulin and they*	3

	seem to other people like they have this bad diabetes that require using insulin, so I think most of the time it is a psychological issue." **IDI _007** *"but then again there are a few patients who generally coz of the stigma of daily injections or just all the psychological aspects associated with daily injections, they may not use it correctly and then that of course, not only compromises on their diabetes, but also their quality of life. They may end up being depressed because they don't agree with daily injections or skipping doses."* **IDI_008** *"In my experience, clients fear insulin so we should try and use orals before insulin. Stigma is a lot and that can affect quality of life in a negatively way"* **IDI_010** *"if the patient doesn't want to use it, it'll be kind of hard for them to be compliant when they are stressed about using insulin"* **IDI_011**	
Low self esteem	*"The quality of life, quality of life for insulin users in diabetic patients, I think… quality of life, is there change… okay insulin can lead to lipodystrophy so it might lead to… especially for ladies injecting around the abdominal area can lead to multiple patches, hyperpigmentation but patches basically so it might decrease their self-esteem."* **IDI 005** *"Another thing is the side effect of insulin like the weight gain and so on those are the major things that the patient…yeah."* **IDI_007**	2