FACTORS ASSOCIATED WITH COMPLIANCE TO TREATMENT AMONG TYPE 2 DIABETES PATIENTS ATTENDING DIABETES OUTPATIENT CLINIC AT MOI TEACHING AND REFERRAL HOSPITAL, ELDORET, KENYA

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APPROVAL SHEET

This thesis entitled ***Factors associated with compliance to treatment among type 2 diabetes patients attending diabetes outpatient clinic at Moi Teaching and Referral Hospital, Eldoret, Kenya***, written and submitted by **Kapten M. Muthoka** in partial fulfillment of the requirements for the degree of Master of Public Health (Generalist and Health Promotion), is hereby accepted and approved.

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ABSTRACT

Medication and treatment noncompliance among type 2 diabetes patients has been shown to predict morbidity, disability, immature mortality and general poor health outcome. Given the increased risks associated with poor treatment compliance, the study aimed at assessing the rate of compliance, as well as factors associated with compliance to treatment among type 2 diabetes patients attending the Diabetes Outpatient Clinic at Moi Teaching and Referral Hospital, Eldoret, Kenya. The study adopted a cross-sectional study design, with data collection taking place over duration of 3 months. Data was entered into SPSS version 20.0 and analyzed using stepwise multiple regression and Pearson's product-moment correlation coefficient to assess for associations of social demographic and social economic factors with compliance to medication and lifestyle modification. Rate of compliance was computed as a percentage on basis of means from indicators of compliance as captured in the questionnaires. Factors associated with compliance were considered to be significant at $p \leq 0.05$. The rate of compliance to treatment among type 2 diabetics was 79.9% while health education ($p = 0.045$), depression ($p = 0.001$) and duration on medication ($p = 0.021$) were the only factors found to be significantly associated with treatment compliance. Therefore, from the study it was concluded that compliance to treatment was 79.9% and patients who are not depressed, have taken medication for a longer time, and have received adequate health education are more compliant. The study recommended that health education efforts as well as strategies to diagnose and manage depression among type 2 diabetics should be enhanced among key Ministry of Health stakeholders in charge of diabetes care programs.

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DEDICATION

I dedicate this thesis to my parents - Paul and Juliana, my wife - Ruth and my daughters - Dainty and Zara for their continued love and support.

TABLE OF CONTENTS

APPROVAL SHEET……....ii
ABSTRACT..... iii
ACKNOWLEDGEMENT iv
DEDICATION.....v
TABLE OF CONTENTS.....vi
LIST OF TABLES..... viii
LIST OF FIGURES ix
LIST OF ABRREVIATED ENTRIES x
CHAPTER ONE 1
INTRODUCTION 1
Background of the Study 1
Statement of the Problem.....4
Main Research Objective.....5
Specific Research Objectives.....5
Assumptions.....5
Significance of the Study.....5
Justification of the Study 6
Conceptual Framework.....7
Scope.....8
Definition of Terms.....8
CHAPTER TWO 11
REVIEW OF RELATED LITERATURE AND STUDIES.....11
Diabetes.....11
Global Burden of Diabetes……..……13
Diabetes in Sub-Saharan Africa.....16
Trends in Type 2 Diabetes……..……18
Management of Type 2 Diabetes 19
Healthy Eating 20
Physical Activity.....21
Monitoring 22
Medication 23
Problem-solving.....24
Risk and Complications Reduction.....24
Psychosocial Support.....25
Compliance to Treatment.....25
Prevalence of Compliance to Diabetes Treatment.....26
Factors Influencing Compliance.....28
Socio-demographic Factors 28
Socio- economic Factors.....28
Health Education in Type 2 Diabetes Management 34
Depression in Type 2 Diabetes 35
Summary.....36
CHAPTER THREE 38
RESEARCH METHODOLOGY.....38
Research Design.....38
Population and Sampling Techniques.....38
Eligibility Criteria 39
Inclusion criteria. 39

Exclusion criteria. 39
Sample Size Determination 39
Research Instruments 40
Validity and Reliability of Research Instruments 40
Data Gathering Procedures 41
Data Management 42
Statistical Treatment of Data 42
Ethical Considerations 43
CHAPTER FOUR 44
PRESENTATION OF FINDINGS, ANALYSIS AND INTERPRETATION 44
Social Demographic and Economic Characteristics of Study Participants 44
Diabetes Condition among Study Participants 46
Analysis of Data for Specific Objectives 47
Compliance to Diabetes Treatment 47
Compliance to Medication 48
Compliance to Lifestyle Modification 49
Factors Associated with Compliance 51
Socio-demographic Factors Associated with Compliance to Anti-diabetic Medication 52
Socio- demographic Factors Associated with Compliance to Anti-diabetic Lifestyle Modification 55
Socio-economic Factors Associated with Compliance to Anti-diabetic Medication 59
Socio-economic Factors Associated with Anti-diabetic Lifestyle Modification 63
CHAPTER FIVE 67
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 67
Summary 67
Summary of Findings 68
Conclusions 69
Recommendations 69
Recommendations for Further Studies 69
REFERENCES 71
APPENDICES 81
APPENDIX 1: QUESTIONNAIRE 81
APPENDIX 2: INFORMED CONSENT DOCUMENT 86
APPENDIX 3: UEAB APPROVAL TO CONDUCT PILOT STUDY 88
APPENDIX 4: UEAB ETHICS APPROVAL 89
APPENDIX 5: UEAB PERMISSION TO GATHER DATA 90
APPENDIX 6: MOI/ MTRH IREC ETHICS APPROVAL 91
APPENDIX 7: MTRH APPROVAL 92
APPENDIX 8: NACOSTI APPROVAL 93
APPENDIX 9: NACOSTI RESEARCH PERMIT 94
APPENDIX 10: DESCRIPTIVE AND RELIABILITY ANALYSIS 95
APPENDIX 11: CURRICULUM VITAE 104

LIST OF TABLES

Table 1: Summary of Diabetes Global Patterns 13

Table 2: Social Demographic and Economic Characteristics of Study Participants 45

Table 3: Characteristics of the Diabetes Condition of Study Participants..... 47

Table 4: Compliance to anti-diabetic medication 49

Table 5: Compliance to lifestyle modification..... 51

Table 6: Correlations between Age, Family Size, and Duration of Medication with medication compliance..... 53

Table 7: Comparison by sex 54

Table 8: Comparison by marital status 55

Table 9: Regression analysis for duration on medication..... 56

Table 10: Comparison by sex 58

Table 11: Comparison by marital status 59

Table 12: Regression analysis for depression and health education..... 60

Table 13: Comparison by employment status..... 61

Table 14: Regression analysis for health education..... 64

Table 15: Comparison by employment status..... 65

LIST OF FIGURES

Figure 1. Conceptual framework. 7

LIST OF ABRREVIATED ENTRIES

AADE7	American Association of Diabetes Educators 7 self-care behaviors
ADA	American Diabetes Association
AIDS	Acquired Immune Deficiency Syndrome
AMPATH	academic Model Providing Access to Health Care
DOPC	Diabetes Outpatient Clinic
HIV	Human Immunodeficiency Virus
IDF	International Diabetes Federation
KDHS	Kenya Demographic and Health Survey
MPR	Medication Possession Ratio
MTRH	Moi Teaching and Referral Hospital
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

Background of the Study

Diabetes is one of the major chronic diseases in the low and middle-income as well as high-income countries. Also known as diabetes mellitus, the disease is characterized by high levels of blood glucose arising from biological defects in insulin secretion, insulin action or both in the human body. Diabetes is highly prevalent, and currently affects approximately 422 million persons worldwide. It is estimated that by the year 2025, the disease will considerably increase in numbers of persons affected, with much of the disease burden being borne by the low and middle income countries resulting from population ageing, unhealthy diets, sedentary lifestyles and obesity (WHO, 2003).

Adherence to treatment regimen, also known as compliance, is defined as the active voluntary involvement of a patient in the management of his/her disease by following an agreed treatment plan, which involves sharing responsibility between the patient and health care provider (WHO, 2003).

In assessing compliance to type 2 diabetes treatment regimen, focus should be made on the following components of the treatment regimen: self-monitoring of blood glucose, administration of insulin or oral hypoglycemic agents, diet, physical activity and foot care among other safe care practices (WHO, 2003).

Prevalence of compliance to type 2 diabetes medication has been sub optimal in various regions of the world, with several study findings giving a picture that the range is between 38.5% to 93.1% (Krass, Schieback & Dhippayom, 2015). In Asia

and particularly in India, prevalence of compliance to medication was found to be 70% among type 2 diabetes patients with significantly associated factors being forgetfulness, illiteracy, health education and use of alternative medicines (Inbaraj, Georg, Kham, & Norman, 2016). Similarly, in Singapore, a cross sectional study found that prevalence of medication adherence among newly diagnosed diabetes patients was 65%. Moreover, male sex, Indian race and hypertension were significantly associated with poor compliance to medication (Lin, Sun, Heng, Chew & Chong, 2017). In Europe, less than optimal diabetes medication compliance rates of 50% have been documented (Labrador et al., 2017) whereas in West Africa, prospective studies showed a medication compliance prevalence of 86.8% after a series of intervention strategies that involved health education and counseling (Awodele & Osuolale, 2015). Closer home, in the East African region, compliance to diabetes medication has been found to be in the region of 68.8% with drug side effects, education level and income level being significantly associated (Kassahun, Gashe, Mulisa & Rike, 2016).

In a research conducted to assess the patterns of blood glucose self-monitoring in Northern California, USA, 67% of type 2 diabetes patients did not perform self-monitoring of blood glucose as frequently as recommended (once daily). Similarly, in India, only 23% of patients performed blood glucose monitoring at home. Adherence to oral hypoglycemic agents was 75% in the USA, with dose omissions as the main cause of non-adherence. Moreover, 30% of patients took more dosage than prescribed, with the over medication being observed among patients with a once daily prescription.

In India, dietary prescriptions have been followed regularly by only 37% of diabetes patients while in the USA only about 50% have followed the recommended

meal plan. Moreover, a survey in USA reported that only 26% of respondents followed a physical activity plan. In a study in Canada focusing on type 2 diabetes patients randomly selected from provincial health records, 37% of respondents participated in informal physical activity programs while only 7.7% participated in organized physical activities (WHO, 2003).

Studies have given rates of diabetes medication adherence of 25.4% in Ethiopia, whereas in Nigeria different studies have showed adherence rates ranging between 27.5% and 50%. Major reasons and predictors of poor medication adherence are high pill burden, complexity of drug regimens, high cost of medications, presence or perceived fear of adverse effects, poor knowledge about the disease as well as forgetfulness (Fadare, Olamoyegun & Gbadegesin, 2015).

In a cross sectional study conducted among type 2 diabetes patients attending outpatient clinic in Muhimbili National Hospital, Tanzania, from 2009 to 2010 it was found that adherence rates to anti diabetic drugs were 60.2% and 71.2% at 1 week and 3 months respectively. Anti-diabetic non-adherence was significantly associated with high cost of drugs, although patients with other medical conditions in addition to diabetes were more likely to adhere to anti diabetic medications (Rwegerera, 2014).

In a Kenya comparative study of the quality of care and glycemic control among type 2 diabetes patients, it was realized that the level of glycemic control among patients was poor and consequently drug compliance levels were low (Mwavua, Ndungu, Mutai, & Joshi, 2016). In fact, low drug compliance levels were reported despite more than three quarters of patients having attended scheduled clinic visits.

The study will seek to investigate the factors that determine success of compliance to diabetes treatment regimen among patients attending the MTRH diabetes outpatient clinic in Eldoret.

Statement of the Problem

Diabetes is a complex chronic lifestyle disease whose treatment and management involves mutual cooperation between the patient and the caregiver. Poor compliance to diabetes treatment is associated with inadequate glycemic control, increased risk of diabetes co-morbidities, acute/chronic complications and mortality, overall poor quality of life as well as increased use of health services. A few studies in Kenya have shown less than optimal treatment compliance of 45% among type 2 diabetes patients in Mbagathi County Hospital and Kenyatta National Hospital (Waari, Mutai, & Gikunju, 2018).

Studies have shown that acceptable diabetes treatment adherence/compliance rates are 80% or above using the medication possession ratio (MPR). However, poor compliance to diabetes treatment has been prevalent among patients, with evidence showing that it's influenced by age, sex and the treatment regimen's complexity level among other factors (Polonsky & Henry, 2016).

With ideal diabetes treatment compliance rates of 80% or above, patients would experience less complications and co-morbidities of diabetes through better glycemic control and reduced cases of mortality. Moreover, acceptable compliance rates would reduce the use of health services in developing countries, where resources geared toward healthcare services are ever so meager or grossly misappropriated.

Poor compliance to diabetes treatment is a problem that burdens the health care system as well as the diabetes patients since it exposes them to increased risk of medical complications and comorbidities, poor quality of life as well as premature

mortality. As a matter of fact, non-compliance to treatment among type 2 diabetics increases the chances of medical complications and death by more than 50% (Garcia-Perez et al., 2013). By investigating the factors influencing compliance as well as the barriers affecting it and through its recommendations and findings, the study aimed to bridge a gap of knowledge and help in improving care of not only diabetes but also other chronic diseases.

Main Research Objective

The main objective of the study was to determine the factors associated with compliance to type 2 diabetes treatment among patients attending the Diabetes outpatient clinic in Moi Teaching and Referral Hospital.

Specific Research Objectives

The following were the specific objectives of the study:

1. To determine rate of compliance to treatment by patients attending the diabetes outpatient clinic in Moi Teaching and Referral Hospital
2. To explore the factors associated with compliance to diabetes treatment by patients attending the diabetes outpatient clinic in Moi Teaching and Referral Hospital

Assumptions

In seeking to evaluate and assess the factors associated with compliance to treatment, the researcher made an assumption that the respondents would give authentic accounts when answering questions in the administered study questionnaire.

Significance of the Study

This research work was instrumental in contributing to the body of knowledge concerned with diabetes care as well as other non-communicable and lifestyle medical conditions. Findings from the study would be used in guiding ongoing and future

diabetes prevention and treatment programs led by relevant stakeholders especially in areas of low resource setting.

Justification of the Study

Type 2 diabetes is one of the major chronic diseases in which self-management plays a key role in care and in fact, poor management of glucose in the individual patients often results in co morbidities, which are detrimental to their health (Oyewole & Otovwe, 2018).

Type 2 diabetes is projected to be the seventh leading cause of death in the world by the year 2030 and greater focus will need to be made on diabetes care among the millions who will be likely patients in future (Usher-Smith, Thompson, Zhu, Sharp, & Walter, 2015).

Very little research has been documented as concerns the compliance of patients to diabetes treatment in Kenya. In as much as a lot of work has gone into studying diabetes trends and prevalence in the country, much more work needs to be done on the care and treatment aspects of the medical condition.

Compliance to medical care regimen is appreciated as an active responsible and flexible process of self-management in which a patient works closely with health care providers for the betterment of their health (Bagonza, Rutemberwa & Bazeyo, 2015).

Common reasons for patients' noncompliance to treatment have been reported as lack of awareness and lack of familiarity with the treatment regimen, with much blame being laid on physician related causes of non-adherence (Furthauer, Flamm, & Sonnichsen, 2013). Little is known about patient related causes of non compliance to chronic diseases treatment regimen and this research aims at improving on this

knowledge for better care in the healthcare industry and especially in developing nations.

Conceptual Framework

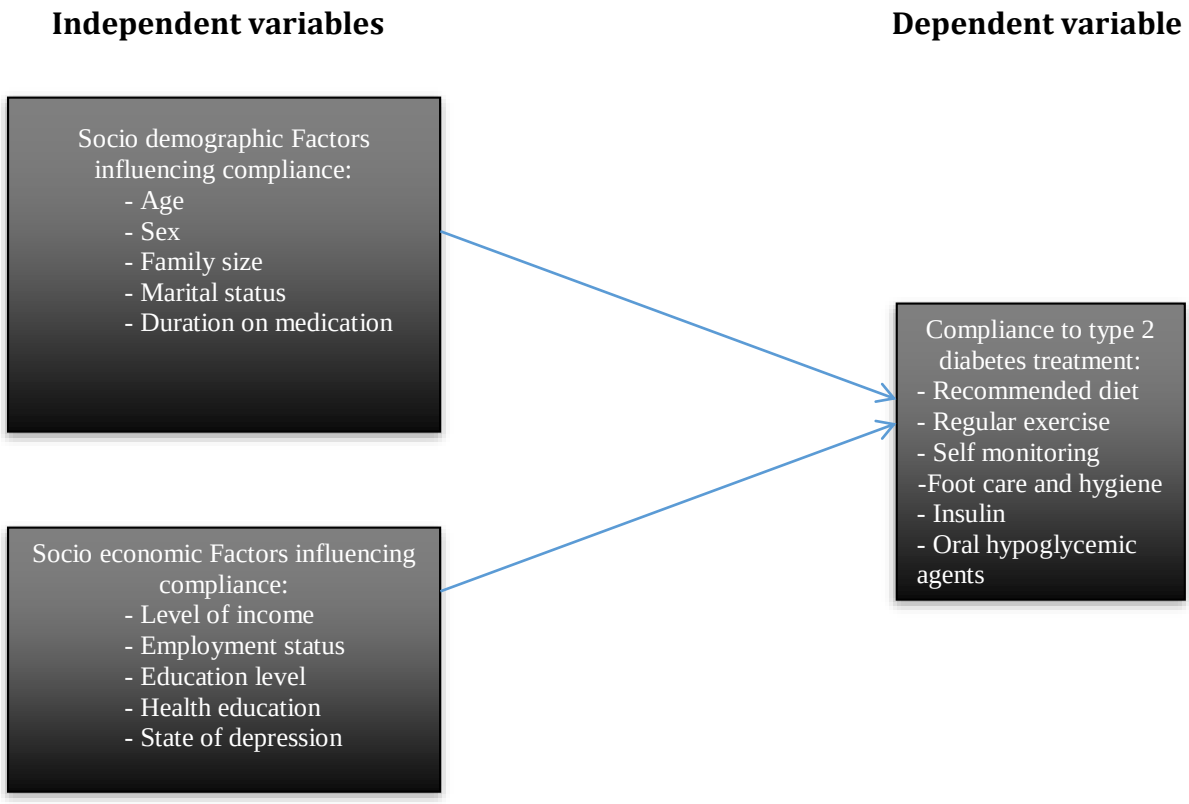

Figure 1. Conceptual framework.

The study's conceptual framework was informed by literature that relates several factors as having a bearing on compliance to type 2 diabetes treatment as a dependent variable. These factors were varied, and included socio economic and socio demographic factors. Socio demographic factors considered were age, sex, family size, marital status and duration of diabetes condition whereas socio economic factors included level of income, occupation, education level, health education and state of depression among study participants (Riaz, Basit, Fawwad, Ahmedani, & Ali, 2014). The level of compliance to diabetes treatment is affected by these factors hence was considered as the dependent variable in this conceptual framework (Mogre, Abanga,

Johnson, & Paul, 2017). State of depression was considered as a socio economic factor because it leads to poor productivity and reduced work output among its patients, hence affecting their overall socio economic status.

In summary, factors that were associated with compliance combined with barriers that affected compliance all had a strong bearing on the rate/prevalence of compliance to diabetes mediation among type 2 diabetics in different settings of the world.

Scope

In this study, the focus was on the rates of compliance to medication and factors influencing it among adult diabetes patients attending the diabetes outpatient clinic in Moi Teaching and Referral Hospital (MTRH). The independent variables in consideration were socio demographic and socio economic factors whereas compliance to treatment of diabetes was considered as the dependent variable. The study enrolled type 2 diabetes patients who were previously seen at the diabetes outpatient clinic in MTRH between January 2016 and December 2017.

The study population was wholly sourced from the diabetes outpatient clinic and the data collection process took place for a period of 3 months; mid December 2018 to mid-March 2019. Data gathering was conducted through use of researcher-developed questionnaires that were administered to the study subjects on a single-visit encounter.

Definition of Terms

Compliance to medication/treatment- the degree to which a patient correctly follows medical advice that includes not only drugs but also medical device use, self-care/self-management and therapy sessions.

Depression- a mood disorder characterized by persistent feelings of sadness, lack of joy and disinterest in normal daily activities

Diabetic- a person suffering from diabetes

Foot hygiene- daily inspection and cleaning of feet, use of recommended footwear as well as keeping feet warm and dry

Gestational diabetes mellitus- a medical condition that is characterized by high blood sugar levels during pregnancy

Glycemic control- the regulation and maintenance of blood glucose levels within normal ranges, which is the chief aim of diabetes treatment

Health education- a teaching process providing basic health knowledge so as to be interpreted into proper health behavior

Healthy eating plan- meal plans that are naturally rich in nutrients and low in fats and calories These include whole grains, lean meats, plenty of fruits and vegetables as well as a limited intake of processed sugars and red meat

Hyperglycemia- elevated levels of blood glucose, which are evidence of suffering from diabetes

Insulin- a protein hormone secreted by the pancreas, that is essential for regulation of blood glucose and when insufficiently produced, results in diabetes mellitus

Oral hypoglycemic agents- anti diabetic drugs that are used by type 2 diabetics to manage their medical condition

Pre diabetes- a medical condition characterized by slightly elevated blood glucose levels, evidence that a person is at high risk of developing diabetes

Prevalence- the number of cases of a disease present in a particular population at a particular time

Regular physical activity- exercise programs that involve 20-30 minutes of work out for at least 5 days a week

Self-monitoring of blood glucose- a regular process through which diabetes mellitus patients measure and monitor their blood glucose levels using a glucometer for glycemic control

Socio demographic factors- characteristics of the study population that potentially have a significant association with medication compliance. These include age, sex, family size, marital status, religion, family history of diabetes and diabetes condition, among others.

Socio economic factors- social and economic factors that have a significant association with medication compliance and are related to employment, education, level of income and depression

Treatment- a process that involves the controlling of blood sugars in a diabetic person so as to limit/prevent complications that may arise from the disease.

Type 2 diabetes mellitus- a chronic medical condition in which the pancreas of the human body produces very little or no insulin to control blood sugars

Type 1 diabetes mellitus- a chronic metabolic disorder that is characterized by high blood sugar levels as a result of insulin resistance and/or the lack of insulin in the human body

CHAPTER TWO

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter contains review of literature material related to the area under study, focusing on diabetes as a chronic disease, type 2 diabetes management as well as aspects of compliance/adherence to diabetes treatment. All material was sourced from articles in print publications such as books, journals, theses and the like, Internet publications, government publications and official reports.

Diabetes

Diabetes mellitus is a serious and complex chronic disease that has been globally recognized as a significant cause of premature death and disability. The medical condition occurs either when the pancreas is unable to produce enough insulin or when the human body is unable to effectively utilize the insulin produced (WHO, 2016). Diabetes requires continuous patient self-care and management combined with health care provider support to prevent acute complications in the short and long term (ADA, 2014). There are several types of diabetes, all of which can cause premature death and disability through damage to the heart, blood vessels, eyes, kidneys and nerves. The condition, which is characterized by raised blood sugar levels, usually requires lifelong treatment (KDHS, 2014).

Diabetes is normally diagnosed using plasma glucose criteria, i.e. fasting plasma glucose or 2-h plasma glucose. Patients are diagnosed with diabetes on the basis of having fasting plasma glucose of 7 mmol/L or more or 2-h plasma glucose of 11.1 mmol/l or more. Recent research work has given credence to the use of A1c tests in diabetes diagnosis (ADA, 2014). The A1c test, also known as the hemoglobin A1c,

hbA1c or glycohemoglobin test, works by giving information about a person's average blood sugar levels over the last 3 months. A1c levels of between 5.7% and 6.4% are used to diagnose pre diabetes whereas levels of 6.5% or above normally diagnose diabetes (NIDDK, 2014).

According to the American Diabetes Association (2014), diabetes is clinically categorized into 3 key types: type 1 diabetes, type 2 diabetes and gestational diabetes.

Type 2 diabetes occurs when body cells fail to respond to insulin appropriately. It develops when the body is unable to produce enough insulin or it cannot make use of the insulin it produces (Asif, 2014). The condition, previously known as adult onset diabetes, is the most common type of diabetes, with a prevalence of 90% and is a leading cause of death among diabetes patients. It was first described as a component of metabolic syndrome in 1988 and is characterized by hyperglycemia, insulin resistance as well as relative insulin deficiency (Olokoba, Obateru, & Olokoba, 2012).

The prevalence of type 2 diabetes has increased over the years in low to middle income as well as high income countries as a result of abundance of food, increased poor dietary choices and sedentary lifestyle (Trikkalinou et al., 2017). Research showed that in 2011, 366 million people had diabetes, a figure that will likely rise to 552 million by the year 2030 (Olokoba et al., 2012).

If improperly managed, diabetes can lead to severe health complications such as stroke, cardiovascular disease, kidney disease, blindness, nerve damage and death (Asif, 2014). As a matter of fact, 50% of adults with chronic kidney disease also suffer from diabetes, whereas 9.8% of diabetics have experienced heart attack, 9.1% are also coronary heart disease patients, 7.9% have suffered from congestive heart failure, 6.6% have had stroke. Moreover, 22.9% of diabetics suffer from foot nerve

damage while 18.9% have eye damage (Trikkalinou et al., 2017). The myriad medical complications that arise with type 2 diabetes demand careful management and planning on the part of both the patient and health care provider.

Global Burden of Diabetes

Diabetes is a chronic lifestyle disease that currently affects 422 million adults as of 2014, a number that has more than tripled since 1980. In 2012, diabetes caused as many deaths as HIV/AIDS, with millions being rendered disabled (Krug, 2016).

In the past 3 decades, the prevalence of diabetes has markedly increased, appearing to grow faster in low and middle-income countries than in high-income countries. The highest prevalence, at 13.7%, has been reported in the WHO Eastern Mediterranean Region that covers the Arab and Islamic States (WHO, 2016). The South East Asia region, the Western Pacific region and the Americas follow closely in that order, as far as diabetes prevalence is concerned.

Table 1

Summary of Diabetes Global Patterns in Terms of Prevalence and Millions Affected

WHO Region	**Prevalence (%)**		**Number (millions)**	
	1980	**2014**	**1980**	**2014**
African Region	3.1%	7.1%	4	25
The Americas	5%	8.3%	18	62
Eastern Mediterranean	5.9%	13.7%	6	43
European Region	5.3%	7.3%	33	64
South East Asia	4.1%	8.6%	17	96
Western Pacific	4.4%	8.4%	29	131
Total	4.7%	8.5%	108	422

Source: WHO Global Report on Diabetes, 2016

In spite of advances in medicine and prevention efforts, diabetes remains a key public health problem in America, where the prevalence of diabetes is expected to grow by 54% to affect more than 54.9 million Americans by the year 2030. Consequently, annual diabetes deaths will increase by 38% to 385,000 with total annual medical costs attributable to diabetes reaching more than $622 billion by the year 2030 (Rowley, Bezold, Arikan, Byrne, & Krohe, 2017). This clearly shows that the growing burden of diabetes is not only being felt in the developing world but also in the developed nations where healthcare systems are relatively more advanced.

In 2013, diabetes caused 749,000 deaths within the US population, with a significant strain on the US economy at a total cost of $245 billion in the heath care industry (Lindgren, 2016). According to a 2014 study on the epidemiology of diabetes, type 2 diabetes accounts for more than 85% of all global diabetes prevalence. Type 1 diabetes occurs at any age, but in many populations mostly affects the age group; birth to 14 years. There's been a marked geographical variation in type 2 diabetes, with prevalence being lowest in rural areas of low to middle income countries and highest in groups that have embraced western lifestyles. Populations with high prevalence of obesity have also reported high prevalence of type 2 diabetes (Forouhi & Wareham, 2014).

According to Telo (2016), the major burden of diabetes is increasingly being felt in low to middle income nations, where 80% of diabetes patients are actually found. Within the South and Central American regions, 8% to 11.3% of the adult population has diabetes, of which 39% remains undiagnosed due to challenges in the health care systems and lack of adequate health education on non-communicable diseases. As a matter of fact, Brazil has the highest number of people suffering from

diabetes in the region, with a prevalence of 10.3% having been reported in 2012, in a gradually increasing pattern.

Population based studies have shown rapidly increasing rates of obesity in all Brazil's age groups and this is compounded by the fact that 41% of Brazil's adult population is not active enough for optimal health benefits. Physical inactivity and poor diet choices are considered important risk factors for diabetes and this may explain the growing burden of diabetes in Brazil (De Almeida-Pititto, Dias, De-Moraes, Ferreira, Franco, & Eliaschewitz, 2015).

It is currently estimated that 20% of the global diabetes burden is in the South East Asian region of the world and WHO has predicted that the maximum escalation of diabetes will be recorded in India within the next decade (Dasappa, Fathima, Prabhakar, & Sarin, 2015). In a 2013 cross sectional study carried out in the Bangalore slums of India, the prevalence of diabetes and pre-diabetes among adults 35 years and above was reported to be 12.3% and 11.6% respectively. Prevalence was higher among women than men (Dasappa et al., 2015). Moreover, physical inactivity, increasing age, female sex and obesity were reported as key risk factors for diabetes. India is home to approximately 69.1 million people with diabetes, a majority of which are in the working poor to middle income social group (Tripathy et al., 2017).

It is estimated that 5.8 million people are living with diabetes in Germany today, a country with a population of 82.67 million, where age standardized prevalence of diabetes was 9.7% in 2009. Prevalence and incidence of the disease has been shown to rise steeply from age 50 to 80 years, with peak incidence being at 85 years of age (Tamayo, Brinks, Hoyer, Kuß, &Rathmann, 2016).

Diabetes in Sub-Saharan Africa

Sub-Saharan Africa contains a majority of the world's least developed nations, where health care systems struggle to cope with not only infectious diseases but also non-communicable diseases. In 1990, the leading causes of death in Sub Saharan Africa were HIV/AIDS, malaria, lower respiratory infections and diarrheal diseases whereas lately non-communicable diseases such as diabetes and heart disease have become more prominent (IDF, 2018). Reports by the International Diabetes Federation (IDF) show that an estimated 15.5 million adults aged 25-79 years of age were living with type 2 diabetes in 2017, signifying a prevalence of 3.3%. Moreover, the Sub Saharan Africa region has the highest percentage of undiagnosed type 2 diabetes, with an estimated 69.2% of adults living with the disease, but unaware of their condition (IDF, 2018). In 2010, 12.1 million people were estimated to be living with diabetes in Africa, a figure that will likely rise to 23.9 million by the year 2030. In a systematic review of papers published on diabetes in Sub Saharan Africa 1999-2011, it was reported that type 2 diabetes accounts for more than 90% of all diabetes cases in Africa, with a population prevalence that ranges from 0-7% Cameroon, Guinea, Ghana, South Africa, Nigeria, Uganda and Kenya, whereas the highest prevalence of type 2 diabetes was reported in Zimbabwe (Hall et al., 2011).

In Nigeria, which is the most populous nation in Sub Saharan Africa, there are 4 million people living with type 2 diabetes. In rural areas, prevalence has been reported to be 0-2% whereas in urban areas the prevalence is much higher, at 5-10% (Fasanmade & Dagogo-Jack, 2015). Among children in Nigeria, type 2 diabetes is not common, although some clinical reports show that it's gradually increasing among small children and adolescents (Fasanmade & Dagogo-Jack, 2015). Type 1 diabetes was reportedly low, at 4/100,000 in Mozambique and 12/100,000 in Zambia. On the

other hand, gestational diabetes was reported to vary from 0% in Tanzania to 9% in Ethiopia (Hall et al., 2011). There's still very little data on the less common types of diabetes such as mitochondrial diabetes and latent autoimmune diabetes of adults (Fasanmade & Dagogo-Jack, 2015).

Closer home, in the northern region of Tanzania, diabetes is not as appreciated as it should be, despite the growing burden. In a 2014/2015 cross sectional study in Northern Tanzania, it was reported that diabetes prevalence was 5.7%; diabetes awareness was low among those diagnosed with diabetes (35.6%) and few people with diabetes were receiving medication (33.3%) at the point of data collection (Stanifer et al., 2015).

In spite of the growing burden of diabetes and non-communicable diseases in Sub Saharan Africa, few national health systems have good infrastructure to deal with the public health problem. This explains the continued reports that the prevalence of undiagnosed type 2 diabetes is higher in Sub Saharan Africa than in any other region of the world, with as many as 2/3 of cases going undiagnosed (Stanifer et al., 2015).

In a study by Ayah et al (2013) conducted in the sprawling slums of Kibera in Nairobi, Kenya's age adjusted prevalence of diabetes was reported as 5.3% and it increased with age to peak at 10.5% in the age bracket of 45-54 years. The most significant correlates to type 2 diabetes were sedentary lifestyle, alcohol consumption, obesity and overweight as well as smoking.

Type 2 diabetes in sub Saharan Africa is a glaring problem that requires urgent attention before it completely gets out of hand. The problem must be tackled from an individual and community approach to a national focus through properly laid health education programs, health care infrastructure for prompt diagnosis and management as well as rehabilitation.

Trends in Type 2 Diabetes

Type 2 diabetes is the most common type of diabetes and currently accounts for 90-95% of all diabetes cases worldwide. Elevated levels of blood glucose, as a result of insulin resistance or relative insulin deficiency, characterize the disease. Type 2 diabetes has increasingly become a significant global health problem, with high income as well as low or middle-income countries becoming affected with rising trends of the disease. Presently, there are an estimated 392 million people living with type 2 diabetes and the figure is projected to rise to an estimated 439 million people by the year 2030 (Wu, 2014).

Recent trends show that the highest burden of type 2 diabetes is shouldered by low to middle income countries, which currently account for more than 80% of all world cases of the disease. The Centers for Disease Control (CDC) reports that there were 25.8 million people living with type 2 diabetes in the United States of America, whereas in Africa, there are an estimated 15.5 million people with the disease (Olokoba et al., 2012). According to the International Diabetes Federation (2018), the highest number of undiagnosed type 2 diabetes cases is in Africa and more than half of type 2 diabetes patients live in urban areas.

Key risk factors to developing type 2 diabetes include older age, obesity, family history, sedentary lifestyle and poor/unhealthy diet. In the past, type 2 diabetes was almost exclusively common among adults but recent years have seen it occur more among the children and those under 20 years of age. These increased cases have been attributed to poor lifestyle choices such as physical inactivity and unhealthy diet (WHO, 2016).

According to the Kenya National Diabetes Strategy: 2010-2015, the prevalence of type 2 diabetes in Kenya is 3.3%, a figure that is likely to be under-

estimation as over 60% of diabetes cases are either undiagnosed, or present with unrelated complications. The strategy details a range of coordinated interventions that encourage individuals to actively maintain healthy weight, adopt healthy diet and embrace regular physical activity in life. Moreover, health education, urban transportation policy and food policy changes has been highlighted as key to successfully promoting positive lifestyle modification in an endeavor to successfully prevent and manage type 2 diabetes.

Management of Type 2 Diabetes

Type 2 diabetes care has seen tremendous improvement and advancement over the last century through the discovery of insulin in 1922 which heralded a new age in better long term glycemic control among diabetes patients (Charttejee & Davies, 2015). The discovery of oral glycemic agents made it easier and more effective for type 2 diabetes patients to self- administer insulin without necessarily having to inject themselves. In recent years, focus has been laid on patient centered approach to type 2 diabetes management through structured health education programs and psychosocial support to enable patient motivation and self-empowerment (Charttejee & Davies, 2015). International diabetes organizations have also played a key role in standardizing and rationalizing treatment guidelines for type 2 diabetes patients in different settings.

Management of type 2 diabetes requires a comprehensive approach that entails health education on diabetes, emphasis on positive lifestyle modification, proper maintenance of glycemic control, minimization of cardiovascular risks and other complications, as well as avoidance of drugs that can potentially cause aggravation of glucose levels from lipid metabolism (Imam, 2012). As a matter of fact, acquiring knowledge about diabetes is a key aspect of type 2 diabetes management since the

chronic condition requires the highest level of commitment from both the patient and caregiver throughout the treatment process.

The paradigm of type 2 diabetes management has greatly shifted over the years to focus more on empowering the patient to better manage the disease with a key goal of improving his/her quality of life. Diabetes self-management education is basically a holistically educational process through which persons with diabetes obtain knowledge and skills in order to modify their behaviors with the aim of successfully managing the disease and its co morbidities (Burke, Sherr & Lipman, 2014).

Diabetes educators are health care professionals who drive the diabetes education process by following the American Association of Diabetes Educators 7 self-care behaviors (AADE7) framework designed by the American Diabetes Association. The 6-step framework includes assessment, goal setting, planning, implementation, evaluation and documentation. The AADE7 framework consists of seven factors that are fundamental for self-management: healthy eating, physical activity, taking medications, monitoring, problem solving, reduction of risk of complications, and psychosocial support (Burke et al., 2014).

Healthy Eating

This involves making healthy food choices and regulating eating times to best manage type 2 diabetes. Through the self-management education program, persons with diabetes are able to better appreciate the effect of particular foods on their blood sugar levels. Skills taught are on reading of food labels, planning and preparing meals, measuring foods to control portions and calorie counting.

Dietary recommendations for type 2 diabetics include limiting intake of foods high in fat, sugar and salt, complete elimination of high calorie beverages from diet,

as well as decreasing food portions per meal (George & Copeland, 2013). In addition, increased consumption of healthy alternatives such as fruits, vegetables and nuts is also recommended.

The American Diabetes Association (ADA) recommends that for optimal health outcome, diabetics should take balanced diet rich in fiber, whole grains and legumes combined with less than 7% saturated fats and very little trans fats (George & Copeland, 2013).

According to Nyenwe, Jerkins, Umpierrez, and Kitabchi (2011), the diet of type 2 diabetics should consistently comprise of 50-55% carbohydrates, 30% fat (with less than 10% being saturated fat) and 15-20% protein as well as plenty of fiber.

Fast food establishments have expanded incredibly fast in the last few decades and the presence of large supermarket chains with ready availability of highly processed foods, high-energy snacks and sugared beverages has negatively affected the health of the public. As such, all health education programs geared toward proper diabetes management should address this nutritional transition that has increased the accessibility of unhealthy foods for all and sundry (Ley, Hamdy, Mohan, & Hu, 2014).

Physical Activity

Regular exercises are essential for general body fitness, weight management and long-term blood glucose control. Through adoption of recommended exercise regimens, non-diabetics can reduce their risk of developing the condition whereas diabetics are able to improve glycemic control. Healthcare providers and their patients are able to work collaboratively on an activity plan that balances food and medication for optimum health outcome throughout the management process (Burke et al., 2014).

Exercise among diabetics has many benefits, which include: improved glycemic control, improved cardiovascular and overall fitness, weight control as well as improved psychological well-being and quality of life. Physical exercises should be carefully planned and scheduled post meals when blood glucose levels are high. Response to exercise varies from individual to individual and the blood glucose patterns are essential in informing how exercise regimens should be planned (Ley et al., 2015).

Monitoring

Daily self-monitoring of blood glucose gives diabetics an opportunity to assess how their food intake, physical activity and medications are affecting their blood sugar levels. Blood glucose monitoring is used to assess whether blood glucose is within normal range of 4 to 7 mmol/L. It involves use of glucose meter, single use test strips and lancets to test for levels of glucose in blood on a daily basis or every 2-3 days, depending on the type of diabetes. For type 1 diabetes, monitoring should be on a daily basis whereas for type 2 diabetes patients, blood glucose monitoring occurs once every 2-3 days. Monitoring also involves regular checking for blood pressure, urine ketones and weight to identify health risks early enough (Burke et al., 2014).

Self-monitoring of blood glucose has both short term and long-term effects in improving glycemic control among diabetics (Zhu, Zhu, &Leung, 2016). It also has many more benefits such as enabling achievement of hemoglobin A1C targets, minimizing glucose variability and prediction of severe hypoglycemia in diabetics. Moreover, in several studies, glucose monitoring has been associated with decreased risk for co-morbidities and mortality as well as increased patients' awareness and control of the disease (Schnell, Hanefeld, & Monnier, 2014).

Diabetes health care providers and educators encourage patients to take up self-monitoring of blood glucose since it has been proven to enable patients to become more involved in their treatment process with a sense of empowerment that motivates them to achieve their health targets. As a matter of fact, the world health bodies- International Diabetes Federation, the European Society of Cardiology and the American Diabetes Association all recommend self-glucose monitoring as an effective process that forms a healthy partnership between the patient and health care provider to improve health outcomes (Schnell et al., 2014).

Medication

Type 2 diabetes is a long-term condition that requires regular taking of medicines as advised and prescribed by the healthcare provider. The type of medicines and regimen depends on the type of diabetes. Effective drug therapy combined with healthy lifestyle modification has been proven to lower blood glucose levels, reduce risk for complications and enhance quality of life for diabetics (Burke et al., 2014).

The goal of health education's focus on medication is for diabetics to stay informed concerning prescribed dosage, action, side effects, efficacy, toxicity and instructions for storage and safety. Since diabetics have increased risk of various medical conditions such as cardiovascular disease, high blood pressure and stroke, they often require more drugs than just insulin (Nyenwe et al., 2011).

Most people with type 2 diabetes don't have to inject insulin. Alternatives to their health management include lifestyle modification and use of oral hypoglycemic tablets known as anti-diabetic medication. Persons with type 2 diabetes only require insulin if they cannot adequately control their blood glucose by lifestyle modifications and taking tablets (Nyenwe et al., 2011).

The decision on the most suitable medication for diabetics usually depends on several factors: treatment goal, age, weight, general health condition, other comorbidities, patient response to medication, any other drugs being taken by patient as well as patient satisfaction with medication (George & Copeland, 2013).

Problem-solving

Diabetics are required to develop problem-solving skills due to the nature of the disease, which is progressive and often brings about chronic complications with time. These skills empower the diabetic to make informed decisions concerning food, activity and medications in order to manage sudden low or high blood glucose episodes as well as sick days (Burke et al., 2014).

Effective self-management of type 2 diabetes requires not only lifestyle modification on the part of the patient but also problem solving skills so as to manage the frequent barriers that affect treatment regimen and adjust appropriately for optimal health outcome. The ideal problem-solving model encompasses 4 key aspects: problem solving skill; problem solving orientation; disease specific knowledge and past experience. Problem solving has been shown to improve adherence to medication as well as uptake of lifestyle modification programs (Fitzpatrick, Schumann, & Hill-Briggs, 2013).

Risk and Complications Reduction

Behaviors geared toward reducing risk of complications for type 2 diabetics involve stopping of cigarette smoking, alcohol consumption, going for regular eye, foot and dental check ups, all aimed at maximizing health and quality of life (Burke et al., 2014).

Diabetes education involves enabling patients to obtain skills and knowledge about standards of care, therapeutic goals and preventive care services to minimize

health risks. Effective long-term management of diabetes requires the patient to understand his condition and regularly seek an array of preventive services to off set co-morbidities in the short and long term (Bansal, 2015).

Psychosocial Support

Type 2 diabetes, as a long term and progressive medical condition, requires psychosocial support for its patients to realize an optimal health outcome. Psychological distress affects a diabetic's motivation to positively manage his/her medical condition. Long-term effective self-care and management requires strong motivation on the part of the patient, which comes through the strongest support from their immediate environment of home, work and health care institution (Burke et al., 2014). Social support from family and the community toward the diabetic patient has been proven to positively influence compliance to medication. When motivation is dampened, the patient's commitment to effective self-care and management becomes difficult to attain and this interferes with treatment outcomes (Tuso, 2014).

Compliance to Treatment

Compliance refers to the measure with which a patient's behavior; taking medication, following prescribed diet as well as other positive lifestyle modification agrees/coincides with the healthcare provider's medical advice and recommendations for good health outcome (Khan, Lateef, Al Aithan, Bu-Khamseen, Ibrahim, & Khan, 2012). The generally recommended treatment regimen for type 2 diabetes includes self- monitoring of blood glucose, dietary modifications, exercise and medication. Poor compliance to treatment is a major public health problem that potentially contributes to development of diabetes complications and co morbidities.

Prevalence of Compliance to Diabetes Treatment

Worldwide, medication and treatment adherence studies have reported varied findings, although generally it is accepted that medication adherence rates are low in both low to middle-income and high-income countries. In a cross-sectional study carried out in the year 2012 in India, it was reported that only 30% of diabetics who had received diabetes health education from a health facility were compliant to anti-diabetic medication whereas only 30% and 19% were complying with the recommended diet and exercise regimen respectively (Mukherjee, Sharmasarkar, Das, Bhattacharyya, &Deb, 2013). Overall, the study concluded that compliance to anti-diabetic medication was poor among participants, with increasing age, male sex, illiteracy, low socio economic status and having long suffered from diabetes being factors significantly associated with non-compliance (Murkhejee et al., 2013). Another study on self-care activities among diabetics in a tertiary care hospital in India showed that adherence to oral hypoglycemic agents on all days of the week was 60.5% whereas adherence to insulin injections was 66.9%. Moreover, compliance to recommended dietary plan and physical exercise regimen were low at 45.9% and 43.4% respectively (Kulkarni, Unnikrishnan, Kumar, &Thapar, 2015).

In a similar cross sectional survey conducted in Saudi Arabia, the overall prevalence of therapeutic non-compliance was 67.9%, with male non-compliance (69.34%) being higher than that of females (65.45%). Similarly, noncompliance among urban dwellers (71.04%) was reported to be significantly higher than that of rural dwellers (60.15%). Factors found to be significantly associated with noncompliance on bi-variate analysis were female sex, level of education, urban residence and irregularity of patient follow up (Khan et al., 2012). Non-compliance to treatment is common in the USA, where it has been estimated that more than half of

chronic disease medications are not taken as recommended. As a matter of fact, more than 50% of patients discontinue their medications and treatment plans within a year (Zullig et al., 2015).

Several studies in Ghana have shown that adherence to type 2 diabetes treatment is generally low where exercise has been reported as the most commonly performed self-care behavior and self-monitoring of glucose is the least adhered to by diabetics. Moreover, health education and the female sex were significantly associated with adherence to diabetes medication (Mogre, Abanga, Johnson, & Paul, 2017). In a 2011 cross sectional study in Ghana, compliance to oral anti-diabetic medication was 38.5%, and the findings showed that level of education was significantly associated with rate of adherence; this being due to the fact that educated patients are more likely to understand/appreciate their medical condition better and hence more likely to adhere to medication (Bruce, Acheampong, &Kretchy, 2015).

In Malaysia, non-compliance among diabetics has been reported as 53%, whereas in India and Ethiopia it stands at 42.3% and 25.4% respectively. In Nigeria, non-compliance has been reported within the margin of 27.5% to 50% in several studies (Fadare et al., 2015).

In Uganda, compliance to antidiabetic medication was found to be 83.3% and significantly associated with duration on treatment, drug availability and health education. On the other hand, socio-demographic characteristics such as age, sex, education level and marital status were not found to be associated with compliance to anti-diabetic medication (Bagonza et al., 2015). According to Rwegerera (2014) in a similar cross sectional study on drug compliance among type 2 diabetes patients in Tanzania, compliance was found to be 60.2% and 71.2% at one week and three months of treatment respectively.

In Kenya, a cross sectional study conducted among type 2 diabetes mellitus patients attending Kenyatta National Hospital, Nairobi, medication adherence was reported to be 45.5% and highly associated with strong family support, medication affordability and good health education (Waari, Mutai, &Gikunju, 2018). In a similar study conducted in Mbagathi District Hospital in Nairobi, the prevalence of non-compliance to oral hypoglycemic medications was found to be 45.1%; non-compliance to medication was found to be significantly associated with taking several treatment regimens and forgetfulness (Maina, Kikuvi, Muthami, & Keter, 2015). Studies in Mexico, Jamaica, USA and India conducted between 1999 and 2002 found compliance to diabetes treatment to be ranging between 23% and 77% in a grim report showing low uptake of diabetes treatment programs.

Factors Influencing Compliance

Generally, rates of non-compliance to long-term medication regimens have been sub optimal and largely depend on characteristics of the condition, the treatment, the patient and the setting (Rwegerera, 2014). The study's focus was on socio-demographic and socio-economic factors that are associated with compliance to treatment among type 2 diabetes patients.

Socio demographic Factors

Several research studies on medication compliance have shown that patients with multiple medical conditions and complications arising with diabetes actively choose to forego some medications when cost pressures become a burden. A study conducted in Ibadan, Nigeria showed that 34.5% of diabetics were non-compliant to medication due to side effects whereas 24.5% of diabetics were non compliant due to depression (Rwegerera, 2014). Depression has been identified as a significant factor

influencing adherence to medication as depressed patients are less likely to report to clinic and embrace positive lifestyle modification.

In a study conducted at Muhimbili National Hospital, Tanzania 18.9% of diabetics reported that disappearance of symptoms was the reason why they had poor adherence whereas 11.49% reported that drug side effects such as fainting, fatigue, palpitations, nausea, vomiting and itching were the reasons for poor adherence (Rwegerera, 2014).

According to Bagonza et al., (2015), adherence to diabetes treatment is strongly associated with duration on medication. The study showed that diabetics who have been under medication for longer than 3 years were more likely to comply with medication than those who had been under medication for less than 3 years. However, the study conflicts with another by Kitzler, Bachar, Skrabal, and Kotanko (2007) which showed that shorter duration on diabetes medication relates to greater family and social support, which translates to better therapy adherence and improved metabolic control.

In a study on factors contributing to non-compliance among diabetics attending primary health centers, in Saudi Arabia, compliance was high among patients who had adequate information on the dose, duration of course and side effects of anti-diabetic medication. Patients who had less than adequate information concerning contingencies in case of missed dose and side effects were more non-compliant (Khan et al., 2012). In the same study, it was reported that compliance to medication was least among patients on combined oral and insulin medication whereas it was highest among patients on single drug regimen.

Medication adherence and persistence become more challenging in cases where treatment is perceived by the patient to be more difficult, meaningless and

burdensome. Studies have shown that the more the number of prescribed doses per day the less the level of medication adherence. As a matter of fact, one particular study found that adherence decreases progressively from 79% in cases of once daily dose to 51% in cases where patients take four times daily dosage (Polonsky & Henry, 2016).

Overall, complexity of diabetes medication and treatment regimen have been shown to predict compliance, with greater complexity contributing to poorer compliance, while greater convenience of medical service positively influences it. Moreover, patients are more likely to adhere to medication when they feel that the prescribed medication is actually necessary and contributes positively to their well-being (Polonsky & Henry, 2016).

In cases where patients hold negative and skeptical beliefs about diabetes medication, compliance to treatment becomes a glaring challenge. This is true especially in societies where traditional herbal medication is widely accepted and favored as compared to evidence based therapies (Garcia-Perez, Alvarez, Dilla, Gil-Guillen, & Orozco- Beltran, 2013).

Depression, stress and emotional problems among diabetics who have had challenges in accepting their medical condition is a major predictor of poor compliance to medication. These emotional problems, when coupled with low self-esteem and a sense of defeat and personal loss, are sure factors that negatively influence adherence to medication and treatment regimen for not only diabetics but also patients of other chronic diseases (Garcia-Perez et al., 2013).

Forgetfulness has been reported as one of the most significant factors influencing compliance to self-monitoring of blood glucose and taking of daily insulin or oral hypoglycemic agents. Some programs have encouraged their patients to use

reminders at home to enable them to easily remember times of medication and hence improve adherence (Furthauer et al., 2013).

According to Oyewole and Otovwe (2018), there's no consensus on the influence of age, sex and education level with regards to medication and treatment compliance. Some research has shown significant influence, while others show no association between these socio demographic variables and compliance. An adherence study in Ghana showed that age, marital status, duration of diabetes and religious following were not significantly associated with treatment compliance (Mogre et al., 2017) whereas a similar study in Uganda gave similar results, finding that age, sex, education level and marital status were not associated with adherence to medication (Bagonza et al., 2015). In contrast, research elsewhere showed that age and sex are significantly associated with non-adherence; females were more likely to be non-adherent to medication, while younger patients who were professionally active were shown to be more likely to skip or forgo their medication (Waari et al., 2018).

Socio-economic Factors

Diabetics and patients of other chronic conditions have been reported as having sub optimal treatment compliance largely due to socio economic factors. Diabetes is a long-term complex medical condition that requires a strong social system as well as reasonably adequate resources for its successful management. In a study to assess adherence to anti-diabetic drugs among diabetics attending Muhimbili National Hospital, Tanzania, high cost of drugs was reported as the most significant factor influencing non-compliance to medication (Rwegerera, 2014). In another study in Uganda, high cost of prescribed oral hypoglycemic medications, coupled with scarcity of newer prescribed brands was found to significantly hinder optimal adherence (Bagonza et al., 2015). As a matter of fact, financial expenses incurred in

seeking long term diabetic care significantly reduce access to medication, hence negatively affecting compliance especially in developing countries.

Medication costs as well as costs associated with healthy fresh foods are barriers associated with compliance to treatment among diabetics. Higher medication costs have been associated with significant non-compliance across a variety of medical conditions. Patients receiving subsidies for anti-diabetic medication have been reported to have better medication adherence than those without any subsidies (Polonsky & Henry, 2016).

High costs of prescribed anti-diabetic medication hinder optimal adherence since inhibitive financial costs reduce access to therapy especially in developing countries. In situations where patients require insulin, high costs have exposed them to risks of complications and death. As a matter of fact, failure to afford medication has been reported as the most common reason for poor compliance among diabetics (Bagonza et al., 2015).

The effect of social and family support on compliance to diabetes treatment cannot be overstated. Several research studies have showed family support to be the strongest and most consistent predictor of compliance to treatment among type 2 diabetics. In studies on gestational diabetes as well, adherence to dietary recommendations has been strongly associated with family social support (Miller & DiMatteo, 2013). Positive dimensions of family functioning and support have been shown to increase adherence behaviors among children, adolescents, middle aged and elderly diabetics in both low to middle income and high-income nations.

A poor relationship between patient and physician has been proven to influence poor compliance to medication especially in situations where the patient doesn’t feel comfortable enough to ask questions and seek clarification on treatment

regimens and methods of care. In the absence of multidisciplinary settings for diabetes care and management, consistent compliance to diabetes treatment is not easily realized especially due to the nature of the disease and its co morbidities and complications. Health care systems with universal health insurance for patients have been proven to positively influence adherence to chronic disease medication in the developed world. In developing nations, access to affordable medication continues to be a key challenge to medication and treatment adherence due to absence of universal health insurance coverage for people of low socioeconomic status (Wens, Vermeire, Royen, Sabbe & Denekens, 2005).

Lack of adequate training for health care professionals on adherence and general chronic care models affects compliance to medications. Proper training enables healthcare providers to promote behavioral change and risk reduction through focus on relationship building skills and as well as patients' conviction on value of the healthcare system (Wens et al., 2005).

Patients' trust in their physician is a key factor influencing adherence to hypoglycemic medications. It has been proven that chronic disease patients' feeling that their needs during medical visits had been heard and addressed predicted treatment compliance over time. Moreover, studies have shown that quality of communication between patient and physician at the time of diagnosis is a strong factor influencing adherence to anti-diabetic medication and treatment (Polonsky & Henry, 2016).

Unavailability of medical service has also been found to be a significant factor affecting compliance as shown by results of a 2008 study in Mulago National Hospital in Uganda where 28.9% of diabetics were non-compliant to diabetes

treatment as a result of non-availability of health care service (Riaz, Basit, Fawwad, Ahmedani, & Ali, 2014).

Health Education in Type 2 Diabetes Management

The World Health Organization defines health education as "any combination of learning experiences designed to help individuals and communities improve their health by increasing their knowledge or influencing their attitudes". Diabetes health education is a collaborative process through which diabetics acquire knowledge and skills necessary for successful management of their condition and its related comorbidities (Burke et al., 2014). Diabetes health education is also defined as the ongoing process of facilitating knowledge, skill and ability necessary for diabetes care by incorporating the diabetic's needs, goals and life experiences through guidance by evidence based standards.

Healthcare providers who are also good health educators have been proven to improve clinical and quality of life outcomes for diabetics in different settings. As a matter of fact, research has proven that diabetes patients who have not undergone basic health education on diabetes self-management miss out on recommended preventive services, have knowledge gaps and are more likely to develop chronic complications (Furthauer et al., 2012).

The key objective of a good diabetic health education program is positive behavior change, which is attained through 6 step collaborative process of: assessment, goal setting, planning, implementation, evaluation and documentation (Burke et al., 2014).

In dissemination of health education material, health educators make use of theories such as health belief model, trans theoretical theory and social cognitive theory depending on several factors and settings. Health education is delivered during

individual clinic visits, in group or community settings or in a combination of these models. Group education is key in fostering support and encouragement through sharing of experiences, whereas individual education is important in creating strong relationships between the health care provider and the patient for a favorable health outcome (Khan et al., 2012).

The value of diabetes health education has been demonstrated in several research findings, by being linked to improvement of clinical outcomes, reduction of overall medical costs in the population and prediction of compliance to treatment recommendations (Burke et al., 2014).

The overall objectives of diabetes health education are to support informed decision-making, self-care behaviors, problem solving and active collaboration between healthcare providers and diabetics for improved clinical outcomes, health status and quality of life (Funnell et al., 2010).

Depression in Type 2 Diabetes

According to the WHO, depression is a mental disorder that currently affects more than 300 million people in the world, with women being more affected than men. As a matter of fact, depression leads to poor productivity, increased disease burden and poor treatment outcomes in chronic diseases such as type 2 diabetes (WHO, 2018). Depression is a very significant co-morbid condition in diabetes, as research studies show that persons who are depressed increase their risk of developing type 2 diabetes by 60%. Moreover, type 2 diabetes patients are two times more likely to develop depression than persons without type 2 diabetes (Penckofer, Doyle, Byrn, & Lustman, 2014).

Studies have shown that there’s no significant difference in the prevalence of depression among patients with undiagnosed type 2 diabetes or impaired glucose

metabolism and those with normal glucose metabolism. This therefore informs the hypothesis that increased depression in diabetes patients is as a result of the knowledge of diabetes diagnosis, challenges that come with managing the condition and debilitating complications (Holt, de Groot & Golden, 2014). In spite of these documented findings, depression in diabetes remains grossly undiagnosed and untreated and this consequently leads to poor treatment compliance and outcomes among diabetes patients (Bădescu et al., 2016). The main reasons for this non-compliance appear to be anxiety and disinterest among patients, leading to a poor prognosis, poor quality of life and increased mortality.

Prevalence of depression is estimated to be 11% in low income countries whereas in high income countries it's in the region of 15%. In a meta-analysis of 9 studies in Ethiopia, comprising of 2944 study patients, it was concluded that prevalence of depression among diabetes patients was 39.73%, which was consistent with reports from Netherlands (31%), Malaysia (30.5%) and Nigeria (30%) (Henok, Getenet, Fasil, Cheru, & Dube, 2018).

Depression can lead to poor diabetes medication and treatment compliance in cases where patients have disinterest in taking medication or embracing recommended lifestyle modification such as recommended diet, exercise and foot hygiene. Depression in type 2 diabetes mellitus patients has been adversely associated with poor disease control, poor health outcomes and general poor quality of life (Andreoulakis, Hyphantis, Kandylis, & Lacovides, 2012).

Summary

Diabetes, being a debilitating medical condition, has required and to a large extent received a focus that has helped to improve its care in both developing and developed world. More of this focus has gone into treatment and management of the

condition, with new advances in technology and medicine strongly coming into play. Cases of diabetes continue to rise rapidly in the world and an effective approach in fighting the disease requires a multidisciplinary approach that involves physicians, dieticians and health educators. Presently, many health care systems are still struggling on the fight against diabetes, but with innovative strategies to improve health education and health promotion on the disease, with a focus on evidence based care practices as well as self-management on the part of the diabetic many gains would be realized toward optimal health outcome among diabetics.

A lot of research across the world has gone into compliance to diabetes treatment, but there's paucity of information on the same in the Kenyan context. Moreover, most of the global research on compliance has laid focus on self-management practices or response to anti-diabetic medication without much concentration on health education, which is a fundamental aspect of sustained optimal adherence to medication for not only diabetes, but all chronic diseases.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter describes the study design and techniques that were used in the study investigations. Determinations of sample size, data instruments and validation as well as methods of data analysis and ethical considerations are also detailed in this section of the proposal.

Research Design

The study was a cross sectional research that involved description, recording, analysis and interpretation of relationships between selected characteristics and compliance to diabetes medication. It entailed measuring of variables and assessment of the relationship between them, without manipulation of the independent variable

This research design was selected because it is good for descriptive analyses and allows for data collection over a short period of time. Moreover, cross sectional research designs do not involve manipulation of the variables, allow for the researcher to look at numerous characteristics at once and are relatively inexpensive. In this particular study, the research design provided a snap shot of the rate of compliance to diabetes treatment and the factors associated (Pelham, Carvalo, & Jones, 2005).

Population and Sampling Techniques

The study focused on type 2 diabetes patients attending the diabetes outpatient clinic in MTRH. The diabetes outpatient clinic was started in 2009 and has been majorly supported by the America Diabetes Foundation (ADF) and United States Agency for International Development (USAID) to offer affordable diabetes care to

patients within Western Kenya. Between January 2016 and December 2017, the clinic served 316 adult diabetes patients; 176 in 2016 and 140 in 2017.

The study population was type 2 diabetes patients aged 18 years and above that had previously received diabetes treatment at the diabetes outpatient clinic in MTRH between January 2016 and December 2017.

Eligibility Criteria

Inclusion criteria.

- Type 2 diabetes patients who are 18 years and above
- Type 2 diabetes patients who previously received care in the diabetes outpatient clinic in MTRH between January 2016 and December 2017
- Patients taking anti diabetic medication
- Ability to provide written informed consent

Exclusion criteria.

- Type 1 diabetes patients or gestational diabetes patients
- Diabetes patients below 18 years of age
- Patients who are not on any anti-diabetic medication
- Inability to understand or provide written informed consent

Sample Size Determination

The total target population of 316 was considered as the study sample, which was identified through census sampling, a non-probability sampling technique.

Adult type 2 diabetic patients who attended the diabetes outpatient clinic in MTRH and were on medication during the data collection period were requested to participate in the study. Data collection continued until a total of 316 patients were enrolled into the study.

Research Instruments

A researcher-developed questionnaire was used as the key research instrument for the study. Contents of the questionnaire included socio-demographics, socio-economic and diabetes condition aspects, compliance to medication/treatment as well as health education and an assessment of depression as a potential confounding variable.

The research instrument was divided into the following main parts:

- Part A that contained demographic information
- Part B that entailed an assessment of the diabetes condition
- Part C aimed at collecting information about compliance to anti diabetic medication and treatment in form of lifestyle modification
- Part D collected information on health education
- Part E contained an assessment of depression among patients

A validated researcher-developed questionnaire was used to assess for medication and treatment compliance. To assess for depression (a potential confounder in the study), the researcher employed the PHQ-9 (Patient Health Questionnaire-9), a tool that has been validated for use in screening for undiagnosed depression in mental health. This tool is simple, short and easy to administer in a variety of settings.

Validity and Reliability of Research Instruments

Questionnaire validity was tested through expert validation and conceptual validation. Guidance and input from the researcher's supervisors formed the basis of expert validation, whereas conceptual validation was achieved through review of literature and carrying out of a pilot study in Turbo diabetes outpatient clinic, which is situated within Turbo Sub-county Hospital, about 30km from Eldoret. The Turbo

diabetes outpatient clinic was established in the year 2013 and offers comprehensive diabetes care to patients within the sub county, supported by the AMPATH Care Program. Cronbach's alpha coefficient was computed to establish the reliability of the questionnaire. The results of the reliability analysis gave a Cronbach's alpha of 0.863 for compliance to anti diabetic medication, 0.933 for health education and 0.785 for the patient health sections of the questionnaire. Therefore, the whole questionnaire was considered to be a reliable instrument since an overall Cronbach's alpha of 0.6 or higher was achieved.

Data Gathering Procedures

The following procedures were used for data gathering in the study:

- Following clearance from the University of Eastern Africa Baraton Research Ethics Committee and Director of Graduate Studies and Research, the researcher sought permission from the Kenya National Commission for Science Technology and Innovation and the Moi Teaching and Referral Hospital (MTRH) institution for data collection
- The researcher presented the letters of research authorization to the MTRH diabetes outpatient clinic in-charge who gave final authorization for data collection
- Training and orientation of research assistants was conducted on the process of data collection
- Census sampling of study participants was conducted with reference to clients' clinic schedules and as per adherence to inclusion criteria. Patients outpatient clinics were held every week on Mondays, Thursdays and Fridays

- Administering of questionnaire to willing study participants through a process that took 3 months for all data to be collected.

Data Management

The data sources included questionnaire data from patients attending the MTRH Diabetes Outpatient Clinic. Data obtained was coded and entered into SPSS version 20.0 database. Only members of the research team performing data entry and retrieval were allowed direct access to the database. Hard copies of patient information were kept in a lockable cabinet, with only authorized study personnel being allowed access.

Statistical Treatment of Data

Frequency distribution and percentages were used to describe the demographic variables. Descriptive statistics were computed for study participants' characteristics, compliance to medication and treatment, as well as factors associated with compliance.

Step-wise linear regression analysis was used to assess the association of the independent variables with the dependent variable. Pearson's Correlation Coefficient was also used to determine the relationship between socio-economic, socio-demographic and health education factors with compliance to medication. T-test for independent samples and one-way analysis of variance were used to compare levels of compliance of patients classified according to sex and marital status and employment status, respectively. In describing the variables, separate analysis was done for each variable. Moreover, characteristics of the study population were analyzed using descriptive statistics.

In the process of entering data for compliance, coding was done as follows: Yes=1, No=0. On performing data entry, the researcher ran a command in SPSS data

analysis software where for statements that suggested non-compliance, i.e No, the code was changed to 1 whereas for statements implying compliance, i.e Yes, the code was changed to 0. A score for compliance was computed for every research participant. As for the PHQ-9 questionnaire to assess for depression (potential confounding variable), each of the 9 questions were evaluated on a 4-point rating scale, with major depressive disorder being considered present if the score was equal to, or greater than 10.

In conducting step-wise linear regression, the researcher did a separate analysis to identify the socio-demographic factors and socio-economic factors that are associated with compliance, where it was treated as a whole.

Ethical Considerations

Participation in the study was voluntary and written informed consent was obtained from all study participants after the study had been clearly explained to them. Privacy and confidentiality of patient information was strictly adhered to through assigning of codes/numbers to patients instead of their names in the course of research. In addition, all collected information was stored in password-protected databases.

Strict honesty in reporting of study results was adhered to and respect for intellectual property rights was observed as well.

CHAPTER FOUR

PRESENTATION OF FINDINGS, ANALYSIS AND INTERPRETATION

This chapter covers presentation of findings, analysis and interpretation of statistics. Comparison of results with other prior related studies is also integrated into the discussion of this research study.

Social Demographic and Economic Characteristics of Study Participants

Table 2 presents a summary of the social demographic and social economic characteristics of the 316 study participants, among which 62% were female whereas 38% were male.

The mean age of the participants was 59.23 years with the minimum age being 30 years and the maximum age being 90 years. The most predominant religion among the study participants was Christianity (97.5%), while on the other hand Islam was practiced by 2.5% of the study participants. There were no Hindu or atheists participating in the study. Moreover, 82.3% of the study participants reported as being married, whereas 11% were widowed at the time of the study. Relatively low percentages were recorded among the divorced/separated (2.5%) and the never married (3.8%) groups of participants.

The percentage of participants who were self-employed at the time of the study was 41.1%, whereas the unemployed were 38.3%. From table 2, as far as income is concerned, 68.7% of participants earned ten thousand Kenya shillings or

Table 2

Social Demographic and Economic Characteristics of Study Participants

Characteristics	Frequency	Percentage
Sex		
Male	120	38
Female	196	62
Age (Years)		
<40	18	5.7
40-49	45	14.2
50-59	91	28.8
≥ 60	162	51.3
Religion		
Christian	308	97.5
Muslim	8	2.5
Marital status		
Never married	12	3.8
Married	261	82.6
Widowed	35	11.1
Divorced/separated	8	2.5
Employment		
Employed	35	11.1
Unemployed	121	38.3
Self employed	130	41.1
Retired	30	9.5
Income (Ksh per month)		
≤ 10,000	123	68.7
10,001-30,000	36	20.1
30,001-50,000	8	4.5
≥50,000	12	6.7
Highest level of education		
No formal education	40	12.7
Primary school	156	49.4
Secondary school	80	25.3
College/University	40	12.6
Family/social support		
Available	306	96.8
Not available	10	3.2

less, whereas 4.5% earned between thirty thousand and fifty thousand Kenya shillings. More than 12% of study participants had attained a highest education level of college/university, while the majority had attained primary school qualification (49.2%) as the highest level of education. The mean size of family among study

participants was 7 persons, with the minimum being 2 and the maximum 17 persons. Family support for anti-diabetic medication was among 96.8%, whereas it was lacking among 3.2% of study participants.

Diabetes Condition among Study Participants

All study participants were type 2 diabetes patients who were on one or several types of anti-diabetic medication for durations ranging from less than a year to 3 years or more. Majority of participants were on oral medication only (oral hypoglycemic drugs) (37.8%), while 35.2% were on injection medication only (insulin) and 27.0% on both oral and injection medication.

More than 11% of study participants had been on anti-diabetic medication for less than a year, whereas 74.1% had been on medication for more than 3 years. Moreover, 14.8% had been on medication for a period of between 1 year and 3 years. As far as accessibility of medication was concerned, 83.9% of participants reported that they could get their medication easily, while 16.1% said that they did not have easy access to their medication. The ease of access to medication can be explained by the presence of a revolving fund pharmacy within the hospital, that provides anti diabetic medication at subsidized prices to diabetes patients. The impressive compliance rate later discussed in this chapter can also largely be attributed to the ease of access to medication within the hospital. On the other hand, 5.1% were using alternative medication, which was either traditional medicine (86.7%) or nutritional supplements (13.3%), most likely as a consequence of financial constraints limiting access to medication.

Table 3 presents the characteristics of diabetes conditions of the study participants.

Table 3

Characteristics of the Diabetes Condition of Study Participants

Characteristics	Frequency	Percentage
Type of medication		
Orals only	119	37.8
Injections only	111	35.2
Both orals and injections	85	27
Duration on medication		
Less than a year	35	11.1
Between 1 year and 2 years	21	6.6
Between 2 years and 3 years	26	8.2
More than 3 years	234	74.1
Access to medication		
Easily accessible	265	83.9
Not easily accessible	51	16.1
Alternative medication		
Used	16	5.1
Not used	300	94.9
Type of alternative medication		
Traditional medicine	13	86.7
Nutritional supplements	2	13.3

Analysis of Data for Specific Objectives

Compliance to Diabetes Treatment

Research objective one: To determine the rate of compliance to treatment regimen by type 2 diabetes patients attending the Diabetes Outpatient Clinic in MTRH

The rate of compliance among patients was assessed on a basis of self - reporting through researcher-administered questionnaires on “yes” and “no” answers to questions aimed at obtaining data. Following data analysis, compliance was reported in form of percentages as shown in table 4 and table 5.

In assessing compliance to treatment, the study considered two aspects: medication and lifestyle change/modification. Medication was defined as the use of medical drugs to control and manage diabetes, whereas lifestyle modification was defined as the day-to-day healthy life choices taken by patients in order to ensure their diabetes condition is managed/ controlled. Medication used in treating diabetes involves oral hypoglycemic drugs and/or insulin whereas lifestyle modification entails proper diet, exercise, blood glucose self-monitoring and foot care.

Compliance to Medication

The study found that 8 out of 10 (79.9%) type 2 diabetes patients were compliant to anti diabetic medication (Mean =0.7989; Standard deviation= 0.2143). Assessment of compliance was on the basis of self-reporting among study respondents to whom structured questionnaires were administered and responses were on a "yes" or "no" basis. This rate of compliance to medication was consistent with a study by Bagonza, Rutemberwa and Bazeyo (2015) that reported an adherence rate of 83.3% among diabetes patients in Eastern Uganda. In a similar cross sectional study conducted in South Africa, patients' self-reported medication adherence was established to be 70% (Adegbola, Marincowitz, Govender, & Ogunbanjo, 2016), a rate moderately lower than that reported in this study.

It was established that 24.1% of respondents sometimes forgot to take their medication, while 20.6% stopped taking their medication as a result of feeling worse after they had taken it. Interestingly, 92.1 % of participants reported that they had taken their diabetes medication the day before, whereas 15% said they were distressed about sticking to the medication plan, as shown in table 4.

A medication compliance of 79.9% is comparatively impressive, as far as other previous studies are concerned. In a study reported by Polonsky and Henry

(2016), it was acknowledged that a compliance of 80% or more is a good mark of the success of a diabetes management program. The medication compliance reported among MTRH type 2 diabetes patients could largely be attributed to a robust health education system, phone call reminder system tailor made for patients and subsidized revolving fund pharmacy that makes it easy for patients to access oral hypoglycemic medication and insulin.

Table 4

Compliance to Anti-Diabetic Medication

	Percentage of Compliance
Not forgetting to take medicine	75.9
Taking daily anti diabetic medicine (for the past two weeks)	83.5
Did not reduce or stop taking your anti diabetic medicine without telling your doctor because of worse feeling in taking it	79.4
Not forgetting to bring along medicine when travelling or leaving home	59.8
Took all required anti-diabetic medicines the previous day	92.1
Continuous taking of medicine even when diabetes is under control	84.5
Not feeling distressed about sticking to treatment plan	84.1
Compliance to anti-diabetic medication	**79.9**

Compliance to Lifestyle Modification

Compliance to treatment in terms of lifestyle modification was 79.9% (Mean= 0.7993; Standard deviation= 0.2014) with regular healthy diet (89.2%), avoidance of harmful beverages/foods (90.2%) and daily cleaning and checking of feet (92.1%) scoring highly as portrayed in table 5. This echoed similar prior related studies such as one conducted by Mbutiti, Makokha, Mbakaya, and Muthami (2015) which found

that diabetes patients had a positive attitude toward adopting lifestyle modification in order to control and manage their diabetes condition.

In essence, 89% of respondents agreed that they were regularly following a healthy eating plan, whereas 92% said that they regularly checked and cleaned their feet. Moreover, 90% reported that they consistently avoided foods/beverages that their health care providers had advised them not to take, whereas 76% reported that they participated in a specific exercise session each day. These statistics were much higher than those reported in a similar study in India, where it was found that 45.9% of patients followed a healthy eating plan, 64.8% cleaned their feet daily and 43.4% took part in a specific exercise session everyday (Kulkarni, Unnikrishnan, Kumar, & Thapar, 2015). The impressive lifestyle modification compliance rate is tied to positive and healthy relationships between patient and physician, which enable the former to readily adopt medical advice. This was confirmed by a study in Austria which reported that 70% of all non-compliance to type 2 diabetes treatment is as a result of lack of proper physician education and the absence of patients' direct involvement in the treatment process.

An impressive 96.8% of study respondents reported that they have previously received health education on key aspects of diabetes self-management such as diet and exercise, whereas 90.2% agreed that they have received training on how to test and self-monitor their blood glucose levels. This may explain why a good number of patients reported having positively responded to lifestyle modification as a means of treating diabetes.

As a measure of compliance, self-monitoring of blood glucose was the lowest percentage (60%) among respondents, which was a huge disparity from other measures of compliance. This portrays a gap within the study population, that is

synonymous with lack of adequate infrastructure or tools for the self-testing of blood glucose among respondents who generally are of low economic status. Similar findings were reported in a cross sectional study to assess adherence to and factors associated with self-care behaviors in type 2 diabetes patients in Ghana. The study, conducted in 2017, found that self-monitoring of blood glucose was the least performed self-care behavior, with only one type 2 diabetes patient complying fully. Moreover, inadequate access to glucose monitoring machines, prohibitive cost of glucose test strips, lack of health care provider support and less than adequate health knowledge was reported as reasons for the non-compliance (Mogre, Abanga, Johnson, & Paul, 2017).

Table 5

Compliance to Lifestyle Modification

	Percentage of Compliance
Regularly following a healthy eating plan	89.2
Eating fruits and vegetables regularly	92.4
Avoiding taking foods/beverages that the healthcare provider has advised not to be taking	90.2
Participation in a specific exercise session each day	76.3
Regularly testing blood sugar levels as recommended by healthcare provider	60.4
Normally testing blood sugar levels as recommended even when stressed	58.9
Checking and cleaning feet everyday	92.1
Compliance to lifestyle modification	**79.9**

Factors Associated with Compliance

Research objective two: To explore the factors associated with compliance to type 2 diabetes treatment among patients attending the Diabetes Outpatient Clinic in MTRH.

In assessing factors associated with compliance, stepwise regression model

was used as a more accurate measure of significant variables though this was only confined to ordinal variables. Association of factors with compliance was considered to be significant at $p \leq 0.05$. Categorical variables were excluded from regression analysis, with their means being compared and Pearson's correlation being used to assess for their association with compliance.

Socio-demographic Factors Associated with Compliance to Anti-diabetic Medication

Pearson's correlation was used to establish the correlation of compliance to anti diabetic medication with age, family size and duration on medication. The findings showed that age (p=0.743), family size (p=0.240) and duration on medication (p=0.194) were not significantly associated with compliance to medication, as depicted in table 6. The other socio demographic factors explored were sex and marital status whose means were compared to establish any relationship with compliance to anti diabetic medication. As shown in table 7 and table 8 respectively, sex (0.444) and marital status (0.975) are not significantly associated with compliance to anti-diabetic medication. These findings were synonymous with those of Bagonza, Rutemberwa and Bazeyo (2015) which established that age, sex, level of education and marital status were not associated with compliance to medication among type 2 diabetes patients in Eastern Uganda. The study results also echoed those from a similar study conducted in Kenyatta National Hospital, which found that age and sex were not significantly associated with compliance to type 2 diabetes medication (Waari et al., 2018).

The study results showed that the older or younger a patient was, the longer their duration on medication or the size of their family had no significant association with medication compliance. This may be explained by the fact that there are other

factors that are significantly associated with compliance, over and above social demographic factors. Such factors may include ease of access to medication, proper physician-patient relationship and active social support at the family level as far as medication compliance is concerned.

As presented in table 6, age (p = 0.743), size of family (p = 0.240) and duration of medication (p = 0.194) were not significantly associated with compliance to anti-diabetic medication, hence there was no need to run a regression analysis.

Table 6

Correlations between Age, Family Size, and Duration of Medication

		Compliance to anti-diabetic medication
Age	Pearson Correlation	-.018
	Sig. (2-tailed)	.743
	N	316
What is the size of your family?	Pearson Correlation	-.066
	Sig. (2-tailed)	.240
	N	316
How long have you been on anti-diabetic medication?	Pearson Correlation	.073
	Sig. (2-tailed)	.194
	N	316

From table 7, the p- value of 0.444 was found to be greater than the level of significance of 0.5, hence there was no significant difference between compliance of male and female patients to anti-diabetic medication. This implied that sex of patients was not significantly associated with compliance to anti diabetic medication and may be explained by an assumption that men and women often react the same way in

managing their chronic medical conditions where sufficient infrastructural support in terms of access to medication has been provided.

Table 7

Comparison by Sex

Group Statistics

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Compliance to anti-diabetic medication	Male	120	.8107	.20802	.01899
	Female	196	.7917	.21832	.01559

Independent Samples T-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Compliance to anti-diabetic medication	Equal variances assumed	.540	.463	.766	314	.444	.01905	.02486

As shown in table 8, the p- value of 0.975 was greater than the significance level of 0.05. From this analysis, it was established that there was no significant difference on compliance to anti diabetic medication among patients classified according to marital status. This implied that marital status is not associated with compliance to anti-diabetic medication and may be explained by the fact that medication compliance requires a personal effort in decision making which is not highly influenced by social factors or close partnerships such as marriage.

Table 8

Comparison by Marital Status

		N	Mean	Std. Deviation	Std. Error
Compliance to anti-diabetic medication	never married	12	.8095	.23062	.06657
	married	261	.7970	.21852	.01353
	widowed	35	.8122	.17927	.03030
	divorced/separated	8	.7857	.22908	.08099
	Total	316	.7989	.21433	.01206

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Compliance to anti-diabetic medication	Between Groups	.010	3	.003	.071	.975
	Within Groups	14.461	312	.046		
	Total	14.471	315			

Socio- demographic Factors Associated with Compliance to Anti-diabetic Lifestyle Modification

The study used regression analysis, Pearson's correlation and comparison of means to explore any association between compliance to lifestyle modification and age, family size, duration on medication, sex as well as marital status.

It was established that age ($p = 0.321$) and family size ($p = 0.981$) did not have any significant association with compliance to anti diabetic lifestyle modification. These findings were consistent with those of a study that was conducted in India, concluding that compliance among diabetics has no significant association with socio-demographic factors of patients (Manobharathi, Kalyani, Felix, & Arulmani, 2017). However, this study did find that duration on medication was significantly associated with compliance. In essence, this meant that diabetes patients who had taken

medication for longer tended to be more compliant to recommended anti-diabetic lifestyle modification most likely because they had obtained valuable information concerning their conditions and had come to accept/understand the importance of lifestyle modification in the successful management of their diabetes. Moreover, the findings echoed those of Bagonza, Rutemberwa and Bazeyo (2015) in Uganda, although they contradicted those of a research conducted in Pakistan, which showed that duration of diabetes was not significantly associated with compliance to treatment (Riaz, Basit, Fawwad, Ahmedani, & Ali, 2014).

As displayed in table 9, it can be shown that there was a significant but weak relationship between duration on medication (p=0.021) and compliance to lifestyle modification. Moreover, 1.4% of the variance in compliance to lifestyle modification was as a result of duration on medication. The linear regression model to predict compliance to lifestyle modification based on duration on medication was; Y= 0.025X + 0.711. On the other hand, age and family size do not affect compliance.

Table 9

Regression Analysis for Duration on Medication

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.130[a]	.017	.014	.20003

a. Predictors: (Constant), How long have you been on antidiabetic medication?

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.215	1	.215	5.362	.021[b]
	Residual	12.564	314	.040		
	Total	12.779	315			

a. Dependent Variable: Compliance to lifestyle modification
b. Predictors: (Constant), How long have you been on antidiabetic medication?

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.711	.040		17.947	.000
	How long have you been on antidiabetic medication?	.025	.011	.130	2.316	.021

a. Dependent Variable: Compliance to lifestyle modification

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	Age	.057[b]	1.012	.312	.057	.984
	What is the size of your family?	.001[b]	.024	.981	.001	.997

a. Dependent Variable: Compliance to lifestyle modification

b. Predictors in the Model: (Constant), How long have you been on antidiabetic medication?

The study also found that sex (p = 0.844) and marital status (p= 0.736) were not significantly associated with compliance to diabetes management. In the analysis, means of these factors were found to be comparable and this was interpreted to show that they were not associated with compliance.

With reference to table 10, the p-value of 0.844 was greater than the significance level, therefore there was no significant difference between compliance of male and female patients to lifestyle modification. Therefore, sex of patients was found to have no significant association with compliance to lifestyle modification, which may be supported by a supposition that men and women all respond the same way in adopting lifestyle changes to manage type 2 diabetes.

Table 10

Comparison by Sex

Group Statistics

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Compliance to lifestyle modification	Male	120	.7964	.18947	.01730
	Female	196	.8010	.20884	.01492

Independent Samples T-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Compliance to lifestyle modification	Equal variances assumed	.616	.433	-.196	314	.844	-.00459	.02338

From table 11, the p- value of 0.736, being greater than significance level of 0.05, meant that there was no significant difference on compliance to lifestyle modification among patients classified according to marital status. Therefore, marital status of patients was not significantly associated with compliance to lifestyle modification and this may be applied to mean that the influence of a spouse in empowering a person to comply to lifestyle modification is not pronounced.

Table 11

Comparison by Marital Status

		N	Mean	Std. Deviation	Std. Error
Compliance to lifestyle modification	never married	12	.7500	.31135	.08988
	married	261	.8024	.18871	.01168
	widowed	35	.8041	.23775	.04019
	divorced/separated	8	.7500	.26175	.09254
	Total	316	.7993	.20141	.01133

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Compliance to lifestyle modification	Between Groups	.052	3	.017	.424	.736
	Within Groups	12.727	312	.041		
	Total	12.779	315			

Socio-economic Factors Associated with Compliance to Anti-diabetic Medication

The socio economic factors explored in the study were income level, employment status, education level health education and state of depression. Regression analysis and comparison of means were used to assess for association between these social-economic factors and compliance to anti-diabetic medication.

The study established that income (p= 0.224) and educational levels (p= 0.728) have no significant association on medication compliance, whereas level of depression (p= 0.01) and health education (p= 0.045) are significantly associated with medication compliance.

As shown in table 12, the relationship between depression and health education with compliance to medication was significant, although weak at 0.296.

Table 12

Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.258[a]	.066	.061	.22031
2	.296[b]	.088	.077	.21841

a. Predictors: (Constant), Depression

b. Predictors: (Constant), Depression, Health education

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.806	2	.403	8.446	.000[b]
	Residual	8.395	176	.048		
	Total	9.201	178			

a. Dependent Variable: Compliance to anti-diabetic medication

b. Predictors: (Constant), Depression, Health education

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
	(Constant)	.722	.073		9.863	.000
	Depression	-.123	.035	-.253	-3.509	.001
	Health education	.166	.082	.146	2.023	.045

a. Dependent Variable: Compliance to anti-diabetic medication

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
	Income level	-.089[b]	-1.220	.224	-.092	.968
	Highest education level	.026[b]	.349	.728	.026	.954

a. Dependent Variable: Compliance to anti-diabetic medication

b. Predictors in the Model: (Constant), Depression, Health education

Moreover, 7.77% of the variance in compliance to anti diabetic medication was accounted for by depression (6.1%) and health education (1.6%). The linear regression model to predict compliance to anti diabetic medication based on depression and health education was; $Y= -0.123X_1 + 0.166X_2 + 0.722$. On the other hand, income level and highest education level have no significant association with compliance.

Table 13 presents a comparison of means by employment status of study participants.

Table 13

Comparison by Employment Status

		N	Mean	Std. Deviation	Std. Error
Compliance to anti-diabetic medication	Employed	35	.7918	.20888	.03531
	Unemployed	121	.8188	.19781	.01798
	Self employed	130	.7810	.23356	.02048
	Retired	30	.8048	.20022	.03656
	Total	316	.7989	.21433	.01206

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Compliance to anti-diabetic medication	Between Groups	.092	3	.031	.669	.572
	Within Groups	14.378	312	.046		
	Total	14.471	315			

From table 13, the p-value of 0.572 was greater than the significance level of 0.05, hence there was no significant difference on the compliance to anti diabetic medication by patients classified according to employment status. Therefore, employment status of patients had no significant association with compliance to anti-

diabetic medication. This may very likely be explained by the presence of a medication subsidization system in the form of a revolving fund pharmacy at the hospital, that made it easy for patients to access medication at fair prices in spite of differing economic levels.

As far as education levels were concerned, the study found no association with compliance to anti diabetic medication (p= 0.728), a finding that differed with that from a Ghana study in 2014; this study reported that education level was significantly associated with compliance on the basis that educated diabetics had better opportunities to understand the disease and hence were more likely to comply with medication (Bruce et al., 2014).

The majority of study participants (68.7%) earned a monthly income of KSh10,000 or less, whereas a majority of participants (49.4%) had only primary school level as the highest level of education. The study findings contradicted those of Kassahun, Gashe, Mulisa and Rike (2016) which established that prevalence of compliance to medication among type 2 diabetics in Ethiopia was significantly associated with level of education and level of monthly income.

With respect to depression and health education, several studies have been conducted to assess their effects on medication compliance among diabetes patients. In a study conducted in Ibadan, Nigeria in 2014, it was found that 24.5% of diabetes patients were non-compliant to medication due to depression (Rwegerera, 2014). This was largely because depressed persons are less likely to embrace long-term medications especially when they are stressed. Depression is a condition characterized by feeling down or hopeless, having little energy and lack of interest in normal day to day activities; as such, studies have shown that diabetics who are depressed can predict poor compliance as a result of lack of personal initiative and drive. In a

previous study by Morello et al. (2011), it was reported that health education is a key factor in improving medication compliance because well informed patients understand that medication is effective in lowering blood glucose as well as how to deal with adverse effects/ side effects. Health education also serves as a powerful tool to empower patients with knowledge on their disease diagnosis and prognosis, as well as how best to manage the condition.

Socio-economic Factors Associated with Anti-diabetic Lifestyle Modification

Using linear regression analysis and comparison of means, the research investigations found that depression (p= 0.346), level of income (p= 0.745) and level of education (p= 0.671) have no significant association with compliance to diabetes treatment in form of lifestyle modification. However, it established that health education (p= 0.000) had a significant association with compliance to diabetes treatment. The focus of the study, as far as lifestyle modification for diabetes treatment was concerned, was on healthy eating, regular physical activity, self-monitoring of blood glucose and proper foot hygiene, all which are recommended by the American Diabetes Association as effective strategies to handle and treat type 2 diabetes.

From table 14, it can be shown that the degree of relationship between health education and compliance to lifestyle modification was found to be significant but moderate at 0.363. As a matter of fact, 12.7% of the variance in compliance to lifestyle modification was attributed to health education, which had previously been offered to at least 96% of study participants as reported in the questionnaire. The linear regression model to predict compliance to lifestyle modification based on health education was; $Y= 0.343X + 0.523$. Income level, highest education level, and

state of depression are not significantly associated with compliance to lifestyle modification.

Table 14

Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.363[a]	.132	.127	.17613

a. Predictors: (Constant), Health education

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.834	1	.834	26.898	.000[b]
	Residual	5.491	177	.031		
	Total	6.325	178			

a. Dependent Variable: Compliance to lifestyle modification

b. Predictors: (Constant), Health education

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.523	.056		9.408	.000
	Health education	.343	.066	.363	5.186	.000

a. Dependent Variable: Compliance to lifestyle modification

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correla-tion	Collinea-rity Statistics Tolerance
1	Income level	.023[b]	.326	.745	.025	1.000
	Highest education level	-.030[b]	-.426	.671	-.032	.984
	Depression	-.066[b]	-.945	.346	-.071	.999

a. Dependent Variable: Compliance to lifestyle modification

b. Predictors in the Model: (Constant), Health education

The p-value of 0.184 from table 15 was greater than significance level of 0.05; hence there was no significant difference on compliance to lifestyle modification among patients classified according to employment status. Therefore, employment status of patients had no significant association with compliance to lifestyle modification.

Table 15

Comparison by Employment Status

		N	Mean	Std. Deviation	Std. Error
Compliance to lifestyle modification	Employed	35	.7673	.17696	.02991
	Unemployed	121	.7769	.22428	.02039
	Self employed	130	.8198	.18955	.01662
	Retired	30	.8381	.17083	.03119
	Total	316	.7993	.20141	.01133

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Compliance to lifestyle modification	Between Groups	.196	3	.065	1.623	.184
	Within Groups	12.582	312	.040		
	Total	12.779	315			

From the study's findings, it can be deduced that compliance with these lifestyle modification activities does not necessarily require one to have a high level of income or high level of education (Adegbola et al., 2016). However, patients must have received good basic health education for them to be empowered to make proper life choices in terms of lifestyle modification for continued optimal blood glucose levels. The study setting was such that patients had ready access to subsidized oral hypoglycemic medication and insulin for use and this may explain why socio-economic status was not a major factor as far as their medication and treatment

compliance was concerned. A detailed Diabetes Self-Management Education (DSME) program for type 2 diabetes patients has been proven to work extremely well in assuring high levels of treatment compliance among type 2 diabetics. Such a plan entails close partnership between the patient and care provider in assessment, goal setting and specific planning for lifestyle modification activities (Burke et al., 2014). The study reported that more than 96% of patients had effectively received health education from their physicians on key lifestyle modification practices and this further explains the self-reported medication and treatment compliance rate of 80%.

In stark contrast to these study findings, other previous studies have shown a strong correlation between compliance and level of income/ social-economic status of diabetes patients especially in areas where there's absence of universal health coverage and significant constraints in access to medication as well as high social economic disparity among patients (Wens et al., 2005).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of the study, conclusions derived and recommendations from the study findings.

Summary

The main focus of this study was on factors influencing compliance to treatment among type 2 diabetes patients attending the Diabetes Outpatient Clinic in Moi Teaching and Referral Hospital, Eldoret, Kenya. Poor compliance to treatment is a major concern among chronic disease management programs throughout the world since it leads to increased risks, co-morbidities, poor quality of life and premature mortality. The main objectives of the study were to determine the rate of compliance to treatment and to explore the factors associated with compliance to treatment among type 2 diabetics attending the diabetes outpatient clinic. Over a span of 3 months, a total of 316 type 2 diabetes patients were consented to participate into the study and data collected by use of a researcher-developed questionnaire. A total of 120 men and 196 women were enrolled into the study, making up 38% and 62% of the study population respectively, with a mean age of 59.23 years.

The study operated on the basis of a theoretical framework that stated that socio-demographic and socio-economic factors have a significant association with compliance to diabetes treatment. From this framework, the study conceptualized that the rate of compliance to treatment was strongly associated with socio-demographic and socio-economic factors as the independent variables.

The study employed a cross sectional research design that involved collection of data on a single visit approach by study respondents, as well as interpretation of relationships between selected characteristics and compliance to diabetes medication and treatment.

Summary of Findings

1. From the study findings, it was established that among the type 2 diabetics attending the outpatient clinic, the rate of compliance to medication (oral hypoglycemic medication and/or insulin) and treatment (lifestyle modification in form of healthy diet, regular exercise, self-monitoring of blood glucose and foot hygiene) was 79.9%. In informing the rate of compliance, of note was the fact that 24.1% of respondents sometimes forgot to take their medication, whereas 20.6% stopped taking it altogether due to adverse side effects. On the other hand, a high percentage of study participants regularly observed recommended foot hygiene (92%), followed a healthy eating plan (89%) and engaged in regular physical exercise (76.3%). However, only a paltry 60% engaged in regular exercises of blood glucose self-monitoring.
2. From the study, level of depression and duration on diabetes medication were found to be associated with compliance to medication and compliance to treatment respectively. Moreover, health education was established to be significantly associated with compliance to mediation and compliance to treatment among type 2 diabetes patients attending the outpatient clinic. Other socio-demographic and socio-economic factors were found to have no significant association with compliance; these factors include age, sex, marital status, family size, level of income, level of education and religion.

Conclusions

1. The rate of compliance to both medication and treatment among type 2 diabetes patients attending the diabetes outpatient clinic in Moi Teaching and Referral Hospital is 79.9%
2. Type 2 diabetes patients who are less depressed and those who have taken medication for longer tend to be more compliant to medication and treatment through recommended lifestyle modification. Moreover, patients who have received adequate health education tend to be more compliant to anti diabetic medication and recommended lifestyle modification, as they understand their medical condition, diagnosis and prognosis better.

Recommendations

The data collected during the study leads to the following recommendations:

1. Type 2 diabetes care programs led by the Kenya Ministry of Health and other relevant stakeholders should improve health education efforts so as to ensure all diabetics are empowered with knowledge and skills to positively handle their chronic conditions and by extension, comply with treatment.
2. Strategies to diagnose and manage depression among type 2 diabetes patients should be encouraged through patient counseling as well as psychosocial groups among patients attending diabetes outpatient clinics.

Recommendations for Further Studies

1. Further studies should be done on rate of compliance to type 2 diabetes treatment with reference to blood glucose levels to compare compliance and response to treatment. Such studies will be instrumental in eliminating bias that comes with self-reported adherence among study respondents.

2. More research should be done through longitudinal study designs to assess long term rates of compliance as well as factors and co-morbidities that may be associated with non-compliance.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

Participant Study No: _____

Date: ____/____/_____ (DD/MM/YYYY)

Please tick only one response unless otherwise instructed.

Part A: Demographic Information

1. Gender: Male ☐ Female ☐

2. Age in years? _____ Years (Indicate number of years)

3. What is your religion?

Atheist ☐

Muslim ☐

Hindu ☐

Christian ☐

Others (Please specify)

……

4. What is your marital status?

Never married ☐

Married ☐

Widowed ☐

Divorced/separated ☐

5. What is your employment status?

Employed ☐

Unemployed ☐

Self employed ☐

Retired ☐

Other specify; ……

6. How much is your monthly income in Kenya Shillings?

≤ 10,000 ☐

10,001- 30,000 ☐

☐

30,001 – 50,000

≥ 50,000 ☐

7. What is your highest education level?

No formal education ☐

Primary school ☐

Secondary education ☐

College/university ☐

Others; ……

8. a) What is the size of your family? ……

b) Do your family members encourage you to take diabetes medication?

Yes ☐ No ☐

Part B: Diabetes Condition

9. a) What type of anti-diabetic medication do you take?

Orals only ☐

Injections only ☐

Both orals and injections ☐

b) How long have you been on diabetes medication?

Less than 1 year ☐

Between 1 and 2 years ☐

Between 2 and 3 years ☐

More than 3 years ☐

c) Do you get your anti-diabetic medication easily?

Yes ☐

No ☐

d) Do you use any alternative medicine?

Yes ☐ No ☐

e) If yes, which one?

Traditional medicine ☐

Nutritional supplements ☐

Other (Please specify)……

Part C: Compliance to anti-diabetic medication

10. Answer Yes or No to each of the following questions concerning adherence to your diabetes medication and management:

	Question	Yes	No
i	Do you sometimes forget to take your medicine?		
ii	Thinking over the past 2 weeks, were there any days when you did not take your anti diabetic medicine?		
iii	Have you ever reduced or stopped taking your anti diabetic medicine without telling your doctor because you felt worse when you took it?		
iv	When you travel or leave your home, do you sometimes forget to bring along your medicine?		
v	Did you take all your anti diabetic medicines yesterday?		
vi	When you feel like your diabetes is under control, do you sometimes stop taking your medicine?		
vii	Taking medicine every day is a real inconvenience for some people. Do you ever feel distressed about sticking to your treatment plan?		
viii	Do you regularly follow a healthy eating plan?		
ix	Do you eat fruits and vegetables regularly?		
x	Do you avoid taking foods/beverages that the healthcare provider has advised you not to be taking?		
xi	Do you participate in a specific exercise session each day?		
xii	Do you regularly test your blood sugar levels as recommended by your healthcare provider?		
xiii	Even when you are stressed, do you normally test your blood sugar levels as recommended?		
xiv	Do you check and clean your feet every day?		

Part D: Health Education

11. Answer Yes or No to each of the following questions concerning your health education on diabetes:

	Question	Yes	No
i	Have you ever received health education from your healthcare provider on key aspects of diabetes self-management such as diet and exercise?		
ii	Has your healthcare provider trained you on how to self monitor your blood glucose levels?		
iii	Has your healthcare provider explained to you why anti diabetic medication is necessary for you?		
iv	Has your health care provider clearly explained to you the causes of diabetes?		
v	Does your health care provider offer you medical advice every time you visit the clinic to collect your medication?		
vi	Has your healthcare provider provided you with information education communication material for your ease of reference at home?		
vii	Does your healthcare provider make it easy for you to ask questions concerning diabetes and its management?		
viii	Has your healthcare provider explained to you the importance of setting personal goals in successful diabetes management?		

Part E: Patient Health

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 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

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 2: INFORMED CONSENT DOCUMENT

INFORMED CONSENT STATEMENT FOR FACTORS INFLUENCING COMPLIANCE TO TREATMENT AMONG TYPE 2 DIABETES PATIENTS ATTENDING DIABETES OUTPATIENT CLINIC AT MTRH, ELDORET KENYA

INTRODUCTION:

You are being asked to participate in this research study because you have been diagnosed with diabetes mellitus. Kapten Muthoka, a master of public health student at University of Eastern Africa Baraton, is the investigator conducting this study. This consent form gives you information about the study. The investigator, and research staff will talk with you about this information. You are free to ask questions about this study at any time. If you agree to take part in this study, you will be asked to sign this consent form. You will get a copy to keep.

STUDY PURPOSE:

The main objective of the study is to determine the factors affecting compliance to diabetes treatment among patients attending the diabetes outpatient clinic in MTRH

Please note that:

- It is entirely your choice whether or not you participate in this study.
- You may stop taking part in the study at any time.
- You will still receive your standard health care if you do not participate in this study.

Diabetes mellitus is a common chronic disease affecting approximately 422 million people in the world today. Many diabetics suffer or die prematurely due to poor compliance/adherence to medication after diagnosis. This study would like to find out the factors that affect compliance to diabetes medication, as well as the role of health education in diabetes medication adherence. Moreover, barriers that are experienced by you as a diabetes patient in seeking medical help will also be assessed. We will administer a questionnaire to you, seeking health information relevant to your diabetes care.

NUMBER OF PEOPLE TAKING PART IN THE STUDY:

If you agree to participate, you will be one of about **316** people who will take part in this research study.

PROCEDURE FOR THE STUDY:

If you agree to be in the study, you will be required to provide information concerning your demographics, compliance to medication, knowledge about diabetes as well as barriers experienced in seeking diabetes medication. The questions that you will be asked will take about 20 minutes to complete. You will only be expected to participate in the study once, since this is a single visit research. No samples will be collected from you in the course of study**.**

RISKS OF TAKING PART IN THE STUDY:

Risks of Breach of Confidentiality
Although the investigator will take care to maintain confidential records, taking part in this study may risk your medical information becoming known to other people.

BENEFITS OF TAKING PART IN THE STUDY:

If you participate in this study, there may be a direct benefit to you, but no guarantee can be made. It is also possible that you may receive no benefit from being in this study. Information learned from this study may help others who have diabetes in Kenya, as far as knowledge in best practices for diabetes care are concerned.

ALTERNATIVES TO TAKING PART IN THE STUDY:

Instead of being in this study you have the choice of not taking part and having your usual care today. If you refuse to take part in the study, you will still receive the usual treatment you would get from your diabetes care clinic.

CONFIDENTIALITY:

The investigator and study team will provide you with an identification number. The identification number, not your name or other information that could be used to identify you, will be used with the information that is collected about you. Your medical records and the list of names, addresses, and identification numbers will be kept in a locked room. Only the study staff will have the keys. Any publication of this study will not use your name or identify you personally. Efforts will be made to keep your personal information confidential.

CONTACTS FOR QUESTIONS OR PROBLEMS:

For questions about your rights as a research participant or complaints about the research study, contact the principal investigator, Kapten Muthoka through 0722173039.

VOLUNTARY NATURE OF STUDY:

Taking part in this study is completely up to you. You may choose not to take part in this study. You may leave this study at any time. You will be treated the same no matter what you decide.

The investigator will tell you about new information from this or other studies that may affect your health, welfare, or willingness to stay in this study. If you want the results of the study, let him know.

PARTICIPANT'S CONSENT:

In consideration of all of the above, I give my consent to participate in this research study. I have read this consent form (or had it read and explained to me), all my questions have been answered, and I agree to take part in this study. I acknowledge receipt of a copy of this informed consent statement.

PARTICIPANT'S SIGNATURE OR MARK:_____Date:_____

SIGNATURE OF PERSON OBTAINING CONSENT:_____Date:_____

APPENDIX 3: UEAB APPROVAL TO CONDUCT PILOT STUDY

OFFICE OF THE DIRECTOR OF GRADUATE STUDIES AND RESEARCH

UNIVERSITY OF EASTERN AFRICA, BARATON
P. O. Box 2500, Eldoret, Kenya

17 July 2018

TO WHOM IT MAY CONCERN:

Re: PILOT STUDY OF RESEARCH INSTRUMENT

Kapten M. Muthoka is a graduate student pursuing the degree **Master of Public Health (Generalist and Health Promotion)** at the University of Eastern Africa, Baraton. He is currently writing his thesis entitled ***Factors influencing compliance to medication in the management of type 2 diabetes among patients attending AMPATH diabetes clinic at Moi Teaching and Referral Hospital, Eldoret, Kenya.***

To establish the reliability of his research instrument, Kapten is conducting a pilot study. Kindly allow him to administer his questionnaires to selected diabetes patients in your clinic.

Any assistance you will grant him will be greatly appreciated. May God richly bless you in all your undertakings.

Sincerely yours,

Prof. Elizabeth M. Role, PhD
Director

Cc: Chair, Department of Public Health
Office File

UNIVERSITY OF EASTERN AFRICA DIRECTOR 17 JUL 2018 Graduate Studies BARATON

A SEVENTH-DAY ADVENTIST INSTITUTION OF HIGHER LEARNING
CHARTERED 1991

APPENDIX 4: UEAB ETHICS APPROVAL

OFFICE OF THE DIRECTOR OF GRADUATE STUDIES AND RESEARCH

UNIVERSITY OF EASTERN AFRICA, BARATON

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

October 31, 2018

Kapten M. Muthoka
University of Eastern Africa Baraton
Department of Public Health

Dear Kapten,

Re: ETHICS CLEARANCE FOR RESEARCH PROPOSAL (REC: UEAB/14/10/2018)

Your masters thesis proposal entitled "***Factors Influencing Compliance to Medication in the Management of Type 2 Diabetes among Patients attending Ampath Diabetes Clinic at Moi Teaching and Referral Hospital, Eldoret Kenya***" was discussed by the Research Ethics Committee (REC) of the University and your request for ethics clearance was granted approval.

This approval is for one year effective October 31, 2018 until October 29, 2019. For any extension beyond this time period, you will need to apply to this committee one month prior to expiry date.

Note that you will need a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI) and clearance from the study site before you start gathering your data.

We wish you success in your research.

Sincerely yours,

Jackie K Obey

University of Eastern Africa, Baraton
31 OCT 2018
P. O. Box 2500-30100, ELDORET
Research Ethics Committee

Prof. Jackie K. Obey, PhD
Chairperson, Research Ethics Committee

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

APPENDIX 5: UEAB PERMISSION TO GATHER DATA

OFFICE OF DIRECTOR OF GRADUATE STUDIES AND RESEARCH
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O. Box 2500, Eldoret, Kenya

08 April 2019

TO WHOM IT MAY CONCERN

Re: REQUEST FOR PERMISSION TO GATHER RESEARCH DATA

Mr. Kapten M. Muthoka is a graduate student pursuing Master of Public Health at the University of Eastern Africa, Baraton. He is currently writing his thesis entitled *Factors **Influencing Compliance to Medication in the Management of Type 2 Diabetes among Patients attending Ampath Diabetes Clinic at Moi Teaching and Referral Hospital, Eldoret Kenya.***

I am requesting you to please allow him to administer his questionnaire to selected respondents in your organization.

Any assistance you will grant him will be greatly appreciated. May God richly bless you in all your undertakings.

Sincerely yours,

UNIVERSITY OF EASTERN AFRICA DIRECTOR 08 APR 2019 Graduate Studies BARATON

Prof. Korso Gude
Ag. Director

Cc: Chair Department of Public Health
Office file

A SEVENTH-DAY ADVENTIST INSTITUTION OF HIGHER LEARNING
CHARTERED 1991

APPENDIX 6: MOI/ MTRH IREC ETHICS APPROVAL

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

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET

Reference: IREC/2018/162
Approval Number: 0003128

22nd October, 2018

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
22 OCT 2018
APPROVED

Kapten M. Muthoka,
University of East African, Baraton,
School of Health Sciences,
P.O. Box 2500-30100,
ELDORET-KENYA.

Dear Mr. Muthoka,

RE: FORMAL APPROVAL

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

"Factors Influencing Compliance to Treatment among Type 2 Diabetes Patients Attending Diabetes Outpatient Clinic at Moi Teaching and Referral Hospital".

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 3128*** on 22nd October, 2018. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; hence will expire on 21st October, 2019. 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,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

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

APPENDIX 7: 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

25th October, 2018

Mr. Kapten M. Muthoka,
University of East African, Baraton,
School of Health Sciences,
P.O. Box 2500-30100,
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:-

"Factors Influencing Compliance to Treatment among Type 2 Diabetes Patients Attending Diabetes Outpatient Clinic at Moi Teaching and Referral Hospital".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

25/10/2018

DR. WILSON K. ARUASA, *MBS*
CHIEF EXECUTIVE OFFICER
MOI TEACHING AND REFERRAL HOSPITAL

MOI TEACHING AND REFERRAL HOSPITAL
CEO
APPROVED
25 OCT 2018
SIGN.....
P.O. Box 3 - 30100, ELDORET

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

APPENDIX 8: NACOSTI APPROVAL

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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

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

Ref No **NACOSTI/P/18/94058/26953** Date **19th December, 2018**

Kapten Mwendwa Muthoka
University of Eastern Africa, Baraton,
P.O. Box 2500-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Factors influencing compliance to treatment among Type 2 Diabetes patients attending Diabetes Outpatient Clinic at Moi Teaching and Referral Hospital"*** I am pleased to inform you that you have been authorized to undertake research in **Uasin Gishu County** for the period ending **19th December, 2019.**

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

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

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Uasin Gishu County.

The County Director of Education
Uasin Gishu County.

APPENDIX 9: NACOSTI RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MR. KAPTEN MWENDWA MUTHOKA
of UNIVERSITY OF EASTERN AFRICA BARATON, 4606-30100 ELDORET,has been permitted to conduct research in *Uasin-Gishu County*

on the topic: *FACTORS INFLUENCING COMPLIANCE TO TREATMENT AMONG TYPE 2 DIABETES PATIENTS ATTENDING DIABETES OUTPATIENT CLINIC AT MOI TEACHING AND REFERRAL HOSPITAL*

for the period ending:
19th December,2019

Permit No : NACOSTI/P/18/94058/26953
Date Of Issue : 19th December,2018
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

APPENDIX 10: DESCRIPTIVE AND RELIABILITY ANALYSES

Health Education

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Have you ever received health education from your healthcare provider on key aspects of diabetes self-management such as diet and exercise?	316	0	1	.97	.175
Has your healthcare provider trained you on how to self-monitor your blood glucose levels?	316	0	1	.90	.298
Has your healthcare provider explained to you why anti diabetic medication is necessary for you?	316	0	1	.97	.175
Has your health care provider clearly explained to you the causes of diabetes?	316	0	1	.69	.462
Does your health care provider offer you medical advice every time you visit the clinic to collect your medication?	316	0	1	.89	.318
Has your healthcare provider provided you with information education communication material for your ease of reference at home?	316	0	1	.57	.496
Does your healthcare provider make it easy for you to ask questions concerning diabetes and its management?	316	0	1	.84	.368
Has your healthcare provider explained to you the importance of setting personal goals in successful diabetes management?	316	0	1	.47	.500
Health education	**316**	**.00**	**1.00**	**.7860**	**.21831**

Depression

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Little interest or pleasure in doing things	316	0	3	1.19	.994
Feeling down, depressed, or hopeless	316	0	3	.39	.779
Trouble falling or staying asleep, or sleeping too much	316	0	3	.94	1.003
Feeling tired or having little energy	316	0	3	1.30	.970
Poor appetite or overeating	316	0	3	.53	.874
Feeling bad about yourself — or that you are a failure or have let yourself or your family down	316	0	3	.42	.834
Trouble concentrating on things, such as reading the newspaper or watching television	316	0	3	.45	.840
Moving or speaking so slowly that other people could have noticed? Or the opposite –being so being so fidgety or restless that you have been moving around a lot more than usual	316	0	2	.34	.746
Thoughts that you would be better off dead or of hurting yourself in some way	316	0	3	.14	.522
Depression	**316**	**.00**	**2.22**	**.6347**	**.46693**

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?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not difficult at all	267	84.2	84.5	84.5
	Somewhat difficult	49	15.5	15.5	100.0
	Total	316	99.7	100.0	
Missing	System	1	.3		
Total		317	100.0		

Compliance to anti-diabetic medication

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
*Do you sometimes forget to take your medicine?	316	0	1	.24	.428
*Thinking over the past 2 weeks, were there any days when you did not take your anti diabetic medicine?	316	0	1	.16	.371
*Have you ever reduced or stopped taking your anti diabetic medicine without telling your doctor because you felt worse when you took it?	315	0	1	.21	.405
*When you travel or leave your home, do you sometimes forget to bring along your medicine?	316	0	1	.40	.491
Did you take all your required anti-diabetic medicines yesterday?	316	0	1	.92	.270
*When you feel like your diabetes is under control, do you sometimes stop taking your medicine?	316	0	1	.16	.363
*Do you ever feel distressed about sticking to your treatment plan?	314	0	1	.16	.366
Compliance to anti-diabetic medication	**316**	**.00**	**1.00**	**.7989**	**.21433**

*Non-compliance – recoded in the computation of the mean

Compliance to diabetes treatment (lifestyle modification)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Do you regularly follow a healthy eating plan?	316	0	1	.89	.310
Do you eat fruits and vegetables regularly?	316	0	1	.92	.265
Do you avoid taking foods/beverages that the healthcare provider has advised you not to be taking?	316	0	1	.90	.298
Do you participate in a specific exercise session each day?	316	0	1	.76	.426
Do you regularly test your blood sugar levels as recommended by your healthcare provider?	316	0	1	.60	.490
Even when you are stressed, do you normally test your blood sugar levels as recommended?	316	0	1	.59	.493
Do you check and clean your feet everyday?	316	0	1	.92	.270
Compliance to diabetes treatment	**316**	**.00**	**1.00**	**.7993**	**.20141**

Reliability (Compliance to Anti-diabetic Medication)

Reliability Statistics

Cronbach's Alpha	N of Items
.863	14

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
*Do you Sometimes forget to take your medicine	9.71	12.042	.304	.866
*Thinking over the past 2 weeks, were there any days when you did not take your anti diabetic medicine?	9.79	11.303	.511	.854
*Have you ever reduced or stopped taking your antidiabetic medicine without telling your doctor because you felt worse when you took it?	9.63	11.984	.362	.862
*When you travel or leave your home, do you sometimes forget to bring along your medicine?	9.71	11.172	.585	.850
Did you take all your anti diabetic medicine yesterday?	9.67	11.275	.576	.850
*When you feel like your diabetic is under control, do you sometimes stop taking your medicine?	9.58	11.993	.391	.860
*Taking medicine everyday is a real inconvenience for some people. Do you ever feel distressed about sticking to your treatment plan?	9.79	11.911	.323	.866
Do you regularly follow a healthy eating plan?	9.54	11.042	.831	.838
Do you eat fruits and vegetables regularly?	9.54	11.042	.831	.838
Do you avoid taking foods/ beverages that the healthcare provider has adviced you not to be taking?	9.50	12.000	.502	.855
Do you participate in a specific exercise session each day?	9.58	11.558	.552	.852
Do you regularly test your blood sugar levels as recommended by your healthcare provider?	9.54	11.216	.756	.842
Even when you are stressed, do you normally test your blood sugar levels as recommended?	9.79	11.650	.403	.861
Do you check and clean your feet everyday?	9.50	11.913	.541	.853

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
10.38	13.288	3.645	14

Reliability (Compliance to Anti-diabetic Medication)

Reliability Statistics

Cronbach's Alpha	N of Items
.762	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
*Do you Sometimes forget to take your medicine	4.12	3.527	.371	.755
*Thinking over the past 2 weeks, were there any days when you did not take your anti diabetic medicine?	4.20	3.000	.674	.687
*Have you ever reduced or stopped taking your antidiabetic medicine without telling your doctor because you felt worse when you took it?	4.04	3.373	.533	.722
*When you travel or leave your home, do you sometimes forget to bring along your medicine?	4.16	3.390	.436	.742
Did you take all your anti diabetic medicine yesterday?	4.08	3.577	.363	.756
*When you feel like your diabetic is under control, do you sometimes stop taking your medicine?	4.00	3.583	.431	.742
*Taking medicine everyday is a real inconvenience for some people. Do you ever feel distressed about sticking to your treatment plan?	4.20	3.167	.562	.714

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
4.80	4.417	2.102	7

Reliability (Compliance to Lifestyle Modification)

Reliability Statistics

Cronbach's Alpha	N of Items
.910	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Do you regularly follow a healthy eating plan?	4.79	3.650	.787	.890
Do you eat fruits and vegetables regularly?	4.79	3.650	.787	.890
Do you avoid taking foods/ beverages that the healthcare provider has adviced you not to be taking?	4.75	3.935	.665	.903
Do you participate in a specific exercise session each day?	4.83	3.623	.725	.896
Do you regularly test your blood sugar levels as recommended by your healthcare provider?	4.79	3.563	.857	.882
Even when you are stressed, do you normally test your blood sugar levels as recommended?	5.04	3.520	.617	.915
Do you check and clean your feet everyday?	4.75	3.848	.738	.896

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
5.63	4.940	2.223	7

Reliability (Health Education)

Reliability Statistics

Cronbach's Alpha	N of Items
.933	8

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Have you ever received health education from your healthcare provider on key aspects of diabetes self-management such as diet and exercise?	6.00	4.333	.664	.932
Has your healthcare provider trained you on how to self-monitor your blood glucose levels?	6.04	4.040	.785	.923
Has your healthcare provider explained to your why anti-diabetic medication is necessary for you?	6.04	4.040	.785	.923
Has your healthcare provider clearly explained to you the cause of diabetes?	6.04	4.123	.722	.928
Does your health care provider offer you medical advice every time you visit the clinic to collect your medication?	5.96	4.290	.866	.920
Has your healthcare provider provided you with information education communication materials for your ease of reference at home?	6.12	3.860	.765	.927
Does your health care provider make it easy for you to ask questions concerning diabetes and its management?	5.96	4.290	.866	.920
Has your healthcare provider explained to you the importance of setting personal goals in successful diabetes management?	6.00	4.167	.800	.922

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.88	5.360	2.315	8

Reliability (Patient Health)

Reliability Statistics

Cronbach's Alpha	N of Items
.785	9

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Little interest or pleasure in doing things	.87	3.300	.000	.798
Feeling down, depressed or hopeless	.74	2.929	.215	.800
Trouble failing or staying asleep or sleeping too much	.83	3.150	.144	.797
Feeling tired or having little energy	.52	1.988	.609	.759
Poor appetite or overeating	.70	1.949	.634	.753
Feeling bad about yourself- or that you are a failure or have let yourself or your own family down	.83	2.696	.820	.739
Trouble concentrating on things such as reading the newspaper or watching television	.83	2.696	.820	.739
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	.83	2.696	.820	.739
Thoughts that you would be better off dead or of hurting yourself in some way	.83	2.696	.820	.739

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
.87	3.300	1.817	9

APPENDIX 11: CURRICULUM VITAE

Curriculum Vitae

PERSONAL INFORMATION	
Surname / First name(s)	**Kapten Mwendwa Muthoka**
Postal Address	P.O Box 4606-30100, Eldoret.
Mobile	+254 722 173 039
E-mail	kaptenmuthoka@gmail.com
Nationality	Kenyan.
Date of Birth	18th October 1985.
Gender	Male.
Languages	English and Swahili.
Profile	Highly motivated, hardworking, honest and self-driven individual with a willingness and determination to excel in the work environment.
Career Objective	To exemplify excellence in projects managerial work by offering committed, dedicated and high quality service and endeavouring to promote proper research ethics and standards in all my work.
WORK EXPERIENCE	
1st June 2013 to Present.	**AMPATH Cervical Cancer Screening Program (CCSP)**
Occupation / Position held	Project Manager
Main Activities / Responsibilities	· Managing/coordinating operations of cervical cancer screening and treatment clinics within the program. · Working under the Project Principal Investigator in personnel management and staff supervision · Offering logistical support for all CCSP site clinics. · Organizing/coordinating mobile outreach cervical cancer screening and treatment clinics in remote regions of Western Kenya. · Conducting periodic Monitoring and Evaluation of CCSP sites. · Overseeing planning and implementation of CCSP work plans. · Coordinating scale up and expansion of CCSP clinics to new areas as per the need. · Overseeing data collection, entry and analysis. · Coordinating and implementing quality assurance/control measures. · Preparing and presenting monthly work reports capturing the Program's progress.
16th May 2011 to 31st May 2013.	**AMPATH Cervical Cancer Screening Program (CCSP)**
Occupation / Position held	Research Assistant.

Main Activities / Responsibilities	· Assisting in Data Entry for program monitoring and evaluation as needed. · Recruiting and enrolment of study participants, including coordination of intake of eligible subjects. · Participant/patient follow-up, scheduling and reminders to coordinate study assessments. · Maintenance of subject records throughout time periods of study. · Conducting health talks and sensitization on the need for women to undergo regular screening for cervical cancer. · Working with nurses to give educational sessions and counseling of patients regarding cervical cancer screening. · Coordinating with Clinical Officer and Medical Officer in charge from AMPATH HIV clinics for systematic screening of HIV infected patients. · Organizing and facilitating cervical cancer outreach clinics.
May 2009 to July 2009	**The Government Chemist's Department.**
Occupation / Position held	Student on Attachment.
Main activities / Responsibilities	· Preparation of Laboratory samples for analysis. · Performing chemical analysis on water, effluents, food products, alcoholic beverages and herbal drugs. · General laboratory housekeeping.
September 2008 to October 2008	**The Kenya Bureau of Standards.**
Occupation / Position held	Student on Attachment.
Main activities / Responsibilities	· Preparation of samples for analysis. · Chemical analysis of samples. · Preparation and autoclaving of media. · Filling of laboratory documents. · General laboratory housekeeping.
EDUCATION	
September 2016 to Present	**Post Graduate Studies** University of Eastern Africa Baraton Master of Public Health.
March 2012 to November 2013	**Post Graduate Diploma School** Kenya Institute of Management. Post Graduate Diploma in Project Management. Upper Credit.

September 2006 to May 2010	**University** Moi University. Bachelor of Science in Biochemistry. 2nd Class Honors Upper Division.
2001 to 2004	**O-Levels** Mang'u High School. Triple Sciences, Geography and History Option KCSE Mean Grade A- (80 out of 84 points).
1992 to 2000	**Elementary** Kangundo Junior Academy. KCPE Mean Grade A (621 marks out of 700).
PERSONAL SKILLS	
Leadership / Organizational skills	Leadership and proper organisational skills exemplified by the following positions: · Inter-Campus Co-ordinator of Moi University Seventh Day Adventists (MUSDA) in the year 2008. · Evangelism co-ordinator of MUSDA in 2007. · Dormitory Head Prefect in the year 2003/2004 in Mang'u High School.
Communication Skills	Proven and sustained communication (verbal and written) skills, ability to write persuasively in a clear and concise manner, prepare detailed reports and make presentations.
Professionalism	Hands on experience in managing cervical cancer screening and treatment clinics operations, as well as overseeing mentorship programs in cervical cancer research projects.
Computer skills	Proficiency in various computer packages including Microsoft Windows and all Microsoft Office applications, Internet and e-mail, attained from the Moi University Computer Society. Excellent PowerPoint presentation skills developed through participation in several scientific forums and conferences.
PUBLICATIONS	Darron Brown, Titus Maina, Philip Tonui, John M Ong'echa, Aaron Ermel, **Kapten Muthoka,** Stephen Kiptoo, Yao Tong, YeungChing Wong, Ann Moormann, Ann Mwangi, Joseph Hogan, Patrick J. Loehrer, and Elkanah Omenge. AMPATH Oncology: Baseline HPV detection in Kenyan Women enrolled in a longitudinal study of modifiable factors predicting cervical dysplasia. Journal of Clinical Oncology, 36 no. 15_suppl (May 20 2018) 5533 J. Oguda, G. Kemboi, **K. Muthoka**, C. Were, and C. Akuku. Adoption of Scale Up Strategy and Its Effects on Healthcare Service Provision in Kenya: A Case of AMPATH Cervical Cancer Program. International Journal of Disaster Management and Risk Reduction 6 (1), 32-39

ABSTRACTS/CONFERENCE PRESENTATIONS	E. O Orang'o, E.Were, S. Kiptoo, **K. Muthoka**, D. Vanden Broeck, M.Von Knebel Doeberitz, H. Bussmann. Comparison of VIA with molecular testing using HPV DNA and the biomarker p16INK4a/Ki67 for cervical cancer screening in a high prevalent cervical cancer setting. Eurogin 2017, Amsterdam, Netherlands, October 8-11, 2017, Abstract number 00529- Oral presentation
	Muthoka Kapten, Oguda John, Were Clive, Peter Itsura, Omenge Orang'o. Improving access to Cervical Cancer Screening Services among HIV Positive Women in Western Kenya through Community Outreach Clinics. Presented at the 37th Annual Scientific Conference of the Kenya Obstetrical and Gynecological Society (KOGS), Eldoret, Kenya 13-15 February 2013
	Clive Were, John Oguda, **Kapten Mwendwa**, Peter Itsura, Omenge Orang'o. Reducing Loss to Follow up among Cryotherapy and Colposcopy Clients in the Cervical Cancer Screening Program. Presented at the 37th Annual Scientific Conference of the Kenya Obstetrical and Gynecological Society (KOGS), Eldoret, Kenya 13-15 February 2013
MEMBERSHIP TO PROFESSIONAL SOCIETIES	Association of Research Administrators in Africa (ARAA) Society of Research Administrators International (SRA) National Council of University Research Administrators (NCURA)
AWARDS/ CONFERENCES AND TRAININGS	
26th August 2011	Attended five day training on cervical cancer screening and cryotherapy-Eldoret.
17th May 2011	Certificate for successfully completing the online Collaborative Institutional Training Initiative (CITI) Human Research 2 Curriculum (Biomedical researcher).
9th August 2013	Participated in a 2-day annual research coordination workshop by AMPATH Research Program-Eldoret.
21st February 2014	Facilitated a 3 day clinical and research training on cervical cancer and prevention in Sub Saharan Africa-Eldoret.
10th April 2014	Certificate for successfully completing the online Collaborative Institutional Training Initiative (CITI) Human Research 2 Curriculum (Social Behavioural Researcher).

1st December 2014	Certificate for successfully completing the Association of Research Administrators in Africa (ARAA) Human Subjects Protection Pre-Conference Training Course-Kampala, Uganda.
4th December 2014	Attended the 5th Annual General Meeting/Conference of Association of Research Administrators in Africa (ARAA)-Kampala, Uganda.
16th September 2015	Certificate for completing the APMG International certification program (PMD Pro 1)- the Essentials of Project Management.
21st October 2015	Participated in the 2015 Society of Research Administrators Conference-Las Vegas- Nevada, USA.
12th August 2016	Attended the 58th Annual meeting of the National Council of University Administrators in Washington DC, USA
14th October 2017	Participated in the 2017 Society of Research Administrators Conference in Vancouver, Canada
7th November 2017	Attended the 11th International Conference on cancer in Africa, Kigali, Rwanda

REFEREES	Dr. Dorothy Onyango Senior Lecturer, University of Eastern Africa Baraton P.O Box 2500 Eldoret 30100 Cell: +254703274803 E mail: dorothyonyango@yahoo.com Miriam N. Kamina, Clinic Administrator, The Orthopaedic Clinic, Upper Hill Medical Centre, P.O Box 76376 Nairobi 00508 Cell: +254722798199. E mail: mndanu2002@yahoo.com Dr.Tonui Philip Gynecological Oncologist & Senior Lecturer, Moi University, P.O Box 3 Eldoret 30100 Cell: +254713320888 E mail: tonui46@yahoo.co.uk