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Effectiveness of Educational Intervention on Diabetic Knowledge & HbA1c Levels on Kenyan Adults with T2DM

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ABSTRACT

EFFECTIVENESS OF EDUCATIONAL INTERVENTION ON DIABETIC KNOWLEDGE & HbA1c LEVELS ON KENYAN ADULTS WITH T2DM

by

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ABSTRACT OF GRADUATE STUDENT PROJECT

Andrews University

College of Health & Human Services

Title: EFFECTIVENESS OF EDUCATIONAL INTERVENTION ON DIABETIC KNOWLEDGE & HbA1c LEVELS ON KENYAN ADULTS WITH T2DM

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Background

Type II diabetes mellitus (T2DM) is a common chronic metabolic disease affecting millions of people globally, which causes many long-term complications such as high blood pressure, chronic kidney disease, improper wound healing and loss of sight. Literature supports that most people, in general and diabetic patients specifically, in Africa, including Kenya are currently not taught about the importance of proper management of their disease. Therefore, many have difficulty following treatment plans, resulting in improper eating, poor glucose control, and diabetic complications. The limited knowledge concerning T2DM contributes to the negative impact this serious disease has on those who live with it. This global trend is significantly problematic for

the efforts to manage and prevent diabetes complications. Lack of diabetic knowledge leads to poor glucose control and, consequently, increased morbidity and motility. In the past, T2DM was regarded as a disease of the affluent. It is now evident that the disease's prevalence is increasing alarmingly in low income countries of Sub-Saharan Africa. The burden caused by diabetic complications is worse in these developing countries compared to the developed world.

Purpose

The purpose of this project was to determine if a structured diabetes education intervention for patients in an urban-rural hospital in Eldoret, Kenya would increase their diabetic knowledge, self-efficacy, hence reduce their HbA1c level. Literature supports that diabetes education has a measurable positive effect in mitigating diabetes complications by reducing the Glycosylated hemoglobin A1c (HbA1c) levels, weight, and blood glucose levels. The phenomenon of structured diabetes education is a novelty in Kenya; diabetes educators and their work are yet to be recognized. Diabetes education is offered only sporadically in hospitals and is usually delivered by providers with limited resources in dissemination of methods hindering expertise in treating the disorder.

Methods

After obtaining ethical approvals, 143 participants, both male and female, were screened and placed into the control or the experimental groups. Consent from both groups was obtained. The experimental group was given lessons on a structured diabetes education once every week for three weeks and then followed up for three months. All the participants were given diabetic knowledge test (DKT) and self-efficacy test at the

beginning and at the end of the project. In addition, each participant's HbA1c was collected before and after the intervention.

Results

At the end of the three months' intervention 123 out of 143 (86%) had completed the project (60 control and 63 experimental). The results showed that the experimental group had significantly reduced their levels of HbA1c compared to the control group ($F_{(1, 122)}$= 9.989, p=0.002). Also, the experimental group improved their diabetic knowledge (t=7.218, p=<0.001) and self-efficacy ($F_{(1, 117)}$= 14.342, p<0.001) significantly compared to the control group.

Conclusion

Structured diabetes education is an important step in reducing HbA1c thus, controlling diabetic complications and that diabetes education increases the patients' self-efficacy, which is crucial in adjusting lifestyles such as diet intake in managing diabetes. This project highlighted the importance of structured diabetes education by to not only the patients but also the diabetes management practitioners, the caregivers and the community at large.

Keywords: impact of dietary diabetic education, diabetic knowledge, self-efficacy, HbA1c, nutrition education, Kenya, and type-2 diabetes, University of Michigan Diabetes knowledge test, Stanford University Diabetes Questionnaire.

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A Scholarly Project

Presented in Partial Fulfillment

of the Requirements for the Degree

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APPROVAL BY THE COMMITTEE:

_____	_____
Chair: Jochebed Bea Ade-Oshifogun	Dean, School of Health Professions Emmanuel Rudatsikira
_____	_____
Member: Eric Rutto	Member: Dixon Anjejo

_____
Date Approved

DEDICATION

My scholarly project is dedicated to my mother, who has been battling T2DM since the late 1980s when the disorder was hardly known about in our community in Kenya. I remember my grandmother crying, “How can this unknown disease target my child out of everybody?” I dedicate this endeavor to my late father as well, who—together with my mom—believed in my potential to achieve great things. My dad once told me, “You will be a great person.” These huge, humbling words have inspired me to get up when I feel discouraged. I am also dedicating this project to my late neighbor Tapsingoei, who, when I was a child, believed that I would one day be a doctor. Well, I will not be a medical doctor but my doctor of nursing practice degree (DNP) will bring me close to her prediction. My husband and daughter deserve all the credit for being there for me all the way.

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LIST OF ABBREAVIATIONS

T2DM	Type 2 diabetes mellitus
HbA1c	Glycosylated hemoglobin
FNP	Family nurse practitioner
BSN	Bachelor of Science in Nursing
DKT	Diabetic Knowledge Test
DK	Diabetic Knowledge
DNP	Doctor of Nursing Practitioner
WHO	World Health Organization
CDs	Communicable Diseases
NCDs	Non-communicable Diseases
WDF	World Diabetes Foundation
CAM	Complementary alternative medicine
ADA	American Diabetes Association
EBP	Evidence-based practice
HIV	Human immunodeficiency virus
MPHS	Ministry of Public Health and Sanitation
GDM	Gestational Diabetes Mellitus
FPG	fasting plasma glucose
AACB	American association of Clinical Endocrinologists
ACE	American College of Endocrinology
SMBG	Self-monitoring of blood glucose
BASNEF	Beliefs, attitudes, subjective norms and enabling factors

HBM	Health Belief Model
IRB	Institutional Review Board
NACOSTI	National Commission for Science, Technology and Innovation
FDA	Food and Drug Administration
ANOVA	Analysis of variance
UEABREC	University of Eastern Africa Review Ethics Committee

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CHAPTER 1

INTRODUCTION

Background and Overview of Diabetes Education and Glycemic Control

The World Health Organization (WHO) (2014) defines T2DM as a chronic disease and even though T2DM is a non-communicable disease, it accounts for over two-thirds of all global deaths. Mbanya et al., (2010) state that according to the 2009 approximations of the International Diabetes Federation, by 2030, 438.4 million adults in the world will have T2DM with the projection of Sub-Saharan Africa observing an increase of 98% from 12.1 million in 2010 to 23.9 million in 2030. According to WHO, in 2012, T2DM accounted for 1% of deaths in Kenya. This is a major concern for Kenya since the country has lower health outcome levels in crucial areas such as T2DM, heart diseases and other chronic disabilities compared to developed countries (Jones, 2013). Jones states that the average life expectancy in Kenya is 56 years of age, due to enormous burden of disease. Communicable diseases (CDs) account for 62% of deaths. While a significant amount of attention and effort have been given to the management and prevention of CDs, non-communicable diseases (NCDs) need more attention. This is because; in 2010, NCDs were responsible for 28% of all the deaths and 2% of these NCDs deaths were attributed to T2DM in Kenya (WHO, 2011).

Many Kenyans are usually under-educated regarding T2DM and seek diabetes care when the complications have already become grave and irreversible (WHO, 2014).

Throughout the country, there is little to no community knowledge concerning T2DM (Jones, 2013). The Kenyan government is trying to address this negative social phenomenon by meeting the need of diabetics. Kenya launched Africa's first national diabetes strategy in 2010 (World Diabetes Foundation [WDF], 2012). In the same year, the Kenya National Diabetes Educators Manual was published (Ministry of Public Health and Sanitation, 2010). Unfortunately, it has yet to be used and its impacts on the population have not been studied (Jones, 2013). This project involved the demonstration of how diabetes education can help manage and prevent diabetic complications, which can be used by other organizations in their efforts in controlling DM complications in the community. This evidence-based project was designed to ascertain whether a diabetes education program could improve the knowledge of Kenyans with T2DM and individual Glycosylated hemoglobin HbA1c levels, as measured over a 120-day period post intervention.

Background and Rationale

T2DM is a common disease, and yet few people know how the disease progresses or why it is imperative to recognize a normal HbA1c level and how it is measured. It is vital that patients comprehend the consequences of mismanagement and the benefits of being adherent to an evidence-based diabetes education regimen. Achieving and maintaining glycemic control are challenging feats. There is a need to educate patients on how T2DM advances so that they may improve their individual glycemic control (Tol, et al., 2015). If left unattended, chronic hyperglycemic levels can be detrimental to the patients' health. Evidence now demonstrates that even small elevations of blood glucose can lead to further complications. According to Park (2018), stringent glucose control is therefore vital to a positive health outcome.

Studies have established that T2DM is a global issue, though for a long time the disease was typically associated with the affluent Western cultures. T2DM now places a huge disease burden on sub-Saharan Africa (WHO, 2014), including Kenya. Some studies suggest that T2DM complications are often neglected, largely due to an educational gap between Kenyan healthcare service providers and their diabetic patients (Jones, 2013). Matheka & Demaio (2013), suggest that most Kenyans manage their T2DM with complementary alternative medicine (CAM) because there is a lack of much-needed T2DM education. Kenyans also choose CAM due to the burdensome cost of allopathic Western medicine.

The diabetic population observed in Eldoret, Kenya, carries the same risk factors as described in other studies. These risk factors, according to a study completed by Chege (2010), agrees with ADA (2018), which include advanced age, T2DM in the immediate family, and girth obesity. Chege suggests that the majority of T2DM studies completed in Kenya have primarily focused on the disease's complications. The urbanization and adoption of new Western lifestyles by Kenyans have contributed to their increased risk of diabetes (Jones, 2013). While this correlation has been previously documented, the continuing lack of public awareness of it diminishes Kenyans' willingness to embrace healthier lifestyles such as diets. Recognizing the great need for patient and provider access to education, Novo Nordisk (2015) has collaborated with the Kenyan government and other organizations to combat the problem that T2DM poses. Novo Nordisk has promised to promote awareness initiatives, but their efforts must be researched to evaluate their impact on the patients' health.

HbA1c level control is highly dependent on the dietary intake of an individual. Different food types bear different nutrients, which affect those levels. While there is high availability of unprocessed food in Kenya, identification of nutrient contents of the different food types is not a common knowledge among the average citizen. Due to this gap, most Kenyans indulge in unhealthy eating habits and, therefore, may end up consuming foods that may increase the level of HbA1c. In this way, given the sensitivity of HbA1c levels to carbohydrate contents in the food, a lack of awareness of the nutritional values of the different food types presents as a risk factor towards high HbA1c levels.

Problem Statement

Currently in Kenya, once a patient is diagnosed with T2DM, medication and a glucometer are prescribed, but the patient is practically self-taught on how to use them. Furthermore, provision of the glucometer is not consistent to all Kenyans and one would be lucky if the glucometer is even provided to them. Patients have difficulty following treatment plans, resulting in unhealthy eating habits, poor glucose control—and eventually, diabetic complications. According to the National Diabetes Education Program (2014), complications can include heart disease, neuropathy, amputation, blindness, premature death, stroke, and oral health issues.

In the Kenyan context, most patients are primarily diagnosed with T2DM when they have already become irreversibly sick. Some are diagnosed at medical outreach camps, while others when they present at hospitals with advanced symptoms such as, increased thirst, polyuria, blurry vision, and increased hunger (WHO, 2014). Mcferran (2008) states that according to data from the Kenyan ministry of health, the estimated number of diabetic patients will rise to 4.5 % by 2025, but two-thirds will be

undiagnosed. These undiagnosed patients will affect both the health levels and the economic capacity of the country. Those who are sick might not follow medical regimens due to cost (Mcferran, 2008). This project was designed to educate diabetic participants on proper dietary intake, which will improve their HbA1c, and boost awareness of T2DM complications and how to prevent them by following a healthy diet.

Statement of Purpose

The purpose of this project was to study the effectiveness of a structured diabetes education on participants' levels of HbA1c. The project pursued to demonstrate that using evidence-based practice (EBP) tools that are measurable through clinical patients' outcomes, diabetes knowledge could be achieved. Increase in diabetes knowledge would result in increase in the patients' self-care efficacy, hence reducing HbA1c levels. By the end of the project, it was aimed that diabetes dietary knowledge would increase by at least 20%, self-efficacy average to increase by 2 points on the 10-point scale, and HbA1c levels to reduce by 1%.

Moreover, the hope is that this project would contribute to the body of research on education programs aimed at improving adherence. Dietary and cultural influences were also examined as barriers to overcome, and teaching was tailored to accommodate the Kenyan culture and modifiable cultural beliefs were discussed. This was done by having the participants discuss the barriers and ways to overcome them in order to realize the benefits of following a balanced portion diet.

Significance of Project

This project aimed at pointing out that diabetic knowledge is an essential tool in managing T2DM complications. There is a wide gap in diabetic knowledge, especially in countries in sub-Saharan Africa such as Kenya. T2DM management through lifestyle

changes such as diet and exercise has been observed to reduce the devastating effects of high levels of HbA1c in T2DM patients (Sharifirad, et al., 2011). Therefore, increasing diabetic knowledge arguably improves patients' adherence to treatment plans, leading to reduction in overall treatment cost, which reduces financial burdens on their families. This project was focused on this particular Kenyan population because there was no evidence of studies on the impact of educating the T2DM patients on self-managing. The project was, therefore, unique and it provided a way forward for other practitioners who wish to implement similar projects in the country. One way that has been proposed to improve the effectiveness of these lifestyles interventions is through self-efficacy (Bandura, 20). This project was designed to highlight the importance of a structured diabetes education and self-efficacy in managing T2DM (Mwavua, 2016).

The education modules used contributed to improving the hospital's educational offerings. The results of this project motivated providers to offer structured educational programs and refer their patients to these resources. This project provided an opportunity to educate patients with T2DM on diabetes education and contribute positively to their welfare.

PICO Question

In experimental compared to control Kenyan groups diagnosed with T2DM and with an HbA1c over 6.5, what is the effect of implementing a diabetes education program on the reduction of HbA1c levels? P—type II diabetes mellitus (T2DM) Kenyan adult patients with an HbA1c level over 6.5; I—Educational Classes; C—no education pre-intervention HbA1c and post-intervention HbA1c; O—a reduction of HbA1c; T, measured over a 120-day period.

The project questions are:

- Does a structured educational intervention increase diabetic knowledge in patients with T2DM?
- Does a structured Diabetic Educational intervention improve participants' self-efficacy in patients with T2DM?
- Does a structured Diabetic Educational intervention reduce HbA1c levels among T2DM patients?

Kenya is on the right path toward recognizing the need for continuous structured T2DM educational programs, among other measures to combat the ever-increasing number of T2DM patients. Glycemic control, according to ADA (2017), is integral to T2DM management. Lack of diabetes education reinforces poor T2DM management and results in suboptimal patient health outcomes. Obesity, a consequence of unhealthy dietary intake, is on the rise in sub-Saharan Africa. It is common scientific knowledge that obesity is the root cause and confounder of many cardiovascular problems as well as T2DM. Ziraba et al. (2009) recommend that the matter of obesity be addressed as a matter of urgency in Kenya—as it should be all over the world. According to Novo Nordisk (2015), many people in Kenya live with undiagnosed T2DM, and because of this, the severity of the disease is high. Nevertheless, diabetes education is the best strategy for defeating T2DM and all that it entails (Mcferran, 2008). Diabetes education will lead to proper meal planning, thus increasing glycemic control and halting the progression of T2DM and its complications.

CHAPTER 2

LITERATURE REVIEW

Until recently, Kenyan healthcare providers, the government, and other world organizations have devoted considerable time and financial and human resources to fighting communicable diseases (CD) such as HIV. Consequently, non-communicable disorders (NCD) such as T2DM were not considered as important and stealthily crept to the forefront until they became epidemics as well. The T2DM problem, as evidenced by the global statistics maintained by the World Health Organization (WHO) (2017) led to the death of 1.6 million people in 2015. World Health Organization predicts that T2DM in the year 2030 will be the seventh-leading cause of death in the world, with the disease rising more rapidly in low-income countries including Kenya. Yet in Kenya, there is little evidence of an extensive campaign to promote public knowledge of the complications of T2DM. According to the Ministry of Public Health and Sanitation (MPHS) (2010), the country's few medical clinics lack structurally sustainable education programs.

Moreover, no studies have been conducted to investigate the effects of T2DM education in Kenya (Jones, 2013). However, around the world, many studies have been conducted to prove that education is fundamental to glycemic control, a fact recognized by the MPHS (2010). The purpose of this project was to educate and study the effects of the education on patients' behavior. Since knowledge is the key to empowering patients to manage and prevent T2DM and its complications, it is hoped that their behavior, as

influenced by the intervention, helped to promote their adherence to medical regimens and allow them to achieve optimal holistic health.

Operating Concepts

Type two Diabetes Mellitus

The disorders of blood sugar metabolism are grouped under diabetes mellitus (DM) and characterized by hyperglycemia (ADA, 2017). These problems could be due to a lack of insulin or insulin resistance by cells. DM disorders have been classified into four primary categories, according to the American Diabetes Association (ADA, 2017).

1. Type 1 DM (T1DM), also known as insulin-dependent DM
2. Type 2 DM (T2DM), also known as non-insulin-dependent DM
3. Gestational DM (GDM)
4. Diabetes resulting from other problems such as hormonal disorders or drugs

In T2DM, either the adipose tissue becomes resistant to insulin or the pancreatic cells are impaired, leading to less insulin production. Both scenarios cause an uncontrolled rise of glucose in the blood vessels while at the same time the tissue starves. Most people with T2DM are over the age of 30. The main risk factors include advanced age, heredity, lifestyle, obesity, race, and prior GDM. Ethnic variables reveal that black people, Hispanics, and Asian Americans are more susceptible, according to the ADA (2017). All the participants in this project were confirmed T2DM and T2DM was considered HbA1c over 6.5%.

The pathophysiology of T2DM is not clear but it does run in families, although the genetic science is not fully understood. The destruction of the B-cell in T2DM starts when the number of insulin-producing cells lessens, leading to insulin resistance. T2DM

is linked to disorder in the ability of the cells to secrete insulin and is compounded with inflammation and metabolic issues. T2DM is diagnosed when fasting plasma glucose (FPG) is ≥126mg/dl on two separate occasions or HbA1c ≥6.5%. When HbA1c is used to diagnose T2DM, it is critical to take into consideration other circumstances that can affect the levels, such as age, ethnicity, and anemia. For example, it's been established that black people may have a higher level of HbA1c than other races (ADA, 2017). The majority of Kenyans are black and all the participants were definitely black. In this project, T2DM is defined as HbA1c equal or over 6.5%.

T2DM in Kenya, and in Africa generally, is increasing alarmingly, especially considering that these countries are not prepared to combat the burden. Bastawrous et al. (2017) state that; T2DM disease burden has an adverse effect on the economies of low- and middle-income countries—and more so in sub-Saharan African countries like Kenya. At both the beginning of the study and at the six-year follow-up mark, the participants were given a full ophthalmic exam and their data on overall health and risk factors was collected. At the six-year follow-up mark, 2,059 of the 4,104 participants without DM were examined. The study found that the cumulative occurrence of DM was approximated at 61.0 per 1,000 in people aged 50 years and older. Out of those 2,059, 123 (6.0%) were newly diagnosed with DM when followed up with six years later. The study concluded that DM is an increasing problem. Out of 1.6 million people in Nakuru County, where the study was conducted, 150,000 were older than 50 in 2009. Thus, the authors estimated that 1,650 individuals in this age group would develop DM annually while 450 will get DR. They also concluded that in order to manage DM and provide

excellent health services, there is a need for high quality information, including diabetes education (Bastawrous et al., 2017).

Glycosylated Hemoglobin A1c

Glycosylated Hemoglobin A1c is the average blood glucose in the last three months (Park & Pastakia, 2018). Unfortunately, globally there is a general lack of knowledge on what HbA1c and its usefulness in managing T2DM. Out of 184 participants in Nigeria 85.3% did not know facts about HbA1c (Jasper et al., 2014). HbA1c is a recent diagnostic test that gives a bigger picture of whether the patient's blood sugar is in control or if a treatment is working or not. However, according to Park (2018) there is difficulty in accessing HbA1c in Africa (Sub Saharan) mainly due to cost. For example in Malawi (Nakanga, Crampin, & Nyirenda, 2016) acknowledges the usefulness of HbA1c but laments that cost is a barrier and therefore, Malawi is not ready to use the tool.

Without HbA1c it is difficult for the doctors to know the glycemic control of the patients (Park & Pastakia, 2018). The clinicians are left to rely on one single fasting blood glucose once a month, resulting in inaccurate measurements and too conservative with medication. The most reliable marker to assess if a patient is managing their T2DM is HbA1c. The physician can use it to guide pharmacological therapy and the dietician to guide dietary. According to American association of Clinical Endocrinologists and American College of Endocrinology (AACB/ACE) HbA1c of lower than 6.5 is recommended if it can be maintained safely and can be affordable for the patient. The patient's medical history must be considered of course (Keresztes & Peacock-Johnson, 2019).

Diabetic Education and Knowledge

Diabetic knowledge is integral in patients' self-care management. Lack of diabetic knowledge is detrimental to the patients' health, because most of the complication that arise can be prevented through self-care management. There is general lack of knowledge globally, and especially in Africa. For purpose of this project, diabetic knowledge had four significant levels of knowledge; definition of diabetes, its physiopathology, symptoms and causes, and management of disease including diabetes diet plans and nutritional values of different cultural food types. The lack of knowledge featured both unawareness and misconceptions regarding causes and outcomes of T2DM, which were mostly influenced by culture and social development achievement such as education and socio-economic backgrounds.

Knowledge of the definition of an ailment allows identification of risk of morbidity, influence of behaviors on that risk, and general reaction to symptoms that manifest. Lack of such knowledge influences the health seeking behaviors of the individual. In Africa, the level of awareness of the definition and is significantly low. Jasper et al. (2014) observed that, while awareness level was at 56.5% of the respondents in Nigeria, 88% did not know what Hb1Ac was and why it is tested in T2DM care, and cited such lack of knowledge as influenced by cultural believes which lead to misconceptions towards the disease. Similarly, in Foma et al (2013), the awareness of DM was widespread (47%) in Gambia, but the 53% were not aware of the causes, risk factors, and complications. In the current setting, Kenya, the lack of knowledge was much dire, with an observed only 27%, by Maina et al., (2010) demonstrating knowledge in diabetes. However, 41% showed good practices towards T2DM management, even though 75% did not follow the required dietary practices and another 80% did not

monitor their weight (Maina et al., 2010). Similarly, Mugure et al. (2014), observed a low knowledge level with 38.4% having no knowledge of the causes of DM, 30% believing it is hereditary, and 33.33% believing it was a lifestyle disease. In line with the evidence offered, the current project provided further proof that the knowledge levels towards T2DM is low as influenced by the level of education and the cultural perceptions of the African, and specifically, Kenyan populations.

The impact of lack of effective knowledge in diabetes and diet planning influences how individuals behaviorally react to the disease. For instance, Matheka & Demaio, 2013, discovered that while 67.7% were aware of the HbA1c test, 32.3% did not know what it was. As a result, only 20.2% had had the test done at least once with the remaining 79.8% never having it performed. The outcome of this lack of knowledge was that, in the study, over 90% of the participants had HbA1c levels ≥ 8. Additionally, Abdulrehman (2016) observed that the lack of knowledge, coupled with cultural practices, financial constraints and low formal education level resulted in poor dietary practices, which negatively affected T2DM management. In Abdulrehman's study, the respondents were unaware of the impact a particular religious practice that involved fasting on the T2DM management effectiveness. Similarly, Wambui et al., (2016) offered that due to lack of knowledge on the importance and significance of self-monitoring, adherence levels to self-monitoring of blood glucose (SMBG) was as low as 34. While the study did not identify a correlation between SMBG adherence and glucose level, it is evident that in the absence of knowledge of such an important aspect in T2DM management, effective HbA1c level control is challenging. The current project

emphasized the significance of diabetic knowledge in testing HbA1c levels, and diet planning knowledge in lowering the HbA1c levels.

The individual lack of awareness extended to the Kenyan communities. Dropkin (2010), observed that there was a large DM knowledge gap in the community, which resulted in unawareness of how financial constraints caused by DM can be reduced through diet and exercise. From a comorbidity perspective, lack of knowledge influenced the attitudes of the community towards comorbid factors such as obesity. Ziraba et al., (2009) studied this phenomenon and observed a growing prevalence of obesity, which was related to the cultural misconception, which connoted obesity as prosperity. With such factors directly linked to the risks of morbidity of T2DM, it is evident that knowledge gaps on the influence of community practices on the risk of an individual towards morbidity is an educational façade, which, when addressed, would improve health outcomes of individuals and the community as well.

Despite the general agreement of the existence of lack of knowledge, defining diabetes education has not been specialized due to the extent and scope of T2DM as a health issue as well as a social concern. However, Xiang et al. (2017) tend to conceptualize diabetes education as encompassing patient-to-patient education, which was observed to have higher glycemic control outcomes. On the other hand, Naccashian (2014), and Mash et al., (2014) describes a formal education structure involving six-week classes and four monthly group sessions respectively. Similarly, the outcome showed positive HbA1c levels signifying effective glycemic control strategies. Whitehead et al. (2017) incorporated the concept of nurse-led education, comparing it to nursing care utilizing education and observed similar reduced HbA1c levels. Another

conceptualization of diabetes education is one that utilizes beliefs, attitudes, subjective norms and enabling factors (BASNEF model), studied by Sharifirad et al. (2011). Under this model, education relates to changes in culture-driven behaviors and attitudes towards dietary intake and meal consumption patterns. This diabetes education model also proved effective in reducing post-intervention HbA1c levels in the patients. Sharifirad et al. confirming observations, by, Shabbidar et al. (2006), discovered that contrary to health professional's belief that it is not easy to motivate T2DM patients to change their lifestyle, especially regarding nutrition; it is possible to motivate change through culture sensitive education. The last structure identified is the education structure offered by Steinsbekk, et al., (2012), which involves education in self-management practices. In this project, the group education model was used due to its advantages including cost effectiveness, encouraging of discussion among participants, and fostering collaboration with other stakeholders.

In addition to the basic concept of education, other contributory educational programs such as, peer support (Sachmechi et al., 2013), lifestyle intervention programs (Etienne et al., 2017), motivation and continuing education (Battista et al. 2012), and nutrition education (Muchiri et al., 2016), were observed to increase self-efficacy and reduce HbA1c levels in patients. According to Sachmechi et al., the peer support involved members of the patient's social circle being involved in motivating and serving as a cue to action for the patient. This support, in addition to the education offered to both the patient and the peers helped reduce reported HbA1c levels. In Etienne et al., the lifestyle intervention involved a structured diabetes education program that targeted eating habits and these were observed to reduce HbA1c levels in the experimental group

significantly. For Battista et al., motivation and continuing education, the authors observed that continuously offering the patient information regarding developing best management practices, and follow up communication to ensure the patients adhered to the management plans. In Muchiri's et al., the nutritional education focused primarily on educating the patient on the benefits and hazards of different food types and structuring eating plans around seasonally available food types. This project relied on the structured education model to dispense knowledge of T2DM and of diabetes dietary needs to improve self-management and self-efficacy among the target population.

One of the causes of community unawareness is the structure of diabetes education in Kenya. The sparse education currently offered at medical facilities only targets diabetics, leaving everyone else — including members of the at-risk population — largely unaware (Chege, 2010). Stakeholders' diabetes health campaigns are not structured because there are no standardized guidelines on diabetes education (Dropkin, 2010). Healthcare providers also lack the expertise to offer diabetes education to their communities. Community education will not only improve the quality of caregivers' service to patients; it will also increase patients' compliance with treatments, resulting in better health outcomes. Poor knowledge equates with poor attitudes. Knowledge obtained from formal education, however, does not necessarily lead to good practices. The influence of cultural beliefs and practices is undeniable (Abdulrehman et al., 2016). This education gap demands a collaborative effort to draw a T2DM awareness curriculum to be used at the community level all the way up to Kenya's top referral hospitals. Dietary knowledge would reduce the incidence of obesity, a known contributor to the risk of T2DM.

Low education levels among the population increase the belief that T2DM is a result of eating too much sugar, and that it is a disease of the rich and those who have adopted Western culture (MPHS, 2010). In most communities in Kenya, a plump body, especially in women, is desirable as a sign of prosperity. Others believe T2DM is a curse, a result of witchcraft, that prayers can cure (Whitehead et al., 2017). Some believe eating bitter leaves will dilute the sugar in the blood (MPHS, 2010).

Lack of diabetic knowledge despite higher formal education is likewise a barrier. Therefore, a structured diabetes educational curriculum is badly needed for the general public, diabetic patients, and healthcare providers in Kenya (Maina et al., 2010). People make decisions based on the knowledge they have. Barriers are created for patients without formal education or T2DM awareness, making it difficult for them to make appropriate dietary choices. This project was prepared to equip participants with empowering knowledge to motivate change through diabetes education.

T2DM is a progressively debilitating metabolic disease that raises morbidity in an individual living with the problem when compared to those without the disease. Deaths caused by T2DM in 2012 were estimated at 1.5 million globally, according to the World Health Organization (2014). In 2015, 5 million people died due to diseases resulting from diabetic complications (WHO, 2014). Dietary behaviors contribute to a large extent to whether patients achieve glycemic control (ADA, 2017). Many Kenyan people, according to literature, lack knowledge of T2DM and its consequences. Most dietary behaviors and patterns are greatly influenced by lack of knowledge, urbanization, adaptation of the Western lifestyle, and cultural beliefs (MPHS, 2010). There are proven

benefits to diet management, as the ADA and the government of Kenya have recommended. Yet, getting patients to follow these guidelines is a challenge.

The literature collectively supports structured education's positive effectiveness as a treatment for T2DM that helps patients achieve glycemic control and adhere to lifestyle changes (Steinsbekk et al., 2012). Patients who receive adequate early education will have fewer diabetic complications. In summary, achieving glycemic control relies heavily on a patient's knowledge of T2DM and T2DM management. An educational collaboration among nutritionists, clinicians, and the patient as the center of care can increase patient empowerment and promote better glycemic outcomes.

Meal Planning Incorporating the Plate Model

In T2DM, hyperglycemia is not readily apparent. Patients might not notice its effects for many years, but chronic elevation is detrimental since it increases patients' risk for cardiovascular problems. It is particularly important for people with T2DM to understand the implications of hyperglycemia and to learn how to prevent complications by incorporating proper nutrition in order to mitigate its repercussions. There are different types of diets but the bottom line for diabetics is to maintain well-balanced nutrition. Diet is considered a treatment and it is one of the fundamental aspects of therapy (McPhee, Papadakis, & Rabow, 2010).

Dietary therapy should be flexible based on individuals' eating patterns. Carb-counting now includes fat and protein, for they too influence glucose levels. It is a challenge for patients and providers to plan the right diet because there is no standardized directive (ADA, 2017). Similarly, dietary therapy goals should be tailored to meet individuals' needs, culture, age, religion, disease stage, and attitude toward change. Assessment of an individual's dietary pattern should precede meal planning. Patients

should be taught to look at the diabetes diet not as restrictive but as a healthy diet that is recommended for the whole family. Meals should be balanced with adequate carbohydrates, protein, fruits, vegetables, fiber, and water. Recommended meals should also be practical and realistic (ADA, 2017).

Dietary meal planning tools recommended by MPHS (2010) include the food pyramid, plate model, food exchange system, carbohydrate counting, and a glycemic index. This project used the plate model because it is less stressful since it uses the qualitative rather than the quantitative approach (MPHS, 2010). Following the ADA (2018) guidelines, the Plate model asks the individual to create an imaginary line down the middle of a 9-inch plate. The first half is to be filled with non-starchy vegetables and the other half is to be shared with carbohydrates and protein. Based on Kenyan diet, (see *Figure 1*), non-starchy vegetables included *Sukuma* (collard greens) *sucha* (black midnight) *isaka* (spider flower) *terere* (amarantha) just to name a few. On the one quarter of the plate served protein such as *nyama choma* (roasted meat) *ndengu* (lentils) *Maharakwe* (beans), milk, eggs, and others. The last quarter will serve the carbohydrates such as ugali (corn meal), rice, *Mokimo* (a mixture of mashed potatoes, beans, greens and corn), pumpkins, yam, cassava, and others. A serving of fruits and milk can be added based on individual meal plan. Lastly, a serving of unsweetened drinks such as unsweetened tea, coffee or water can be enjoyed.

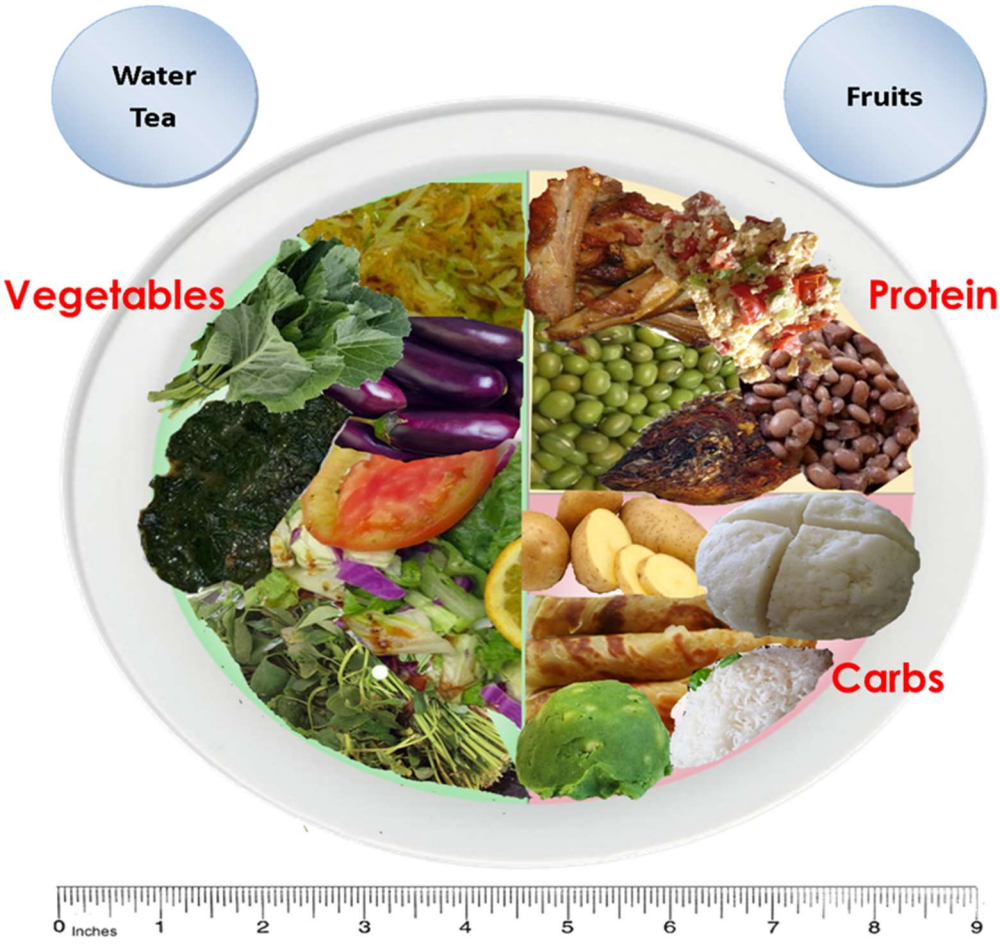

Figure 1.The plate model based on the Kenyan staple food types and meal combinations. This plate is modified from the ADA 2018 The Plate model (American Diabetes Association, cr. 2019)

The structured diabetes education brings awareness that a balanced meal is beneficial in reducing the blood glucose. In this project a balanced meal was considered having food items from all the food groups—carbohydrates, protein, fats, and vegetables. The plate model is the chosen method because it is easy to follow and helps the client with portion control without the stress of precise measurements. The portion control notion allows the individual to eat more vegetables less carbohydrates, protein and fats—thus reducing blood glucose hence decreased HbA1c, which means less complications. In

this project, the participants were taught how to control portions using the plate method everyday with all meals at home and outside the home. The individual goals were used to focus and visualize the benefit. Reduced HbA1c was the goal of the benefit.

The proposed action in this project was the plate method as mentioned above which calls for vegetables fill half the plate, ¼ carbohydrates and ¼ proteins. The Kenyan adults might view vegetables cost as a barrier to the plate model. Education through group discussion was used to identify the barriers and seek ways to overcome. For instance, given that cost is one of the barriers to increasing vegetables the group discussions allowed the participants to explore ways to mitigate cost such as by using the money saved from reducing carbs and protein to buy more vegetables. Another alternative is to plant the vegetables for those who have land.

The government of Kenya intends to provide education programs to the public, and some instruction is indeed offered sporadically in the country's hospitals and clinics. As yet, though, there are no sustained, standardized structured lessons that address various preventive aspects such as diet (Jones, 2013). Moreover, the effects of these education programs on Kenya's diabetic population have not yet been studied. This project was hoped to add to the knowledge of effectiveness of diabetes education.

Self-efficacy

Self-efficacy is the level of confidence an individual has in their ability to carry out the recommended action (LaMorte, 2018). In the current project, the interactive lessons given offered the participants the guidance and reinforcement they needed to maintain a balanced portion control diet using the plate method with the hope of a reduced HbA1c. Through group activities, each individual was guided to demonstrate their understanding of the plate method by making complete meals using the plates given

and food replicas and real food. The individual goals made helped to focus their actions and their success solidified their confidence in their abilities. A study by Gilis-Januszewska (2011) showed that a comprehensive model for T2DM training through lifestyles such as diet and exercise could help mitigate type-2 diabetes. Evidence suggests that adherence to lifestyle interventions can be challenging for most patients (Dunkley et al., 2014).

King et al. (2010) recruited 463 T2DM adults through a randomized approach, to investigate the relationship between social-environmental variables; and T2DM self-management and T2DM. In their results, they found out that self-efficacy and problem solving were independently associated with lifestyle interventions such as diet and exercise, increasing the variance they reported by 19% and 23%, respectively. Self-efficacy had a stronger correlation with healthy eating and calories burned in physical exercise (King et al., 2010). In another study, Al-Khawaldeh et al. (2012) used a cross-sectional study of T2DM 223 participants to explore correlation between T2DM management self-efficacy and T2DM self-management behavior and glycemic control. In their results, they found that diet self-efficacy and diet self-management activities predicted better glycemic control. In addition, participants with higher self-efficacy reported better self-management behavior in diet, exercise, blood sugar testing and taking medication. In conclusion, 42% of the participants had lower self-efficacy and thus poor control of their T2DM, indicating that there is need to promote self-efficacy management education for T2DM (Al-Khawaldeh et al., 2012).

Theoretical Framework

Theoretical framework helps understand people and their health issues. In addition, it helps to consider and plan for the appropriate intervention in practice. It also helps to study the effectiveness of the intervention. In short, theory organizes nursing knowledge by providing a systematic approach to explaining nursing practice (Kenney, 2006; Meleis, 1997; Smith, 1994). Diabetes education has been widely accepted as the key to glycemic control among people living with T2DM. To help apply the educational intervention, this project used the health behavior theory because it is integral to diseases management and prevention. Nurses are vital in integrating theory into practice through education and counseling in all disorders but more so in chronic diseases such as T2DM. Education can be delivered in a clinical setting but good results can be achieved in different settings including church, workplaces, and community centers.

Health behavior theory is critical to illness prevention and management. Counseling on how to prevent complications from chronic diseases like T2DM can help to bring change. Health behavior and health education assist in generating and applying new knowledge (Butts & Rich, 2013). In this project therefore, the Health belief model (HBM) one of the health behavior-change models was used.

The Health Belief Model (HBM)

The HBM is an interpersonal behavioral health theory based on the knowledge and perceptions of an individual or a group in regards to their health (LaMorte, 2018). This project was guided by the health belief model (HBM) (See Figure 2), which was first used by the US Public Health Service in the 1950s and the purpose was to make sense why patients fail to recognize the dangers they face health-wise and fail to take advantage of preventative measures to avoid diseases (Butts & Rich, 2013). The HBM is

rooted in the psychological and behavioral theory that a person's prediction of change of a behavior such as lifestyle is based on the person's perception of threat of a disease that prompts a desire to prevent the illness or get better if already sick (LaMorte, 2018). The person would also act based on their perception of the benefits of the behavior change and barriers associated with the health behavior in question.

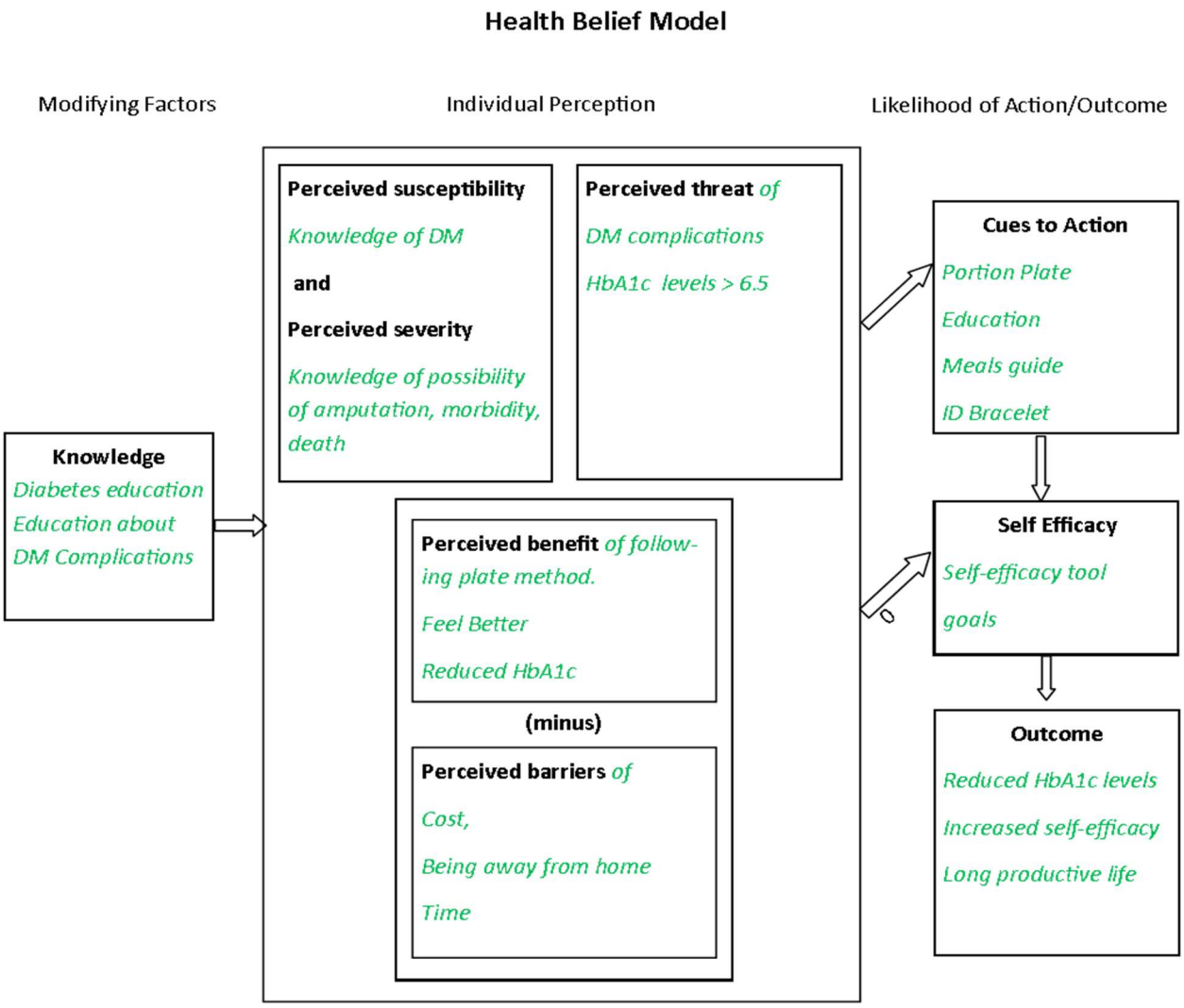

Figure 2. Health Belief Model explaining impact of diabetes knowledge on individual perceptions. Adapted from, Rosenstock, et al., (1974)

The HBM has evolved since its conception as evidenced by the addition of two constructs to the original four (Wdowik et al., 2001). The HBM states that there are six main constructs that determine people's choices on whether to take action to prevent a health condition. The six constructs include perceived susceptibility, perceived severity, perceived benefits, perceived barriers and self-efficacy. Educational classes, reveal to the participants that uncontrolled T2DM is serious. The findings will demonstrate the efficacy of the T2DM self-management education classes in improving T2DM self-care management skills (Butts & Rich, 2013). The health belief model helps the patient understand that a disease like T2DM can lead them to amputations and heart problems, and that changing their lifestyle and taking medications as prescribed will give them optimal health (Butts & Rich, 2013). Dietary behaviors are indispensable ingredients channeled at teaching people ways to prevent obesity and manage chronic ailments such as T2DM (ADA, 2017).

The HBM guided this project by teaching patients with elevated HbA1c to accept that they are susceptible to T2DM complications (perceived susceptibility), even if they do not feel sick. They must believe that uncontrolled elevated blood glucose can lead to cardiovascular problems, stroke, amputations, and other complications—including death (perceived severity). They may see that following the taught diet can reduce these risks (perceived benefits) without side effects or difficulty in getting the recommended food (perceived barriers). The education program can hopefully motivate and stimulate change (cue to action). Dietary behavioral change can help patients maintain healthy HbA1c levels, promoting confidence in self-care (self-efficacy). In the succeeding subsections, each construct of the HBM model, demonstrated in Figure 2 is discussed in detail.

Modifying Factors

Knowledge.

In a study, which measured dietary behavior among low-income Spanish speaking populations with T2DM in the US, Fernandez, Olendzki, and Rosal (2011) found that education based on dietary behaviors could produce significant behavioral changes that were realized in the interventional group through improvement of the HbA1c levels. The authors noted that the dietary behaviors of the participants could be used by providers as pointers to where interventions should be concentrated per patient.

In another research study, Adejoh (2014) studied how Diabetes knowledge (DK) and beliefs can affect T2DM management among Nigerian T2DM adults (Adejoh, 2014). Questionnaires were sent to 152 respondents; about half had low level of DK and the impact was shown in their poor management of their T2DM. Adejoh used the HBM and he noticed a remarkable favorable association between perceived severity (0.549, p = .000), perceived benefits (12.383, p=0.000) and T2DM management. However, in his conclusion, DK and health belief are necessary in T2DM management, but other social factors should not be ignored. The intention of HBM was to motivate the participants to change their behavior based on their perceptions (Adejoh, 2014). In this project knowledge was enhanced through lessons on what T2DM is and how it changes the body metabolism; Ways to manage T2DM through diet and how to live with the disease on a daily basis.

Individual Perception

Perceived susceptibility & perceived severity.

Perceived Susceptibility is where a person believes there is a reason for concern about a certain disease or condition that one can get and Perceived Severity is how serious the condition is per the individuals' perception (Butts & Rich, 2013).. The individual must admit the disease as something negative and possibly even harm them. In this project, susceptibility of developing complications of T2DM complications is an HbA1c of equal or over 6.5%. Some of the complications include heart diseases, kidney issues, blindness, amputations and nerve disorders. Through education, the individuals are made aware that these conditions are widely recognized as no joke prompting the person to acknowledge it is scary and they are at risk. There are several reasons that contribute to elevated HbA1c and in this project focused on lack of T2DM and dietary knowledge which lead to poor food choices and uncontrolled portion sizes. For example, the common food in Kenya is *ugali* (a corn meal) that is consumed in large amounts and is eaten with little vegetables almost for every meal. The lesson on food groups explains ugali is carbohydrate and it will increase their blood sugar unless they control the amount and eat more vegetables.

Perceived threat.

Perceived threat is where an individual comes to a realization that they might be personally vulnerable to the particular disorder contingent to their perception as to how their present lifestyle is leading to bad outcomes (Butts & Rich, 2013). For example, not following a healthy diet such as consuming meals high in carbohydrates is known to increase blood glucose placing an individual at higher risk of developing diabetic complications. However, because DM complications are subtle and can take a long time

before the consequences are noticed this project used education and high HbA1c results to bring awareness to the facts of threat.

Perceived benefits minus perceived barriers.

Perceived Benefits minus perceived Barriers encompasses the force of weighing the cost of the required behavior against the possible benefit (Rosenstock et al., 1974). In this case, the individual must belief that changing their behavioral change is possible within their means and will benefit their health in a positive way. Therefore, if an individual decides that T2DM complications are notable health concerns and that they are personally vulnerable to the problem then they may be willing to change their eating habits/behavior. However, if they perceive that the barriers to making a change outweigh the benefits they might not follow through with adopting (the plate method) the recommended change.

The *perceived benefits*, according to the HBM model refer, to the perceptions of an individual towards positive consequences of engaging in a particular behavior (Butts & Rich, 2013). The assumptions of the model, as regards the perceived benefits is that an individual would engage in a behavior if they are inclined to believe that engagement in the particular behavior would result in positive health consequences. In addition, the perception of benefits extends to social benefits, which include how the society may perceive the individual when they engage in the given behavior. The role of the perceived benefits is to motivate an individual to engage the behaviors recommended (Adejoh, 2014). In the current project, it is observable that perceived benefits, in the context of a Kenyan diabetic patient would include improved health outcomes, reduced HbA1c levels, and overcoming cost burden and difficulties that stream from DM complications. The

benefits would motivate the individual to adhere to T2DM management practices that would ensure that they access the perceived benefits.

The *Perceived Barrier* relates to the presumption that there are elements in the environment that would hinder the achievement of positive consequences (Butts & Rich, 2013). These barriers, according to the HBM model tend to restrain an individual's decision towards engaging in a health seeking behavior. In a cross-sectional study Wdowik, et al. (2001) used the expanded health belief model (EHBM) to predict T1DM college student's T2DM self-management. In the study, it the observed perceived barriers included stress, time constraints, and issues of dealing with the effects of hypoglycemia, rebellion and the general inconvenience of managing T2DM. Based on the results of the study, the authors opined that elimination of perceived barriers was more impactful than increasing perceived benefits in achieving T2DM management objectives. The Kenyan context, while largely similar to the general perceived barriers, is unique to the extent of lack of transport to the hospital for the lessons, no insurance, cost to buy the right food items and being away from home during meal times just to mention a few. In this project, transport subsidy was given to alleviate cost.

Perceived barriers and obstacles specific to Kenya.

According to MPHS (2010), barriers facing Kenyan T2DM patients hoping and needing to make positive dietary behavioral changes include cost, distance to healthcare centers, food insecurity, poor education, belief in African traditional medicine, cultural beliefs, and political instability. These can influence how individuals react to the need for a behavioral change, based on which barriers they face and the degree of difficulty such obstacles pose.

Economy: The financial demand of buying foods that meet T2DM dietary requirements, along with medications, is a burden for most Kenyans. According to the Kenya Ministry of Health, 58.3% of Kenyans live on a meager income of less than two US dollars a day (Mcferran, 2008). People eat what they can get. Most women think of their families first before they can plan for their own T2DM diet, and most patients feel guilty about the extra burden their needs impose on family finances, according to Abdulrehman (2016). Poverty increases food insecurity, a high indicator of an individual's future risk for T2DM (Chege, 2010).

Broken Healthcare: The healthcare delivery system in Kenya is fragmented and lacks equal service coordination, thus adding to the other challenges patients face (Jones, 2013). In comparison, patients that attend rural clinics have less access to T2DM health care compared to those patients who are in urban centers (Mwavua, 2016). The disparities in the Kenyan healthcare system are brought on by political instability, low literacy, poor access to healthcare facilities, lack of healthcare insurance, and low economic status, as reported by the MHS (2010).

Cultural beliefs: Patients in Kenya are forced to travel long distances to get care. Indeed, sometimes they have to travel on foot, increasing their reluctance to seek modern medicine. They are motivated to stick to traditional remedies instead (Mcferran, 2008). Mcferran observed that easy access to complementary and alternative medicine (CAM)—perceived to be both less expensive and culturally readily acceptable in Kenya and other developing countries—is the main reason for Kenyans' preference for traditional medicine. Matheka and Demaio (2013) report, however, that CAM's effects on T2DM have not been fully studied, which means safety is not guaranteed. In addition, patients

fail to report that they are using CAM, raising concerns about drug interactions when they take allopathic medicine. According to MPHS (2010), many Kenyans believe some food and herbal supplements can cure T2DM.

Likelihood of Action/outcome

Cues to action.

Cues to action are strategies to stimulate the individual to be ready to make a health related decision towards a recommended health action (LaMorte, 2016). In this project, the desired behavior was following a balanced diet using the plate method. The most important thing was to help the participants to use the plate method. Secondly, show the benefits of the controlled portions that lead to reduced HbA1c—meaning reduced risk to DM complications. Thirdly, give reminders such as a plate already portioned according to the plate model to help remind the method. Also, give printed material of the lessons, guide for meal planning and follow up the participants with phone calls or test messages. Encourage wearing of medical identification.

Self-efficacy.

The effectiveness of HBM model heavily depends on how the patients apply the DK in their lifestyles. Lifestyle interventions changes that can help prevent diabetic complication have been the focus for many studies (Steyn et al., 2004; Cardona-Morrell, et al., 2010). Self-efficacy as incorporated in the model in the 1980s refers to an individual's confidence in their ability to carry out a task based, on modifying factors and individual perceptions (LaMorte, 2016). The model seeks to show that the factors that influence the individual perceptions of an individual further determine their confidence in their capabilities. In the current project, the aim was to ensure that patients have self-

efficacy in T2DM management, which is known to improve T2DM management outcomes and thereby reducing HbA1c levels. With this objective in mind, it is predicted that self-efficacy towards adherence to dietary and physical activity plans would be higher in the patient population. Self-efficacy, having been observed to increase likelihood of goal achievement was be a beneficial outcome for the project.

Synthesis

From the different studies, it becomes evident that there is an existing DK gap in Kenya and around the world. The gap can be eliminated using diabetes education programs that seek to change the behaviors and practices of the patient and at-risk population. It also becomes observable that the structure should not only involve knowledge on what T2DM is, its causes, symptoms, and management, but also an education on the contributing factors, the environmental factors, and the socio-economic factors that increase potentiality of morbidity. The diabetic education, as a concept, and for purposes of the current project therefore, encompasses all those information dispensation models that seek to change the behaviors, attitudes and practices of an individual towards the increase of self-efficacy, and reduction of risks of T2DM complications and HbA1c levels. Dietary knowledge was emphasized in this project as a focal point of behavioral change.

In project development and implementation, the application of theoretical models is important in aligning the scope and objectives of the project to its outcomes. Reliance on the health belief model helped in increasing the effectiveness of the project as it became possible to identify challenges, knowledge gap areas, and the impact of different cultures on the individual perceptions of the individuals. The project, in applying the

HBM was able to target those knowledge gaps and cultures that negatively influenced participant behaviors negatively. The modifying factors structured in order to reflect the existing knowledge needs of the community and the population. The individual perceptions became necessary in structuring the curriculum of the educational modules. The cues to action and outcomes became vital in designing the personal goals of the participants as well as the overall project goals. Based on the insight gained in the theoretical framework development, the project was designed to fit the needs of the population as discussed in the succeeding chapter.

CHAPTER 3

METHODOLOGY

In this chapter the investigator describes, the research design, research methods used for the project, the rationale for choosing the methods and methodology, population and sample, variables, data collection procedures, ethical considerations, research instrument, as well as reliability and validity of the instrument. In addition, potential challenges, confounding variables, and mitigating bias.

Project Design

This project followed a non-randomized experimental design. Project participants were divided in two groups – a control and an experimental group – and enrolled in a four and half-month education program (See Figure 3).

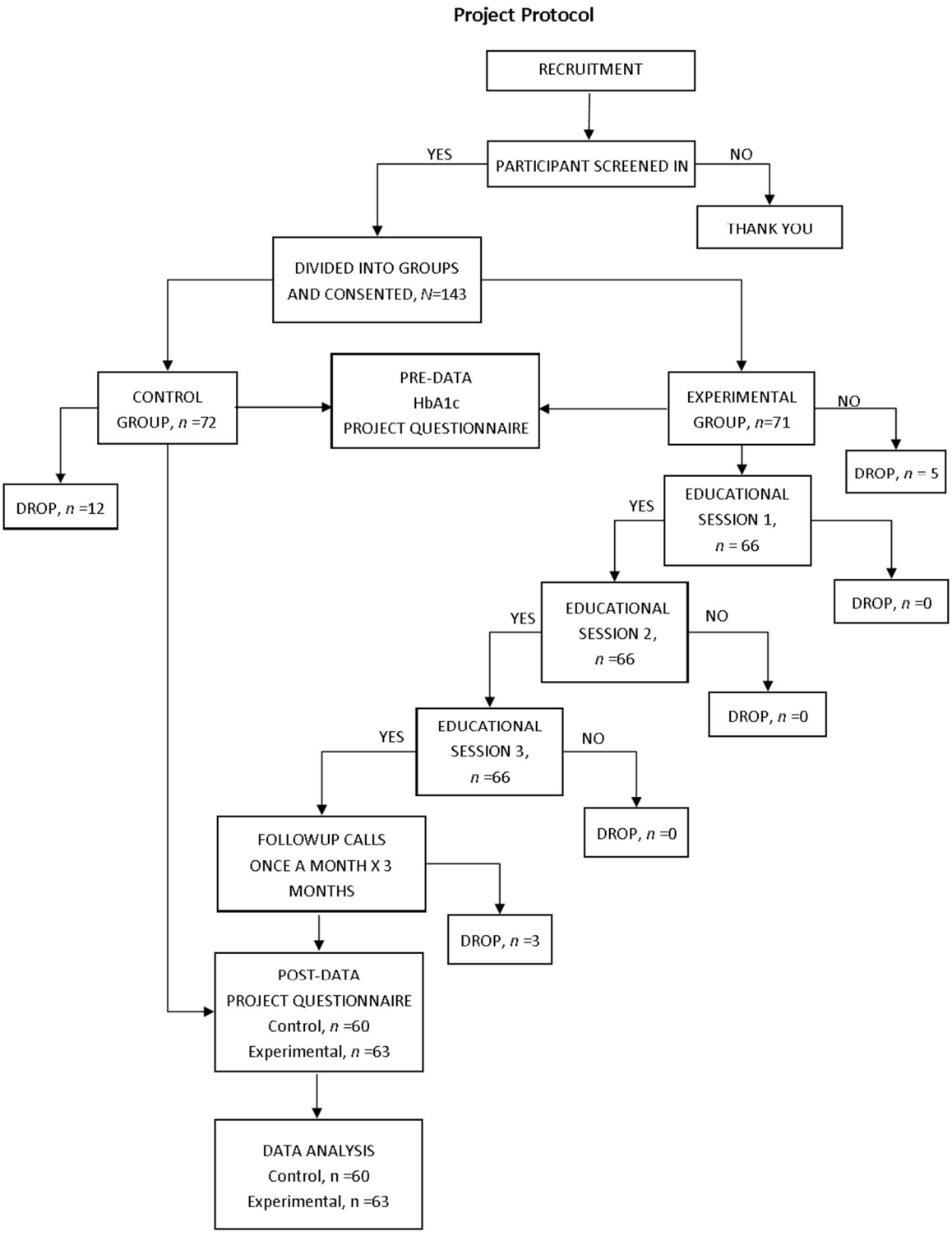

Figure 3. Project design protocol

Participants

Population and Setting.

The country of Kenya is divided into regions composed of tribes, but the urban population represents almost all the tribes found in the country. The study population was diabetic patients who utilized the Reale Hospital, which is located in Eldoret, an urban cosmopolitan city in western Kenya. Most Kenyans are of African descent, but other ethnicities from all over the world live in the country. Native Kenyans come from diverse ethnic/cultural communities that speak multiple languages. Most patients who visit the hospital come from a wide geographical area that includes both urban and rural locations. Conducting the project study in Eldoret assured the generalizability of its findings.

Reale Hospital is a well-equipped, 500-bed private institution that offers a variety of medical services. These include but are not limited to inpatient and outpatient surgeries, maternity, and primary care for both communicable and non-communicable diseases. The hospital sees up to 750 outpatients a day; of those, about 100 are diabetic patients. The hospital has an endocrinologist but not an established T2DM clinic. T2DM education is given during clinical visits, and the content is limited to do's and don'ts of T2DM management due to time constraints. Consequently, it was anticipated that conducting the project at this location would provide a clearer picture of how the lack of T2DM education affects patients' overall quality of life.

Inclusion and Exclusion Criteria.

The participants were confirmed T2DM patients with HbA1c over the normal limits (6.5%) for at least a year. In this project, the HbA1c levels were determined when the patient brought the results from the lab. They were black Africans of both genders

and all tribes between the ages of 25 and 75 years old. They were able to read, write, and speak in English.

Those exempted from the project included T2DM patients who did not wish to participate; patients who failed to continue the lessons; and patients who were participating in other projects. The rationale to exclude patients younger than 25 or older than 75 years was based on the assumption of the emergence of a need to recruit assistants due to an assumption dependency of the population. The patients from races other than black African were excluded to allow for homogeneity of culture across the group. Lastly, patients who were ill were also excluded, since according to McCance, et al. (2017), sickness can affect metabolism and hence, blood glucose.

Sampling Strategy.

Most patients seen at Reale Hospital are walk-ins. A convenient systematic sampling (Sullivan, 2012) was used. In addition, those with appointments are generally tardy according to the hospital administration. As patients came for outpatient care, they were approached, given information on the project and invited to participate. To eliminate patient bias, an invitation flyer (see Appendix D) was also posted around the hospital.

If they were interested and accepted to participate, their written consent was obtained, and they were screened according to the inclusion criteria send to the lab for confirmation of HbA1c equal or higher than 6.5%. After their consent, participants were informed that they would be assigned to either group 1 or group 2

Sample Size.

Per the G*Power Version 3.1 statistical power analysis program, this project used t-tests between two independent groups. A required sample was divided equally into the study group and control group as follows: Sample Group A=59 and Sample Group B 59, for a total sample size of 118 with an effect size of 0.05 and an actual power of 0.85 (Faul et al., 2009). According to Sullivan (2012), the sample size should not be too small so that the effect is not significant or too large to incur a waste of money.

By the end of this project sample selection process, 143 participants were recruited. The rate of attrition was fortunately low with the final attrition number being 8 participants for the experimental group and 13 participants in the control group. At the completion of the project, the number of participants who participated from commencement to completion was 123 and the data for those 123 participants were used in the analysis.

Using a systematic approach, participants were assigned alternating numbers (odds and evens) as they come in to ensure equality across the two groups. Then, the first participant flipped a coin to determine the experimental or the control groups. "Heads" was assigned to the experimental group, "tails" being the control group. Consequently, all the odds numbers went to the experimental group and the even number to the control group.

Ethics.

Participants' anonymity and confidentiality was maintained. The recruitment, intervention, and data collection commenced once the investigator received approval from the Andrews University IRB, the University of Eastern Africa Baraton REC and

NACOSTI, an institutional consent letter (Appendix B), and consent from the participants (Appendix C).

Incentives.

Each participant got "The Plate" to guide them in portion control (ADA, 2017). They received a meal-planning guidebook with pictures of food and various natural ways to use measurements. Transportation reimbursement was provided for those completing the project—five dollars to the control group and ten dollars to the experimental. Since the hospital has clinics in two small rural towns—Kabarnet to the east of Eldoret and Kapsabet to the west—the investigator travelled to Kapsabet to spare them the commute. The same materials and methods were used in all locations.

Tools and Measurement

Variables.

The independent variable identified for the project was T2DM education, which was measured as the structured diabetes education. The dependent variables were HbA1c levels, diabetic knowledge and self-efficacy. The T2DM education level was measured as a construct of both formal and informal knowledge of T2DM as measured by the University of Michigan DKT. The HbA1c level data was collected using the FDA approved Afinion HbA1c Dx test kit. Lastly, self-efficacy data was collected through the Stanford University Diabetes Questionnaire.

Tools.

The first outcome of this project was measured using HbA1c levels from the participants at the beginning of the project and at the end of the intervention. According to ADA (2017), the HbA1c is an accurate measure of the patient's blood glucose in the past three months. HbA1c is thus a way to measure a patient's glycemic control.

The second outcome was participants' self-efficacy score, which was measured using a modified Stanford diabetes questionnaire (See Table *1*). An example question was: "How confident do you feel that you can chose the appropriate foods to eat when you are hungry?" Answer option ranged on a 10-point scales (1 = *Not at all confident* and 10 = *Very confident.*)

The third outcome was diabetes knowledge before and after. It was measured using the. Michigan DKT, (Appendix A). The original Michigan DKT has 23 questions but 2 questions were added, and some of the questions modified with permission from the author, to fit the cultural context of the project settings. An example of the 23 questions was: "What effect will an infection most likely have on blood glucose?" Answer options included: "Lowers it", "Raises it", and "Has no effect." One of the two added questions was: "The food group that makes your blood sugar go up is." Answer options was: "Bread/starch, fruit, and milk (carbs)", "meat", and "vegetables."

Demographics on tribe, occupation, gender, age, education, marital status, income, and household size were also collected.

Table 1

Data collection tools and measurement

Tools	Measure	Description	Validity & Reliability

Alere Afinion HbA1c Dx test kit	HbA1c level	Over 6.5	Consistent validity and reliability as a point-of-care test kit (Jain et al., 2017)
Stanford University Diabetes questionnaire	Self-efficacy	Confidence level of adherence to glycemic control strategies. Each of the 8 items scored at a scale of 1(Low confidence) to 10 (Highest confidence). Average score of the 8 items was the confidence level. In this project, an average of 7 and above is considered high confidence. Project objective was an increase of 2 on the average confidence score.	Validity of .80 for self-efficacy Lorig et al., (2009)
University of Michigan DKT	DKT	Test scored out of the maximum 25, with higher scores considered as higher level of knowledge. In the project, scores of 20 and above is considered high DK. The project objective is an increase of 5 points post-study	Consistent validity and reliability in measuring general knowledge of T2DM (Fitzgerald et al. 1998). Consistent validity of simplified (True/False) questionnaire of Michigan DK test (Collins, Mughal, Barnett, Fitzgerald, & Lloyd, 2011).

Procedure

Data collection.

The questionnaire was used to collect demographic and research data, which was recorded electronically by the investigator. Names were collected but coded before entry into collection tools, to ensure participants' privacy. No personally identifiable information was retained.

Control group.

For the control group, after pre-data collection, the participants in the group were asked to return after three months with no communication between the investigator and

members of the group. The control participants returned for one day at the end of the three months for collection of post-data and for their educational sessions. During the sequential educational classes, the investigator documented attendance of the experimental group. The participants each got a follow up reinforcement phone call every four weeks after the lessons were done. At the end of the project, the data collected from both groups were analyzed.

Experimental group.

The experimental group received diabetes education in three 120-minute classes within one week for each lesson (See Appendix E). At the first lesson following recruitment period, the participants were taught what HBA1c lab collection entails, medications and a general introduction to diabetes. In addition, each participant made goals. Barriers to these goals were discussed in groups (Given, et al., 1983). The second lesson addressed how to manage T2DM through educational interventions. Participants were engaged in many structured tasks, such as reading labels for carbohydrate calculations and sampling the right food on "The Plate" (ADA, 2017). The goals made previously were reviewed. The benefits of diet education were identified and discussed minus the barriers (Given et al., 1983). The third lesson was on coping with T2DM through family support and a recap on the previous lessons. Perceptions of benefits minus barriers was discussed and cues to action emphasized (Given et al., 1983). Review was done and a posttest given. In each lesson, they had an opportunity to ask questions and participated in group discussions and quizzes. The group activities included demonstrations of how to make a balanced plate. Some of the teaching aids included replica human muscle and fat models for pathophysiology, replica food models, real food, videos, handouts and meal planning guidebook with visual cues (Appendix F).

Those in the control group were given the same educational material after the project was completed in 120-135 days. All participants continued to receive routine medical care from their physicians.

Evidently, literature supports that education is the key to effective T2DM management, and dietary knowledge is critical to glycemic control (ADA, 2017). According to Arcangelo, et al. (2017), it is of the utmost importance that patients understand the difference between foods with low glycemic index and those with high glycemic index in order to make wise choices that will help control their HbA1c levels (Arcangelo et al., 2006). The modules covered all of these while also emphasizing the critical importance of adhering to prescribed medication regimens and following sick-day guidelines (Arcangelo et al., 2006). This project therefore, sought to equip patients with the knowledge they needed to make smart dietary choices and, ultimately, positively affect their HbA1c levels.

Demographics on tribe, occupation, gender, age, education, marital status, income, and household size were collected. Participants also completed the self-efficacy and DKT questionnaires (see appendix A) before and after the intervention.

Analysis

After verification and clean up, the collected data were imported from Excel spreadsheet to SPSS, version 25 for analysis. Descriptive statistics were computed on demographic variables such as age, tribe, gender, education and occupation. Independent sample t-test was done to compare outcomes between experimental and control groups. Paired sample t-tests were done to determine if the structured diabetes education intervention increases DK, improves participants' self-efficacy, or reduces HbA1c levels in patients with T2DM.

CHAPTER 4

RESULTS

The purpose of this project was to study the effectiveness of a structured diabetes education on lowering levels of HbA1c, increasing diabetic knowledge and improving self-efficacy of project participants.

After obtaining all IRBs' approvals and recruiting the participants—and consents signed, data were collected and analyzed. This chapter reports the results that include the demographics, the Pre/post HbA1c, self-efficacy and DK of all the participants.

Participant Demographics

There were 63 participants in the experimental group, and 60 in the control group with a total of 123 participants. The participants' demographics are summarized in

Table *2*. The largest age group represented among all participants was 55 to 65 at 52.8%. It was 56.7% for the control group (See Figure 4). Nearly one third of the participants were teachers and farmers, 30.1% and 31.7% respectively.

Table 2

Demographic Characteristics of Project Participants by Group and Total Sample

Variable	Control (2) (n=60) *f* (%)	Experimental (1) (n=63) *f* (%)	Total (n=123) *f* (%)
Age Group			
25 – 34	1 (1.7)	2 (3.2)	3 (2.4)
35 – 44	7 (11.7)	7 (11.2)	14 (11.4)
45 – 54	18 (30.0)	23 (36.5)	41 (33.3)
55 - 65	34 (56.7)	31 (49.2)	65 (52.8)
Occupation			
Teacher	20 (33.3)	17 (27.0)	37 (30.1)
Farmer	22 (36.7)	17 (27.0)	39 (31.7
Doctor	0 (0)	1 (.6)	1 (0.8)
Shopkeeper	2 (3.3)	1 (1.6)	3 (2.4)
Other	16 (26.7)	24 (38.1)	40 (32.5)
Education			
Primary School	12 (20)	16 (25.4)	28 (22.8)
Secondary school	11 (18.3)	14 (22.2)	25 (20.3)
College/university	30 (50)	29 (46.0)	59 (48)
Graduate	7 (11.7)	1 (1.6)	8 (6.5)
Marital status			
Married	47 (78.3)	52 (82.5)	99 (80.5
separated	6 (10.0)	5 (7.9)	11 (8.9)
widowed	1 (1.7)	2 (3.2)	3 (2.4)
single	5 (8.3)	4 (6.3)	9 (7.3)
Gender			
Male	26 (43.3)	33 (52.4)	59 (48.0)
Female	34 (56.7	30 (47.6)	64 (52.0)
Income			
< KSH 25,000	25 (41.7)	31 (49.2)	56 (45.5)
KSH 25,000 - 50,000	21 (35)	15 (23.8)	36 (29.3)
> KSH 50,000	8 (13.3)	7 (11.1)	15 (12.2)
Other	2 (3.3)	5 (7.9)	7 (5.7)
I do not know	4 (6.7)	4 (6.3)	8 (6.5)
Household size* (Mean ± SD)	7.75 ± 5.344	6.95 ± 3.603	7.33 ± 4.510
Tribe			
Kalenjin	42 (70)	33 (52.4)	75 (61.0)
Luo	2 (3.33)	2 (3.2)	4 (3.3)
Luyha	7 (11.7)	11 (17.5)	18 (14.6)
Kikuyu	6 (10)	13 (20.6)	19 (15.4)
Other	3(5)	4(6.3)	7(5)

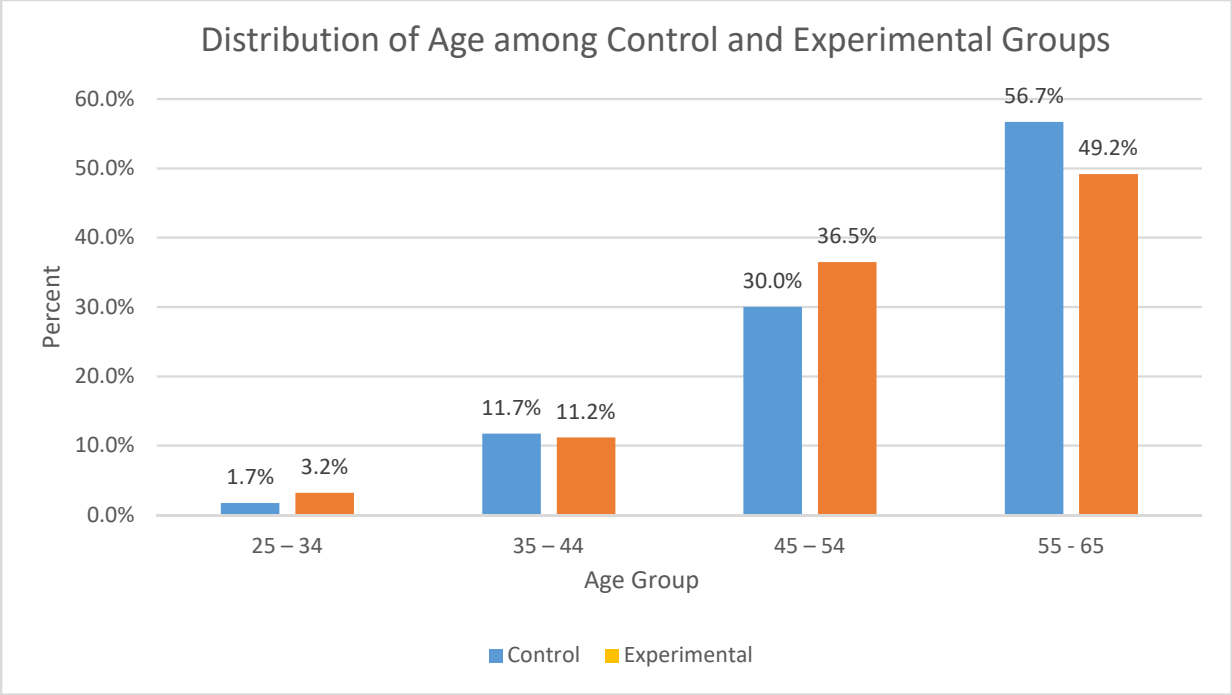

Figure 4. Distribution of age among control and experimental groups

The education category that was most represented was college/University at 48% (control group 50% and experimental group 46.0%). Most of the participants (80.5%) were married (control group 78.2% and experimental group 82.5%). The proportion of female participants was 57% for the control group and 48% for the experimental group. (See Figure 5). The largest tribe represented was the Kalenjin at 61% (χ=136.14, p<.001). Nearly half of the participants (45%) earned less than 25,000 shillings a month, which is equivalent to less than 250 US dollars a month. The median household size was 6.5, ranging between 1 to 30 people.

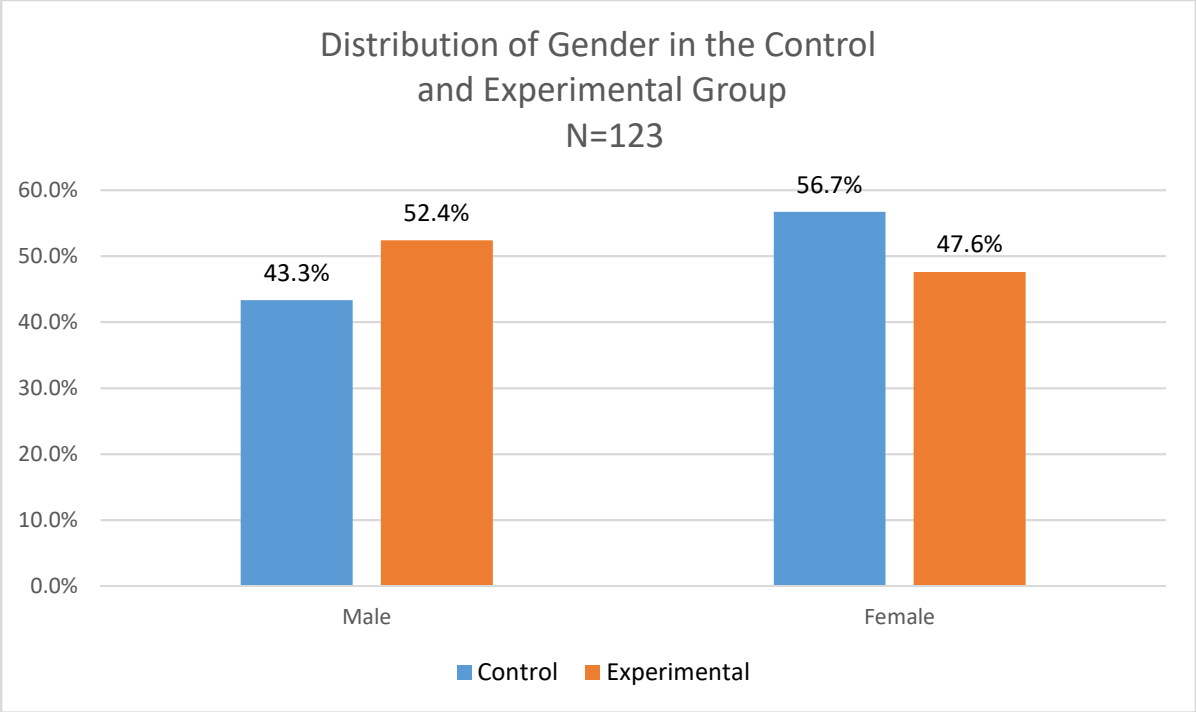

Figure 5. Distribution of gender in the control and experimental group

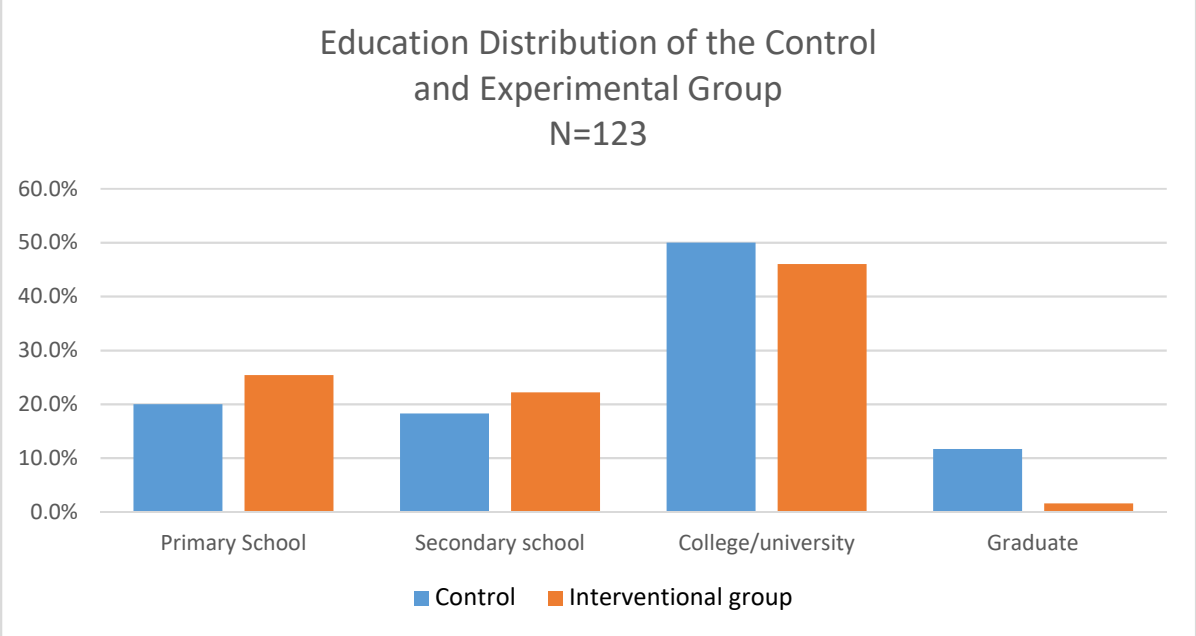

Figure 6: Education distribution of the control and experimental group

Among the participants, 45.5% had lived with T2DM for 2 to 3 years, and 33.3% had it for 4 to 10 years. In addition to T2DM, 43.1% of them (control group 48.3% and

experimental group 38.1%) also reported having hypertension and 13% had high cholesterol (See Table 3). Before the intervention, 44.2%of participants perceived their pre general health to be good. That percentage increased to 48.6% after intervention. . On the question, if they had a glucose-monitoring device at home, nearly two-third of the project participants did not have a glucometer.

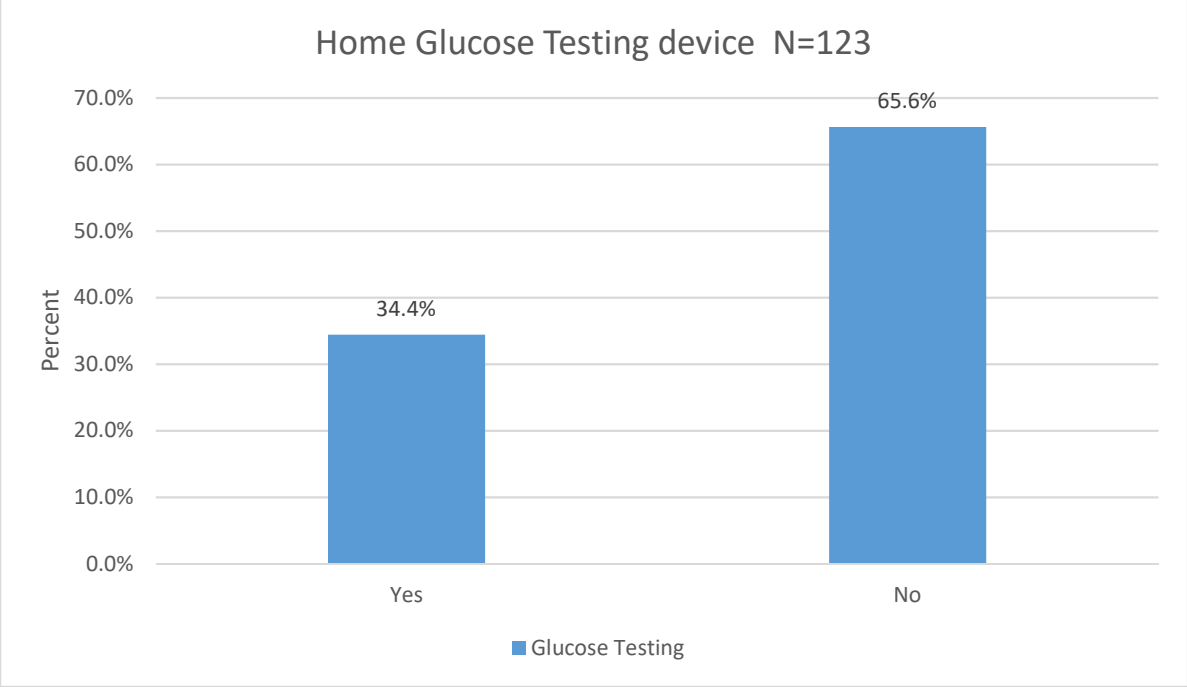

Figure 7: Ownership of home glucose testing devices

Regarding medication intake, 63.4% of the 123 participants were on oral T2DM medications only while 17.1% were on both oral medication and insulin. Half of the participants were on blood pressure medication, and 14.6% indicated they were on cholesterol medication (See Figure 8).

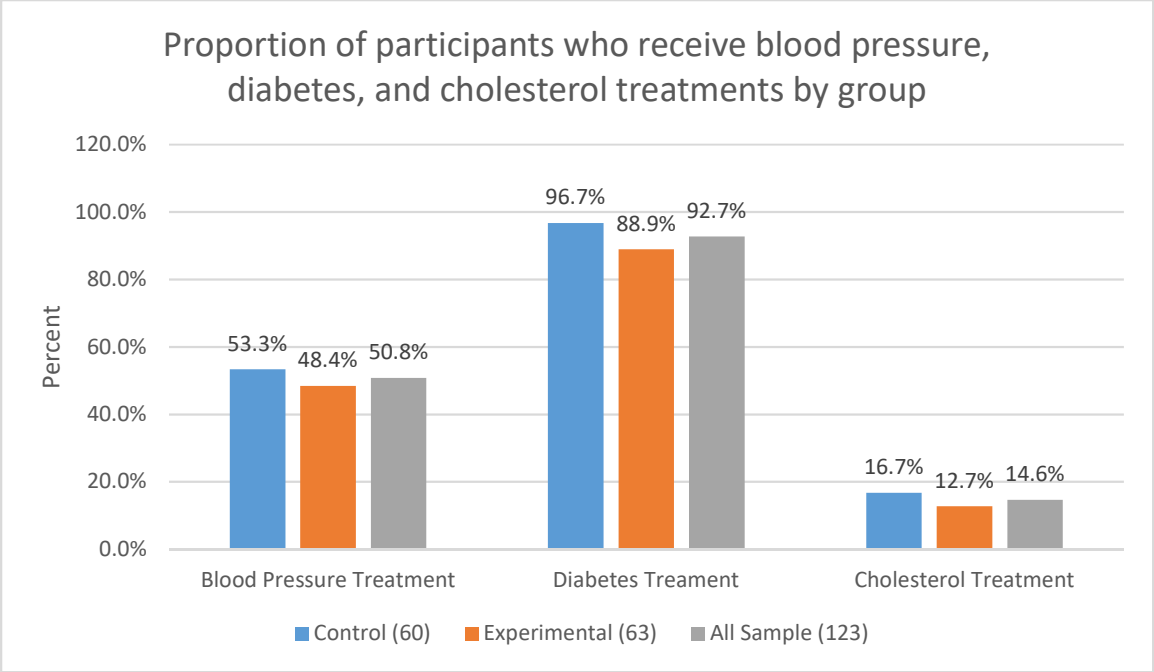

Figure 8. Proportion of participants who receive blood pressure, diabetes, and cholesterol treatments by group.

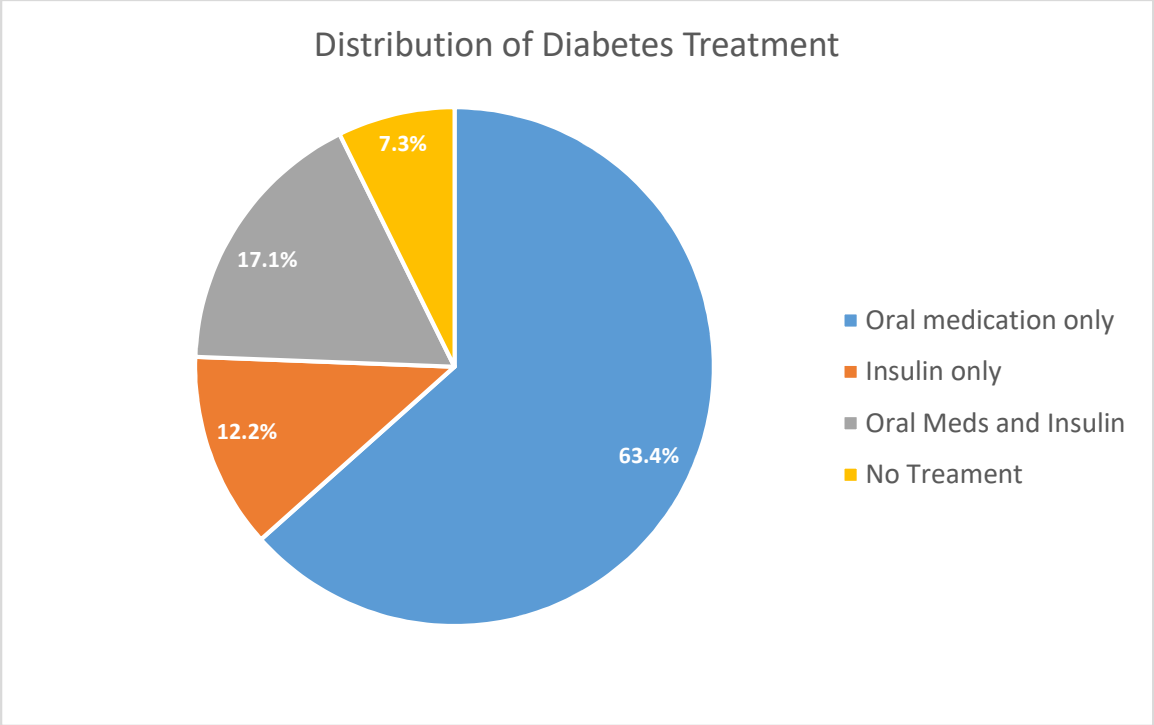

Figure 9. Distribution of Diabetes Treatment

Table 3

Health History of Project Participants by Group and Total Sample

Variable	Control (2) (n=60) *f* (%)	Experimental (1) (n=63) *f* (%)	Total (n=123) *f* (%)
Cholesterol	9 (15.0)	7 (11.1)	16 (13.0)
Hypertension	29 (48.3)	24 (38.1)	53 (43.1)
Heart disease	1 (1.7)	-	1 (0.8)
Lung disease	-	-	
Other Condition	3 (5.0)	2 (3.2)	5 (4.1)
Diabetes duration*			
2 to 3	24 (40)	32 (50.8)	56 (45.5)
4 to 10	18 (30)	23 (36.5)	41 (33.3)
11 to 20	13 (21.67)	6 (9.5)	19 (15.4)
21 to 30	4 (6. 7)	1 (1.6)	5 (4.1)
> 31	1 (1.7)	1 (1.6)	2 (1.6)

*Duration in years

Statistical Analysis

The project wanted to investigate if a structured T2DM diet education would decrease HbA1c levels, increase self-efficacy and improve diabetic knowledge.

Glycosylated hemoglobin (HbA1c)

An independent sample t-test was performed to compare the two groups. The results indicated that the pre-intervention mean HbA1c of the experimental group (M = 9.30, SD = 2.64) was not different than that of the control group (M = 9.11, SD = 2.19), $t(121) = 0.43$, one-tailed $p = .336$. Whereas the post-intervention mean HbA1c of the experimental group (M = 8.07, SD = 1.89) was statistically significantly lower than that of the control group (M = 9.13, SD = 2.22), $t(121) = 2.87$, one-tailed $p = .003$, $d = .52$.

Next, a dependent t-test was done to compare the mean HbA1c within each group. The results indicated that within the experimental group, the post-intervention HbA1c mean (M =8.07, SD = 1.89) was statistically significantly lower than the pre-intervention

HbA1c mean (M = 9.30, SD = 2.64), $t(62) = 4.40$, one-tailed $p < .001$, d = .54. Whereas, in the control group, the post-intervention HbA1c was not lower than the pre intervention one, one-tailed $p = .467$.

Diabetic knowledge

An independent sample t-test was performed to compare the two groups diabetic knowledge. The results indicated that the pre-intervention mean diabetic knowledge score of the experimental group (M = 14.33, SD = 3.52) was not significantly lower than that of the control group (M = 15.08, SD = 3.52), $t(121) = 1.18$, one-tailed $p = .120$. Whereas the post-intervention mean diabetic knowledge score of the experimental group (M = 20.44, SD = 3.47) was statistically significantly higher than that of the control group (M = 15.80, SD = 3.51), $t(116) = 7.22$, $p < .001$, $d = 1.33$.

Next, a dependent t-test was done to compare the mean diabetic knowledge score within each group. The results indicated that within the experimental group, the post-intervention mean diabetic knowledge score (M = 20.44, SD = 3.47) was statistically significantly higher than the pre-intervention mean diabetic knowledge score (M = 14.33, SD = 3.52), $t(62) = 12.61$, $p < .001$, d = 1.75. Whereas, in the control group, the post-intervention mean diabetic knowledge score was not higher than the pre intervention one, one-tailed $p = .467$.

Self-efficacy test

An independent sample t-test was performed to compare the two groups self-efficacy scores. The results indicated that pre-intervention mean self-efficacy scores of the experimental group (M = 6.37, SD = 1.43) was not higher than that of the control group (M = 6.08, SD = 1.99), $t(121) = 0.96$, one-tailed $p = .169$. Whereas the post-intervention mean self-efficacy score of the experimental group (M = 7.94, SD = 1.31)

was statistically significantly higher than that of the control group (M = 6.37, SD = 1.82), $t(96) = 5.32$, one tailed $p < .001$, $d = 1.01$.

Next, a dependent t-test was done to compare the mean self-efficacy score within each group. The results indicated that within the experimental group, the post-intervention mean self-efficacy score (M = 7.94, SD = 1.31) was statistically significantly higher than the pre-intervention mean self-efficacy score (M = 6.37, SD = 1.43), $t(62) = 7.29$, one-tailed $p < .001$, d = 1.15. Whereas, in the control group, the post-intervention mean self-efficacy score was not higher than the pre intervention one, one-tailed $p = .165$.

Table 4

Mean, Standard Deviation and Statistical values of Pre and Post measures of HbA1c, Self-efficacy and Diabetes knowledge

Variable	Control (n=60)		Experimental (n=63)		Test Statistics	p*
	M	SD	M	SD		
Pre-HbA1c	9.11	2.19	9.30	2.64	$t(121)=-0.426$	.336
Post-HbA1c	9.13	2.22	8.07	1.89	$t(121)=-2.87$	.003**
Pre-Self efficacy	6.08	1.92	6.37	1.43	$t(121)=0.962$	.169
Post-Self efficacy	6.37	1.82	7.94	1.31	$t(96)=5.323$	<.001**
Pre-Diabetes Knowledge Test	15.08	3.524	14.33	3.524	$t(121)=-1.180$	0.120
Post-Diabetes Knowledge Test	15.80	3.509	20.44	3.468	$t(116)=7.218$	<0.001**

*1-tailed ($\alpha = 0.025$)
**p values are significant

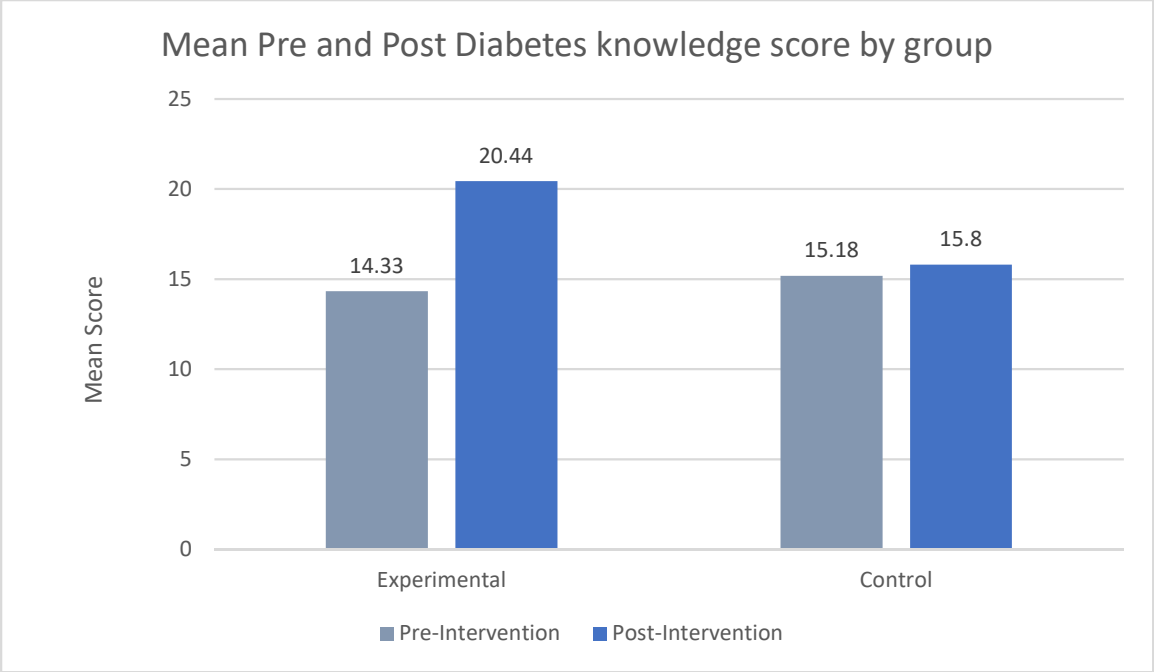

Figure 10. Mean Pre and Post Diabetes knowledge score by group

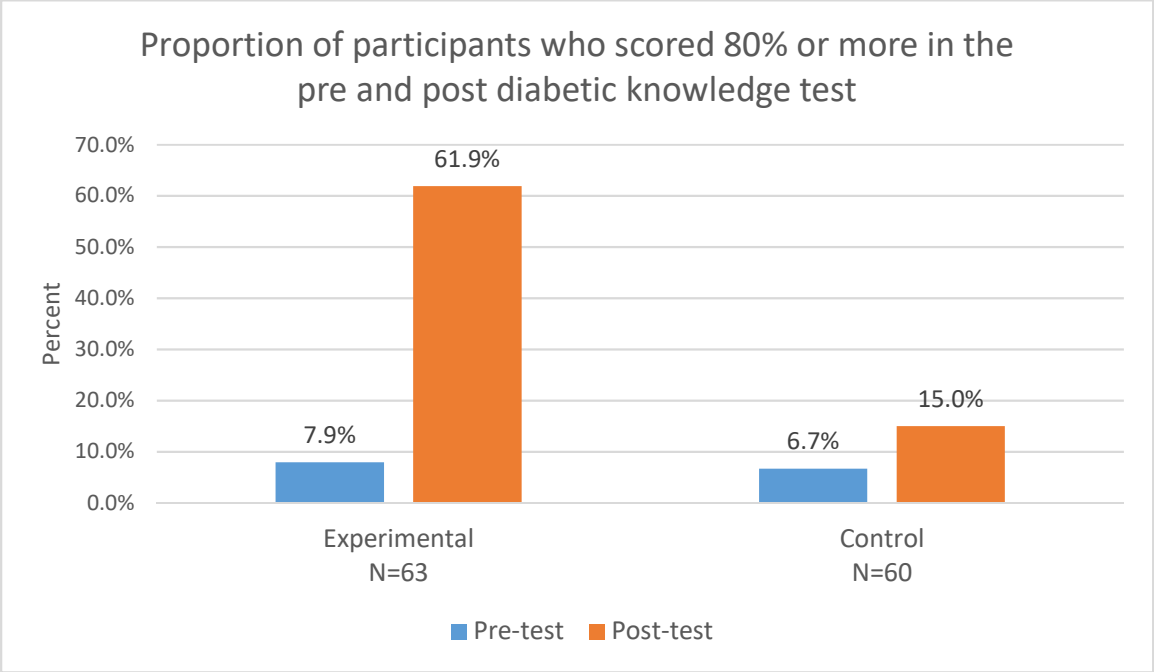

Figure 11: Proportion of participants who scored 80% or more in the pre and post diabetic knowledge test

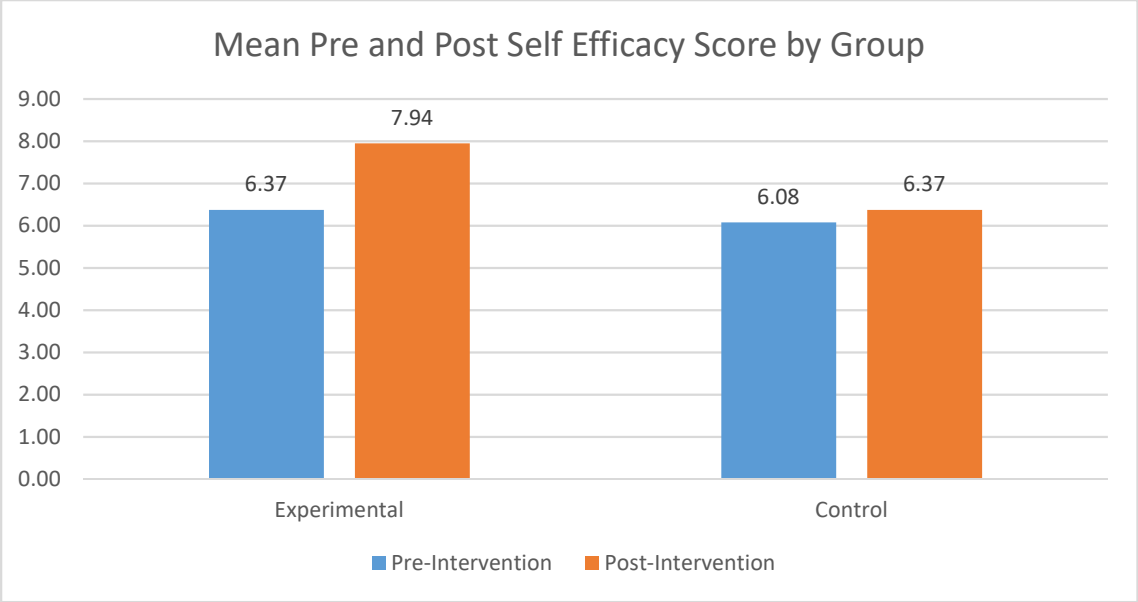

Figure 12: Mean Pre and Post Self-Efficacy Score by Group

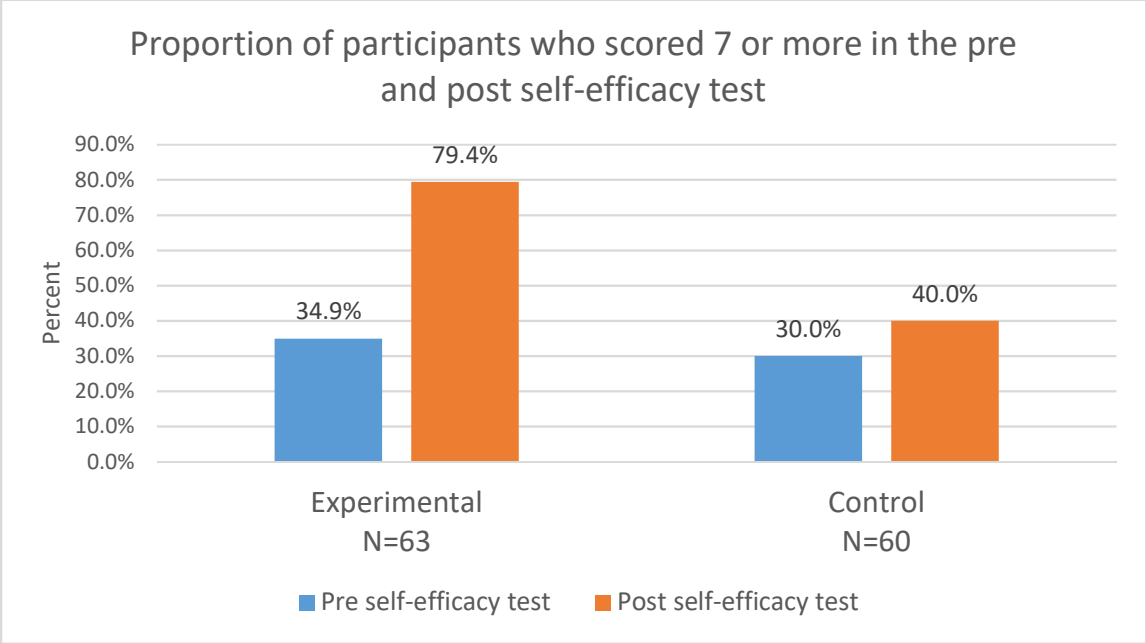

Figure 13. Proportion of participants who scored 7 or more in the pre and post self-efficacy test

Table 5

Mean and Standard Deviation and *t*-test Value of Pre and Post Measures of Selected Variables for Both Groups

Variable	Pre-test		Post		*t*-test	*p**
	M	SD	M	SD		
Diabetes knowledge score in experimental group	14.33	3.524	20.44	3.47	*t*(62)=12.604,	<.001**
Diabetes knowledge score in control group	15.18	3.502	15.80	3.51	*t*(62)=1.824,	.037
Self-efficacy score in experimental group	6.37	1.43	7.94	1.31	*t*(62) = -7.29	<.001**
Self-efficacy score in control group	6.10	1.87	6.37	1.82	*t*(54) = -.984	.165
HbA1c in experimental group	9.30	2.64	8.07	1.89	*t*(62)=4.396,	<0.001**
HbA1c in control group	9.11	2.19	9.13	2.22	T(59)=-0.083, df=59,	.467

*1-tailed ($\alpha = 0.025$)
***p* values are significant

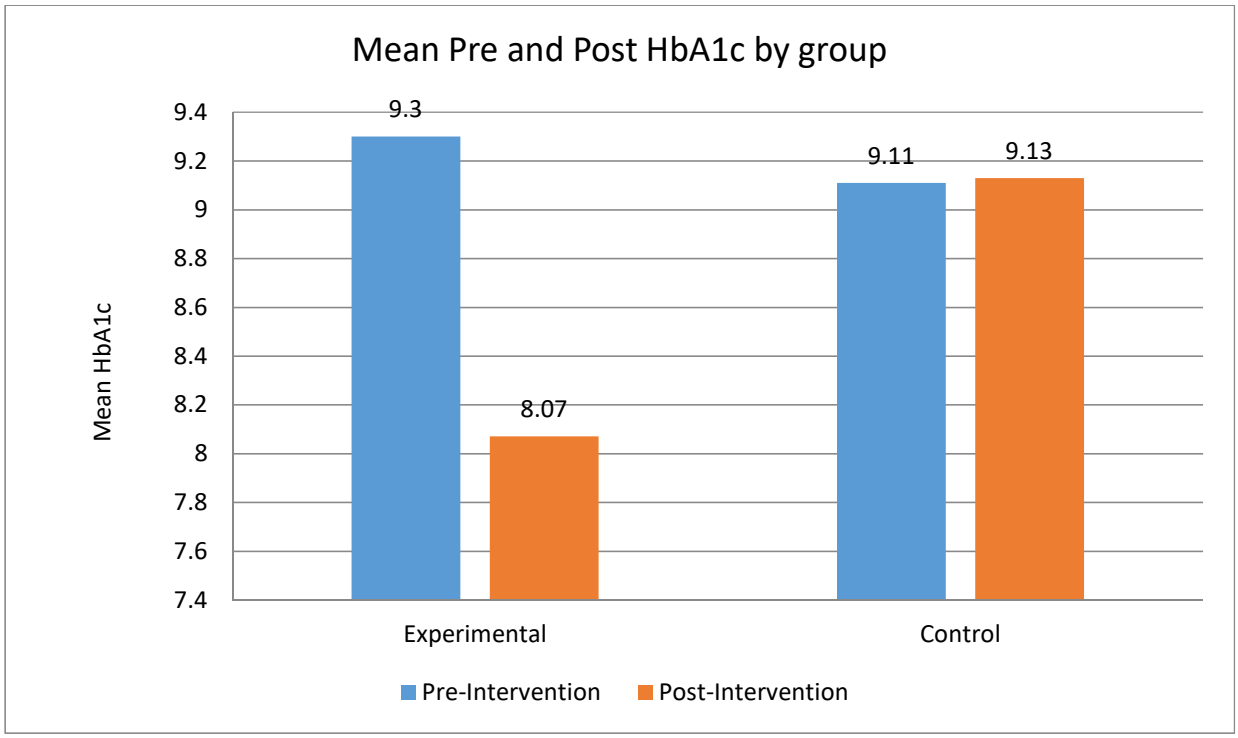

Figure 14. Mean Pre and Post HbA1c by group

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CHAPTER 5

DISCUSSION

Diabetes education has been shown in various studies to be important in managing T2DM (Xiang et al., 2012). The main aim of this project was to assess whether diabetes education can mitigate the effect of T2DM by lowering Hb1Ac among participants, selected in Eldoret, Kenya. Disease self-management, support, and nutrition therapy are important components of T2DM care and necessary to ensure favorable outcomes in all people with DM.

Managing T2DM is difficult not only for the patient but for the healthcare organizations and the community at large. There are overwhelming evidences in the literature that back efficiency of structured T2DM education as a treatment for T2DM. Steinsbekk et al., (2012) state that, effective T2DM education focus on helping people achieve glycemic control and stick to lifestyle changes through diet and exercise. Early education has been shown to reduce diabetic complications in individuals (Piri, 2010; Sachmechi et al., 2013; Steyn et al., 2004; Xiang et al., 2017). Therefore, achieving glycemic control relies heavily on a patient's knowledge of T2DM and its management strategies. On that note, the purpose of this evidence-based project was to examine the effectiveness of diabetes education on HbA1c levels of adults living with T2DM. The project was designed to bring awareness of T2DM complications and its prevention strategies using a healthy diet. Moreover, this project will contribute to the research on

education programs aimed at improving adherence. The dietary and cultural influence was also examined as a barrier and teaching was tailored to appreciate the culture and discuss modifiable cultural beliefs.

Summary of Findings

This project showed that education was the key ingredient on glycemic control among the participants. First, the general knowledge of how various food choices are used by the body and how it affects blood sugar allowed the participants to understand why eating a balanced diet is vital. Secondly, the knowledge that what they eat affects their sugar directly made them aware that they are in control because they are the ones that cook the food that they eat. Lastly, they were able to apply the knowledge in their life thus changing their eating habits, which resulted in lower HbA1c. The outcome of the project was particularly inclined to the findings of Dropkin (2010), Dunkley et al. (2014), Muchiri et al. (2016), Mwangi, et al. (2011), Norris, et al. (2002) Steinsbekk et al. (2012), and Xiang et al. (2017), who observe that patient education is critical to T2DM management. Additionally, the findings confirm that positive results stem from T2DM education, such as dietary instructions, which results in reduced HbA1c levels as similarly discovered by Amendezo et al. 2017 and Battista et al., 2012.

The Health Belief Model (HBM) modified and used in this project, as constructed by Rosenstock, et al., (1974), helped in focusing the scope of the project to a specific structure that took the existing knowledge gap in the project setting into consideration. Based on the model, the project emphasized empowerment of the patient through DM education, which focused on diabetes education and self-efficacy.

In developing nations like Kenya, the level of education is still improving slowly compared with developed nations. This has also influenced T2DM education and awareness because most of the older population (45 years and older), who have a higher risk of T2DM, have little or limited formal education. Whenever these T2DM patients attend a medical care at the hospital, the doctors and nurse inadvertently ignore to educate them about health conditions. This project was to create awareness and bring this point into attention for both the patients and the medical staff. The demographics of this project were mainly older generation of 45 years or older. This is not surprising because it is a fact that T2DM affects older generations and fewer younger people are affected (Chege, 2010). The control and the experimental group had similar demographics (see table 1). This project leveraged the use of HBM model to show that behavior of the patients can be influenced by their perceptions on their health and the desire to improve through lifestyle interventions such as diet and exercise which could lead to the desired outcome of better health and prevention of DM complications. We hypothesized that improving patients' DK can lead to increased levels of self-efficacy among the participants. Increased self-efficacy can lead the patients to make better lifestyle choices and proper T2DM diet that can eventually lead to reduction of Hb1Ac levels. To improve self-efficacy, while following on the HBM model, modifying factors in the form of T2DM education needs to be implemented in order to reconstruct individual perceptions. As such, by introducing lessons to the participants, there knowledge on T2DM and T2DM management enhanced their perceptions evidenced by lower HbA1c levels post-intervention.

Most project participants were above 50 years of age. This is similar to what Bastawrous et al., (2017) found. This project began by first measuring the baseline level of HbA1c in both the control and the experimental group. After three months of education intervention with the experimental group, HbA1c levels of all the participants were measure again, and the reduction in HbA1c level in the experimental group exceeded the expected 1-point reduction objective. It went down by 1.23, which represented a 13.23% reduction from the baseline HbA1c level. Therefore, to answer the project question, does a structured diabetes education intervention reduce HbA1c levels among Kenyan T2DM patients; it is evident that it did. Thus, diabetes education intervention can help patients control T2DM through changing their lifestyles such as diet and exercise.

This project found that DK improved significantly in the experimental group compared to the control group (See Table 4). Increased DK enables the patients to make careful and better decisions about their self-care, especially through diet and exercise. This is important in eliminating superstitions and misconceptions about T2DM, which is rampant in developing nations (Foma et al., 2013; Jackson, 2012; Maina et al., 2010; Mbanya et al., 2010). As expected, this increase in knowledge also leads to an increase in self-efficacy. This project showed that the experimental group level of self-efficacy improved significantly while that of the control group did not show significant difference (see table 3). Before the intervention, 34.9% of the experimental group, and 30.0% of the control group scored 7 or more. After the intervention, the proportion increased to 79.4% in the experimental group, and to 40% in the control group. Therefore, to answer the project question, does a structured diabetes education intervention improve participants'

self-efficacy; the project showed that a structured diabetes education intervention improved the self-efficacy of participants in the experimental group.

The results of this project are in agreement with what has been published (Butts & Rich, 2013), suggesting that HBM can help patients comprehend the seriousness of a diseases such as T2DM can lead to severe complication and even death and by changing their lifestyles such as dietary behaviors can results in optimal health. For HBM to be effective, patients must first believe that by changing a behavior will direct them to a positive outcome or avoid a negative value outcome (Given et al., 1983). Secondly, it is vital that the patients perceive that the behavior if acted upon will result in a desired outcome (Given et al., 1983).

The HBM was applied in this project by giving the participants a structured diabetes education. The diabetes education emphasized that to the participant that their elevated Hb1Ac places them at risk of T2DM complications. The participants desire to change their lifestyles was underscored through goal setting sessions. The participants' cues to acting on their goals were captured during the teaching sessions and the most common emerging theme was planning my meals daily or weekly. The participants were given portion plate, meal guide and education as cues. Regarding their perception of the benefits versus perceived barriers, cost and time were the most common barriers. As initially assumed, the unique nature of the perceived barriers in the Kenyan context prioritized cost and time. Cost was mostly a co-factor of the existing economic environment that featured high food costs, high medical costs, and high transport costs to attend training. Time was influenced by the social objective of spending more time with family.

Project Analysis and Commentary

Project Strengths

This experimental education project was the first in the Eastern region of Africa at large and in Kenya in particular. It was the first project done in the hospital. This allowed physicians to refer their T2DM patients for the project. The project acted on an assessment of need for T2DM education in the community. This resulted in one-day seminars that lasted for two weeks. It strengthened collaboration in many disciplines as the nurses, dieticians, doctors and hospital staff came together to help seminar sessions. The Local TV station interviewed the principal investigator/project manager and the doctors to promote awareness of DM. Because of the publicity thus received, the hospital received more patients with DM than in previous years. The group teaching was cost effective and created a comradery among the participants. It was easy to coordinate the project and sessions because all the participants had cell phones.

Project Limitation

It was festive season during the months of November to December. There was a possibility that the post-HbA1c result was affected by the historic effect as it has been shown to do in Tappen (2011). The Kenyan people tend to eat more during this season. Though there was a reduction in HbA1c after the intervention in the project, it might have been lower if the project was conducted off festive season. Also, the testing effect, (Tappen, 2011) could have factored in because the same questions were used for pre and post-test, though a period of 12 weeks elapsed between tests. The differences in ages and the level of education could have had an effect on the level of understanding during the lessons. This effect may originate from the perceptions towards words and phrases used

in the lessons, which is often dependent on the psychological factors not considered in the project.

Self-professional analysis

This project made me appreciate the choices to pursue DNP for it allowed me to have a platform to help my community through T2DM education. When I was going out about the project, I interacted with many people that helped me surmount obstacles. As I reflect the moments I had an obstacle, it was an opportunity to be creative in problem solving. For example, I discovered that it was easier to reach out to the participants via text message rather than phone calls. I was able to communicate with my project committee on a regular basis through email and phones calls and face to face with my preceptor on site. I collaborated with the teams created on the ground on daily basis.

Personal analysis as a scholar

My project was guided by Essentials for Doctoral Education for Advanced Nursing practice, specifically essential I, II, III, IV, VI, VII, and VIII according to AACN (2006). We will look at each as it applies to my project:

Essential I (Scientific Underpinnings for Practice) directed me to apply evidence-based theories for practice. As such, I was able to draw on basic sciences, being mindful of ethics, to conduct my project in a highly scientific adherence. The intervention—education—is based on scientific theories and is evidence-based.

Essential II (Organizational and Systems Leadership for Quality Improvement and Systems Thinking) led me to identify the need for education in my population of T2DM patients. I considered the cost to the patient, the hospital, and myself. I made a budget to manage expenses, ensuring that I stayed within everyone's

financial boundaries. As a leader, it was my duty to assess how diet change might affect participants. In my teaching, I emphasized safety in knowing the signs and symptoms of hyper- and hypoglycemia due to the impending changes in the participants' eating habits.

Essential III (Clinical Scholarship and Analytical Methods for Evidence-Based Practice) guided me, in my literature review to extract education as an evidenced intervention that helps to lower HbA1c. The intervention was safe and patient-centered because it empowered the patient to take charge of their eating using the plate method. It influenced my collection of data. I was able to analyze outcomes in a way that solidified the hypothesis of education lowering HbA1c.

Essential IV (Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Healthcare) influenced my use of technology in collecting, storing, and analyzing data using the computer among other things. In this process, participants' privacy was preserved, and autonomy kept.

Essential VI (Interprofessional Collaboration for Improving Patient and Population Health Outcomes) shaped my collaboration with all disciplines in the hospital including, but not limited to, nursing, front office registration, and lab for HbA1C results. I was able to lead in teaching the community by being a team member.

Essential VII (Clinical Prevention and Population Health for Improving the Nation's Health) was vital in identifying the target population's needs and developing intervention and implementation. In this process, the cultural beliefs concerning diet were considered. For example, the Kenyan diet must have cornmeal to be viewed as adequate. The participants were told they could still enjoy cornmeal but in small portions.

Essential VIII (Advanced Nursing Practice) directed my practice of nursing intervention. Thinking in an intrinsic manner, I had to deliver and study evidence-based interventions. Essential VIII, as a culmination of all the essentials, assisted with incorporating the HBM to guide the project.

Impact of the project to the community

One of the main goals of this project was to increase available service in the hospital to the community. I shared my finding on daily basis with the doctors and they were impressed on how the experimental group was improving in their wellness and attitude. There was an interest in using the project to reach out to the community. A team of doctors, nurses, lab technicians, IT technicians, dieticians and registration personnel came together to invite other patients with T2DM for the one-day teaching during teaching of the control group. My task was to teach the structured diabetes lessons. The nurses and staff made my teaching less challenging by offering to assist with the logistics like vitals collections such as height and weight, handing out materials, registering patients, drawing blood and directing.

The events were highly successful with high satisfaction reported by the participants and the guests. The participants wanted to continue care with the hospitals. They made consents to be followed by the dieticians and doctors after the project. The awareness created through the local media stations increased interest among members of the community in the region. This was observed with enhanced health-seeking behaviors demonstrated by an increase in the number of patients who visited the hospital for check-ups and reviews during and after the project. Moreover, the subsidized costs of HbA1c testing implemented by the hospital allowed the community to have increased access to

the healthcare facilities and this increased general community health levels. Additionally, following the success of the project, a one-day seminar that was open to the public for two weeks helped to improve community knowledge levels and general awareness resulting in the initiation of a social media group made up of different community stakeholders who would collaborate and assist each other in maintaining optimal HbA1c levels.

Impact of the project to the hospital

- Increased efficiency of hospital services by enhancing patient outcomes through the diabetes educational lessons offered.
- The lessons developed were left at the hospital for the dieticians and nurses to use and there is plan to work with the dietician to improve education curriculum tailored to Kenyan culture.
- Doctors order HbA1c more than before. The significance of HbA1c tests in sugar level control was highlighted leading to increased perception of significance of the tests.
- The hospital reduced the cost of HbA1c testing so that the test could be affordable to private paying patients during the two weeks in which the One-day seminars were conducted. This increased access to the hospital and healthcare services to the public.
- The doctors followed up the participants during the project and beyond. This impact enhanced the health behaviors of the patients as they were continually instructed on glycemic control and dietary issues by the physicians.

Impact on the future professional development

It is common knowledge that T2DM is a very serious disease and the prevalence is rising but more so in sub-Saharan Africa. The estimated number of people living with T2DM by 2030 is staggering and if nothing is done, the results will be detrimental to low income countries like Kenya, where the majority of the people are already burden with other diseases and poverty. There is dire need for not only bringing awareness to the public but structured education is vital. People need to know and understand DM, as both an individual ailment and a negative social phenomenon, and the ways to prevent the associated complications. I am very passionate about this initiative and I will continue to organize and collaborate with stakeholders to educate and empower self-management and prevention of T2DM.

Impact on practice

The majority of the participants had little or no knowledge about DM. Most people get information during diagnosis such as 'you have DM; you need to stop eating sugar and start taking medication'. The stress of the diagnosis will not allow the person to understand exactly what is going on without proper DM education. The result is uncontrolled T2DM as evidenced by the high level of HbA1c in my participants, which could lead to high incidences of complications. The project proved that structured diabetes education could promote change in patients' dietary behavior, thus lowering HbA1c and improving their confidence in self-management. The health care practitioners have now implemented the testing of HbA1c to their patients. The hospitals have also subsidized the price for patients without insurance. In addition, for the patients with insurance, sometimes their hospital charges can reach the maximum daily allowance but

doctors can order HbA1c test on another day to allow the insurance to cover the test and alleviate burdens on the patients.

This major impact attributed to this project is the influence on the doctors and dieticians to follow up with their patients even after the project for HbA1c testing and educating the patients. For nursing practice in Kenya, the project demonstrated the need for attending nurses to ensure that the patients who visit the hospital for diabetes clinic possess the required knowledge. The nursing practitioners who serve as the first point of contact with the patients would be able to collect data regarding the patients' lifestyle and self-efficacy and recommend consultations with T2DM educationists and nutritionists.

Personal analysis as a project developer

From the beginning, I worked with my professors who helped me to think critically and follow my passion of taking my project to Kenya. It was quite a challenge but the process has built my confidence, knowing that I can overcome any obstacle. The project demanded a lot of collaboration and timely communication. Working with my project committee sharpened my listening skills and learning to filter and act upon a decision. I now feel that I have gained expertise in carrying out a research outside the US. I can provide guidance to another study on how to get research approval and carry out research on the ground. I also feel that this project helped me gain confidence in my leadership skills, such as guiding a team of staff to support me to teach the 100 extra patients for two weeks during the post-test of the control group successfully. My teaching skills improved and my DK deepened. The hospital requested me to develop a three day structured T2DM education in collaboration with the hospital dieticians. The local county

of Uasin Gishu requested to hold a T2DM awareness campaign. The local TV station wanted to interview the hospital staff and me for public teaching purpose.

Plan for project dissemination

The success of this project is a huge addition to new knowledge not only to the local hospital but also to the surrounding community hospitals, the nation of Kenya, Africa and the world. Therefore, the dissemination will not only prove that the diabetes education is vital to patient self-care but will also open a discussion on how to improve ways of cost-effective T2DM education delivery further. My first audience is the staff of Reale hospital and the participants. They are my ambassadors. I also intend to present my research findings to other local hospitals, the county and other research forums in Kenya. I will also publish my research findings in one of the diabetes journals. I am also a member of Sigma Teta Tau and Phi Kappa phi and I am going to apply to present my research in one of their conferences. I am applying to present at the Adventist research conference. I will also make a poster for the nursing department at Andrews University. Family and community support of the diabetic patients can never be undermined. Without support, patients feel isolated and misunderstood. The family can also support the patients by eating a healthy diet similar to that of the diabetic patient.

Recommendations to the government of Kenya

The effect of T2DM can be mitigated by the community as well as the government. T2DM not only poses threat to the health of a nation, but also the economy and living standards. As in many of other countries, the cost of T2DM is subsidized by the governments or covered by insurances companies. However, such coverage often extends

only to the care, and treatment of the disease. It is recommended that the insurance should cover the following costs as well:

- Glucometer
- Strips
- HbA1c test
- Diabetes education

There is progress regarding the government involvement because Uasin Gishu county government, impressed by the project made a request that the primary investigator and the project chair should return to the site of the project to present the results to the community in collaboration with Real Hospital. This milestone is a significant, as it would help the investigator achieve one of the goals of the project; to increase responsiveness of authorities in educating the community on diabetes, towards enhancing engagement with the social problem of diabetes.

Evaluation

The project was evaluated in order to assess its relevance to the setting and specific problems of the population under study. The applied evaluation strategy involved a continuous assessment of individual educational sessions, and a focus group interview that was conducted on December 15th 2018. During the continuous assessment, the participants were required to show increased competency using group discussions to overview and incorporate other culture specific issues that affected them as a community. The focus group interview at the end of the project involved 2 doctors, 3 nutritionists and a nurse. The purpose of this part of the evaluation process was to understand the perceptions of the individuals who would be responsible for implementation of the

intervention following successful determination of its effectiveness. For focus group interview, a committee was established and was asked three main questions concerning the relevance of the curriculum, the understandability and simplicity of the materials, and the flexibility of the materials and curriculum to client specific needs.

The continuous evaluation highlighted the following strengths of the project. The awareness creation strategy generated tremendous interest among the participants and the community at large. The study population was hungry for knowledge, which was highlighted by the high turnout both for the project participation and for the post-project seminars. More than three hundred people had volunteered to be included in the study. A request by members of the community outside the project to be involved in the one-day seminars that was conducted after the study, and the creation of a social media group to assist in dispensing the knowledge gained by the intervention to other members of the community. In addition, the success of the project attracted the attention of the local media, which hosted the project investigator and the hospital's director for a live interview on diabetes knowledge. Additionally, the local government's attention was also captured resulting in a request that the project investigator should present the results of the project to the community in a conference to be conducted as part of the dissemination strategy. Moreover, there was significant collaboration efforts between the internal (Participants, Doctors, nurses, nutritionists, lab and IT technicians) and external (government agencies, community, media) stakeholders, which ensured effective planning and implementation of the project.

The focus group evaluation interview highlighted the following strengths of the project. According to one of the nutritionists, the materials used for teaching were

relevant to the problems being faced by most of the participants. Moreover, it was simple to adapt to the needs of the patients, which heavily relied on the individual perceptions of the patient. This increased its effectiveness, as one of the most significant factors contributing to low diabetes knowledge was the influence of cultural perceptions on dietary practices. In concurrence, the nurse observed that the structure of the educational sessions allowed for greater effectiveness in interdisciplinary collaboration since it became easier to assign duties and roles and sequentially control the process of diagnosis, education and treatment interventions, and patient follow-up. According to the doctors, the design and implementation strategy of the project that required participation by nurses and nutritionists reduced their burden of healthcare by ensuring that there was reduced risk of complications emerging. This greatly improved the quality of healthcare services offered by the hospital at large.

The weaknesses of the project identified through continuous assessment were addressed immediately and it was noted that most of the weaknesses were controllable. The main weakness was capacity issues due to the sharp increase in patients that presented to the hospital for checkup due to the increased awareness. The high cost of HbA1c tests were reduced through sponsorship by the hospital. Very few patients had home glucose testing machines and strips making it difficult to monitor blood glucose levels to determine the required dietary measures to take. There were also incidences of delays of services, during the one-day seminars because of procedural inadequacies, which were highlighted and the need for additional staffing recognized. It is recommended that during such projects, additional resources (staffing and equipment) be provided in order to prevent strain of current resources, and to improve on time

management. For purposes of continuity, four representatives from the nutrition department were allowed to shadow the project investigator in the educational sessions in order to learn the teaching strategies employed by the project investigator, and to develop skills to implement the implementation after conclusion of the project.

Spiritual encouragement

There is a saying that 'a stich in time saves nine'. Diabetes education is that stich in time that can empower the patient to prevent complications and even reverse some of the symptoms. Following a diet requires a great discipline. Therefore, the most important thing is to inspire the patients that it is about them and that they are in control of their care and management of T2DM not the doctor or anyone else. Daniel in the Bible and his friends made a profound decision because they believed in God and in their ability to remain true to their convictions. The results of their decisions to eat only vegetables and avoid rich and unhealthy food were very significant compared to those who ate the king's menu. Their well-being was excellent and their intellect was 10 times better than their counterparts. Their choices did not affect them positively only but influenced the community they lived in because they were evidently more productive and effective leaders. As a DNP, it is my duty to seek ways to help my patients to depend on God and focus on their inner self and to bring healing to their bodies. My prayer is; to successfully help the local hospital to establish diabetes education that will set an example to the rest of the hospitals and inspire confidence in patients. The Lord is the only one who can restore the health of all of us so my main prayer is to get God's wisdom to know what to say and do. In James, 1:5 (King James V.) there is a promise of wisdom for those who ask.

REFERENCES

Abdulrehman, M. S., Woith, W., Jenkins, S., Kossman, S., & Hunter, G. L. J. G. q. n. r. (2016). Exploring cultural influences of self-management of diabetes in coastal Kenya: an ethnography. *3*, 2333393616641825.

ADA. (2017). Standard of medical care in diabetes-2017. *Journal of Clinical and Applied Research and Education, 40 (1)*.

ADA. (2018). Standards of medical care in diabetes—2018. *Diabetes care*, *41*(Supplement 1), S13-S27.

Adejoh, S. O. (2014). Diabetes knowledge, health belief, and diabetes management among the Igala, Nigeria. *Sage Open, 4*(2), 2158244014539966.

Al-Khawaldeh, O. A., Al-Hassan, M. A., & Froelicher, E. S. (2012). Self-efficacy, self-management, and glycemic control in adults with type 2 diabetes mellitus. *Journal of Diabetes and its Complications, 26*(1), 10-16. doi:https://doi.org/10.1016/j.jdiacomp.2011.11.002

Amendezo, E., Walker Timothy, D., Karamuka, V., Robinson, B., Kavabushi, P., Ntirenganya, C., . . . Bavuma, C. (2017). Effects of a lifestyle education program on glycemic control among patients with diabetes at Kigali University Hospital, Rwanda: A randomized controlled trial. *Diabetes Research and Clinical Practice, 126*, 129-137. doi:https://doi.org/10.1016/j.diabres.2017.02.001

Arcangelo, V. P., & Peterson, A. M. (2006). *Pharmacotherapeutics for advanced practice: a practical approach* (Vol. 536): Lippincott Williams & Wilkins.

Bastawrous, A., Mathenge, W., Wing, K., Bastawrous, M., Rono, H., Weiss, H. A., . . . Kuper, H. (2017). The incidence of diabetes mellitus and diabetic retinopathy in a population-based cohort study of people age 50 years and over in Nakuru, Kenya. *BMC endocrine disorders, 17*(1), 19-19. doi:10.1186/s12902-017-0170-x

Battista, M.-C., Labonté, M., Ménard, J., Jean-Denis, F., Houde, G., Ardilouze, J.-L., . . . metabolism. (2012). Dietitian-coached management in combination with annual endocrinologist follow up improves global metabolic and cardiovascular health in diabetic participants after 24 months. *37*(4), 610-620.

Butts, J. B., & Rich, K. L. (2013). *Philosophies and theories for advanced nursing practice*: Jones & Bartlett Publishers.

Cardona-Morrell, M., Rychetnik, L., Morrell, S. L., Espinel, P. T., & Bauman, A. (2010). Reduction of diabetes risk in routine clinical practice: are physical activity and nutrition interventions feasible and are the outcomes from reference trials

replicable? A systematic review and meta-analysis. *BMC Public Health, 10*, 653. doi:10.1186/1471-2458-10-653

Chege, M.P. (2010). Risk factors for type 2 diabetes mellitus among patients attending a rural Kenyan hospital. *African Journal of Primary Health Care & Family Medicine, 2*(1).

Collins, G. S., Mughal, S., Barnett, A. F., Fitzgerald, J., & Lloyd, C. E. (2011). Modification and validation of the Revised Diabetes Knowledge Scale. *Diabetic Medicine, 28*(3), 306-310.

Dropkin, B. M. (2010). An Approaching Epidemic: Exploring Diabetes Awareness & Care in Mombasa, Kenya.

Dunkley, A. J., Bodicoat, D. H., Greaves, C. J., Russell, C., Yates, T., Davies, M. J., & Khunti, K. (2014). Diabetes prevention in the real world: effectiveness of pragmatic lifestyle interventions for the prevention of type 2 diabetes and of the impact of adherence to guideline recommendations: a systematic review and meta-analysis. *Diabetes Care, 37*(4), 922-933. doi:10.2337/dc13-2195

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. *Behav Res Methods, 41*(4), 1149-1160. doi:10.3758/brm.41.4.1149

Fernandez, S., Olendzki, B., & Rosal, M. C. J. J. o. t. A. D. A. (2011). A dietary behaviors measure for use with low-income, Spanish-speaking Caribbean Latinos with type 2 diabetes: the Latino Dietary Behaviors Questionnaire. *111*(4), 589-599.

Fitzgerald, J. T., Funnell, M. M., Hess, G. E., Barr, P. A., Anderson, R. M., Hiss, R. G., & Davis, W. K. (1998). The reliability and validity of a brief diabetes knowledge test. *Diabetes Care, 21*(5), 706-710.

Foma, M. A., Saidu, Y., Omoleke, S. A., & Jafali, J. (2013). Awareness of diabetes mellitus among diabetic patients in the Gambia: a strong case for health education and promotion. *BMC Public Health, 13*(1), 1124. doi:10.1186/1471-2458-13-1124

Gilis-Januszewska, A., Szybinski, Z., Kissimova-Skarbek, K., Piwonska-Solska, B., Pach, D., Topor-Madry, R., . . . Disease, V. (2011). Prevention of type 2 diabetes by lifestyle intervention in primary health care setting in Poland: Diabetes in Europe Prevention using Lifestyle, physical Activity and Nutritional intervention (DE-PLAN) project. *The British Journal of Diabetes, 11*(4), 198-203.

Given, C. W., Given, B. A., Gallin, R. S., Condon, J. W. J. R. i. n., & health. (1983). Development of scales to measure beliefs of diabetic patients. *6*(3), 127-141.

Jackson, M. (2012). Nutrition and Diabetic Management in Urban Kenya. *Independent Study Project (ISP) Collection*. 1386.

Jasper, U. S., Ogundunmade, B. G., Opara, M. C., Akinrolie, O., Pyiki, E. B., Umar, A. J. J. o. D., & Disorders, M. (2014). Determinants of diabetes knowledge in a cohort of Nigerian diabetics. *13*(1), 39.

Jones, T. L. J. S. S. M. J. (2013). Diabetes Mellitus: the increasing burden of disease in Kenya. *6*(3), 60-64.

Keresztes, P., & Peacock-Johnson, A. J. A. T. A. J. o. N. (2019). CE: Type 2 Diabetes: A Pharmacologic Update. *119*(3), 32-40.

King, D. K., Glasgow, R. E., Toobert, D. J., Strycker, L. A., Estabrooks, P. A., Osuna, D., & Faber, A. J. (2010). Self-Efficacy, Problem Solving, and Social-Environmental Support Are Associated With Diabetes Self-Management Behaviors. *Diabetes Care, 33*(4), 751. doi:10.2337/dc09-1746

LaMorte, W. W. (2018). The Health Belief Model. *Behavioral Change Models.* Retrieved from http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories2.html.

Lorig, K., Ritter, P. L., Villa, F. J., & Armas, J. (2009). Community-based peer-led diabetes self-management. *The Diabetes Educator*, *35*(4), 641-651

Maina, W. K., Ndegwa, Z. M., Njenga, E. W., & Muchemi, E. W. J. P. A. M. J. (2010). Knowledge, attitude and practices related to diabetes among community members in four provinces in Kenya: a cross-sectional study. *7*(1).

Mash, R. J., Rhode, H., Zwarenstein, M., Rollnick, S., Lombard, C., Steyn, K., & Levitt, N. (2014). Effectiveness of a group diabetes education programme in under-served communities in South Africa: a pragmatic cluster randomized controlled trial. *31*(8), 987-993. doi:doi:10.1111/dme.12475

Matheka, D. M., & Demaio, A. R. J. P. A. M. J. (2013). Complementary and alternative medicine use among diabetic patients in Africa: a Kenyan perspective. *15*(1).

Mbanya, J. C., Motala, A. A., Sobngwi, E., Assah, F. K., & Enoru, S. T. (2010). Diabetes in sub-Saharan Africa. *Lancet, 375*(9733), 2254-2266. doi:10.1016/s0140-6736(10)60550-8

McCance, K. L., & Huether, S. E. (2018). *Pathophysiology: The biologic basis for disease in adults and children*: Elsevier Health Sciences.

Mcferran, L. (2008). Obstacles to diabetes care in Kenya. *Medical journal of therapeutics Africa, 2*(2), 127-129.

McPhee, S. J., Papadakis, M. A., & Rabow, M. W. (2010). *Current medical diagnosis & treatment 2010*: McGraw-Hill Medical New York:.

Ministry of Public Health and Sanitation. (2010). Kenya National Diabetes Educators Manual. *Ministry of Public Health and Sanitation, Nairobi, KE.*

Ministry of Public Health and Sanitation. (2010). *Kenya National Diabetes Educators Manual* (1st ed.). Nairobi: Ministry of Public Health and Sanitation. Retrieved July 30, 2017, from https://www.worlddiabetesfoundation.org/sites/default/files/Kenya%20National%20Diabetes%20Educators%20Manual.pdf

Muchiri, J. W., Gericke, G. J., Rheeder, P., & Africa, D. o. S. (2016). Impact of nutrition education on diabetes knowledge and attitudes of adults with type 2 diabetes living in a resource-limited setting in South Africa: a randomised controlled trial. *Journal of Endocrinology, Metabolism, 21*(2), 26-34.

Mugure, G., Karama, M., Kyobutungi, C., & Karanja, S. (2014). Correlates for cardiovascular diseases among diabetic/hypertensive patients attending outreach clinics in two Nairobi slums, Kenya. *Pan Afr Med J, 19*, 261. doi:10.11604/pamj.2014.19.261.5261

Mwangi, M. W., Githinji, G. G., & Githinji, F. W. (2011). Knowledge and awareness of diabetic retinopathy among diabetic patients in Kenyatta National Hospital, Kenya. *International Journal of Humanities and Social Science, 1 (21)*, 140-146.

Naccashian, Z. (2014). The impact of diabetes self-management education on glucose management and empowerment in ethnic Armenians with type 2 diabetes. *The Diabetes Educator, 40*(5), 638-647.

Nakanga, W., Crampin, A., & Nyirenda, M. (2016). Personal View: Should haemoglobin A1C be used for diagnosis of diabetes mellitus in Malawi? *Malawi Medical Journal, 28*(1), 28-30.

Novo Nordisk (2015). Diabetic Screening in Kenya., Retrieved from https://www.novonordisk.com/about-novo-nordisk/novo-nordisk-in-brief/stories/citizenship/diabetes-screening-in-kenya.html.

Norris, S. L., Lau, J., Smith, S. J., Schmid, C. H., & Engelgau, M. M. (2002). Self-Management Education for Adults With Type 2 Diabetes. *Diabetes Care, 25*(7), 1159. doi:10.2337/diacare.25.7.1159

Park, P. H., & Pastakia, S. D. (2018). Access to Hemoglobin A1c in Rural Africa: A Difficult Reality with Severe Consequences *Journal of Diabetes Research, 2018*, 5. doi:10.1155/2018/6093595

Piri, A. (2010). Effects of education based on health belief model on dietary adherence in diabetic patients. *Journal of Diabetes Metabolic Disorders, 9*, 15.

Rosenstock, I. M., Hockbaum, G. M., Kegels, S., & Leventhal, H. (1974). Historical origins of the health belief model. *Health education monographs, 2*(4), 328-335.

Sachmechi, I., Wang, A., Kim, P., Reich, D., Payne, H., & Salvador, V. B. J. B. J. o. M. P. (2013). Impact of diabetes education and peer support group on the metabolic parameters of patients with diabetes mellitus (type 1 and type 2). *6*(4), 10-15.

Shabbidar, S., Fathi, B., & Shirazifard, N. M. J. I. J. D. D. C. (2006). Effects of clinical nutrition education on glycemic control outcomes in type 2 diabetes. *26*(4), 157.

Sharifirad, G., Najimi, A., Hassanzadeh, A., & Azadbakht, L. J. J. o. r. i. m. s. t. o. j. o. I. U. o. M. S. (2011). Application of BASNEF educational model for nutritional education among elderly patients with type 2 diabetes: improving the glycemic control. *16*(9), 1149.

Steinsbekk, A., Rygg, L., Lisulo, M., Rise, M. B., & Fretheim, A. J. B. h. s. r. (2012). Group based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus. A systematic review with meta-analysis. *12*(1), 213.

Steyn, N. P., Mann, J., Bennett, P. H., Temple, N., Zimmet, P., Tuomilehto, J., . . . Louheranta, A. (2004). Diet, nutrition and the prevention of type 2 diabetes. *Public Health Nutr, 7*(1a), 147-165.

Sullivan, L. M. (2012). *Essentials of biostatistics in public health* (2nd ed.). Burlington.

Tol, A., Alhani, F., Shojaeazadeh, D., Sharifirad, G., & Moazam, N. (2015). An empowering approach to promote the quality of life and self-management among type 2 diabetic patients. *J Educ Health Promot, 4*, 13. doi:10.4103/2277-9531.154022

Wambui Charity, K., Kumar, A. M. V., Hinderaker, S. G., Chinnakali, P., Pastakia, S. D., & Kamano, J. (2016). Do diabetes mellitus patients adhere to self-monitoring of blood glucose (SMBG) and is this associated with glycemic control? Experiences from a SMBG program in western Kenya. *Diabetes Res Clin Pract, 112*, 37-43. doi:10.1016/j.diabres.2015.11.006

Wdowik, M. J., Kendall, P. A., Harris, M. A., & Auld, G. J. J. o. N. E. (2001). Expanded health belief model predicts diabetes self-management in college students. *33*(1), 17-23.

Whitehead, L. C., Crowe, M. T., Carter, J. D., Maskill, V. R., Carlyle, D., Bugge, C., & Frampton, C. M. J. J. o. e. i. c. p. (2017). A nurse-led education and cognitive behaviour therapy-based intervention among adults with uncontrolled type 2 diabetes: A randomised controlled trial. *23*(4), 821-829

World Health Organization. (2014, November). *Kenya Faces Rising Burden of Diabetes*. Retrieved June 19, 2017, from WHO: http://www.who.int.features/2014/kenya-rising-diabetes/en/

World Health Organization. (2011). Non-communicable disease country profiles, Kenya. *World Health Organization*. Retrieved July 30, 2017, from http://apps.who.int/iris/bitstream/10665/44704/1/9789241502283_eng.pdf

Xiang, Y., Luo, P., Cai, X., Tang, Y., & Wu, Z. (2017). Results of a pilot study of patient-to-patient education strategy on self-management among glycemic uncontrolled patients with diabetes. *Patient preference adherence, 11*, 787-793.

Ziraba, A. K., Fotso, J. C., & Ochako, R. J. B. p. h. (2009). Overweight and obesity in urban Africa: a problem of the rich or the poor? *, 9*(1), 465.

APPENDICES

Appendix A: Project Questionnaire

Section[a, b]	Description	Data
Section 1	10-question Demography related questions	Personal Information, Tribe, occupation, gender, age, education, marital status, income status, and health condition
Section 2	Single question on perception of wellness	General wellness scored from poor to excellent
Section 3	8 questions relating to self-efficacy	Low to high confidence in diet planning, exercising, blood sugar control, reaction to high or low blood sugar level, health seeking response, and diabetes management efficiency
Section 4	Single question with probing follow-up questions	Ability of patient to self-administer glucose level testing
Section 5	5 questions relating to hospital utilization	Patients consistency in using healthcare facilities
Section 6	4 questions relating to allopathic medicine	Patients adherence to allopathic treatment plans
Section 7	25 multiple questions on diabetic knowledge	Scored rating to test level of knowledge about diet perceptions, HbA1c testing practices, dietary strategies of glucose control, exercise, risk factors, symptoms, and diabetes comorbidities

[a] Questions from sections 1-6 were used with permission from Stanford University: https://www.selfmanagementresource.com/resources/evaluation-tools/english-evaluation-tools

[b] The questions in section 7 were used with permission and adapted from the Michigan Diabetes Research Center: http://diabetesresearch.med.umich.edu/

Appendix B: Institutional Consent Letter

Reale Hospital
Quality Healthcare made affordable

Services
24 Hours Out patient | Casualty Services | Inpatient Services | Maternity & Child Health | Theatre | I.C.U -: Neonatal, Pediatric & Adult | Radiology -: Ultrasound & X-ray | Pharmacy | Laboratory Services

30th November 2017

To: Institutional Review Board
Andrews University
4150 Administrative Drive, Room 322 Berrien Springs, MI 49104-0355

Institutional Consent Letter

Dear Sir / Madam,

This letter is to notify the Institutional Review Board of Andrews University that Sabina Bett, who is currently a Student at Andrews University, will be conducting her research on diabetes at Reale Hospital Eldoret Kenya. We have many patients suffering from diabetes and that can benefit from her research and most importantly: The Diabetes Plate knowledge and the dietary modules that she will educate our patients.

Sabina has been a Registered nurse for more than 10 years and she will carry out research under Dr. Rutto's supervision, she can effectively do her research in our hospital. Sabina will be doing blood pressure checks, weight and height checks. The hemoglobin A1C level will be checked at our lab as a routine test, at least every three months. Sabina will be the one giving the diabetes patients consent forms to sign. The patients who agree to be involved in her study and sign the consent forms shall become the participants in her study for diabetes entitled Effectiveness of Dietary Education on type II Diabetic Patients in Eldoret Kenya.

We welcome her to conduct the research here at Reale Hospital and we promise to give her the needed guidance and support for her to complete her studies at Andrews University as a DNP student.

With Best Regards

ASUMANI Abdillahi
Hospital Administrator

ADMINISTRATION
REALE HOSPITAL
ELDORET

Located at Elgon View - Nyerere Road | Next to Potters academy 500 metres from Eldoret C.B.D
Hospital Emergency Line: 0705 671 057 | Mobile no: 0720 738 740 | **Email:** info@realehospital.com | www.realehospital.com

Reale Hospital
Quality Healthcare made affordable

Services
24 Hours Out patient | Casualty Services | Inpatient Services | Maternity & Child Health | Theatre | I.C.U - Neonatal, Pedriatic & Adult | Radiology - Ultrasound & X-ray | Pharmacy | Laboratory Services

28th August 2017

Our ref. RHL /adm/17/120

To Andrews University,
Department of Nursing

Dear Sir / Madam,

RE: OPPORTUNITY TO PRACTICE AS DNP STUDENT AT REALE HOSPITAL LTD

The above matter refers;

We hereby confirm that the Hospital management and Administration has granted SABINA JERUTO BETT a student with a course code faculty of NSRG 801, CAPSTONE SCHOLARLY PROJECT an opportunity to practice.

We look forward to receiving SABINA JERUTO BETT and she is to abide by the Hospital rules and regulation.

Yours faithfully,

ASUMANI Abdillahi
Hospital Administrator

ADMINISTRATION
REALE HOSPITAL
ELDORET

Located at Elgon View - Nyerere Road | Next to Potters academy 500 metres from Eldoret C.B.D
Hospital Emergency Line: 0705 671 057 | Mobile no: 0720 738 740 | **Email:** info@realehospital.com | www.realehospital.com

Andrews University
Office of Research & Creative Scholarship

April 24, 2018

Sabina Jeruto Bett
Tel: 269-262-4185
Email: sabett@andrews.edu

RE: APPLICATION FOR APPROVAL OF RESEARCH INVOLVING HUMAN SUBJECTS
IRB Protocol #: 18-036 **Application Type:** Original **Dept.:** Doctor of Nurse Practitioner (DNP)
Review Category: Expedited **Action Taken:** Approved **Advisor:** Jochebe Bea Ade-Oshifogun
Title: Effectiveness of Dietary Education on HbA1c Levels of Kenyan Adults with Diabetes.

This letter is to advise you that the Institutional Review Board (IRB) has reviewed and approved your IRB application for research involving human subjects entitled: *"Effectiveness of Dietary Education on HbA1c Levels of Kenyan Adutls with Diabetes"* IRB protocol number 18-036 under Expedited category. This approval is valid until April 24, 2019. If your research is not completed by the end of this period you must apply for an extension at least four weeks prior to the expiration date. We ask that you inform IRB whenever you complete your research. Please reference the protocol number in future correspondence regarding this study.

Any future changes (see IRB Handbook pages 12) made to the study design and/or consent form require prior approval from the IRB before such changes can be implemented. Please use the attached report form to request for modifications, extension and completion of your study.

While there appears to be no more than minimum risk with your study, should an incidence occur that results in a research-related adverse reaction and/or physical injury, (see IRB Handbook page 18-19) this must be reported immediately in writing to the IRB. Any project-related physical injury must also be reported immediately to the University physician, Dr. Katherine, by calling (269) 473-2222. Please feel free to contact our office if you have questions.

Best wishes in your research.

Sincerely

Mordekai Ongo
Research Integrity & Compliance Officer

Institutional Review Board - 4150 Administration Dr Room 322 - Berrien Springs, MI 49104-0355
Tel: (269) 471-6361 Fax: (269) 471-6543 E-mail: irb@andrews.edu

OFFICE OF THE DIRECTOR OF GRADUATE STUDIES AND RESEARCH

RESEARCH ETHICS COMMITTEE

University of Eastern Africa, Baraton

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

July 27, 2018

Sabina Jeruto Bett
Department of Nursing
School of Health Professions
Andrews University
Berrien Springs, Michigan, USA

Dear Sabina,

Re: ETHICS CLEARANCE FOR RESEARCH PROPOSAL (REC: UEAB/20/2018)

Your doctoral research proposal entitled ***"Effectiveness of Dietary Education on HbA1c levels on Kenyan Adults with Diabetes"*** 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 July 27, 2018 until June 26, 2019. For any extension beyond this time period, you will need to apply to this committee one month prior to expiry date.

Kinldy note that you will need permission from The National Commission for Science, Technology and Innovation (NACOSTI) before conducting your study. You will also need a clearance from the study site before you start gathering your data.

We wish you success in your research.

Sincerely yours,

for

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

Prof. Jackie Kpeinzeh Obe
Chairperson, Research Ethics Committee

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

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/18/43129/24515**

Date: **18th August, 2018**

Sabina Jeruto Bett
Andrews University
USA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Effectiveness of dietary education on HBA1C levels on Kenyan adults with diabetes,"*** I am pleased to inform you that you have been authorized to undertake research in **Uasin Gishu County** for the period ending **17th August, 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.

DR. MOSES RUGUTT, PHD, OGW
DIRECTOR GENERAL/CEO

Copy to:

The County Commissioner
Uasin Gishu County.

The County Director of Education
Uasin Gishu County.

THIS IS TO CERTIFY THAT:
MS. SABINA JERUTO BETT
of ANDREWS UNIVERSITY, 6185-49103
Berrien Springs,has been permitted to conduct research in *Uasin-Gishu County*

on the topic: *EFFECTIVENESS OF DIETARY EDUCATION ON HBA1C LEVELS ON KENYAN ADULTS WITH DIABETES*

for the period ending:
17th August,2019

.....
Applicant's Signature

Permit No : NACOSTI/P/18/43129/24515
Date Of Issue : 18th August,2018
Fee Recieved :Ksh 2000

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

CONDITIONS

1. The License is valid for the proposed research, research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
4. The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.
5. Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.
6. This Licence does not give authority to transfer research materials.
7. The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.
8. The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No.A 20131

CONDITIONS: see back page

COUNTY GOVERNMENT OF UASIN GISHU

DEPARTMENT OF HEALTH SERVICES
County Director of Health-Clinical services

Ref:CDH/INTRO/2018/01 **24th August 2018**

To

THE HOSPITAL ADMINISTRATOR

REALE HOSPITAL

ELDORET.

Dear sir,

RE: MS SABINA JERUTO BETT

The above mentioned is the chief investigator of the research proposal entitled **"Effectiveness of Dietary Education on HBA1C levels Kenyan Adults with Diabetes".**

She is a student at Andrews University in the USA .She has gotten research approval from University of East African Baraton .She has also received an authority from National Commission For Science, Technology And Innovation (NACOSTI) to undertake the research in Uasin Gishu County. She has chosen to do the research at your hospital Reale Hospital,Eldoret.

The essence of this letter is to acknowledge receipt of all prerequisite documents. We have no objection to the research being carried out in Uasin Gishu because all the requirements have been complied to.

We therefore introduce her to you kindly accord her all the necessary support.

Yours sincerely,

COUNTY DIRECTOR-CLINICAL SERVICES
24 AUG 2018
UASIN GISHU COUNTY
P. O. Box 5665-30100, ELDORET

Dr.K.W.KURIA

Ag County Director of Health-Clinical Servises

Appendix C: Participants consent letter

Andrews University

Informed Consent Form-I

Principal Investigator: Sabina Jeruto Bett
Advisor: Dr. Jochebed Ade-Oshefogun

Proposal: Effectiveness of Diabetes education on Patients with Type II Diabetes

Introduction

I am Sabina Bett, a doctoral student at Andrews University in Michigan, USA. I am doing a controlled project on the possible effectiveness of diabetes education on efforts to prevent diabetic complications. I am going to give you information and invite you to be part of this research to investigating if better knowledge of diabetes and meal planning will help mitigate the problem. You do not have to decide today whether or not you will participate in the research. Feel free to seek advice from family and friends before you decide. If at any time you find words that you do not understand, please stop me and I will take the time to explain. There will be time to ask questions later if you need clarification.

This Informed Consent Form has two parts:

- **Information Sheet (to share information about the research with you)**
- **Certificate of Consent (for your signatures if you agree to take part)**

You will be given a copy of the full Informed Consent Form

PART I: Information Sheet

Purpose of the research

The purpose of this project is to evaluate Kenyan type 2 diabetes patients` knowledge base of controlling diabetes with diet. The bottom line is to assist our patients in developing a diet that helps improve HbA1c levels and prevent complications. The education modules will contribute to the hospital's educational. It is improvement and hoped that the results of this project will motivate providers to offer structured educational programs and refer patients to these resources.

Type of Research Intervention

You will be given a questionnaire to complete at the beginning of the intervention study. Your height, weight, blood pressure, temperature, heart rate, and breathing rate measurements will be taken, as well as a blood sample. You will also participate in three lessons of food education program which will be offered every one to two weeks for at least one month. During the three months after the lessons I will give you a call once a month to check how you are doing and to answer any questions you might have. You can also call me any time you have a question. During this education program you will complete pre and post survey. At the end of three months after the last lesson, your height, weight, blood pressure, temperature, heart rate, and breathing rate measurements will be taken, and a blood sample will also be taken again.

Participant Selection

We are inviting all black Kenyans adults between the ages of 25 to 75 years with a confirmed diagnosis of type 2 diabetes for at least one year to participate in this study.

Permission to Access Records

In order to get your lab reports, I need your permission consent to access your medical records. Your information will be held in the highest confidence and it will be used only by me. Please check Yes to indicate your consent and no for your refusal.

Yes---------- No----------

Voluntary Participation

Your participation in this research is entirely voluntary. You are free to choose whether or not to participate, and you can quit at any time. Whether you choose to participate or not, all the services you receive at this hospital will continue.

Study Procedures

Once you have signed the informed consent, your height and weight measurements will be taken. Your blood sample will also be taken. You will be given instructions specific to your group. At the end of the four months, you will be given the same questionnaire to

complete. Your height and weight measurements and a blood sample will also be taken again.

Duration

The research takes place over four to four and half months in total.

Potential Risks

The finger prick to measure your HbA1c levels is part of your routine care and will be collected by your usual caregivers. The education program is not a guarantee that your HbA1c levels will decrease. In the event that your HbA1c level does not get better, I will refer you to your doctor. This research does not replace your regular medical care and medication.

Benefits

You will go through a nutritional education program that will help you in making healthier meals that will, in turn, help with glucose control. By participating in this research, you will enjoy the following benefits: a clearer understanding of diabetes and what HbA1c measures, new ideas to incorporate in your day-to-day meal planning, and healthier cooking that will help your family fight diabetes, too.

Confidentiality

The information that we collect from this research project will be kept confidential. Information about you that will be collected during the research will be stored safely and no one but the researchers will access it. All the information about you will have a number on it instead of your name, and the assigned number will be used only for this study. Only the researchers will know what your number is, and it will be under lock and key.

Who to Contact:

Sabina Bett DNP student investigator 0746 508 165

Dr. Dr. Jochebed Ade-Oshifogun +12694713312

Dr. Erick Rutto 0705671057

Andrews University IRB +12694716361

University of Eastern Africa-Baraton REC

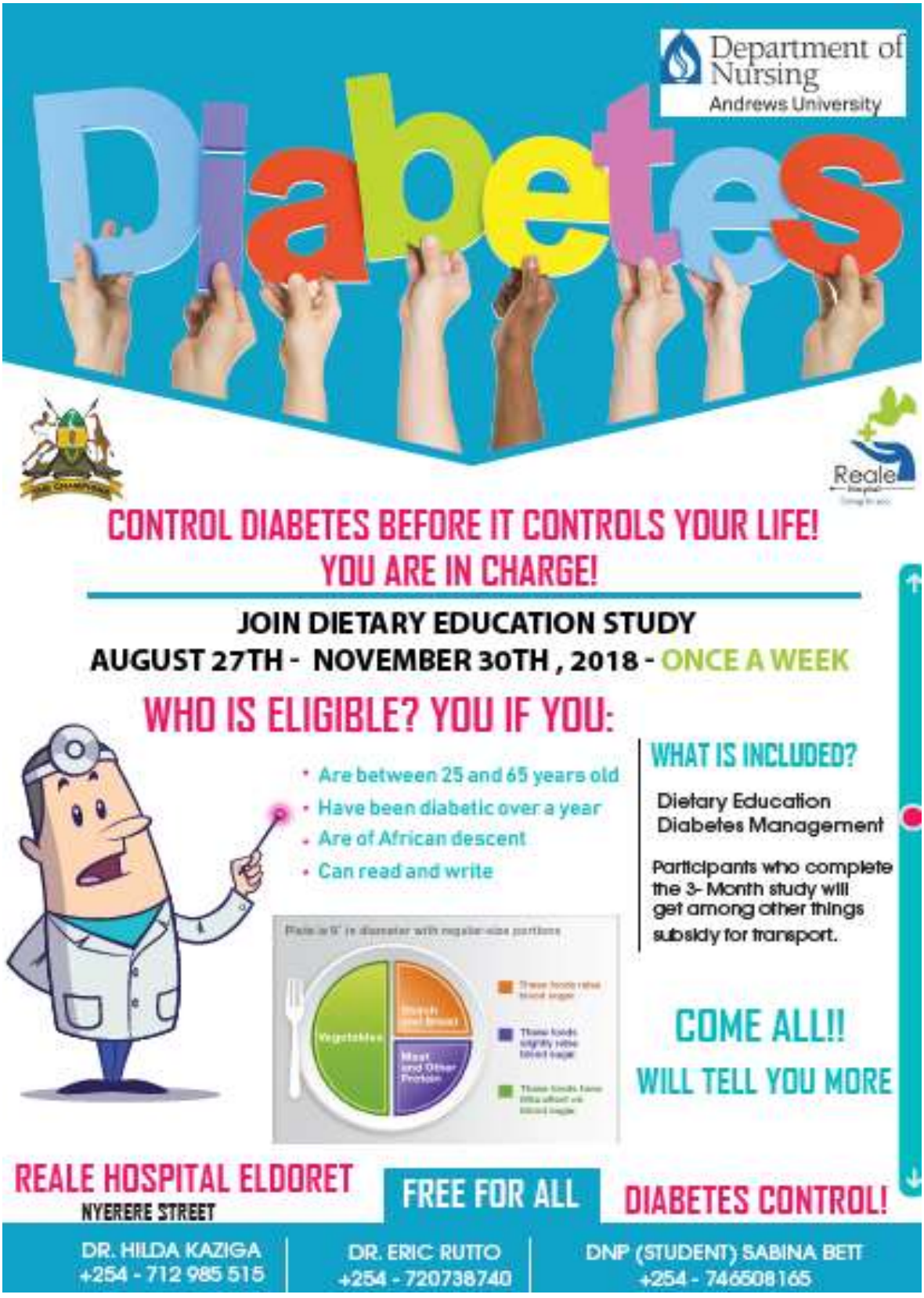
Certificate of Consent

I have read and understood the foregoing information. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I hereby voluntarily consent to participate in this research.

Print Name of Participant_____

Signature of Participant _____
Date _____
Day/month/year

Appendix D: Invitation Flyer



Appendix E: 120-minute class lessons

Adapted with permission from the Diabetes and Nutritional department, Lakeland Health

Educational session 1 Managing your health

What do I need to know?
- Meal planning, moving, medication and monitoring

What is diabetes?

What happens to the body with diabetes?
- Insulin does not work as it should
- Less insulin is produced
- Leads to higher blood sugar levels

What does insulin do?
- Helps the body use carbohydrates, protein and fat

How the body works with diabetes?
- *Show video*

Normal blood sugar levels
- *Show graph*

Types of diabetes
- Type 1 and type 2

Risk factors
- Heredity
- Overweight
- Age
- Stress
- Pregnancy
- Lack of exercise
- Pre-diabetes

Steps to better management
- Education
- Meal planning
- Exercise or physical activity
- Medication
- Self-monitoring

Why monitor blood glucose?

Medications-oral, injectable, inhaled and newer medications and alternatives

Exercise

Set goals

Educational session 2 Smart Eating and Diabetes

What is diabetes?

How to manage diabetes

Healthy eating

Food components

Carbohydrates

- Reading labels
- Why fiber is important
- Alcohol and beverages
- Sick day management
- Foods for hypoglycemia
- Can you name a healthy carb?

Fats
- Healthy fats
- Unhealthy fats
- Trans Fat
- Know what kinds of fat you are eating
- Questions on fats

Protein
- Serving size
- Questions on protein

Non-starchy vegetables
Sodium and blood pressure management
Meal planning: putting things together
- What should your plate look like?
- Your plate should be balanced
- Review

Things to remember
- Let`s test your knowledge
- Which is it….? Carbohydrate? Protein? Fat?
- Carb quiz

Eating away from home
Calculating home recipes
Set goal for future

Educational session 3 managing your health (wrap up)

Making complex medical information simple
- Metabolic syndrome
- Checking your blood sugar
- Foot care
- Injecting insulin
- High HbA1c results
- Carbohydrate counting
- Nutrition and healthy eating

Be prepared
- Take correct amount of medication
- Plan meals and times well
- Wear or carry diabetes identification

Uncontrolled diabetes can lead to complications
- Prevent
- Delay onset
- Decrease the symptoms

Complications of high blood sugar
- Blindness
- Kidney disease heart
- Disease and stroke
- Nerve disease
- Amputation

Ketoacidosis
Keeping blood vessels healthy
How to eat less salt
Act in time to heart attack signs
Lipid levels (blood fats)
- Know your numbers

Smoking
- Narrows blood vessels
- Reduces amount of oxygen carried
- Causes damage to blood vessels
- Raises blood sugar

Skin care
- Protect your skin from the elements
- Treat minor injuries promptly
- Know signs of injection

Foot care
- Wash and inspect daily
- Trim nails following curve of toe
- Use stone for calluses
- Wear comfortable shoes
- Don`t go bare foot
- Avoid soaking feet

Exercise daily
Sick day management

Appendix F: Teaching aids

Balanced plate per Kenya

Samaki, salad, rice

Ugali, karanga, sukuma, carrots

Kachumbari, nyama choma, ugali

Mokimo, greens

https://delishably.com/misc/30-Foods-You-should-eat-in-Kenya