# Prevalence Of Depression And Associated Factors Among Patients With Diabetes In An Outpatient Clinic In Dar Es Salaam, Tanzania

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Abstract-Depression and diabetes mellitus are chronic diseases with profoundly negative effects people's health and life expectancy. on Depression is a state of low mood and aversion to activities previously most enjoyed, affecting a person's thoughts, behavior, feelings, and a sense of wellbeing. Diabetes mellitus (DM) is a chronic disease in which blood sugar levels are too high. Depression is the second leading cause of disability in young to middle-aged adults in low and middle-income countries, following HIV/AIDS. Depression and DM co-occur in a bidirectional relationship, with a stronger association noted for the depression-predicting onset of diabetes. This co-occurrence is a major problem impacting the lives of DM patients. The purpose of this research was to uncover the links between depression and DM, aiming to propose strategies to manage depression in DM patients. Key objectives of the study were to: (i) identify key socio-demographic factors associated with the prevalence of depression among DM patients in an outpatients' clinic in Tanzania; and (ii) propose a model health care practitioners and institutions can adopt for the prevention and management of depression among DM patients. Quantitative methods helped to uncover the impact of socio-demographic factors in the prevalence of depression in DM patients and establish the correlation between depression and diabetes as they co-occur. The research established a positive correlation between undetected and late identification of depression and the deterioration of the health condition and quality of life of DM patients; significantly higher health care bills occur when socio-demographic determinants of depression prevalence are not being well understood and Desmond Ayim-Abogye, PhD, Sweden Regent University College of Science & Technology Department of Human Development and Psychology Accra, Ghana desmond.ayim-aboagye@regent.edu.gh

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managed; and a significant improvement in the quality of life when educated and counselled DM patients collaborate in managing their status. Finally, the research proposes a patient-physician Collaborative Care Model as an effective strategy for managing the pathology.

Keywords—Psychology; Depression and Diabetes; Diabetes Mellitus; Muhimbili Hospital; Depression; Diabetes; Nutrition and Diabetes.

# DEDICATION

I dedicate this piece of work to God Almighty for His light and guidance throughout the course. To my children Ginho and Leroi for their understanding when I had to divide my attention with my studies even when they needed me. To all patients of depression, diabetes, and related chronic illnesses around Africa and to their respective caregivers.

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### II. LIST OF ACRONYMS

BDI	Beck Depression Inventory			
СВТ	Cognitive Behaviour Therapy			
CDC	Centre for Disease Control			
CES-D	Centre for Epidemiologic Studies Depression Scale			
CVD	Cardiovascular Disease			
DALYS	Disability Adjusted Life Years			
DM	Diabetes Mellitus			
DM1	Diabetes Mellitus Type 1			
DM2	Diabetes Mellitus Type 2			
DSM-5	Diagnostic and Statistical Manual - 5 <sup>th</sup> version			
HADS	Hospital Anxiety and Depression Scale			
HPA-Axis	Hypothalamic-Pituitary-Adrenal Axis			
ICD-10	International Classification of Diseases: Tenth Revision			
IDF	International Diabetes Foundation			
PHC	Primary Health Clinics			
PHQ-9	Patient Health Questionnaire			
SPSS	Statistical Package for Social Sciences			
тнс	Traditional Healers Centres			
WHO	World Health Organization			

#### CHAPTER ONE

#### Introduction

#### 1.1 Background to the Study

Depression and diabetes mellitus "are two chronic disease states that have a profoundly negative impact on people's quality of life and overall life expectancy" (Shirey et al., 2015).

Depression can be described as a "state of low mood and aversion to activity that can affect a person's thoughts, behavior, feelings, and sense of wellbeing" (Khan et al., 2019), leading to feelings of "sadness, anxiety, emptiness, hopelessness, helplessness, worthlessness, guilt, irritability and restlessness" (Khan et al., 2019).

Diabetes mellitus (DM) is a chronic disease in which blood sugar levels are too high. There are two types of diabetes. In diabetes mellitus (DM1), the body does not produce sufficient insulin. 'In diabetes mellitus (DM2), is the most prevalent. In DM2, the body does not make insulin and cannot use them properly; it is an insufficient amount of insulin, and sugar stays in the blood is present (Ahmed, 2016).

Research has demonstrated that depression and diabetes co-occur in a "bidirectional relationship, with a stronger association noted for the depressionpredicting onset of diabetes (Chen et al., 2013; Eker, 2018; Pan et al., 2010; Shirey et al., 2015; Mann, 2010; Zanoveli et al., 2016). In other words, "depression can lead to diabetes mellitus, and conversely diabetes mellitus could facilitate the emergence of depression" (Zanoveli et al., 2016), Confirming the stronger association for depression-induced diabetes, (Mezuk et al., 2008) found that depression was associated with a "60% increased risk of DM2, while DM2 was associated with only modest increased risk of depression. The co-occurrence between depression and diabetes mellitus is called "comorbid depression" (De Groot et al., 2001).

Concerning the relationship between depression and diabetes mellitus, Shirey et al., (2015) suggests that there is "more than a threefold increase in the prevalence of depression in people with diabetes mellitus type 1, and nearly a two-fold increase in people with diabetes mellitus type 2". Consistent with the findings of De Groot et al. (2001) and Mann (2010) depression increases the risk for diabetes. Mann (2010) also found that depressed women that participated in the study "were 17% more likely to develop diabetes".

The International Diabetes Federation considers that "diabetes is one of the largest global health emergencies of the 21st century" (Badescu et al., 2016). Worldwide there were 463 million adults suffering from diabetes in 2019 (IDF, 2020), and projections estimate an increase to 700 million by the year 2045 (IDF, 2020). In sub-Saharan countries, the prevalence of diabetes was "19 million with projections indicating a 143% increase, to 47 million persons with diabetes" (IDF, 2019). In Tanzania, IDF (2020) Diabetes atlas estimated a "5.7% prevalence in the population aged 20-79 years, corresponding to 997,400 with projections pointing to an increase to 3,359,300 cases in 2045".

Depression is a "common and often undiagnosed condition for patients with diabetes." It is also a condition associated with increased health care use and expenditures (Egede et al., 2002). risk of complications including stroke and myocardial infarction; and "elevated suicide risk" (Jin et al., 2015). In addition, scientific research has shown that depressed people "are more likely to skip medications, get little exercise, have an unhealthy diet, and have difficulties managing their weight" (Khan et al., 2019). Overall, comorbid depression in diabetes patients is associated with a 1.5 - fold increase in mortality risk as compared with those without depression (Shirey et al., 2015). According to Shirev et al. (2015), depression is also the "second leading cause of disability in young to middle-aged adults in low and middle- income countries, surpassed only by HIV/AIDS."

Despite the risks it poses, depression is one of the most neglected symptoms in diabetic patients and is

directly linked with lowering of quality of life and, the treatment of depression in patients with diabetes is still quite ineffective" (Zanoveli et al., 2016). As such, paying attention to the "co-management of diabetes and depression is critical" (Shirey et al., 2015) and justified, particularly in sub-Saharan Africa where such programs are virtually nonexistent. The purpose of this research is to uncover the links between depression and diabetes, in Tanzania, underscore the importance of identifying depression in diabetic patients and identify possible strategies to address both diseases.

#### 1.2 Statement of the Problem

Undetected depression leads to poor health among patients with diabetes mellitus. Early identification of depression-associated factors in diabetes mellitus patients and adequate education of the measures patients should observe may contribute to the improvement of their condition and hence their quality of life.

### 1.3 Purpose of the Study

The purpose of the study is to identify factors associated with depression among patients with diabetes mellitus in the context of Tanzania. The research also aims to propose a strategy and a model that institutions and health care practitioners can adopt for the prevention, management, and control of the pathology among patients with diabetes mellitus, enabling them to live like non-diabetic people, with no recourse to expensive medical care.

#### 1.4 Research Objectives

(i) To review the trends of the evolution of depression among patients with diabetes mellitus.

(ii) To identify key socio-demographic factors associated with the prevalence of depression among diabetes mellitus patients in an outpatients' clinic in Dar-es-Salaam in Tanzania.

(iii) To propose an effective model that institutions and health care practitioners can adopt for the prevention, management, and control of the depression pathology among patients with diabetes mellitus, enabling patients to live like non-diabetic people, with no recourse to expensive medical care.

# **1.5 Research Questions**

(i) What are trends of the evolution of depression among patients with diabetes mellitus?

(ii) What are the key socio-demographic factors associated with the prevalence of depression among diabetes mellitus patients in an outpatient clinic in Tanzania?

(iii) What strategies (or Models) can institutions and health care practitioners adopt to reduce the prevalence and manage depression in diabetes mellitus patients?

# 1.6 Hypotheses

The research pursued three hypotheses as follows.

**Hypothesis A** - There is a positive correlation between undetected and late identification of depression and the deterioration of the health condition and quality of life of DM patients.

**Hypothesis B** - There is a significantly higher likelihood of unsustainable health care bills for patients with DM if key socio-demographic factors associated with the prevalence of depression among patients with DM will not be well understood and managed.

**Hypothesis C** - There will be a significant improvement in the quality of life and a reduction in health care bills of DM patients if an effective care model, based on the education and counselling of DM patients in managing the determinant of depression will be adopted.

### A. 1.7 Organization of the Study

This research comprises five chapters. In Chapter One, the researcher presents an introduction to the background information and problem statement of the study, the purpose of the study, the research objectives, the research questions, the hypotheses. Chapter Two reviews relevant literature on the study. Chapter Three talks about the methodology of the study, data used in the research, research design, and techniques. The fourth chapter covers the data presentation and discussion of results. Chapter Five presents the conclusion and recommendations of the study.

#### **CHAPTER TWO**

#### Literature Review

### 2.1 Introduction

This chapter reviews available relevant literature on the topic. The aim is to enable the researcher to better understand about the developments around the topic and better understand terms and concepts related to depression among patients with diabetes around the world, the Africa Region and Tanzania, zeroing into Muhimbili Hospital in Dar-es-Salaam, the capital of Tanzania. The idea is to use research findings from elsewhere to understand the prevalence of depression among people with diabetes mellitus (DM) and the prevalence of depression in DM, identifying and determining the socio-demographic factors associated with depression among patients with DM. The literature review also seeks to investigate the biopsychosocial factors associated with depression among patients with DM. The two diseases, DM and depression, are both chronic and characterized health complications by major worldwide. In this research, they are studied together in their comorbid (Khan et al., 2019) relationship.

Depression and diabetes mellitus "are two chronic disease states that have a profoundly negative impact on people's quality of life and overall life expectancy" (Shirey et al., 2015).

#### 2.2. Depression: Cases and Prevalence

Depression can be described as a "state of low mood and aversion to activity that can affect a person's thoughts, behavior, feelings, and sense of wellbeing" (Khan et al., 2019), leading to feelings of "sadness, anxiety, emptiness, hopelessness, helplessness, worthlessness, guilt, irritability and restlessness" (Khan et al., 2019).

Depression is a "leading cause of disability worldwide, and a major contributor to the overall global burden of disease" (WHO, 2020) and "can lead to suicide: (WHO, 2020). Other complications include reduced concentration and attention; reduced selfesteem and self-confidence; ideas of guilt and unworthiness (even in a mild type of episode); bleak and pessimistic views of the future; ideas or acts of self-harm or suicide; disturbed sleep and diminished appetite.

According to Richter and Roser (2018), in 2017, 264 million people in the World lived with depression. The evolution of depression between 1990 and 2017 is presented in figure 3 below. More women are affected by depression than men (WHO 2020). Accordingly, as Figure 3 also shows, the prevalence in males corresponds to 2.7% of the world population, corresponding to 102.88 million, while females account for a higher prevalence of 4.1% or 161.56 million persons.

Depression prevalence in sub-Saharan Africa increase from "13.26 million persons in 1990 to 28.12 million in 2017" (Richter and Roser, 2018; Gosh, 2012). Prevalence in Tanzania over the same period evolved from just a little over "700.000 in 1990 1.43 million persons suffering from depression in 2017" (Richter and Roser, 2018), as shown in Figure 1 below.

"Not much is known about depression in DM in East Africa" (Khan et al., 2019), and the "cause of depression in DM is yet to be discovered but, genetic, biological and psychological factors are potential contributing factors" (Khan et al., 2019). Khan et al. (2019) suggest that the "coexistence of depression in people with diabetes might be associated with poor adherence to treatment; poor metabolic control; higher complication rates, decreased quality of life; increased healthcare use and cost; increased disability and loss of productivity; and increased risk of death." Given the high risk of comorbid prevalence of depression in DM patients, "the International Diabetes Foundation (IDF) recommends periodic assessment and monitoring of depression among patients" (Khan et al., 2019).

Note. This figure demonstrates the consistent rise in number of persons reportedly suffering from depression from 1990 to 2017. Adapted from *Mental Health* by Ritchter and Roser, 2018 (https://ourworldindata.org/mental-health) In the public domain.

#### Figure 1

Number of People with Depression in the World

Number of people with depression, World, 1990 to 2017 Total number of people of all ages with depression, differentiated by sex. Figures attempt to provide a true estimate (going beyond reported diagnosis) of the number of people with depression based on medical, epidemiological data, surveys and meta-regression modelling.



Note. The figure attempts to provide a true estimate of the number of people with depression based on medical, and epidemiological data. Adapted from *Mental Health* by Ritchter and Roser, (2018) (https://ourworldindata.org/mental-health) In the public domain.

Tanzania had 676.807 registered persons suffering from depression in 1990, rising to 1.43 million in 2017.

Depression risk varies with age. Globally, "older individuals (in the 70 years and older age bracket) have a higher risk of depression, relative to other age groups" (IDF, 2020).

#### Figure 2

The evolution of depression in Tanzania between the years 1990 and 2017



#### Figure 3

Number of People with Depression by Age groups



**2.3.** Diabetes Mellitus: Causes, Types, and Note. This figure shows a noticeable decline in risk percentage to depression as age decreases. Adapted from *Mental Health* by Ritchter and Roser, 2018 (<u>https://ourworldindata.org/mental-health</u>) In the public domain.

#### Prevalence

Diabetes is a chronic disease that "occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces" (WHO. 2020). There are two types of diabetes. In DM1, the body does not adequately produce sufficient insulin. In DM2, which is the type most prevalent, the body does not make insulin and cannot use it properly; an insufficient amount of insulin causes sugar to stay in the blood, (Ahmed, 2016).

#### 2.3.1 Causes of DM1

According to (Castro, 2017) the "precise cause of DM1 is not known". Research findings confirm that a "combination of genetic susceptibility and environmental factors are associated with DM1 prevalence" (Castro, 2017). The mechanism leading to diabetes may be summarized in the fact that a "person's immune system, which is responsible for fighting harmful bacteria or viruses, attacks and destroys cells responsible for the production of insulin - a hormone that regulates the glucose (sugar) in the blood - in the pancreas. Consequently, the body remains with little or no insulin, and sugar that was supposed to be taken into the body cells, builds up in the bloodstream" (Castro, 2017).

### 2.3.2 Causes of DM2

DM2 occurs "when cells become resistant to the insulin action, and the pancreas is not able to produce sufficient insulin to make up for the resistance, causing sugar to build up in the bloodstream, instead of moving into the cells where it is needed for conversion into energy" (Ahmed, 2016). The exact reason why it happens is yet to be certain. Like in DM1, "genetic and environmental factors contribute to the development of DM2" (Castro, 2017). Despite the fact that not everyone with DM2 is overweight or obese, being overweight or obese is strongly associated with the development of DM2 (Castro, 2017).

#### 2.4. Diabetes Prevalence

Diabetes prevalence "has been rising more rapidly in low- and middle-income countries than in highincome countries" (WHO 2020). The International Diabetes Federation (IDF, 2020) considers that "diabetes is one of the largest global health emergencies of the 21st century" (Badescu et al., 2016). Figure 5 presents diabetes prevalence data, indicating that, in 2019, worldwide, there were 463 million adults suffering from diabetes (IDF 2020). Projections estimate an increase to 700 million by the year 2045 (IDF 2020). In sub-Saharan countries, the prevalence of diabetes stood at "19 million, in 2019, with projections indicating a 143% increase, to 47 million persons with diabetes" (IDF 2020) by the year 2045. In Tanzania, (IDF 2020), the Diabetes atlas estimated a "5.7% prevalence in the population aged 20-79 years, corresponding to 997,400, in 2019, with projections pointing to an increase to 3,359,300 cases in 2045".

Zanoveli et al., 2016). In other words, "depression and diabetes may be comorbidities and exist in a bidirectional relationship" (Allen 2014; De Groot et al., 2001; <u>Alzoubi</u> et al., 2018; Manigault 2016; Pan et al., 2010; Mezut et al., 2008). Depression "may be a cause of diabetes, and diabetes may be a cause of depressive symptoms" (Allen, 2016; Zanoveli et al., 2016). The incidence of depression in patients with DM2 is increased, as is the occurrence of diabetes in patients with depression" (Allen 2014; <u>Alzoubi</u> et al., 2018; Manigault 2016; Pan et al., 2010). Patients with "depression have an increased risk for early death, in which the most common cause is coronary vascular disease" (Allen, 2016).



Research has demonstrated that depression and diabetes co-occur in a "bidirectional relationship, with a stronger association noted for the depression-

Note. This figure demonstrates the consistent rise in percentage of number of persons reportedly suffering from diabetes in Africa by 143% and worldwide by 51%. Adapted from *Diabetes Facts and Figures* by International Diabetic Foundation, 2020 (<u>www.idf.org</u>).) In the public domain.

predicting onset of diabetes (Chen et al., 2013; Shirey et al., 2015; Mann, 2010; Zanoveli et al., 2016).

The association varies depending on whether depression co-occurs with DM1 or DM2. Shirey et al. (2015) and Golden (2016) suggest that there is "more than a threefold increase in the prevalence of depression in people with Type 1 diabetes, and nearly a two-fold increase in people with Type 2 diabetes". Mann (2010) also found that "depressed women that participated in a study they conducted "were 17% more likely to develop diabetes".

Depression is a "common and often undiagnosed condition for patients with diabetes" (Golden 2016; Khan et al., 2019). It is also a condition associated with increased health care use and expenditures (Edge et al., 2016); risk of complications including stroke and myocardial infarction; lower quality of life (Das et al., 2013) and "elevated suicide risk" (Jin et al., 2017). In addition, scientific research has shown that depressed people "are more likely to skip medications, get little exercise, have an unhealthy diet, and have difficulties managing their weight" (Khan et al., 2019). Overall, comorbid depression in diabetes patients is associated with a 1.5 - fold increase in mortality risk as compared with those without depression (Shirey et al., 2015). According to Shirey et al. (2015), depression is also the "second leading cause of disability in young to middle-aged adults in low and middle-income countries, surpassed only by HIV/AIDS."

Golden (2016) considers that "15% – 20% of type 1 diabetes will have elevated depressive symptoms, and about 23% subclinical depressive symptoms", ranked DM within the 10 leading killer diseases in Tanzania. Similarly, Khan et al., (2019) noted that "15% - 20% people with DM in Tanzania, struggle with moderate to severe depression each day while having proper treatment". Recent studies also established that children and adolescents with DM "had a higher prevalence of depression than those in the same age group with no DM" (Petrak et al., 2018).

Socio-demographic, socio-environmental factors, and biopsychosocial conditions also "contribute significantly to depression" in DM patients through lifestyle habits, the relationship to caregivers or relatives, the patients' perception about the caregivers, among others. For that reason, the analysis of depression prevalence among people with DM in Tanzania considered these factors. (Petrak et al., 2018).

Despite the risks it poses, depression is one of the most neglected symptoms in diabetic patients and is directly linked with lowering of quality of life and, the treatment of depression in patients with diabetes is still quite ineffective" (Zanoveli et al., 2016). As such, paying attention to the "co-management of diabetes and depression is critical" (Shirey et al., 2015) and justified, particularly in sub-Saharan Africa where such programs are virtually nonexistent.

#### 2.2 The Socio-Demographic and Socioenvironmental Factors

Socio-demographic, socio-environmental factors, and biopsychosocial conditions also "contribute significantly to depression" (Petrak et al., 2018) in DM patients through lifestyle habits, the relationship to caregivers or relatives, the patients' perception about the caregivers, among others.

In their study, Khan et al. (2019) found "significantly elevated levels of depression in DM patients who smoke and in patients who were on insulin treatment." Both categories of patients had mild to moderate depression. These findings lead to the conclusion that "smoking and taking insulin are predictors of mild to moderate depression among diabetic patients" (Khan et al., 2019). Patients on therapy "were almost twice as likely to have mild to moderate depression" (Khan et al., 2019). "DM smoking patients were found to have approximately seven times the likelihood for mild to moderate depression" (Khan et al., 2019). Exposure to stressful conditions is another socio-environmental factor. Khan et al. (2019) reported "higher depression prevalence among DM patients in Palestine", probably because of exposure to "stressful conditions due to wars and violence, among other instabilities" (Khan et al., 2019).

A study done in Dar-es-Salaam with the aim of determining common mental disorders among users of traditional healers centers (THC) and primary health clinics (PHC), found higher levels of prevalence compared to the prevalence of mild and moderate depression among cigarette smoking and insulin therapy patients. Patients attending THC had a "prevalence of 55% and those attending PHC 48%" (Khan et al., 2019).

The study by Khan et al. (2019) found out that DM patients on insulin therapy had twice the possibility of having mild to moderate depression than patients who were on other therapies. The unimpressive results for DM patients in insulin therapy suggest an impact of the fear of the process itself (self-injection), conducted daily.

#### 2.3 The Biopsychosocial Factors

# Figure 5 Engel's Biopsychosocial Model of Health and Disease

Engel's biopsychosocial model of health and illness has been used effectively in clinical practice and research by psychologists, nurses, physicians, and social workers" (Habteworld et al., 2016). This model is based on the principle that "any chronic disease, such as depression, is caused by a combination of biologically (physiological or genetic predispositions); psychological (health beliefs and lifestyle); and, social factors such as (family relationships, socioeconomic status, and social support) factors (Habteworld et al., 2016). The diagram in Figure 6, illustrates the interconnectivity of these factors to create the state of mind and body of patients. The diagram illustrates the association of depressive symptoms and DM2 and explores the "potential underlying associated risk factors." (Habtewold et al., 2016). Psychological factors contributing to depression in DM patients are "unemployment, financial stress, negative life events, polypharmacy, smoking, lack of regular physical activity, perceived fear of complication and death, perceived high healthcare cost" (Habtewold et al., 2016). The psychosocial factors vary from socioeconomic status, education, marital status, maior family conflicts, and poor social support.

Social support is a major depressing factor in DM patients. The problem arises when the patients get very concerned regarding the psychological state of the family or caregivers, because of feelings of becoming a burden or pain to family or caregivers, and fears that caregivers or family members may give

up on them at some point. Under such circumstances, patients feel that the "family or caregivers wish they died in order for them to have some rest and feels like a failure and or weak for being in that condition" (Khan et al., 2019).

Depression brings major complications such as "cardiovascular diseases (CVD) like stroke, hypertension among others" (Allen 2014; <u>Alzoubi</u> et al., 2018; Manigault, 2016, Pan et al., 2010. In severe levels, depression in DM patients can lead to "severe damage to kidneys (nephropathy) and/or irreversible

Note. This figure demonstrates the role biological, psychological and social factors play in influencing chronic disease. From "Comorbidity of Depression and Diabetes: An Application of Biopsychosocial Model," Habteworld, T.D, Radie, T.Y, and Tegegne, S.B, 2016, International Journal of Mental Health Systems. (https://doi.org/10/1186/s13033-016-0106-2.

end-stage kidney disease, requiring dialysis or kidney transplant" Lieberman, 2003), among many other complications. Depression comorbidity in diabetes patients is "associated with macro-vascular complications and increased mortality" (Petrak et al., 2018), "compromised their quality of life, which is made worse because of lack of adherence and defaulting treatment" (Petrak et al., 2018).

#### 2.3.1Psychological Depression Risks in Patients with Diabetes

Depression in "individuals with diabetes, both diagnosed and undiagnosed individuals, is on the rise" (Badescu et al., 2016). Even patients previously



undiagnosed with DM, research found still high depression prevalence. The psychological tension of the illness may, probably, trigger depressive symptoms" (Badescu et al., 2016), presumably "due to inappropriate lifestyles, such as lack of physical inactivity, improper diet, stressful life" (Badescu et al., 2016). Psychosocial stress originated from DM and its complications, contributes to the rise of depression. The comorbidity depression in DM patients leads to other complications, such as "hyperglycemia and vascular complications that cause high mortality rate in DM people" (Petrak et al., 2018). Unfortunately, the level of detection of depression in DM patients is extremely low. As a result, patients remain inadequately treated.

Depression is also "associated with a chronic dysregulation of the Hypothalamic-Pituitary-Adrenal Axis (HAP Axis)" (Petrak et al., 2018). Excess "cortisol hinders neurogenesis in the hippocampus, a region implicated in both depression and DM2" (Petrak et al., 2018). According to Badescu et al. (2016), diabetes produces structural changes in the brain: cerebral atrophy and lacunar infarcts blood flow changes of both hypo and hyper fusion". Furthermore, Badescu et al. (2016) argue that in "developed nations, DM is the 8<sup>th</sup> cause of disability adjusted life years (DALYS)".

In conclusion, although there are no common genetic factors referring to the positive correlation between depression and DM, "various environmental and epigenetic factors may promote the association between depression and DM" (Badescu et al., 2016).

# 2.5 Prevention of Depression in People with Diabetes

There is, currently, no specific scientific approach to preventing depression, particularly in people with DM. However, considering the significant risk factors of depression in people with DM, there is urgency in finding preventive strategies. WHO accords priority to both diabetes and depression in men and women in the world. Depression is covered by WHO's mental health Gap Action Programme (mhGAP) that "aims to help countries increase services for people with mental, neurological and substance use disorders through care provided by health workers who are not specialists in mental health" (Lieberman, 2003). Petrak et al. (2018) recommend sessions on cognitive behavioural therapy (CBT) for a stipulated period of time, depending on the severity of the comorbid depression". According to Petrak et al. (2018) "CBT proved to be efficient as it prevents depression to increasing/rising. There are also different depression screening and diagnostic tools recommended to produce faster and easier results. The various versions of the Patient Health Questionnaire (PHQ-9/12) are a good example. These are the tools most used and have demonstrated a "sensitivity of 92.3% with acceptable specificity of 79.4%, in order to select patients who, need urgent psychological assessment for depression" (citation). Other tools include the Beck Depression Inventory (BDI), the Hospital Anxiety and Depression Scale (HADS), and the WHO-5 Well-Being Index, among others.

Lieberman (2003) demonstrated the "dietary, evolutionary and modernizing influences in the prevalence of Type 2 Diabetes". Modernization or globalization "include the availability and abundance of calorically dense/low-fiber / high glycemic foods and the adoption of sedentary Western lifestyles, which are driving the rising prevalence of obesity and Type 2 diabetes among children and adolescents and adults in developed and developing countries" (Lieberman, 2003). Culture-specific public health programs that target decreases in energy intake and increases in energy expenditure are needed to alter the modern obesogenic and diabetogenic environments created by globalized economies.

WHO's response to diabetes "aims to stimulate and support the adoption of effective measures for the surveillance, prevention, and control of diabetes and its complications, particularly in low- and middleincome countries (WHO, 2020). WHO "Global strategy on diet, physical activity and health" complements WHO's diabetes work by "focusing on population-wide approaches to promote healthy diet and regular physical activity, along with lowering of blood glucose and the levels of other known risk factors that damage blood vessels. Tobacco use cessation is also important to avoid complications, thereby reducing the growing global problem of overweight and obesity (WHO 2020). "Simple lifestyle measures have been shown to be effective in preventing or delaying the onset of type 2 diabetes". Early diagnosis is of great importance and can be achieved through relatively inexpensive testing of blood sugar" (WHO, 2020).

# CHAPTER THREE

# Methodology

This chapter focuses on the conceptual framework, methodology, use of techniques, and statistical tools for undertaking this research. It describes the population under investigation, the rationale for selecting the sample, and the approach that led to the data used in the research. The methodology helps readers to appreciate the design of the work; by stating the appropriate tools used and the manner in which those were applied to get the results for the population under investigation. The chapter also identifies the key limitations of the research and explains the choices made in applying the methods and statistical tools.

# 3.1 Theoretical Framework

The researcher chose the Etiologic Theoretical Framework as a key tool to uncovering the origins of depression in DM patients and the different roles various socio-demographic factors play in the prevalence of depression. This theoretical framework also helped to understand the nature of the cooccurrence of depression and diabetes.

As depression and diabetes co-occur in a comorbid relationship, the comorbidity conceptual framework constituted the basis for identifying a potential successful care model integrating prevention, self-care, and treatment, to improve patients' health outcomes while reducing health care costs (Meghani et al., 2013).

# B. 3.2 Research Method

Initially, the research was designed to considered primary data collection at an outpatient clinic in Dares-Salaam, using a 9-item Patient Health Questionnaire (PHQ-9). However, the outbreak of the

COVID-19 Pandemic in Tanzania in late February, and the restrictions imposed to reduce the spread of COVID-19 infections, made data collection impossible. In view of this impediment, the researcher consulted with her supervisor on the way forward. It was eventually agreed that the use of secondary data collected at the same clinic using the same data collection tool was a good alternative.

Subsequently, the research identified a Dataset and a descriptive cross-sectional survey conducted at the Muhimbili Hospital at the diabetes outpatient in Dar-es-Salaam. The selected data set considered the population of male and female patients of different age groups, from young adults to older people. Quantitative methods were applied to the identified secondary data.

A Bivariate analysis was done to "determine the presence of significant associations and the strength of associations between independent and outcome variables reported" (Khan et al., 2019). A Logistic regression was applied for "identification of independent associated risk factors for all bivariate variables with associations at p<0.2" (Khan et al., 2019). Tables and figures were used to display variables, descriptive and inferential statistics to analyze the data.

**Population:** All male and female patients, aged 20 years and over 61 years, checked up at the Muhimbili Outpatients Hospital over a period of  $\geq$  1 year, diagnosed with diabetes mellitus (DM).

#### 3.3 Description of the Study Area

The Muhimbili Outpatients Hospital in Dar-es-Salaam in Tanzania is an outpatient diabetes center dedicated to providing a complete spectrum of diabetes services. The clinic offers personalized diabetes care plans for all its patients. Specialized clinics offer services that include the diagnosis and treatment of diabetes, cardiology related diseases, endocrine diseases, such as thyroid, menstrual and other hormonal disorders, kidney, general outpatient clinics, cardiac imaging, retina (eye) imaging, health education, and patient wellness services, pharmacy and laboratory service.

# 3.3 Data Collection Tools

# 3.3.1Socio-demographic characteristics and biopsychosocial factors

Socio-demographic characteristics assessed included age, sex, marital status, level of education, and occupation. Biopsychosocial factors such as:

- Alcohol intake:
- Type of DM: T1 and T2
- Duration of illness from 1 year onwards
- On insulin therapy: p value = 0.015
- Cigarette smoking: moderate =1, intense = 2, p value = 0.025

# 3.3.2 Depression

In order not to divert from the original approach of the research, a data set based on data collected using the 9-item Patient Health Questionnaire (PHQ-9) tool to screen for depression was selected. The tool was translated, adapted, and validated in the Tanzanian context. The data set ranked participants using different score intervals. Participants with a "scores 0-4 were considered to have 'none or minimal depression', 5-9 considered to have 'mild depression', 10-14 'Moderate depression', 15-19 'moderately severe depression' and 20-27 were considered to have 'Severe depression'" (Kroenke and Spitzer, 2002).

Location of the research site:





Muhimbili Hospital in Dar-es-Salaam, Tanzania.

**Sample Size:** systematic sampling. The extracted data set used the "sample size formula  $n=Z^2 P(1-P)/d^2$  where Z=confidence interval 95% (standard value of 1.96) P=Proportion 9.1% (0.091) prevalence of depression in a study done in Tanzania.

E-margin of error=3% (0.03)

N= (1.96)2\*0.091 (1-0.091)/ (0.03)2 =353

N=353" (Kroenke and Spitzer, 2002).

# *1)* **3.4.2 Data Collection and Analysis Tools**

No primary data was collected. Instead, secondary data from a dataset was used. The Dataset source selected for the research used the Statistical Package for Social Sciences (SPSS) version 23 to perform all the statistical analysis (Kroenke and Spitzer 2002).

The source also used "Bivariate Analysis technics to determine the presence of significant associations and strength of associations between independent and outcome variables reported" (Kroenke and Spitzer, 2002), and applied "Logistic regression for the identification of independent associated risk factors" (Kroenke and Spitzer, 2002).

Tables and figures were used to display variables and descriptive and inferential statistics to analyze the

data" (Kroenke and Spitzer, 2002). Factors "associated with depression were analyzed using Chi square tests" (Kroenke and Spitzer, 2002).

Statistically significant factors in the "univariate associations were put in a regression model to determine factors independently associated with comorbid depression while controlling for confounding effects' (Kroenke and Spitzer, 2002). The statistical tests were "performed at 5% level of significance (p value less or equal to 0.05 were interpreted as significant)" (Kroenke and Spitzer, 2002). The data, tables, and diagrams that the researcher selected for approaching the key issues of this research, in Chapter Four, all conform to the criteria used by the source.

#### 3.4.3 Reliability and Validity

Data used in the research were collected using the Health Questionnaire (PHQ-9) tool Patient recommended by WHO, and analyzed using the Statistical Package for Social Sciences (SPSS) version 23 (Kroenke and Spitzer, 2002), which is recommended in social sciences quantitative research. No self-observation or interviews were conducted. Adequate internationally recommended depression and diabetes treatment guidelines were used to generate a model that the research recommends health care institutions and practitioners adopt, in the prevention and treatment of the pathology, in the future. Reliability refers to the consistency or repeatability of findings and is intricately linked to the quality of measurement (Golafshani, 2003, p.598). Validity refers to the credibility or believability of research results. It includes 'Internal Validity': "the assurance that the results are true, and conclusions correct" (Easterby-Smith et al., 2008, p.342); and 'External Validity' or the "ability of research results to be generalized or transferred to other settings or contexts" (Easterby-Smith et al., 2008, p.342). The use of the PHQ-9 and SPSS tools guarantee the reliability of the research and its finding. The use of quality, credible data, and the adherence to international guidelines ensures its internal and external validity. Since the quality of data used was certified through peer review and no physical or psychological risks to participants were involved, the research does not raise any ethical issues.

#### **CHAPTER FOUR**

#### DATA ANALYSIS AND FINDINGS

This chapter presents an interpretation of results from different researchers regarding the prevalence of depression and associated factors among patients with diabetes mellitus (DM), specifically in Tanzania. The chapter reveals data analysis using SPSS version 23, with detailed findings to confirm the hypothesis established in chapter one.

#### 4.1 Demographic and Clinical Characteristics

A total of 353 participants filled the questionnaires for the data set selected. Most of them were aged 41-60 (44.2%); female 226 (64.9%); most of the participants were married, amounting to a total of 222 (62.9%); and those who had primary school education made a total of 174 (49.3%)" (Kroenke and Spitzer, 2002). Regarding the occupation, the unemployed total number of participants was "152 (43.1%). The substance use among participants, e.g., the number of individual alcohol intakes was 18 (5.1%), and the number of cigarette smokers was 7 (2%)" (Kroenke and Spitzer, 2002). Most of the participants had DM1 diabetes and less than ten years of diagnosis as evident in Table 1 below.

# 4.2 Prevalence of Depression among Diabetes Patients

Figure 2 demonstrates the results, in percentages, for the total prevalence of participants with comorbid depression with DM. 87% of the sample and some form of depression. 56.7% referred to the participants with minimal depression, 22.1% had mild depression, followed by 13% for non-depression participants, 8.2% had moderate depression, and 0%, or no patient had severe depression in this study. Among the participants with depression, 9.9% had suicidal thoughts, as demonstrated in Figure 3. We may conclude that although there was no patient with severe depression, the level of depression among the patients diagnosed with depression was high (87%).

#### 4.2.1 Proportions on the Manifestation of Depression Symptoms in Patients

Figure 3 shows various proportions in percentages of how the depression symptoms manifested in the participants. Fatigue was the highest symptom, with 66.8% described by the participants, and the suicidal tendency or ideation the lowest with 9.9%. This leads to the conclusion that depression is indeed significantly prevalent in DM patients.

Variable	Frequency	Percentage (%)	
Age group (years)	45	12.7	
Less than 20	45	12.7	
21 to 40	53	15.0	
41 to 60	156	44.2	
61 and above	99	28.0	
Sex: Female	226	64.9	
Marital Status	71	20.1	
Single	71	20.1	
Married	222	62.9	
Divorced	11	3.1	
Widow	49	3.9	
Education Level No formal education	46	13.0	
Primary School	174	49.3	
Secondary School	90	25.5	
College/University	43	12.2	
Occupation Employed	133	37.7	
Unemployed	152	43.1	
Retired	68	19.3	
Current Alcohol Intake	18	5.1	
Current Cigarette Smoking	7	2.0	
Type of DM	72	20.4	
Туре 1			
Туре 2	281	79.6	
Duration since DM (years)	226	64.0	
1 – 10 years	220	04.0	
> 10 years	127	36.0	
On Insulin Therapy			
Yes	152	43.1	
Νο	201	56.9	

Table 1-Demographic and Clinical Characteristics of the Study of Population (N = 353)



Figure 6- Prevalence of Depression among Patients with Diabetes Source: Khan Z.D., et al (2019)





### 4.3Bivariate Analysis on the Association Between Depression and Demographic Characteristics

It was observed that there was an association between depressive symptoms and participants' occupation, with 36.8% of unemployed participants reporting mild to moderate depressive symptoms (p=0.067). Cigarette smoking (71.4%), and on insulin therapy (36.8%), were also associated with depressive symptoms p=0.029 and p=0.026, respectively as seen in Table 2 below.

#### 4.4 Multivariate Analysis for Predictors of Mild to Moderate Depression among Diabetes Mellitus (DM) Patients

Among all the variables, only two were found to be statistically significantly associated with mild to moderate depressive symptoms, insulin therapy with p=0.015 and current cigarette smoking with p=0.025, as observed in table 3.

to moderate depressive symptoms, insulin therapy with p=0.015 and current cigarette smoking with p=0.025, as observed in table 3.

# Table 2 – Association between Depression andClinical/Sociodemografic Characteristics

Variable	No – Minimal Depression Mild – Moderate Depression Total			p-
<b>U</b> IIIIDIC	(n = 246)	(n = 107)	(N = 353)	Tuluc
Age group (years)			0.001	
Less than 20	30 (66.7)	15 (33.3)	45	
21 to 40	35 (66.0)	18 (34.0)	53	
41 to 60	109 (69.9)	47 (30.1)	156	
61 and above	72 (72.7)	27 (27.3)	99	0.810
Sex				
Male	88 (71.0)	36 (29.0)	124	
Female	158 (69.0)	71 (31.0)	226	0.700
Marital Status	10 (07.0)	22 (22 1)		
Single	48 (67.6)	23 (32.4)	/1	
warried	157 (70.7)	65 (29.3)	222	
Divorced	6 (54.5)	5 (45.5)	11	
Widow	35 (71.4)	14 (28.6)	49	0.677
Education Level				
No formal	22 (22 2)	10 (00 1)		
education	28 (60.9)	18 (39.1)	46	
Primary School	123 (70.7)	51 (29.3)	1/4	
Secondary School	64 (71.1)	26 (28.9)	90	
College/University	31 (72.1)	12 (27.9)	43	0.577
Occupation	00 (74.4)	34 (35.6)	122	
Linemployed	96 (63.2)	56 (36.8)	153	
onemployed	50 (05.2)	50 (50.0)	132	
Retired	51 (75.0)	17 (25.0)	68	0.067*
Current Alcohol Intake	11 (77.0)	1 (22.0)		
Yes	14 (77.8)	4 (22.2)	18	0 601
Current Cigare	232 (05.5)	105 (50.7)	335	0.001
Smoking				
Yes	2 (28.6)	5 (71.4)	7	
No	244 (70.5)	102 (29.5)	346	0.029*
Type of DM				
Type 1	46 (63.9)	26 (36.1)	72	
Type 2	200 (71.2)	81 (28.8)	281	0.251
Duration since [	M			
(years)	100 (70.0)	66 (20.2)	226	
1 – 10 years	160 (70.8)	66 (29.2)	226	0.540
> 10 years On Incutin Thorany	86 (67.7)	41 (32.3)	127	0.549
Vec.	96 (63 2)	56 (36.8)	152	
No	150 (74.6)	50 (30.0)	201	0.026*
NO	150 (74.0)	51 (25.4)	201	0.020

Source: Khan ., et al (2019

# Table 3 – Significant Associations Among RiskFactors and Depression

Variable	OR	95% CI	p- value
On Insulin Therapy	1.78	1.12 - 2.82	0.015
Current Cigarette Smoking	6.72	1.26 - 35.70	0.025

Source: Khan ., et al (2019)

### 4.5 Discussion

# 4.5.1 Prevalence of Depression in People with Diabetes

In the study by Khan et al. (2019), the prevalence of depression and associated factors among patients with diabetes in a clinic for diabetes in Dar-es-Salaam in Tanzania, was "87%. 56% of patients/participants were diagnosed with minimal depression, the mild depression patients were 22.1%, while the moderate depressive patients were 8.2%" (Khan et al., 2019). Although there was no diagnosis of severe depression, among participants, at the time of the study, the prevalence of depression in 87% of participants is evidence that health providers and mental health workers (the psychologists) need urgently to shift their attention to prioritizing counselling in hospitals and clinics to minimize the risk of depression in DM patients. Another aspect to consider is educating patients about their condition associated factors for depression, (the risks, preventive measures and lifelong management of the illness).

The cost of accessing health care facilities, the cost of adequate food as well as the ordeal of the diet plan contribute to the problem for DM patients in Tanzania and in low and middle-income nations. DM poses a major health problem in this category of countries.

According to Khan et al. (2019) "a study survey, carried out in 60 countries across the world, using a one-year prevalence of depressive episodes in people with diabetes, prevalence of depression was 9.3% as compared to 3.2% in people without diabetes. However, a more comprehensive approach that focuses on prevention measures and management of depression remains to be implemented. Tanzania has very little published information/literature on the prevalence of depression among patients with diabetes. lt is our responsibility as African psychologists to research more about one of the diseases that is creating health problems to Africans. Studies conducted in Kenya in 2016, and Uganda in 2015, revealed that the prevalence of depression among DM patients were 32% and 34% respectively" (Khan et al., 2019). The World Health Organization (WHO), found out that the comorbidity of depression with a chronic illness fast deteriorates a patient's health condition, as compared to having depression alone or any chronic illness alone, or a multiple of chronic illness other than depression. In DM patients, depression increases the risk of complications of cardio-vascular nature and increased hyperglycemia, with high mortality" (Badescu et al., 2016). Depression on its own reduces the individual's quality of life, but together with DM, cause great ill health.

# 4.5.2 Impact of Undetected or Late Identification of Depression in Patients with DM

According to Egede et al. (2002), "late identification of depression in DM patients, leads to the deterioration of their health condition and leads to poor quality of life". Among people with diabetes, the total health care expenditure for those with depression was 4.5 times higher than for people with no depression. These were the costs findings; "\$247,000,000 vs \$55,000,000, <0,0001" (Egede et al., 2002).

Late identification of the disease, which leads to poor health conditions, can be due to lack of knowledge about the disease, limited information about the disease, inadequate or little education and propagation about it in public places, health facilities and in the media, particularly radio and television.

# 4.5.3 Socio-Demographic Factors Associated with the Prevalence of Depression in DM Patients

This situation leads to unsustainable health care bills affecting the quality of life of DM patients. According to Wu et al., (2014), low and middle-income countries have high percentage of DM and depression, which combined with their low income, lack of medical aid and financial resources lead to unsustainable health care bills. As a result, people with DM fail to meet the food requirements adequate for their condition. Consequently, their poor health both physical and mental causing further depression and other comorbid illnesses. As outlined along the research, depression has a high impact on DM patients in a number of factors such as, reduced selfcare e.g., non-adherence to meal plans, to prescribed medication, to routine check-ups, regular exercise. In many, cigarette smoking, and alcohol intake compound these cases. This situation leads to prejudice and promotes medical complications apart from health care costs.

In the variate analysis, occupation was associated with depressive symptoms. E.g., unemployment and or being retired. The fact that patients need to take medication and restrictive lifestyles for life, is also a stressor on its own. The patient feels at life risk with only two options; having the resources and follow the requirements or simply die.

# 4.6 Treatment

When depression is diagnosed in a DM person, the most realistic is to target the two illnesses simultaneously. The main target of the treatment is to significantly alleviate the symptoms of depression, suicidal tendencies through therapy and antidepression medication, and preventing relapses of depressive episodes. The "improvement of health, environment (household, neighbourhood, and work) and lifestyle of the patient should be looked into as it contributes to the depression comorbid in DM patients" (Petrack et al., 2018). Diabetes mellitus (DM) and depression are chronic illnesses. Therefore, they are life-long comorbidities. What it means is that the medication given is to be taken for life. For DM1 patients, the treatment and management of the illness are a bit different from the patients with DM2. The former is given insulin therapy dosages adjusted accordingly and is injected by the patient daily. They monitor their glycaemia frequently, follow a strict meal plan composed of healthy food, observing specific food portions at a given time, and therapy.

For DM2 patients, in most cases, the treatment involves a strict lifestyle adjustment such as healthy food, adequate liquid intake, exercise, lifestyle with reduced stress, and in some cases, insulin therapy. Depression in DM patients is also treated with antidepressants. Petrak et al. (2018), suggest that the response to depression medication is visible within 2 to 4 weeks, and it should be taken immediately after diagnosing. On the other hand, the treatment results for DM take longer. Usually, patients with minimal to mild depression respond better to the medication than those with moderate to severe depression. Patients with a jovial mood also respond faster to medication, and they are less likely to default the treatment. Above all, treatment must be focused on minimizing DMrelated complications, which in most cases lead to premature mortality.

# 4.7 Limitations of the Research

Due to problems with the understanding of the local languages, the researcher worked with local assistants who aided her with the collection of data. Though this is a minor shortcoming in research, the present author does not believe that this has affected the reliability and validity of the data. If anything, this approach helped her to get the best opportunity to work with people who are adapted to the environment and understand the narratives of the illness. As a result of this approach, the researcher did not have the opportunity to add other variables that could be associated to depression and DM, such as social support. The researcher did no self-observation or interview concerning the participants because thus the work is based on a purely quantitative method. Later work by the researcher in the future will consider using the qualitative method in order to acquire soft data concerning patients' understandings and their narratives about the diseases.

# CHAPTER FIVE

# **Conclusions and Recommendations**

# 5.1 Conclusions

With 463 million adults suffering from diabetes in 2019 (IDF, 2020) and projections estimating an increase to 700 million by the year 2045 (IDF, 2020), diabetes is and will continue to be a major public health concern. In Tanzania, IDF (2020) Diabetes Atlas estimated a "5.7% prevalence in the population aged 20-79 years, corresponding to 997,400 persons

suffering from diabetes, with projections pointing to an increase to 3,359,300 cases in 2045". Therefore, diabetes is and will equally continue to be a major public health issue in Tanzania. Golden (2016) ranked DM within the 10 leading killer diseases in Tanzania. The simultaneous occurrence of depression in diabetes patients compounds the problem.

This research sought to investigate the effects of comorbid depression based on data collected at the Muhimbili Outpatients Hospital in Tanzania. Data analysis based on a sample collected by Khan et al. (2019) demonstrated that "87% of patients with diabetes also had depression. However, their depressive state was only confirmed many years after complaints of continuous deterioration of their health conditions. This confirms **Hypothesis A** that 'There is a positive correlation between undetected and late identification of depression and the deterioration of the health condition and quality of life of DM patients' (Egede et al., 2002).

The research also found that health care expenditure for DM patients with comorbid depression was "4.5 times higher than for DM patients with no depression" (Egede et al., 2002). This finding confirms Hypothesis B 'on unsustainable health care bills, for DM patients in Tanzania'. This finding is also consistent with the general trend in the prevalence of "DM and depression in low and middle-income countries" (Wu, 2015), which combined with low income, lack of medical aid and financial resources lead not only to "unsustainable health care bills (in Tanzania, the cost per person with diabetes - age bracket 20-79 years - is estimated at USD 170.1, an amount way beyond the reach of the average Tanzanian), but impacts on the quality of life of DM patients" (Wu, 2015).

Diabetes Mellitus "prognosis and progression are closely linked with the person's lifestyle and selfmanagement behavior, such as engaging in physical exercise, a strict healthy diet and treatment, lifelong controlling (regular check-ups) planning, and managing the condition" (Petrack, 2019). The majority of DM patients fail to adhere to positive behavior, increasing the risks for comorbidities" (Petrack, 2019). Therefore, along with Hypothesis C, Educating and counselling patients on positive lifestyle measures they can adopt could lead to improved quality of life, better management of the disease and reduced healthcare bills. In conclusion, the research confirmed all three hypotheses that guided it.

Modernization with the inherent "availability and abundance of calorically dense/low-fiber/high glycemic foods and the adoption of sedentary Western lifestyles, drive the rising prevalence of obesity and Type 2 diabetes among children, adolescents and adults in developed and developing countries" (Lieberman, 2003). Solutions should focus on mitigating the effects of modernization-related factors.

#### **5.2 Recommendations**

The main purpose of the research was to propose a model that institutions and health care practitioners can adopt for the prevention, management, and control of the depression among patients with DM in Tanzania, enabling them to quality lives, with no recourse to expensive medical care.

Lifestyle, behavior towards the disease, and its management, emerged as key factors affecting the quality of life and the ability of patients suffering from comorbid depression with diabetes to manage their condition. Collaborative care between patients and providers, has been shown to be efficient and costeffective (Jin and Wu, (2014) in the treatment of depression. WHO (2020) recommends "earlv diagnosis and simple lifestyle measures as effective relatively inexpensive means of managing the pathology". Therefore, "culture-specific public health programs targeting decreases in energy intake and increases in energy expenditure that alter the modern diabetogenic obesogenic and environments" (Lieberman, 2003) could offer an ideal solution. The approach would promote "healthy diet and regular physical activity, along with tobacco smoking, lowering of blood glucose and the levels of other known risk factors" (WHO, 2020). Along these lines, the researcher proposes a Collaborative Care Model based on two pillars:

# - Pillar 1 – Focusing on Prevention and Early Detection of Depression in DM patients and,

# - Pillar 2 – Focusing on Clinical Management of the Diseases.

Following is the description of the two Pillars of the proposed model.

# Pillar 1 – Prevention and Early Detection would entail:

- The administration of the Patient Health Questionnaire (PHQ-9) to all new patients diagnosed with diabetes, in order to establish whether diabetes is associated with depression or not.

- Educating and Counselling – This would entail educating and counseling patients, as early as they are diagnosed with diabetes, on positive lifestyle measures they can adhere to, such as dietary requirements and healthy eating; the importance of engaging in physical exercise and types of effective physical exercise. Education could also target the public in general, regardless of health status, to extend the benefits of the model to prevent the pathology on healthy persons and be delivered through a variety of channels and media, including social media, schools, workplaces, posters in public places, radio, and television.

**Pillar 2 – Clinical Management of the Disease –** Would be triggered as soon as a patient is diagnosed with depressions. It would entail:

- Regular check-ups.

- Clinical treatment of depressive synthons, and,

- Life-long planning.

The research recommends also further studies with primary data collection, aiming at uncovering common triggers for both DM and depression in order to address them more effectively.

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