UNIVERSITY FOR DEVELOPMENT STUDIES

KNOWLEDGE LEVEL OF DIABETIC PATIENTS AND CARE PROVIDERS ON DIABETES AND TUBERCULOSIS CONDITIONS IN TAMALE METROPOLIS IN NORTHERN REGION OF GHANA

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UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE

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BY

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DECEMBER, 2015

DECLARATION

Student's Declaration

I hereby declare that this thesis is the results of my own original work and that no part of it has been presented for another degree in this University or elsewhere:

Abdulai Issah Bakari 09/02/2016

(Student's Name) Signature Date

Supervisors'

I hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Dr. Gideon Kofi Helegbe 09/02/2016

(Supervisor) Signature Date

ABSTRACT

Tuberculosis (TB) is a global public health concern, mainly affecting poor and vulnerable populations especially in South Saharan Africa. A phenomenon that has shifted attention towards risk factors that influence TB outcomes and one of such factors is diabetes. Diabetes is increasing continuously in Northern Region as it accounted for more than 2,000 cases in 2010 and increased to 3, 000 cases in 2012 as Out Patient Diagnosis. The main objective of this study was to determine the knowledge levels of diabetic patients and care providers on diabetes, TB, and the co-morbidity of the two diseases in Tamale in the Northern Region of Ghana. A retrospective cross-sectional study was conducted by using both qualitative and quantitative method of data collection. The Convenient sampling method was used to sample diabetic patients while purposive sampling method was used to sample care providers. Quota sampling method was used to determine the unit of samples to be collected from each sampling site. A sample frame of 355 diabetic patients between the ages of 10 and above, registered in the diabetic clinics were used with a sample size of 187 diabetic patients and 30 care providers interviewed using structured questionnaires. Additionally, folders of diabetic patients were examined to assess results of TB test. The quantitative data were analyzed using SPSS (Version 16) and MS excel (2007). The results showed that the prevalence of TB among diabetic patients ranges between 1.07% to 2.7% per the 187 populations, 43% of diabetic patients and 73% of care providers do not know that diabetes is independent risk factors for TB, and more than 80% of diabetic patients and 68% of care providers did not know that diabetes and TB co-exist. The study revealed that the knowledge levels on diabetes, TB and the co-morbidity of the two diseases are not good among care providers and diabetic patients. Finally the research recommended the need for the Ministry of Health to educate care providers and diabetic patients on the co-morbidity of diabetes and TB diseases.

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DEDICATION

I dedicated this project to Allah the owner of the world, my mother Madam Lamba Pankani, to my late father Mr. Abdulai Bakari, to my two sons Bunyanso and Boresa, and finally to my wife madam Braimah Ayisha and daughter Ellham.

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ABBREVIATIONS

HA- Alternative Hypothesis

ADMI - Administration

AJDM - African Journal of Diabetes Medicine

ATR - African Traditional Religion

BCG - Bacillus Calmette-Guerin

BMI - Body Mass Index

CDC - Centre for Disease Control

CHD - Community Health and Development

CT - Computer Tomography

Dev. - Development

Diab. - Diabetes

DM - Diabetes Mellitus

DOT- Directly Observed Therapy

DR - Drug Resistant

GMJ - Ghana Medical Journal

GSS- Ghana Statistical Service

HAHSPW-Holistic Assessment of the Health Sector Programme of Work

HIV - Human Immune-deficiency Virus

IDD - Insulin Dependent Diabetes

IDF - International Diabetes Federation

IFNC - Interferon-c

IGRs - Interferon-Gamma release assays

IL-12 - Interferon-12

Mar - March

MDR - Multi-drug Resistance

MNT - Medical News Times

N - Population Size

NIDD - Non-Insulin dependent diabetes

NIH - Isoniazed

OGTT - Oral Glucose Tolerance Test

PAMF - Palo Alto Medical Foundation

PPD - Purified Protein Derivative

PTB - Pulmonary Tuberculosis

QA - Quality Assurance

ROS - Reactive Oxygen Species

SPSS – Statistical package for social sciences

SSM - Sputum Smears Microscopy

Th-1 – T-helper

TIDM - Type 1 Diabetes Mellitus

TMHA - Tamale Metropolitan Health Authority

TTH -Tamale Teaching Hospital

UDS - University for Development Studies

USA – United State of America

WHO - World Health Organization

XDR - Extra-drug Resistant

OPERATIONAL DEFINITIONS OF TERMS

Diabetic Clinic

A diabetic clinic is usually a place selected by a health institution where people who are clinically diagnosed or confirmed diabetic patients are attended to by a selected medical team. The team is usually made up of medical Doctors or Medical Assistants, Nutritionists and Nurses. The diabetic clinic team usually sets a fixed day or days for each diabetic patient to report for review. Where clients are many two or more attendances may be organised per week or per month.

Diabetic Clinic Register

This is a book where the names, ages, sex, addresses, diabetic information, and any other necessary information concerning the health of the patients are recorded during each visit.

TBO4 Register

This is a book in which the names, ages, sex, addresses, telephone or mobile numbers, test results, remarks on clients suspected and tested for TB are recorded.

Client Folders

The Client Folders is also a book in which the name, age, sex, addresses, telephone or mobile numbers, test requests and the results of tests on clients are recorded.

Knowledge/Awareness

Ability to determine what the disease condition is, what causes the disease, persons at risk, mode of transmission, prevention techniques, treatment or management.

Co-morbidity

The possibility of two or more disease conditions to co-exist within one patient and or occurs when one disease condition has the potential of exposing the patient to another.

Tuberculosis Treatment Form Four Register (TBO4)

This is a book in which the names, ages, sex, addresses, telephone or mobile numbers, test results and remarks on clients suspected and tested for TB are recorded.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

For several years now, the international community has put in place measures to prevent the spread of Tuberculosis. Even though this has lowered its incidence, much is still needed to be done to reduce it even further. This has currently shifted the focus towards risk factors involved in the spread of TB. One of such factors is diabetes mellitus (DM) because of its ability to lower the immunity of patients. Diabetes, therefore, is an independent risk factor for TB. It has therefore prompted issues relating to the association between diabetes and tuberculosis. In line with this many such hypotheses have been postulated; the evidence base has grown for some but generally remains inconclusive across the world.

Ghana is one of the sub-Saharan African countries where TB is constantly present in high proportions and despite strong efforts at controlling the menace are achieving great result year after year, much is needed to be done to identify issues of susceptibility. This is in-spite of the fact that the nation has continued to improve on its case notification, detection and treatment success rates (Amo-Adjei et al, 2013).

Available evidence in Ghana shows that the implementation of TB control activities started in the early 1900s. In spite of that, TB continues to be one of the common diseases in the country, leading again to the reopening of local and international policy windows in 1994 to renew strategies for the control of TB (Amo-Adjei et al, 2013). Furthermore, in spite of the many years TB has been diagnosed among the Ghanaian populace, it was not until 1994 that the Ghana National TB Control Program was established and has since achieved 100% "Directly Observed Therapy, Short-course" (DOTS), coverage in 2005 (Amo-Adjei et al, 2013).

The National Tuberculosis Control Programme (NTP) entered its fourth year in implementing TB control activities with support from the Global Fund Round 5 Grant in 2009 (Warren et al, 2013). The key milestone for the year under review was the unveiling of the five-year "National Tuberculosis Health Sector Strategic Plan (2009-2013)". The plan aimed at increasing TB case detection rate from 27% to 72% in 2013 as well as increasing TB treatment success rate from 84.7% to 90% in 2013. The plan also highlights the Ghanaian Government's aspiration of introducing new innovative TB Diagnostic technologies so that TB diagnosis can be performed at the point of care (Amo-Adjei et al, 2013).

Even though the rates of new and existing cases, and death from TB are decreasing globally, the margin of decline is much slower than forecast (National Tuberculosis Health Sector Strategic Plan, 2009-2013). Given that this slow rate of decline is maintained, the Millennium Development Goal target of halving TB prevalence and death rates by 2015 will not be met compared with their levels in 1990 in all WHO regions (Borgdorfff et al, 1995).

Diabetes Mellitus is a chronic condition that occurs when the body cannot produce enough or effectively use insulin. As a result, a person with diabetes does not absorb glucose properly allowing glucose to stay in circulation, (hyperglycaemia) damaging tissues over time. This damage leads to life-threatening health complications and immune suppressions, which may pave way for infectious diseases like the TB and or *Pseudomonas* spp. to multiply.

The cause of diabetes is a mystery, although both genetics and environmental factors such as obesity and lack of exercise appear to play roles. It is a condition that can go on silently, undetected for a long time without symptoms. Many people first become aware that they have diabetes when they develop one of its potentially life-threatening complications, such as heart disease, blindness and nerve disease.

There were 346 million people living with diabetes type 1 and this number is projected to rise to 436 million in 2030 (Assayed et al, 2013). Also according to Assayed et al (2013), type 2 diabetes is more common accounting for 90-95% of all diabetes and is believed to be more associated with TB than the type1. Furthermore, despite the rising rates of diabetes, little attention is paid to the problem in Africa (Oputa et al, 2013). More importantly; the increase in the prevalence of diabetes may hinder efforts at TB control. This in turn may increase the number of susceptible individuals in populations where TB is endemic thereby making successful treatment difficult to implement (Young et al, 2009).

1.2 Problem Statement

Tuberculosis is a global public health concern, mainly affecting poor and vulnerable populations around the world. Every year, more than 9 million people fall ill with the infectious disease, and close to 2 million die from it worldwide (Oputa et al, 2013).

What is more worrying is that diabetes cases are in the increase and is perceived to influence TB outcomes especially in areas where the burden of TB is high (Young et al, 2009).

According to the Holistic Assessment of the Health Sector Programme of Work (2012), Ghana could not achieved the 89% treatment success target by the end of 2012, in line with the fact that TB is spreading in the Tamale Metropolis at a rapid rate (Daily Graphic Report, Thursday January 12, 2012).

Tuberculosis detection rates in Northern Region is relatively low as compared to the national levels i.e. 74.8% as to 77.9% in 2008, 76.3% as to 77.5% in 2007 and 66.4% as to 76.1% in 2006 (Ghana Health Service Annual Report, 2009). This trend could be reflective of the insufficient knowledge and attention to TB and diabetes association in the region.

Additionally, it seems there is no hope for improvement because at the moment there are no policy compelling clinicians to request TB tests for all diabetic patients visiting the hospitals or diabetic clinics.

The continued increases in the levels of prevalence of diabetes may hinder efforts at tuberculosis control since it increases the number of susceptible individuals especially in the Tamale metropolis where tuberculosis is becoming a nightmare to stakeholders in the health industry, a trend that is likely to make successful TB treatment rather difficult.

More so diabetes as OPD diagnosis accounted for 2, 000 cases in 2010 and 3, 000 cases in 2012 in the region (GNA Thursday August 15, 2013). This increasing trend of diabetes in the region makes the situation worrisome and as a result the significance of this study will establish the contribution of diabetes to TB outcomes in the Tamale Metropolis of the Northern Region of Ghana.

1.3 Research Questions

To address the study hypothesis, the following research questions were developed. These are:

1. . What is the knowledge level of diabetic patients and their care providers on diabetes the in Tamale Metropolis of the Northern Region of Ghana?
2. What are the knowledge level of registered diabetic patients and the perception of care providers on diabetes as a risk factor for TB in the Tamale Metropolis of the Northern Region of Ghana?
3. What is the proportion of diabetic patients who were suspected for TB among registered diabetic patients in the Tamale Metropolis of the Northern Region of Ghana?
4. What is the prevalence of TB among registered diabetic patients in the Tamale Metropolis of the Northern Region of Ghana?

1.4 General Objective

The general objective of the study was to determine the knowledge levels of diabetic patients and care providers on diabetes, TB, and the co-morbidity of the diseases conditions in the Tamale Metropolis of the Northern Region of Ghana.

1.4.1 Specific Objectives

1. To determine the knowledge levels of diabetic patients and care providers on diabetes in the Tamale Metropolis of the Northern Region of Ghana
2. To determine the knowledge levels of diabetic patients and care providers on diabetes as a risk factor for TB in the Tamale Metropolis of the Northern Region of Ghana.
3. To determine the percentage of diabetic patients who were suspected for TB in the Tamale Metropolis of the Northern Region of Ghana.
4. To determine the prevalence of diabetic patients living with TB in the Tamale Metropolis of the Northern Region of Ghana.

1.5 Hypotheses

The study will be guided by the following hypotheses:

HA: low detection of TB among diabetics in the Tamale Metropolis of the Northern Region of Ghana is due to insufficient knowledge and attention to TB/diabetes association among diabetic patients and care providers.

Ho: low detection of TB among diabetics in the Tamale Metropolis of the Northern Region of Ghana is not due to insufficient knowledge and attention to TB/diabetes association among diabetics and care providers.

1.6 Significance of the Study

Tuberculosis is an age-old disease that has caused lots of suffering including the death of men and women, young and old than any other infectious disease and continues to be a major

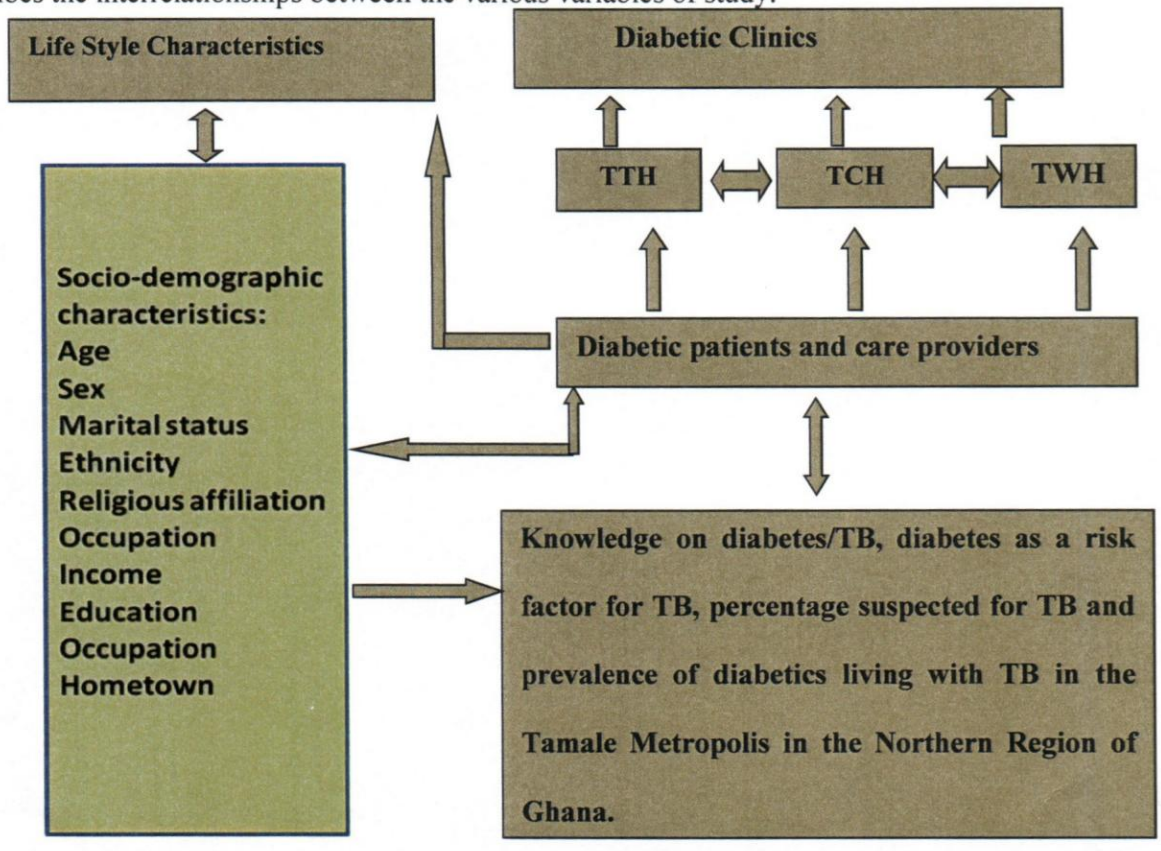
public health problem worldwide. About 9.4 million new TB cases occur globally with eighty percent occurring in 22 high-burden countries; mainly resource-poor settings, particularly in Sub-Saharan Africa (Parsons et al, 2011). Also, the increasing rates of diabetes as a result of demographic and epidemiological transitions, as well as urbanization, have rendered diabetes as one of the non-communicable disease (NCD) burdens in SSA (Belue et al, 2009).

An attempt to deal with TB dates back to the early 1900s in Ghana, yet TB is still the number one infectious disease that is killing people in Ghana today (Amo-Adjei et al, 2013). There is the need therefore to continue to find out the various predisposing factors and strategies that can help hault the spread of TB in Ghana. The significance of this study was to establish the link between TB and diabetes; contribute to source of knowledge/awareness on TB and diabetes, and the co-morbidity of the two disease conditions.

The study therefore, assesses knowledge, awareness and managerial abilities of both diabetic patients and care providers on diabetes as well as TB and their co-morbidities. The study will finally provide empirical data on knowledge/awareness of diabetic patients and care providers on diabetes, TB, the co-morbidity of the two disease conditions and above all establish the need and time to screen all diabetic patients for TB. Data generated from this study can influence further studies and policy decision on the said topic.

1.7 Conceptual Framework of the Study

The study was conducted based on this framework presented below in fig 1.1. The framework describes the interrelationships between the various variables of study.



Source: Field Survey, October 2013.

Figure 1.1 Conceptual Frame Works

1.7.1 The Health Facilities

The health facilities in the Northern Region operating regular and effective diabetic clinic are the T.W.H, T.C.H and T.T.H. Their regularity and effectiveness in operation influence knowledge/awareness of diabetic patients on diabetes/TB and the co-morbidity of the two conditions.

1.7.2 Socio-Demographic Characteristics

The socio-demographic characteristics that were considered are age, sex, marital status, ethnicity, hometown, and religious affiliation. The rest are educational status of diabetic patients/care providers, occupation, income per month and Occupation of care providers. Their possible effects on the knowledge/awareness on diabetes/TB, the co-morbidity of the two disease conditions and their overall influence on the behavior of the diabetic patients and the care they receive from the care providers.

1.7.3 Diabetic Patients and Care Providers

These groups form the focus of the study. The knowledge/awareness level of these groups influences early diagnosis, treatment and care.

1.7.4 Knowledge/Awareness on Diabetes, Tuberculosis and their Co-morbidity

These describe the extent of knowledge/awareness on diabetes/ **Tuberculosis**. These influence the response rates of the disease.

1.7.5 Screening Suspected Diabetic Patients for Tuberculosis /Diabetes Co-Morbidity

These are diabetic patients suspected of TB and screened for TB. The number suspected and screened will increase the chance of establishing the co-morbidity of the two disease conditions and further help inform policy decisions.

1.7.6 Tuberculosis Test: Positive/Negative

The outcome of laboratory investigation on screened diabetic patients describes whether the test is positive or negative and is used to calculate the percentage of diabetic patients who also have TB.

1.8 Justification

A report established that, 11 percent of the population in Northern Region suffered from TB (Dery, 2012). It was also noticed in the same report that reasons why TB patients fail to

report at health facilities for early detection and treatment are partly due to serious psychological problems as they are discriminated against by allowing them to eat in separate bowls and drink from separate cups.

Furthermore, poverty incidence remains high in the Northern Regions. According to the Ghanaian Millennium Development Goals Report page 11(2010) the three northern regions are targeting a deficits of not less than 20 % in an attempt to move out of the upper poverty line. Northern Region also has the lowest adult school attendance rate which stands at 56.6% with the remaining nine other regions having school attendance rates of more than 71%.

Over 86,000 individuals were diagnosed with TB in the UK between 2000 and 2011. More than 70% of the cases were diagnosed in the most deprived 40% of the UK population. Not only do deprived groups have higher rates of TB, but there is also evidence of a significant association between levels of deprivation and diagnostic delays, often due to problems among these groups in accessing healthcare (Murray et al, 2014). Undiagnosed TB of the lungs increases the probability of transmission'' (Murray et al, 2014).

Going forward, detailed research and affirmative action will be needed to control susceptibility to the TB bacterium that may be due to diabetes and other related factors. For example all diabetic patients may be screened for TB as all HIV/AIDs infected persons are screened for TB by all health facilities in Ghana.

1.9 Organization of the Thesis

This dissertation has been organized into six chapters. Chapter one includes introduction to the study, background to the study, the problem statement, objectives of the study, significance of the study, conceptual framework and operational definition of terms of the study. Chapter two takes a look at review on diabetes, TB, and the co-morbidity of the two disease conditions and reviewed relevant literature in relation to the study and some

presumed bare facts and myths about diabetes. Chapter three is made up of methodology, which comprises the introduction, background of the study, scope of the study, the study design, the study variables, sampling procedure, data collection tools, data organization, processing and analysis, ethical considerations, quality control measures, limitations of the study and plan for dissemination of results. Chapter four consists of the results and findings of the study while chapter five consists of discussion of results. Chapter six consists of conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this chapter, a review of previous literature on different research works is discussed. It reviews first the basic information on diabetes and TB; their classifications, causes, aetiologies, diagnosis, early warning symptoms and complications, management and epidemiology. And also review on diabetes-TB co-morbidity and the factors that predispose diabetic patients to TB.

2.1 Reviews on Diabetes

The prevalence of diabetes is increasing rapidly in Sub-Saharan Africa (Kengne et al, 2013), and with diverse health challenges, health authorities in Sub-Saharan Africa and international donors need robust data on the epidemiology and impact of diabetes in order to plan and prioritize their health programmes.

2.1.1 Classification of Diabetes

Many schools of thought classify diabetes into two main types, namely; type 1 and 2. However, some other schools of thought have the belief that there are three types namely; type 1, type 2 and gestational diabetes. Type 1 is characterised by defective insulin production thus the movement of glucose into cells becomes difficult. In order words ''Type 1 diabetes is a disease that starts when the pancreas stops making insulin. Insulin allows blood sugar-also called glucose to enter the body's cells to be used for energy. Without insulin, the cells cannot get the sugar they need, and too much sugar builds up in the blood'' (CDC, 2011) and (ADA, 2010). It accounts for 5-10% of all diabetes in the United States. People who are mostly at risk of type 1 diabetes are children and young adults but it does occur among all ages. There is a genetic component to Type 1 diabetes, but the cause is yet to

be identified. This type of diabetes requires insulin injection that replaces the insulin missing or ill produced in the body identified (Assayed et al, 2013).

Type 2 diabetes is the case in which insulin is either not produced in sufficient quantities or the insulin produced is defective and cannot move glucose into the cells. It is much more common and accounts for 90-95% of all diabetes. Those mostly at risk for type 2 diabetes are adults but it does occur among children too. Its treatment will vary depending on blood sugar levels (Assayed et al, 2013).

Gestational diabetes on the other hand is a temporary form of insulin resistance that usually occurs halfway through pregnancy as a result of excessive hormone production in the body, or the pancreas' inability to make the additional insulin that is needed during some pregnancies in some women without a previous history of type 1 or type 2 diabetes. Gestational diabetes usually goes away after pregnancy, but women who have had gestational diabetes are at an increased risk for later developing type 2 diabetes (CDC, 2011).

2.1.2 Causes of Diabetes

The cause of diabetes is yet a mystery, although both genetics and environmental factors such as obesity and physical inactivity are said to play significant roles (Al Ayoubi et al, 2013). It is postulated as the failure of the body to produce the required insulin or utilize the insulin produced. Demographic and epidemiological transitions, as well as urbanization coupled with an aging population are said to be the leading cause of increasing prevalence of diabetes especially in South Saharan Africa (Young et al, 2009). Finally the etiologic of type 1 diabetes mellitus (T1DM) is incompletely understood but environmental agent(s) are thought to trigger it in genetically at-risk persons (Dow, 2012).

2.1.3 Diagnoses of Diabetes

It is possible to determine whether a patient has a normal metabolism, pre-diabetes or diabetes in one of these three possible ways: the A1C test (at least 6.5% means diabetes, between 5.7% and 5.99% means pre-diabetes and less than 5.7% means normal). Fasting plasma glucose test (at least 126 mg/dl means diabetes, between 100 mg/dl and 125.99 mg/dl means pre-diabetes, and less than 100 mg/dl means normal) and the oral glucose tolerance test (OGTT) at least 200 mg/dl means diabetes, between 140 and 199.9 mg/dl means pre-diabetes, and less than 140 mg/dl means normal (CDC, 2011).

Diagnosis of diabetes is made by a simple blood test to measure blood glucose level, repeated usually on a subsequent day to confirm the diagnosis. Fasting blood sugar is done if the patient has not eaten any food at the time of test (normal range 3.4 mmol/L- 6.4 mmol/L) and random blood sugar is done if the patient has already eaten at the time of test (normal range ≤ 11.0 mmol/L) (CDC, 2011).

2.1.4 Symptoms of Diabetes

Symptoms of diabetes include blurred vision, unusual thirst, frequent urination, slow-healing soars, unexplained tiredness, rapid weight loss (Type 1 diabetes), erectile dysfunction, numbness or tingling in hands or feet. Symptoms may occur rapidly with Type 1 diabetes. However, with Type 2 diabetes the onset is more insidious and may not be noticed (Assayed et al, 2009). People with badly controlled diabetes are much more susceptible to infections, pain in the leg and nerve damage which can lead to several different problems. The muscles of the stomach may stop working properly; there is high prevalence of gum disease as well as high risk of developing hearing problems. It can also raise the risk of suffering from depression; anxiety and some other mental disorders. High risk of kidney disease, eye

problems, heart attack and stroke are other possible complications among diabetes patients (CDC, 2011).

2.1.5 Trends and Complications of Diabetes

The proportions of patients with diabetes related complications range from 7-63% for retinopathy, 27-66% for neuropathy, and 10-83% for microalbuminuria (Hall et al, 2011). It is likely to increase the risk of several important infections in the SSA region, including tuberculosis, pneumonia and sepsis (Hall et al, 2009)

Diabetes is a major and growing health care problem, primarily because of the increasing prevalence of type 2 as well as type 1 diabetes (Hall et al, 2009). In Ghana 97% of patients are estimated to have DM and 75% of them are females within 40 to 60 years age brackets Danquah et al (2011). It was estimated that the number of people living with the disease could double. Young et al (2009) also reported that the condition accounts for a huge burden of morbidity and mortality with a prevalence of 10.4 million individuals in SSA (i.e. 4.2%) of global prevalence. Wild et al (2004), also estimated the prevalence rate of type 2 diabetes in Africa to be about 2.8% with urban areas reporting higher prevalence, ranging from about 1.3% to 6.3% and rural areas reporting as low as <1% to 4.8%. Furthermore, close to 75 percent of people who have diabetes die of heart diseases or stroke, and they are likely to die at a younger age than non-diabetic persons. Such people have the same cardiovascular risk as those who already have heart attack. Diabetic patients are two to four times likely to develop heart diseases than those without diabetes. Heart disease death rates are also two to four times higher (Joen et al, 2008).

About 10 to 21 percent of all diabetics develop kidney disease and diabetic nephropathy is observed to be the number one cause of kidney failure, with an incidence rate of 43 percent. Patients with kidney failure require dialysis or a kidney transplant to survive. About 60 to 70

percent of diabetic patients have mild to severe forms of diabetes-related nerve damage, which can lead to lower limb amputations with the risk of a leg amputation to be 15 to 40 times greater for a person with diabetes. As a result, about 82,000 people lose their limbs to diabetes annually. It is observed that about 13 percent of men who have type 1 diabetes and eight percent of men who have type 2 diabetes are afflicted with Impotence (American Diabetes Association, 2008). Men over the age of 50 have impotence rates as high as 50 to 60 percent; annually 12,000 to 24,000 people lose their sight due to diabetes and it is currently believed to be the leading cause of blindness in people 20 to 74 years of age. It was again estimated in 1999 that 38,160 pupils initiated treatment of kidney failure due to diabetes and also, 114,478 dialysis or kidney transplantation were due to diabetes (CDC, 2005).

The total annual cost of diabetes in the in SSA region was estimated at US$67.03 billion (i.e. US$8,836 per diabetic patient) (Young et al, 2009).

2.1.6 Management of Diabetes

All types of diabetes are treatable but both type 1and type 2 diabetes usually lasts a life time (ADA, 2010). There is no known cure to either form. However, type 2 diabetes can be managed, through a lot of physical exercises, dietary therapy and excellent body weight control to get rid of symptoms in the absence of medication (CDC, 2011). According to Assayed et al (2013), diabetes requires a multi-disciplinary approach at the level of healthcare and a multi-dimensional social approach at the level of community. At the health facility level management requires appropriate and sustainable stocks of medicines, sophisticated laboratory tests and equipment, trained health personnel, and clear feasible policies. At the community level, accessible and affordable care, good knowledge and correct personal care practices are required.

It has also been observed that no treatment for diabetes exist as at now (Young, 2009) although there are many ways of keeping diabetes under control. More so diabetes treatments are designed to help the body control the sugar levels in the blood. Good control of blood sugar is the key to avoiding diabetic complications. These include learning how to balance insulin with one's food intake, increase fibre intake, decrease carbohydrate intake, limit intake of concentrated sweets, test blood sugar at varying times of the day and physical activity is another way of management. Many patients are counseled to change their lifestyles and lose weight. Treatment begins with changing certain food choices and beginning an exercise program. Treatment may change over time because diabetes is a progressive disease requiring oral medication. If a person is already taking medication then the person may need an increased dose or multiple medications and eventually may have to be kept on insulin (Naizi et al, 2012).

Managing diabetes involves the initiation of insulin therapy at the onset or the use of basal bolus regime or premixed insulin. The use of modern insulin or insulin analogues is recommended as they are more predictable in action and cause less hypoglycaemia thus the use of traditional human insulin is discouraged (Assayed et al, 2013). Generally, diabetes prevention and care require technical inputs, political will and positive policy enforcement, and community and civil society involvement (Young et al, 2009). Dairy milk, cheese, and yoghurts are rich sources of calcium, a mineral that increases insulin secretion and may reduce insulin resistance. Another way of reducing the risk of diabetes is to consume foods that are low in carbohydrate. However, diabetic patients can consume carbohydrate food but in moderation (Aune et al, 2013).

2.1.7 Presumed Bare Facts about Diabetes

Due to low knowledge level, many presumed bare facts are thrown about in papers, magazines and or on the internet regarding diabetes (CDC, 2005 & 2011). Here are some myths presumed as bare facts of diabetes:

Diabetic patients should not exercise is one of the myths being circulated as facts. However, exercise is important for people with diabetes, as it is for all persons. Exercise helps the body manage weight, improves cardiovascular health, improves mood, helps blood sugar control, and relieves stress. Patients should discuss exercise with their doctor first. The belief that Fat people always develop type 2 diabetes eventually is not entirely correct but being overweight or obese raises the risk of becoming diabetic. They are risk factors, but do not mean that an obese person will definitely become diabetic. Many people with type 2 diabetes were never overweight. The majority of overweight people do not develop type 2 diabetes. In addition, it is not true that diabetes is not a harmful or serious disease. This is because two thirds of diabetes patients die prematurely from stroke or heart disease. The life expectancy of a person with diabetes is from five to ten years shorter.

It is not true that if one eats too much sugar he/she will develop diabetes. Reason being that persons with diabetes type 1 develop the disease because their immune system destroys the insulin-producing beta cells. In addition, a diet high in calories, which can make people overweight/obese, raises the risk of developing type 2 diabetes, especially if there is a history of this disease in the family. Similarly, it is not true that only older people develop type 2 diabetes. This is because life style changes results in a growing number of children and teenagers developing type 2 diabetes making expert's link this to the explosion in childhood obesity rates, poor diet, and physical inactivity. And it is not true that one person can transmit

diabetes to another person, just like a broken leg is not infectious or contagious. However, a parent may pass the disease on through their genes to their offspring.

Although high or low blood sugar levels may cause some symptoms, such as weakness, fatigue and extreme thirst it is not true that one can tell when his or her blood sugar levels are high or low. In addition, it is not true that diabetes diets are different from other people's diets. This is because the diet doctors and specialized nutritionists recommend for diabetes patients are healthy ones; healthy for everybody. Again, it is not true that diabetics cannot eat bread, potatoes or pasta. This is because people with diabetes can eat starchy foods. However, they must keep an eye on the size of the portions.

2.2 Reviews on Tuberculosis

2.2.1 Classification of Tuberculosis There are two main types of TB; namely pulmonary TB and extra pulmonary TB. Pulmonary TB is the type of TB that affect the lungs and extra pulmonary TB is one that spread to other organs of the body such as the brain, the kidneys, or the spine (WHO, 2009).

2.2.2 Trends of Tuberculosis

Tuberculosis is a major cause of illness and death worldwide, especially in Africa and Asia (WHO, 2009), with one third of the world's population (2 billion people) being infected with the bacterium (Global Fund, 2013). Current estimates suggest that there are over 8.8 million new TB cases globally and nearly 1.5 million people die from TB yearly with 98% of these new cases and deaths occurring in developing countries.

The WHO predicted that 36 million people will die of TB between 2002 and 2020 if control measures do not improve (Ulla et al, 2013). Though rates of new and existing cases, and death from TB are decreasing globally, the margin of decline is much slower than forecast. Given that this slow rate of decline is maintained, then the Millennium Development Goal

target of halving TB prevalence and death rates by 2015 will not be met compared with their levels in 1990 in all WHO regions. Furthermore, indicators on the ground are pointing to the fact that the world as a whole is far from the trend required to reach the long-term rates of eliminating TB i.e. ''less than 1 incident case of TB per one million populations by 2050'' (WHO, 2011).

The world in general is not doing well globally with respect to TB case detection because TB detection rate stagnated at about 60% between 2005 and 2009 and rates are even lower in many countries because of delays in diagnosis and treatment, which further aggravate transmission (WHO, 2011). Drug-resistant TB (DR-TB) threatens global TB control and is a major public health concern in all countries. DR-TB is estimated to cause about 10% of all TB deaths. Globally, around 4% of new cases and 20% of previously treated cases are estimated to have multi drug resistance TB (MDR-TB). Previously treated patients are more at risk of MDR-TB and therefore should be investigated for drug susceptibility (Global Fund. 2013). Levels of MDR-TB remain high in some parts of the world, notably countries in Eastern Europe and Central Asia. In most of these countries (Russia, Belarus and Ukraine), between 9 and 32% of new cases and more than 50% of previously treated cases have MDR-TB (WHO, 2010).

The WHO estimates that the incidence of new multi-drug-resistant TB (MDR-TB) cases in the world in 2011was 440,000, but estimates a prevalence of 650, 000 cases of DR-TB in total in the world at any one time. Of these cases, 65 000 (representing about 10%) have the most extreme form of the disease known as extra-drug-resistant TB (XDR-TB).

Tuberculosis prevalence for adults in Ghana as at 2013 was 300 per 100,000 populations, more than twice the WHO value for all ages. High prevalence occurred in the age group 65-74 years whilst the least prevalence occurred in the age group 25-34 years in 2013.It was

observed that 15, 533 cases were recorded in 2013 while 15,187 cases were recorded in 2012, difference of 346 cases between 2012 and 2013. Meanwhile the highest cases occurred in Ashanti Region (3,041), followed by Greater Accra (2,901), Volta and Western Region (1,758), Upper East(1,511), Upper West (330) and Northern Region (642) cases (Ghana New Agency, 2014).

Additionally, Ghana achieved success in treatment target, i.e. above the global target of 86 percent. Seven out of 10 regions achieved their treatment success target. Other successes achieved were support systems for patients and affected families; diagnostic and management successes; new technology to help detect some of the cases that are normally missed, using older technologies and new systems for managing childhood TB, use of digital x-ray imagery; infrastructure to diagnose and manage multi drug resistant TB (Ghana New Agency, 2014).

2.2.3 Causes and Transmission of Tuberculosis

Mycobacterium tuberculosis (Mtb) is contracted when tiny droplets (0.5 to 5 μm in diameter) are inhaled usually from the coughs, sneezes, talk, or spit of an infected person (Grange 2002). Tuberculosis germs known as bacilli are usually released into the air by infected persons and only a small number of the bacilli are needed to be inhaled to cause an infection. Also, a single sneeze by an infected person can release up to 40,000 droplets. Most infected people never become ill. A third of the world's population is actually infected with TB because the human immune system usually contains the infection. However, the bacteria remain dormant within the body and can cause disease many years later if host immunity declines because of increasing age or because of other medical conditions such as HIV infection.

Similarly, Drug resistant tuberculosis (DR-TB) spread quite the same way as TB but the most serious concern has to do with persons infected by someone with extensively drug-resistant TB (XDR TB) who subsequently develop TB disease. Such persons will have XDR TB (CDC, 2011). However, a high proportion of childhood TB cases are contracted from a family member with active infection (WHO, 2010)

2.2.4 Aetiology of Tuberculosis

Close to half of those who develop TB disease will do so within the first two years of infection. Furthermore, those with HIV infection are at an increased risk of developing TB disease than for persons with normal immune systems (CDC, 2011).

According to Knechel, (2009), when a person becomes infected with TB, the bacteria in the lungs multiply causing pneumonia; the patient experiences chest pain and has a persistent cough, which often brings up blood. Lymph nodes near the heart and lungs become enlarged. As the bacteria try to spread to other parts of the body they are interrupted by the body's immune system. The immune system forms scar tissues or fibrosis around the bacterium, which helps fight the infection and prevents it from spreading within the body and to other people. If the bacteria manage to break through the scar tissue the disease returns to an active state; pneumonia develops and there is damage to kidneys, bones, and the meninges that line the spinal cord and brain.

Tuberculosis infects all manner of persons but not everybody that is infected with TB will become sick of TB. The immune system either kills the germs, or "walls off" the bacilli where they can lie dormant for years (latent TB infection). However, a decline in the immune system may cause the infection to flare up giving rise to active TB disease (WHO, 2013).

2.2.5 Symptoms of Tuberculosis

Tuberculosis may or may not present symptoms depending on whether it is in the latent TB phase or the active TB phase. In the latent phase, the patient has no symptoms and TB at this stage is not contagious. However, in active phase, the bacteria are active and can make the patient ill (CDC, 2010). Persons with latent TB infection do not feel sick and do not have any symptoms. The only sign of TB infection is a positive reaction to the tuberculin skin test or TB blood test. The general symptoms of TB disease include unexplained weight loss, loss of appetite, night sweats, fever, fatigue and chills. Symptoms specific to the lungs are coughing that lasts for 3 or more weeks, coughing up blood, chest pain, painful breathing and pain when coughing (CDC, 2011).

2.2.6 Diagnosis of Tuberculosis

The only sign of latent TB infection is a positive reaction to the tuberculin skin test or TB blood test (CDC, 2011). A person with latent TB infection usually has a normal chest x-ray and a negative sputum test, has TB bacteria in his/her body that are alive but inactive, and cannot spread TB bacteria to others. Also for a reliable diagnosis of active TB to be made, the patient must undergo a blood or skin test, a sputum test, and a chest X-ray. The Manitou test is a simple skin test in which a small amount of purified protein derivative (PPD) tuberculin is injected into the forearm. After 48 to 72 hours, a reaction is expected at the injection site; a hard, raised red bump usually indicates a positive test for TB (CDC, 2011).

TB blood tests also known as interferon-gamma release assays (IGRAs) which measure how the patient's immune system reacts to Mycobacterium tuberculosis (CDC, 2011). Other methods of TB diagnosis are chest X-rays and computer tomography (CT) scans. If the immune system traps the TB bacteria and creates scar tissues, this tissue and the lymph nodes may harden like stone in a calcification process. This results in granulomas (rounded marble-

like scars) that often appear on x-rays and CT scans (CDC, 2011). However, diagnosis of TB in children is particularly difficult because of the challenges in obtaining sputum for smear preparation (WHO, 2013).

2.2.7 Risk Groups of Tuberculosis

Foreign-born individuals living in the Americas and Europe, individuals of low socioeconomic status, cancer patients, cigarette smokers, corticosteroids users, individuals with ill-developed and declining immune system and health care workers serving high-risk clients are at high risk of TB (WHO, 2013). The rest are individuals living with active TB patients, poor or homeless people, nursing home residents, alcoholics and intravenous drug users, anybody who suffers from malnutrition, patients with HIV/AIDS or other immune system problems (CDC, 2011).

Medical risk factors for TB include co-infection with HIV (Gampper, 1999). People living with HIV are up to 34 times more likely to develop TB. Tuberculosis co-infection with HIV accounted for about 13% of all TB cases globally in 2011. HIV increases the likelihood that a person infected with latent tuberculosis will progress to active disease, shortens survival times among co-infected individuals and increases the likelihood of a typical tuberculosis manifestation that can be difficult to diagnose. The rest are overcrowding, living in close quarters with TB patients like in the mosque, orphanages, buildings of poor architectural designs, prisons and people working in mines (Acquahet al, 2012).

2.2.8 Treatment of Tuberculosis

Tuberculosis was a major health problem in most developed countries like the UK before the development of antibiotics (WHO, 2013). Cases have since declined sharply after routine detection and use of antibiotics. In the last two decades, however, cases of TB have gradually increased, especially among ethnic minority communities and immigrant population.

Furthermore, TB is endemic in many developing and under-developed countries; particularly Sub-Saharan Africa still suffers from a TB epidemic because of the increased susceptibility of the population due to concomitant HIV infection. In the absence of treatment, about 5 to 10% of infected persons will develop TB disease at some time in their lives. Ensuring TB patients adhere to treatment is vital to achieve cure, interrupt further transmission of infection and prevent the emergence of drug-resistant forms. Tuberculosis treatment involves a course of antibiotics, usually for six months. More than one antibiotic is used to prevent emergence of resistance of the bacteria to the antibiotics. Those infected with a drug resistant form of TB may be prescribed a longer course of antibiotics.

WHO (2013) recommends that TB treatment must be continued regularly and uninterrupted for six to eight months. The internationally recommended approach to TB control is DOTS, which is a cost-effective public health strategy to identify and cure TB patients. Directly Observed Therapy (DOT), which is part of the global strategy to prevent DR-TB means that a designated individual watches the patient swallow every dose. This has resulted in major achievements in TB care and control (WHO, 2013). Tuberculosis bacteria are very hard to kill and therefore the standard WHO regiment is a combination of four first-line drugs taken for six months (WHO, 2010). The drugs used are isoniazid and rifampicin supplemented by two further drugs (pyrazinamide and ethambutol) for the first two months.

Vitamin C can shorten treatment duration when added to existing TB medications (Jacobs et al, 2013). For example, the combination of ionized and vitamin C will sterilise the *M. tuberculosis* culture and drug-susceptible TB; the combination may also sterilise the MDR-TB and XDR-TB strains. Also according to a study by the Global Tuberculosis Control (2013), new and improved TB drugs, vaccines, and diagnoses can reduce the global incidence of TB by 71 % by 2050, a reduction equivalent to 6.5 million cases per annum.

Successful treatment for TB depends on whether the disease is active or latent. If TB is in an inactive state, an antibiotic called isoniazid (INH) is prescribed for six to twelve months but not for pregnant women, it is not recommended because of its side effects, including liver damage and peripheral neuropathy. However, if latent TB infection is due to exposure and infection by a person with multidrug-resistant TB (MDR TB) or extensively drug-resistant TB (XDR TB), then preventive treatment may not be an option (CDC, 2011). Generally XDR-TB can be cured, but the likelihood of cure is smaller than in patients with standard TB (>85% successfully treated) or even MDR-TB (48% cases successfully treated).

Active TB is also treated with INH in combination with other drugs such as rifampin, ethambutol, and pyrazinamide. Streptomycin may be added if the disease is extensive. If a patient has a drug-resistant strain of TB, several drugs in addition to the main four are usually required. Such a patient has to undergo drug therapy for much longer periods. Sometimes surgery may be required to remove damaged lung tissue (CDC, 2011). Finally the FDA in the USA approved Sirturo (bedaquiline) as part of a combination therapy for adults with multi-drug resistant TB in December 2012 (CDC, 2011).

2.2.9 Barriers to Successful Tuberculosis Treatment

The largest barrier to a successful TB treatment is adherence. As soon as many TB patients start to feel better, they suspend taking their medication. To eradicate *Mycobacterium tuberculosis* from the body it is important to complete the full course of treatment.

The inappropriate use of anti-TB drugs and poor management of the disease including infection control resulted in the development of drug-resistance. Drug-resistant TB (DR-TB) refers to strains of tuberculosis bacteria that are resistant to at least one anti-tuberculosis drug. Generally, DR-TB can develop if a patient does not complete the full course of treatment, the

correct therapies are not prescribed or available, if treatment is interrupted due to drug stock-outs, or the drugs are of substandard quality (WHO, 2010).

2.2.10 Cost of Treating Tuberculosis

A course of standard TB drugs costs approximately US$ 19, but DR-TB treatment can cost over 450 times much – up to US$ 9,000 for a standard 18-24 month treatment course in developing countries, if available at all. These high prices are a reflection of the fact that current market demand is low because most people who have the disease do not have enough resources to pay for treatment; and the limited capacity to diagnose and treat DR-TB does not also provide the market incentive to manufacturers (WHO, 2010).

In the UK where there is universal access to diagnosis and treatment of a typical TB case is estimated to cost around £5,000 to treat; a case of MDR-TB costs between £50,000 and £70,000 and rising to over £100,000 per patient for the most extreme forms. Cumulative investments in TB research and development totaled US$ 3.6 billion over the last seven years while annual spending toward research for new and improved TB tools falls far below the US$ 2 billion global target plan to Stop TB between 2011–2015 Tripathi et al, (2005) and (WHO, 2010).

2.2.11 Interventions to Preventing Tuberculosis

The Bacillus Calmette–Guérin (BCG) vaccine is used in several parts of the world where TB is common. It usually protects children and infants from the disease, but its efficiency diminishes when the child reaches adulthood (CDC, 2011). Eating a healthy diet that boosts the immune system, having regular TB tests if the person works or lives in a high risk environment, and completing a TB medication regimen are methods of preventing TB relapse. The rest are infected persons should stay home, cover their mouths when coughing, and ensure proper ventilation to prevent transmitting the disease to others (CDC, 2013).

Other ways are the effective implementation of TB control through DOTS and improving on the rate of detection and treatment outcomes.

Additional interventions to BCG's are therefore required to meet the goals for TB control and elimination. This should involve further efforts to improve TB case detection and treatment outcomes, with the ultimate aim of getting as close to 100% case detection rate and treatment success rate (WHO, 2011). Moreover, new tools for diagnosis, prevention and treatment are urgently required. Efforts should also include prevention by intervening on known social determinants and risk factors of TB (WHO, 2011).

Studies have revealed that involving the private medical sector in TB control has proved to be highly effective in improving access and quality of TB care in urban settings. Partnership with the private medical sectors has proved to enhance TB case notification, achieving internationally agreed targets and maintaining higher rates than planned averages in specific study areas (Foma et al, 2013).

2.3 Diabetes and Tuberculosis Co-Morbidity

Theoretically, diabetes and TB can complicate each other at many levels. Conceivably, people with diabetes may be more easily infected with TB than non-diabetic people leading to a higher risk of TB incidence even though the evidence of their relationship remains weak. Tuberculosis infection may progress at a faster rate in people with diabetes than in those without diabetes (WHO, 2011).

The clinical presentation of TB in people with diabetes may be altered and therefore change the sensitivity and specificity of conventional diagnostic algorithms. Among those with active TB, diabetes may adversely affect TB treatment outcomes by delaying the time to microbiological response, reducing the likelihood of a favourable outcome, and increasing the risk of relapse or death (WHO, 2011).

Diabetes may also accelerate the emergence of drug-resistant TB, especially multidrug-resistant TB (defined as strains of TB resistant to both rifampicin and isoniazid) among those receiving TB treatment, although the evidence is limited. Diabetes may also interfere with the activities of certain anti-TB medicines (WHO, 2011). Young et al, (2009) observed that an increasing prevalence of diabetes can hinder efforts at tuberculosis control, increasing the number of susceptible individuals in populations where tuberculosis is endemic, and making successful TB treatment more difficult.

2.3.1 Immune Factors in Diabetes and Tuberculosis Co-morbidity

WHO (2011) in a collaborative study with the International Union against Tuberculosis and Lung Diseases found that changes in lifestyle and diet have contributed to an increased prevalence of diabetes in many low-income and middle-income countries where there is high burden of TB. The growing burden of diabetes is contributing to sustained high levels of TB in communities, and the proportion of TB cases attributable to diabetes globally is likely to increase over time.

Kovalovsky, et al, (2000), associated diabetes with a decrease in cellular immunity because of the net decrease in T lymphocytes and neutrophil in diabetics. The reduction in the response level of T-helper1 (Th1) cytokine, the production of TNF alpha, and IL-1 beta and IL-6 production is also observed amongst people with both diabetes and TB as compared to non-diabetic patients. The decrease in T lymphocyte number and function is the cause of the susceptibility of diabetics to TB. Macrophage function is also observed to be inhibited in individuals with diabetes, with an impairment of the production of reactive oxygen species (ROS), and phagocyte and chemo tactic function (Kovalovsky, et al, 2000). Hyperglycemias have a direct depressive effect on the respiratory bust. A combination of these dysfunctional processes contributes to an increased risk of TB in diabetics (Assayed et al, 2013).

Assayed (2013), indicates that the interaction between Diabetes, HIV/AIDS, and TB is well established globally and in Africa specifically. AIDS patients are at higher risk of diabetes due to the toxic side-effects of treatment. Also, diabetes has been confirmed by the journal to be a major risk factor for TB. These three epidemics are not happening in isolation or just linked by TB. Rather they are inter-relating and affecting each other. The study concluded that, the newly emerging diabetes epidemic will be a major challenge to Africa in the next 10–15 years. Also according to the Journal, the amount of research about diabetes in Africa is still failing to explore all aspects of the problem. The incidence and prevalence of the disease is rising and affects all social classes. It continued that, the current health system capacity is far less than can address and tackle the problem.

2.3.2 Interventions to Reducing Diabetes and Tuberculosis Co-Morbidity

The co-occurrence of diabetes, TB, and HIV/AIDS and the complex interaction of these conditions is a further emerging and increasing problem. A study recommended that a robust Africa-tailored research system which covers all aspects of diabetes care is urgently needed (Assayed, 2013). Scientists should alert and mobilize the political will in order to table diabetes for discussions and policy formulation. Diabetes associations in all Africa should play their role and lead the change. More collaborations and partnerships are urgently needed. The study also recommended that integration of chronic diseases is essential, and TB/ diabetes bi-directional screening is a good way of early detection of these two diseases. It is also important to encourage scientists and health institutions to invest in innovative new strategies and therapies, and these should be cost-effective and affordable. Africa needs to strategically and collectively plan for the future as well as current problems; otherwise the disease will devastate the people and the economies.

Tuberculosis remains a considerable global public health concern, mainly affecting poor and vulnerable populations; more than 9 million people fall ill with this infectious disease and close to two (2) million dies from the disease yearly. Diabetes is also increasing globally, especially in areas with high burden of TB; diabetes is associated with higher risks of TB and adverse TB treatment outcomes (WHO, 2011). The collaborators believe that the increase in the number of people with diabetes may further complicate care and control of TB, especially in the many areas with high burden of both diseases.

2.3.3 Trends in Diabetes and Tuberculosis Co-Morbidity

Restrepo et al (2011) in a Cross-sectional assessment reveals high diabetes prevalence among newly-diagnosed TB cases. The objective of the study was to estimate the contribution of clinically-confirmed diabetes mellitus to TB rates in communities where both diseases were prevalent as a way to identify opportunities for TB prevention among diabetic patients. A prospective study was employed in which TB patients ≥ 20 years old at TB clinics in the Texas–Mexico border areas were tested for diabetes. The risk of TB attributable to diabetes was estimated from statistics for the corresponding adult population.

The study revealed that the prevalence of diabetes among TB patients was 39% in Texas and 36% in Mexico. Diabetes contributed 25% of the TB cases studied, whereas human immuno deficiency virus (HIV) infection contributed 5% or les. Among TB patients, fewer Mexicans than Texans were aware that they had diabetes before this study (4% and 19%, respectively). Men were also less frequently aware than women that they had diabetes. Patients who knew that they had diabetes before the study had an 8-year history of the disease, on average, before being diagnosed with TB. The study therefore established that patients with diabetes are at higher risk of contracting TB than non-diabetic patients.

A study by Gupta et al, (2011) on Diabetes mellitus and HIV as co-morbidities in tuberculosis patients of rural South India showed that the incidence of tuberculosis (TB) is greatest among patients with impaired immunity. In addition, India was experiencing a double epidemic of HIV and diabetes mellitus (DM), both of which are strongly associated with immune-suppression. The objective of the study was to discover the prevalence of HIV and DM in both the pulmonary and extra-pulmonary TB patients of rural south India, retrospectively. The study thoroughly reviewed Medical records of 192 microbiologically diagnosed pulmonary TB and 37 extra-pulmonary TB patients and extracted data for analysis. The frequency distribution of HIV and DM was evaluated along with other demographic details such as age, sex and occupation in both groups.

The study revealed that the mean age (standard deviation) of the pulmonary TB patients was 41.11(15.7) years, with significantly higher ($p<0.0001$) preponderance of DM (31.8%) over HIV (8.9%).About 72.13% of the diabetic patients belonged to the age group of 41-60 years. Extra-pulmonary TB patients had a mean age (standard deviation) of 34.62(12.9), years with a significantly higher ($p<0.006$) HIV prevalence of 32.43% over DM (5.4%).Historically 75% of the HIV patients belonged to the age group of 41-60 years. Occupationally, the majority of the pulmonary TB patients were agricultural laborers (25.2%) while the majority of the extra-pulmonary TB patients were house wives or self-employed (18.92%). In conclusion, though more importance is being given to HIV-TB co-infection, DM cannot be overlooked, which showed a significantly higher prevalence in pulmonary TB patients compared to HIV. The rising prevalence of DM in high TB burden countries may adversely affect TB control (Gupta et al., 2011).

2.3.4 Treatments in Diabetes and Tuberculosis Co-Morbidity

Suleiman et al, (2013), conducted a study to determine the impact of diabetes mellitus on treatment outcomes of tuberculosis patients in tertiary care setup. This was done by employing a retrospective cohort study design at a respiratory clinic of Hospital Palau Pinang, Malaysia. The study registered all TB patients from January 2006 to December 2007 and included them in the study. Data was collected by means of a validated data collection form and used a WHO criterion for categorizing treatment outcomes. The study found that, of the 1267 patients, 338/1267 (26.7%) patients had concurrent TB-DM.A multivariate analysis of the study revealed that patients age 46 years and above and patients with pulmonary TB stand the chance of developing TB-DM concurrently than others of different ages and conditions.

About 78.8% of the patients were successfully treated and no statistically significant difference was observed between patients with TB-DM and patients with only TB. Successful treatment outcomes were observed in patients having age of 46 to 60 years than the male gender and patients with relapse TB. The high prevalence of TB-DM in the study signifies that patients with DM are at higher risk of developing TB than those without diabetes.

2.3.5 Risk groups and Determinants of Diabetes and Co-Morbidity

Jeon et al., (2008) observed that since the early part of the 20th century, clinicians have observed an association between diabetes mellitus (DM) and TB, although they were often unable to determine whether DM caused TB or whether TB led to the clinical manifestations of DM. The study also found that multiple rigorous epidemiological studies investigating the relationship have demonstrated that DM is indeed positively associated with TB. The study observed that while the investigators suggested that the association reveals the effect of DM on TB, some controversy over the directionality of the association remains due to

observations that TB disease induces temporary hyperglycemias, which resolves with treatment.

Patients with DM had a threefold to fourfold increased risk of developing TB (Ruslami et al, 2010). A study by Swai et al, (1990), in Dar es Salaam, Tanzania found that in 1250 diabetic patients, 5.4% had developed pulmonary TB (PTB) and 0.2% spinal tuberculosis. It was observed that prevalence was greater in young Africans with low body mass index (BMI), in patients with insulin dependent diabetes mellitus (IDDs) as compared to those with non-insulin-dependent diabetes mellitus (NIDDs) (9.0% vs. 2.7%). Again in South Africa, TB was reported in 6.1 per cent of 66 black IDDs within 30 years. Similarly, the study observed that, TB was the most common complicating illness of young diabetics in Addis Ababa, Ethiopia, as it occurred at some time in 16.5 per cent of 431 consecutively registered Ethiopian types 1 (IDDs) patient.

The study further observed that generally, 5-10 per cent of type 1diabetic (NIDDs) in developing countries have PTB and this was evidenced in Bombay where 50.9 per cent of 8793 hospitalized type 2 diabetics was diagnosed. Similarly, in Port Moresby, Papua New Guinea, of 88 newly diagnosed Melanesian NIDDs, 5.7 percent were suffering from PTB. The study also observed at a teaching hospital in Concepcion, Chile that a ten year actuarial risk of acquiring tuberculosis was 24.2 per cent for 116 IDDs and 4.8 per cent for the NIDDs out of 1529 diabetic patients (Swai et al, 1990).

Mahdi et al, (2005), conducted a study With the aid of a cross sectional study design done on two groups the first group were110 cases of type -1 diabetic child (aged from 5-10 years old) who had a regular follow study among children with type -1 diabetes Mellitus attending El-Minya University Hospital with the aim of identifying the epidemiological relationship between TB and diabetes in children using Microdot test up in paediatric diabetes Mellitus

out-patient clinic in El-Minya university hospital. The second group consisted of the same number of children (as a control non-diabetic group) age and sex matched from paediatric out-patient clinic in the same hospital. The study found among the 110 diabetic children, six cases (5.5%) were positive for TB using Microdot technique and only one positive case (0.9%) among the control cases using the same test. Furthermore, a systematic review in India reported that, with an estimated 900,000 incident PTB cases in 2000, diabetes accounted for nearly 15% - 20% of smear-positive PTB (Obgera et al, 2014).

Studies strongly support the hypothesis that DM directly impairs the innate and adaptive immune responses necessary to counter TB infection. First of all, Babad et al (2010), in various studies found by studying animal models that diabetic mice experimentally infected with M. tuberculosis have higher bacterial loads compared to non-diabetic mice regardless of the route of inoculation; chronically diabetic mice had significantly lower production of interferon-c (IFN-c) and interleukin-12 (IL-12); fewer M. tuberculosis antigen responsive T cells early in the course of M. tuberculosis infection and marking a diminished T helper 1 (Th1) adaptive immunity, which plays a crucial role in controlling TB infection compared to non-diabetic mice.

In a second study Babad et al (2010), found through an experimental study of human plasma cells that high levels of insulin have been shown to promote a decrease in Th1 immunity through a reduction in the Th1 cell to Th2 cell ratio and IFN-c to IL-4 ratio. In a third study, Babad et al (2010) in an ex-vivo comparison study of the production of Th1 cytokines revealed that, nonspecific IFN-c levels were significantly reduced in people with diabetes compared to controls without diabetes.

In the same study, Babad et al (2010) indicated a dose–response relationship; levels of IFN-c were negatively correlated with levels of HbA1c (i.e. a measure of serum glucose levels over time in humans).

Finally Babad et al (2010), found that neutrophils from people with diabetes had reduced chemo taxis and oxidative killing potential than those of non-diabetic controls, and leukocyte bactericidal activity was reduced in people with diabetes, especially those with poor glucose control.

2.3.6 Knowledge and Awareness Levels on Diabetes and Tuberculosis, and the Co-morbidity of the Two Diseases

Little has been published on the knowledge and awareness levels on diabetes and TB, and the co-morbidity of the two disease conditions in Ghana. Meanwhile a research conducted in the Gambia among diabetics showed that only 47% of diabetics knew what DM is, 53% had no knowledge of the causes of DM and about 50% were not aware of the methods of DM prevention (Foma et al, 2013).

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The items addressed in this chapter include: the description of the study area, study design, scope of the study, sample size and sampling procedure, data processing analysis and ethical issues relating to the study.

3.1 Background to the Study Area

Tamale Metropolis is one of the 26 districts in the Northern Region. The Metropolis is located in the central part of the Northern Region and is bounded by Sagnarigu to the North, Mion District to the East, Tolon to the West, Central Gonja to the South West and East Gonja to the extreme South.

The Metropolis has a total estimated land size of 550 km sq which is about 12% of the total land area of the Region. The Metropolis is located at an altitude of about 180 meters above sea level with some few isolated hills. It has a single rainfall season (May - October) in a year, characterized by dry Harmattan winds from November to February. Temperature: maximum of 40°C and minimum of 25°C. The Metropolis has a limited number of water bodies.

The Metropolis lies within the Savannah Woodland Region of the country. The main soil types are sandstone, gravel, mudstone and shale that have weathered into different soil grades. Due to seasonal erosion, soil types emanating from this phenomenon are sand, clay and literite Ochrosols.

The Metropolis is a cosmopolitan area with Dagombas as the majority. Other minority ethnic groupings are Gonjas, Mamprusis, Akan, Dagaabas, and tribes from the Upper East Region.

The area has deep rooted cultural practices such as festivals, naming and marriage ceremonies.

The Metropolis has about 42% of the working class in agriculture related activities. Majority of the workforce in the Metropolis of 58% are engaged in Sales, Services, Transport and Production. This is as a result of the increase in Marketing, Banking and other Non-Governmental activities in the Metropolis.

The 2010 Population Census pegged the population of the Tamale Metropolis at 371,351. This is made up of 185,995 males and 185,356 females. This figure shows an increase of 75 percent over the 1984 population of 167,778 and represents an intercensal growth rate of 3.5 percent. This is far higher than the national and regional rates of 2.7 percent and 2.8 percent respectively.

With an urban population of 67.1 percent, the Metropolis is the only district in the region which is predominantly urban. The population density is 318.6 persons per square kilometre for the Metropolis which is about 12 times higher than the Regional average density of 25.9 persons per square kilometre. There exists vast difference between the densities of the urban and rural areas. This is an indication of influx of people to urban Tamale, and gives credence to the assertion that facilities and opportunities for modern employment are concentrated in few central places.

The structure of the population of the metropolis indicates a broad base that gradually tapers off with increasing age due to death. The youthfulness of the population implies that the metropolis has an important human resource potential and that this tremendous potential will determine the strength and resilience of the metropolis in pursuing social, economic and political development goals.

On the other hand, the proportion of people aged sixty years and above is about 4.1 percent lower than the regional and national averages of 4.5 percent and 5.3 percent respectively, an indication of a comparably low life expectancy (GSS, 2000). Islam is the predominant religion in the Metropolis with 84 percent of the population affiliated to it. Christians follow with a proportion of 13.7 percent while the traditionalists constitute 1.6 percent of the population. All other religious denominations constitute 0.7 percent of the population in the Metropolis.

There are 240 nurseries, 274 primaries, 89 Junior High, and 11 Senior High schools in the Tamale metropolis. In addition to these, there are two vocational and Technical schools, one Polytechnic and one campus of the University for Development Studies. The total primary school enrolment in 2005/2006 was 53,889 comprising 29,303 males and 24,586 females. The pupil- teacher ratio was 1:33 for the primary and 1:21 for the Junior High schools.

The Tamale Teaching Hospital, Tamale Central Hospital and the West End Hospitals are the main health institutions in the Tamale metropolis. But there are several health centers and clinics in the metropolis.

The high level of illiteracy and poverty as well as limited access to safe drinking water and poor Sanitation have combined to expose many people to health hazards which accounts for the low standard of living of the people .

Malaria and diarrhoea are among the top five diseases in the metropolis and these have severe effect on the lives of the people. Malaria alone contributes about 25 percent of total deaths in the metropolis. The Tamale Metropolis is as vulnerable to the HIV/AIDS pandemic as other districts in the country. High poverty rate which compels people especially women to engage in unsafe sex practices is a predisposing factor to the spread of the disease in the metropolis. Also, the long dry season when traditional farming is at its lowest ebb also encourages a

greater proportion of the youth particularly young women who move down south in search of non- existing jobs. Most of the young women who come to the cities become head porters or "kayaye", which is another predisposing factor to the spread of the pandemic.

3.2 The Scope of the Study

The scope of the study encompasses all diabetic clinics in Tamale in the Northern Region with regular attendance by both health care providers (clinicians, nurses and attendance) and diabetic patients between the ages of 10 and above (persons who have been clinically diagnose and confirmed through laboratory test). This employed the reviewing of diabetic clinic registers, TB treatment form four (TBO4) registers, and clients' folders. The study also administered questionnaires and conducted one-on-one interactions with key stakeholders. Interviews were conducted to determine the awareness and knowledge levels of diabetic patients and care givers on diabetes/ TB and co-morbidity of the diseases. Also, the study determines the percentage of diabetic patients who have been suspected of TB and those who actually have TB or have been treated of TB.

3.3 The Study Design

A retrospective cross-sectional study design was employed with effect from January, 2013 to June, 2013. This type of study looks at the relationship between exposure and the prevalence of diseases in a given defined population at a single point in time. In relation to this study an assessment was done to determine the exposure to diabetes and the subsequent development of TB. Also an assessment of the knowledge on diabetes, TB was done through structured questionnaire (Appendix 'A' and 'B') which determines diabetic patients' perception during episodes of diabetes as well as care providers' perception when attending to diabetic patients.

3.4 Study Variables

The Variables and Measurements in the study include independent and dependent variables. The independent variables include Socio-demographic and life-style characteristics of diabetic patients and care providers. The Dependent Variables on the other hand include the knowledge level of diabetic patients and care providers on DM and TB, the management of DM and TB, and the co-morbidity of the two diseases among registered diabetic patients and their care providers in the Northern Region.

3.5 Sampling Procedure

3.5.1 Study Population

The target populations for the study were both diabetic patients and care providers. The study mainly considered only registered diabetic patients in the diabetic clinics between the ages of 10 years and above. Children below the age of ten were left out because at age below ten, children may not be able to say much about themselves and what affects them directly or indirectly and therefore may not grant useful information. However, the care providers who work in the diabetic clinics or who attend to diabetic patients at the wards between the ages of 10 and above were the main target for the study. This is because they are the experts attending to the diabetic patients and could therefore grant useful information needed for the study.

3.5.2 Sample Frame

A total number of three hundred and fifty-five (355) males and females between the ages of 10 and 60 years and above were obtained from the sum of the clients in the three diabetic clinics, i.e. 35 clients in Tamale West Hospital, 120 in Tamale Central Hospital and 200 in Tamale Teaching Hospital (TTH). This represented the sample frame for the questionnaire survey.

3.5.3 Sample Size Determination

The sample size was determined by the use of a known population size statistical table (Krejcie and Morgan, 1970) as indicated in appendix 'C'.

The diabetic patients in the three hospitals numbered 355 and this is closer to 360 than 340 from the mathematical table. Therefore the appropriate population size 360 (N) was used to determine the sample size (S) by tracing from the three hundred sixty (360) to the sample size column giving 186. Ten per cent contingency was added to the one hundred and eighty six (186) to take care of questionnaires that might not be returned after completion. This was to ensure that the sampled mean was closer to the population mean and minimize errors.

The clients were selected proportionately from the three diabetic clinics. For example10% of diabetic patients from Tamale West Hospital, 34% of diabetic patients from Tamale Central Hospital and finally 56% of diabetic patients from Tamale Teaching Hospital were proportionally selected to participate in the study. Also thirty (30) Care Providers; made up of four clinicians, twenty three attendance (Staff nurses and Enrolled Nurses) and three Nutrition Officers attending to the diabetic patients in the three hospitals were also sampled.

3.6 Data Collection Methods

Both quantitative and qualitative methods were used in the data collection. The qualitative designs consist of observation.

One-on-one interviews' using structured questionnaires was used to collect primary data from diabetic patients and care providers. The questionnaires consisted mainly of closed-ended questions which were used to collect information on the study variables.

3.6.1 Sampling Techniques

The convenient, purposive and quota sampling techniques were the main techniques used for the data collection.

3.6.1.1 The Convenient Sampling Technique

The convenient sampling technique was used to select the individual diabetic patients and care providers at each of the three sites by enrolling on those who were willing to participate until the needed numbers of participants were obtained. The data were collected from the diabetic patients because they were the main subjects under study and could provide information on what affects them directly. In addition, the data were collected from Care Providers because they were attending to diabetic patients and could provide accurate information on what affected the diabetic patients. The type of data collected from each diabetic patient is as shown in (Appendix 'A' and 'B').

3.6.1.2 The Purposive Sampling Technique

The purposive sampling technique was used to include clinicians, nutritionists and nurses present at each of the host hospitals at the time of the survey. Purposive sampling technique was used to select the above stakeholders. As the name implies, in trying to adhere to the objectives of the study, respondents who could answer the research questions best were selected. In this case, these key stakeholders were expected to have the necessary information, adequate knowledge and experience on diabetes and TB in the study area.

3.6.1.3 The Quota Sampling Technique

The quota sampling technique was used to determine the sample units to be collected at each sampling sites.

3.6.2 Primary Data Collection Tools

Primary data were collected through preliminary field investigation, questionnaires survey and observation.

3.6.2.1 Questionnaire Administration

Structured questionnaire (Appendix 'A and 'B') was administered to both patients and care providers to obtain information for the study. Patients who could read or write were given the opportunity to complete the questionnaires but those who could not read were supported to complete the individual questionnaires. Data collected were on the following variables:

i. Background and socio-economic status of the participants

ii. Awareness and knowledge of diabetic patients and care providers on diabetes and TB

iii. Awareness and knowledge of diabetic patients and care providers on TB and diabetes co-morbidity

iv. Life style characteristics and management of diabetes and TB

3.6.2.2 Observation

Informal observation was done on day to day bases to obtain information from the clinicians, nurses, nutritionists, patients' relatives and patients themselves. The main variables were:

i. Client and care providers relationship

ii. Education given to the clients about diabetes controlled by care providers

iii. Venue used as diabetic clinic.

3.6.3 Secondary Data Collection Tools

Secondary data were obtained from patients' folders, TBO4 and diabetic clinic registers, books, articles, newspapers, Ghana Statistical Service Annual Reports, and internet sources to review literature. Secondary data were also obtained from the Ghana Health Service and Regional Health Directorate's Annual Reports. The data obtained include number of diabetic patients with confirmed diabetes; the status of diabetes and TB in the nation and in the region with specific reference to the main indicators; incidence rates, prevalence rates, notification rates, detection rates and treatment success rates.

3.7 Data organization, Processing and Analysis

The Statistical Package for Social Sciences (SPSS version 16) was used to analyze the data into statistical tables and charts for interpretation and discussion. Data analyses were further divided into the various classes of respondents interviewed. The univariate and bivariate statistics were used to analyze data where appropriate. The analysis was used to establish the relationship between TB and diabetes using quantitative variables such as age, educational levels, occupation etc.

Data were also extracted to estimate the knowledge levels of diabetic patients and care providers on diabetes and TB, the knowledge of diabetes patients and care providers on diabetes and TB co-morbidity, percentage of diabetic patients who were suspected for TB, percentage of diabetes patients who have TB, and TB risk attributable to diabetes among diabetic patients in Northern Region. Again data were used to estimate the percentage and mean of age, sex, and socio-economic status of the respondents.

3.8 Ethical Consideration

The study was approved by the Ethics Committee of the University for Development Studies, School of Medicine and Health Sciences, Ghana. An introductory letter was also obtained from the head of Allied Health Science Department of the university (UDS), explaining the study objectives. In addition, all three-hospital authorities and their heads of departments were visited in person, and permission sought to conduct this study within their respective hospitals. Every respondent selected also gets the same introduction to the study as the authorities at the beginning of the interview. All respondents were asked for their consent and made clear that participation is voluntary. They were informed that all answers are confidential and that the information will not be shared with parties. It was also specified that during the interview they were free to withdraw at any time or skip any questions.

3.9 Quality Control Measures

i. **Training:** there was one day training session held for the three persons who assisted in the data collection to ensure that valid and reliable data were collected. The collectors were well informed through the training that they understood every aspect of the data collection process and what is sought to be achieved.

ii. **Pre-testing of questionnaires:** Samples (20 each) of structured questionnaires for diabetic patients and care providers were pretested on any kind of client visiting the TWH, TCH and TTH days before the set date for data collection and analysis. Questionnaires for diabetic patients and care providers were examined to check completeness, accuracy and consistency of responses in order to detect and eliminate errors.

iii. **Pre-entry of data**: Answered Samples (20 each) of structured questionnaires for diabetic patients and care providers were first entered in SPSS to check completeness, accuracy and consistency of responses in order to detect and eliminate errors.

3.10 Limitations of the study

Doctors in particular and some diabetic clinic attendance were not ready to answer the questionnaires because of their perception that the two disease conditions are not related in anyway and it was not easy to convince them since an attempt to convince them will dilute the substance of the study.

3.11 Plan for dissemination of results

The results of the study would be disseminated to the following bodies for action; University for Development Studies (UDS), the Tamale Health Directorate, the Tamale Teaching

Hospital and the Northern Regional Health Directorate. The results will also be published in the UDS Medical Journal.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter provides results and analyses of the primary data collected from the diabetic patients and care providers, and the secondary data collected through the folder survey of the diabetic patients.

4.1 Results of Folder Survey and Questionnaire Administration (Diabetic Patients)

To study the socio-demographic factors such as age, sex, marital status, occupation, ethnicity, hometown and religion among others, one hundred and eighty seven (187) folders were assessed. To avoid being bias, random sampling technique was used to select the folders. It studied the clinical summary of the diabetic patients with the aim of obtaining the total number of diabetic patients who were suspected and screened for TB.

It is important to state that those interviewed might have had their folders assessed and others not since random sampling was used to assess the data in the folders.

4.1.1 Socio-Demographic Characteristics of Respondents (Diabetic Patients)

4.1.1.1 Age of Respondents

Figure 4.1 indicates that of the total one hundred and eighty seven 187 diabetic patients' folders assessed, forty five (45) were males representing 24% and one hundred and forty two 142 females representing 76% of the respondents with a mean age of 45.5 (±4.2) years. The majority of the respondents were in the age group of 51-60 and above years and formed 58% of the whole sample. It was observed that of all respondents, 4% were between 10-20 years old, 8% were between 21-30 years old, 9% were between 31-40 years old, 22% were between 41-50 years and 58% were between 51- 60+ years old(Figure 4.2).

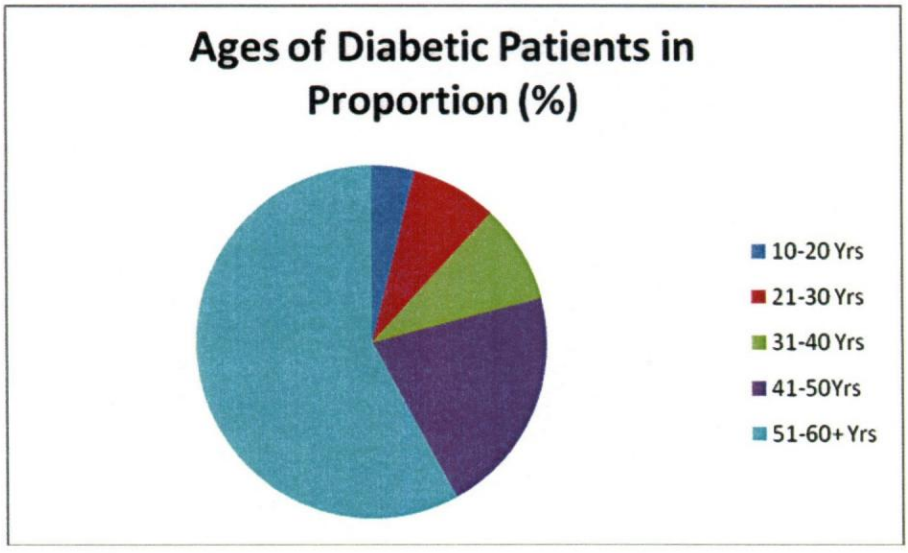


Figure 4.1: Age Group of Respondents (*Source: Field Survey, October 2014*)

4.1.1.2 Gender (Sex) of Respondents

The majority of the respondents, 74% were females and 26% were males

4.1.1.3 Educational Status of Respondents

The study showed that less than fifty percent of the respondents (43%) had formal education whiles the majority (57%) had no formal education. Of the 43% who had formal education, 16% had primary education, 13% had secondary education, 4% had technical and vocational education, and 10% had tertiary education.

4.1.1.4 Marital of Respondents

It was observed that more than half of the respondents (51%) were married, 31% were widows, 12% never married and 6% were divorcees.

4.1.1.5 Religious Status of Respondents

Majority of the respondents, representing 68% were Muslims, 30% were believers of the Christian religion and 2 % Traditional believers.

4.1.1.6 Ethnicity, Residential, and Nationality of Respondents

It was also observed that of the one hundred and eighty seven (187) diabetic patients, 45% were residents of Tamale and its surroundings, the rest represent smaller percentages from different areas of the region and beyond including Gonja, Manprugu, Nannum, and Dagbon. The Dagomba tribe formed the majority (53%), 13% Gonjas, and 34% of other tribes such as Manprushi, Nannumbas, Konkombas, Frafra, and Ewes.

Ghanaian nationals formed the majority of the respondents with 90% representation and the remaining 10% are citizen of Togo, Burkina Faso and Ivory Coast among others.

4.1.1.7 Occupational and Income Status of Respondents

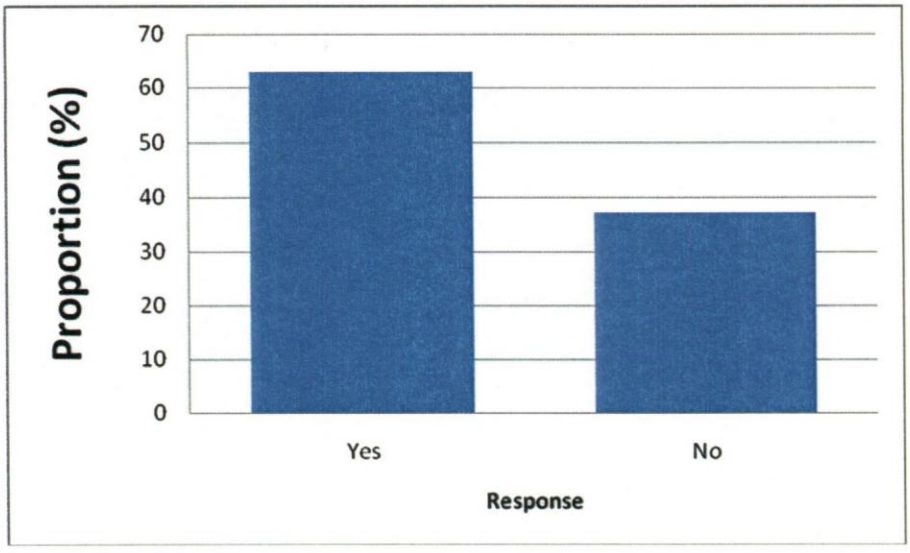
The study shows that of the different occupational groups that participated in the study, 37% were traders, 18% were farmers, 9% were not employed or are retired, 17% were formal sector workers and 19% of other occupational groups.

The mean monthly income was observed to be GH₵ 325(GH₵±2.8) with the majority, 30% of the respondents earning incomes between GH₵20 to 50 per month, 21% earn income between GH₵60 to 100 per month, 15% earn income between GH₵150 to 500 per month, 5% earn income between GH₵600 to 1000 per month and 29% earn between GH₵1000 above per month,

4.1.1.7.1 Occupational and Income Status per Sex and Education of Respondents

The majority of the respondents were traders (37%) and farmers (18%). It was observed that of the respondents who were farmers, 41% were males and 59% were females. Of the respondents who earn low incomes (GHC 20 -50) per month, the majority 68% were females. Also the majority, 71% of farmers and 65% of traders had no formal education and formed the bulk of all the low income earners (71.4%).

4.1.2 Knowledge/Awareness Level of Respondents on Diabetes



(Source: Field Survey, October 2014)

Figure 4.2: Patients' Knowledge/Awareness of Diabetes before Diagnosis

Figure 4.2 indicates that of the one hundred and eighty seven (187) respondents who participated in the study, 118/187 representing 63% were aware of diabetes before they were clinically confirmed to have developed diabetes and 37% never heard of diabetes till they were told they had developed diabetes.

4.1.2.1 Knowledge Level on Diabetes per Age and Sex of Respondents

The study also showed that 63% of the respondents who have heard of diabetes before developing the condition, majority of them, and 81% were greater than or equal to forty one years old (≥41). Of the one hundred and eighteen (118) respondents who have heard of diabetes before developing the condition, 31% were males and 69% were females and of those who never heard of diabetes before developing the condition, 19% were males and 81% were females. On the other hand, of those who have heard of diabetes before being confirmed to have diabetes, 23% were males and 77% were females.

4.1.2.2 Knowledge Level on Diabetes per Residential Status of Respondents

Of those who have heard of diabetes before being confirmed to have diabetes, the majority, (42%) were living in Tamale and its surrounding areas. Also 14% were residents of Damongo and its surroundings, 11% were residents of Yendi and its surroundings, 4% were residents of Walewale, 2% were residents of Bimbila and 3% were residents of other communities other than those stated above.

Of those who never heard of diabetes before developing the condition, 51% were residents of Tamale, 9% were residents of Damongo and its surroundings, 7% were residents of Yendi, 2% were residents of Walewale and its surroundings, 4% were residence of Bimbila and 28% were residents of other communities and towns other than those stated above.

4.1.2.3 Knowledge Level on Diabetes per Education of Respondents

Of the respondents who have no education, 55% have never head of the causes of diabetes and therefore related the cause to a curse, eating too much sugar and witches and wizards. However, 45% of them related it to the failure of the body to produce and regulate sugar in the body. The majority, (55%) of all those who have education from primary to tertiary have knowledge on the cause of diabetes.

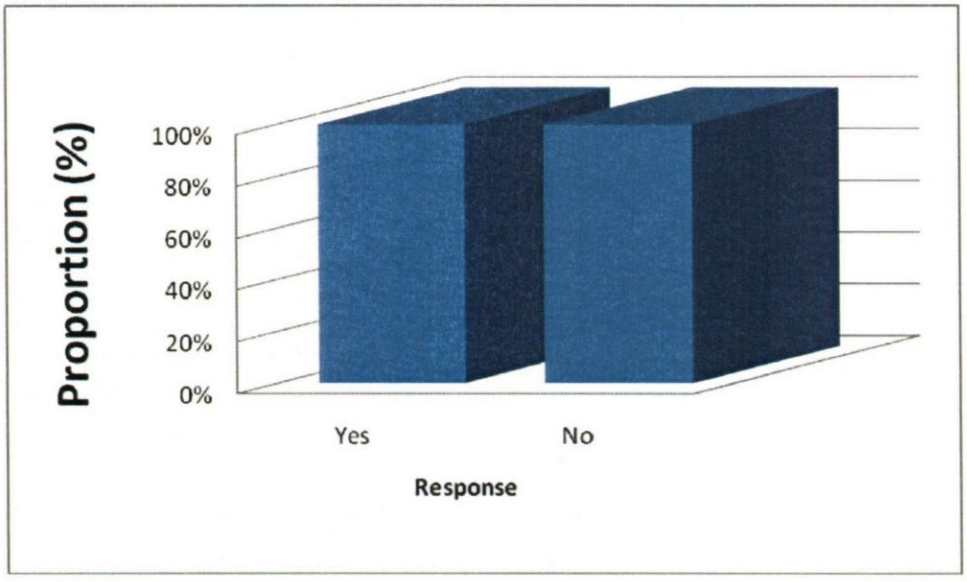
Finally of those who have had knowledge on the causes of diabetes before been confirmed to have diabetes, 57% have had no education at all, 16% (13/84) have had primary education, 13% have had education up to secondary school level and 14% have had other forms of education different from the main stream education.

4.1.2.4 Knowledge Level on Diabetes per Religion of Respondents

Regarding Respondents who have had knowledge of the causes of diabetes before being confirmed to have diabetes, 68% were Muslims and 32% were Christians. Those who have had no knowledge of the causes of diabetes before being confirmed to have diabetes, 83%

were Muslims, 28% were Christians, 3% were believers of A.T.R. and 1% Buddhism. Of the respondents who have heard of diabetes before developing the condition, 80/118 of them representing 68% were Muslims and 35/118 of them representing 30% were Christians and 3% belonged to African Traditional Religion.

4.1.2.5 Knowledge of Respondents on Treatment of Diabetes



(Source: field survey, October 2014)

Figure 4.3: Knowledge/Awareness of Respondents on any Treatment for Diabetes

The figure 4.3 above indicates that 60.4% of respondents knew that diabetes is being managed and not treated while 39.5% of respondents did not know that diabetes is managed and not treated.

3.1.2.6 Knowledge of Respondents on Treatment of Diabetes per Age and Sex

Of the respondents who know that diabetes is managed and not treated, 25% were between 10- 40 years old and 75% of them were between 41- 60 and above years old. With regards to those who did not know that diabetes is managed, 14% were between 10 – 40 years old and

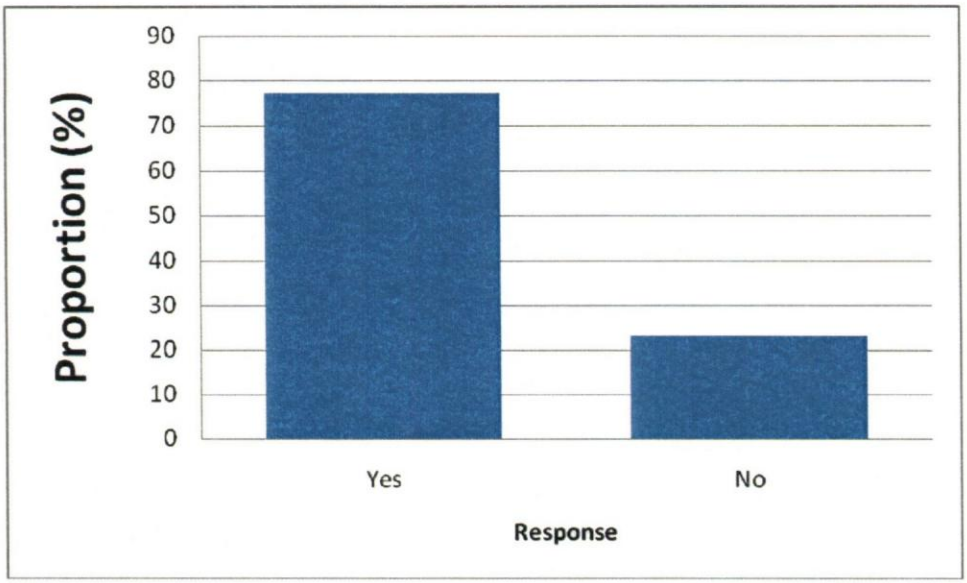
86% of them were between 41- 60 years old. Of those who know that diabetes is for now being managed and not treated, 28% were males and 72% females.

Furthermore, those who did not know that diabetes is managed and not treated, 23% were males and 77% females

4.1.2.7 Knowledge on Treatment of Diabetes per Religion and Education of Respondents

Of those who know that diabetes is for now being managed and not treated, 65% were Muslims and 30% Christians, 4% were believers of the African Traditional Religion and 1% Buddhism. However, 53% have had no education at all, 12% have had primary education, 19% have had education up to secondary level, 11% have had education up to tertiary level and comprises of 70% Muslims and 30% Christians. Of those who know that diabetes is for now being managed and not treated, 60% have had no education, 18% of them have had primary education, 10% each have had education up to secondary and tertiary levels and 12% have had other forms of education.

4.1.2.8 Knowledge of Respondents on Diabetes as a Genetic Disease



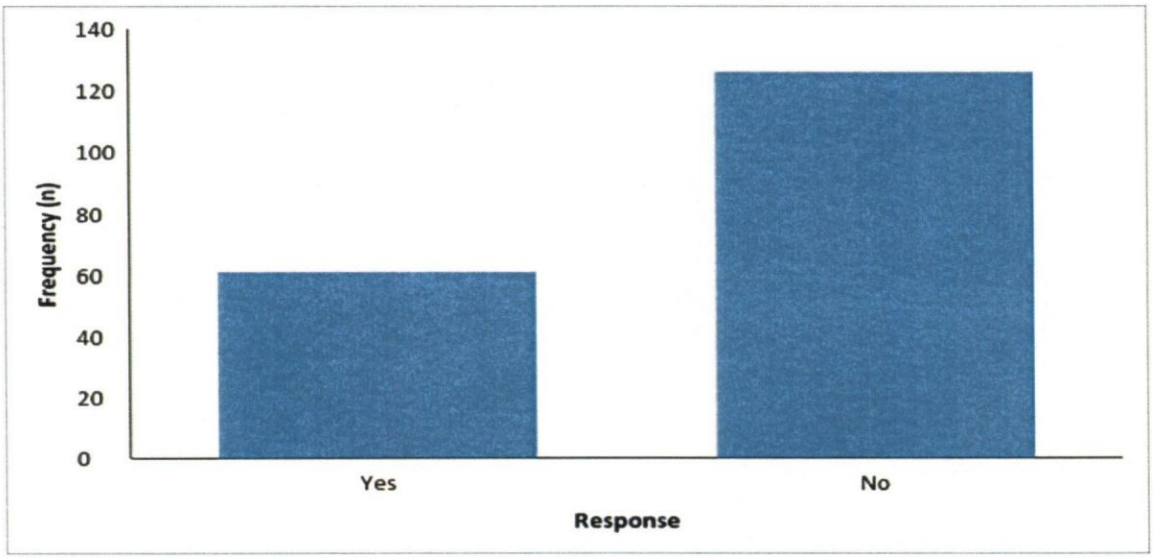
(Source: Field Survey, October 2014).

Figure 4.4: Knowledge on Whether Diabetes is a Genetic Disease or Not

Figure 4.4, indicates the responses of one hundred and eighty seven (187) respondents on whether diabetes can be passed on from parents to their offspring. Of the one hundred and eighty seven (187), 77% were aware that diabetes can be passed on from parents to their offsprings and 23% did not. Also, 76% of all the respondents believe the offspring of diabetic patients can be prevented against diabetes through early life education and 24% do not know how the offspring of diabetic patients can be prevented from acquiring diabetes.

Again, 41% of the respondents did not know that diabetes is not a communicable disease that can be passed on from one person to the other. Similarly, 47% of the respondents did not know that diabetes is a disease for people of all ages and not for a particular age group of people alone. The results further indicated that, 33% of the respondents did not know that diabetic patients' diets are not different from people without diabetes, even though diabetic patients are usually advised to eat certain foods in moderations.

4.1.2.9 Knowledge Level of Respondents on Body Size and the Risk of Developing Diabetes



(Source: field survey, October 2014)

Figure 4.5: Knowledge on Whether All Fat People Eventually Develop Diabetes

Figure 4.5: indicates responses of the one hundred and eighty seven (187) diabetic patients' knowledge on whether all fat people eventually developed diabetes (type 2). Of the one hundred and eighty seven (187) respondents, 33% did not know that type 2 diabetes is a disease for people of all sizes and not for only fat people, even though fat people are more at risk than slim people. However, 67% did know that diabetes is a disease for people of all sizes and not only for fat people.

4.1.2.10 Knowledge of Respondents on Healthy Life-Style Practices to Reducing the incidence of diabetes

Responding to whether exercise is recommended for diabetic patients, 43% did not know that exercise is good for diabetics but a greater number of the respondents (107/187) representing 57% are aware that diabetics are encouraged to do regular exercises.

Of the one hundred and eighty seven (187) respondents, 56% did not know that diabetic patients can detect the rise and fall of their own blood sugar levels without actually testing depending on the signs and symptoms that are being presented. Whiles 44% are able to detect the rise and fall of their blood sugar without testing but depending on signs and symptoms that are being presented. All 44% who are able to detect the rise and fall of their blood sugar without testing said they are able to confirm the high blood sugar levels through the taste of their own urine.

Those who were aware that exercise is good for them said they were told by the specialized doctors. Again in assessing the habit of whether inactivity is a risk factor for diabetes, a substantial number of the respondents (69%) of them believed developing diabetes did not depend on whether one did an activity or not. It was what has been ordained to happen. However, 31% believed that the habit of not performing any activity can predispose a person to diabetes.

Of the one hundred and eighty seven (187) diabetic patients interviewed, a substantial number of them (158/187) representing 85% suggested public education on healthy life style, health check, and a combination of other recommended options by health personnel are the best possible measure at reducing the incidence of diabetes. However, 15% of them could not suggest any possible measures that can help reduce the incidence of diabetes.

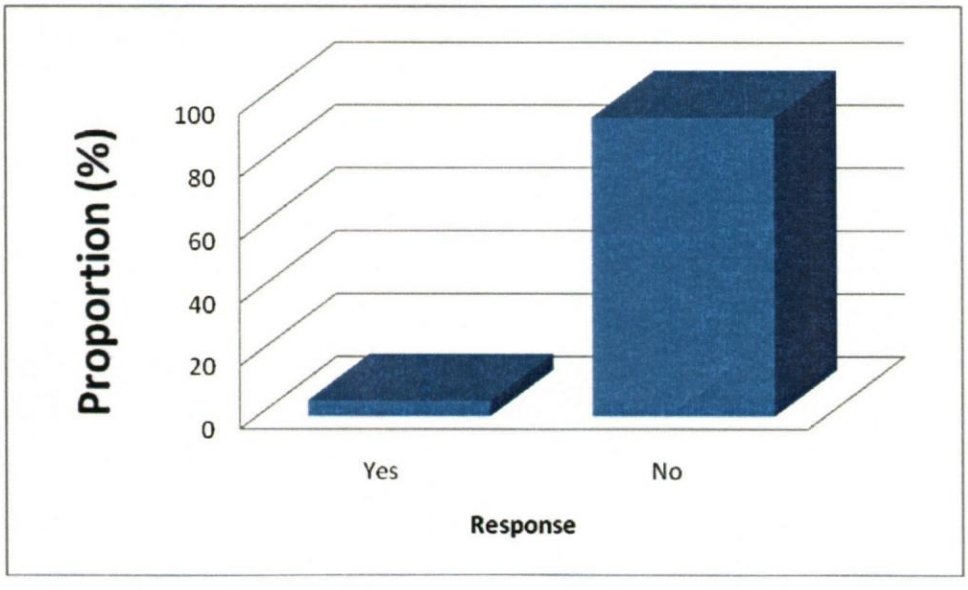
Responding to dietary management to Blood Sugar level, 84% of the respondents said they were very conscious of what they ate and the remaining 16% ate whatever they got. Regarding the reason why the 84% of the respondents said they were conscious of their diet, the majority of the respondents (81%) responded that they believed being conscious would not cause their blood sugar levels to rise. In other words the 81% of the respondents want to stay healthy. Twenty (20) of the respondents, representing 12.7% were conscious because of

the nutritionist advice on healthy diet and good eating habit but ten (10) representing 6.4% believe all the above options put into practice would help maintain their general good health.

Similarly on the period at which diabetic patients should eat, the majority, 69% (129) of respondents said they did not eat later than 7pm but 58 (31%) said they ate any time food was available.

On whether there was the need for all diabetic patients to be screened for TB, 62% (116/187) of the respondents agreed that TB test be conducted on all diabetic patients but 38% (71) believed it was not necessary (figure 4.7).

4.1.2.11 Policy Compelling Clinician to Request Tuberculosis test for Diabetic Patients



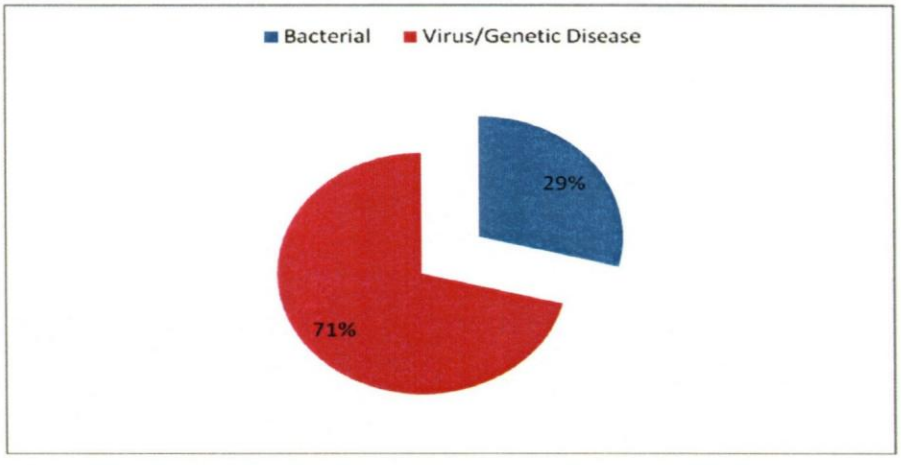
(Source: Field Survey, October 2014)

Figure 4.6: Responses by Respondents on the need for Tuberculosis screening for all Diabetic Patients.

Of the one hundred and eighty seven (187) respondents, the majority, 95% (177) were unaware of any policy compelling clinician to request TB test for diabetic patients as it was

done for HIV/AIDS patients. The 95% also believed there was no need for a policy that will compel clinician to request TB test for all diabetic patients. The remaining 5% (10) of respondents said there was such a policy already in place also felt there was the need for such a policy (Figure 4.6).

4.1.2.12 Knowledge Level of Respondents on Tuberculosis

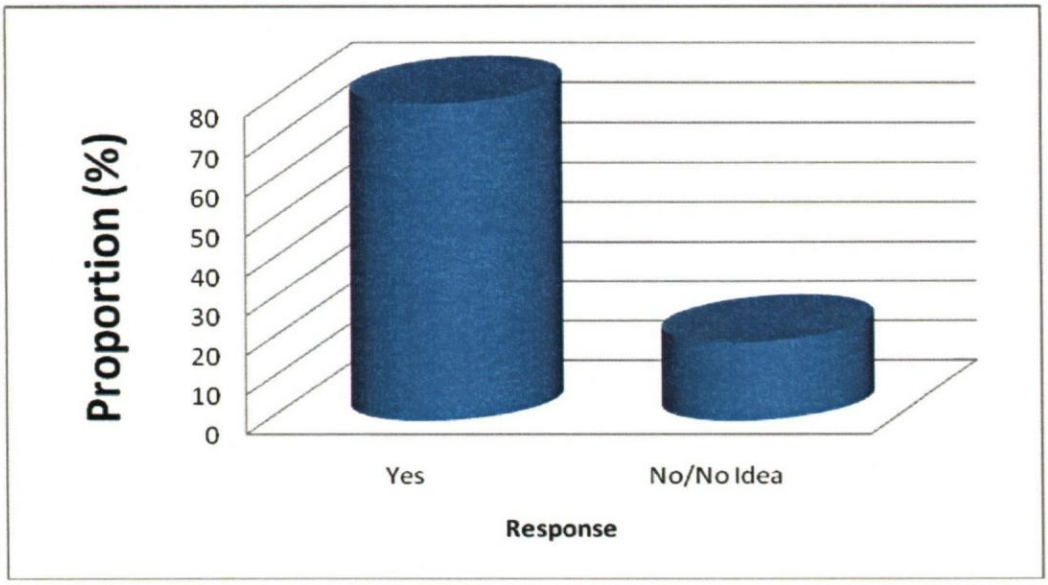


(Source: Field Survey, October 2014)

Figure 4.7: Respondents Knowledge on the Causative Agent of Tuberculosis

The study reveal that majority of the respondents (71%) did not know what causes TB and only 29% really know that TB is cause by bacteria and not a viral or genetic disease (figure 4.7). Also, of the one hundred and eighty seven (187) respondents, sixty four (64) which represent 34% did not know that TB can be treated but the majority (123) representing 66% were aware that TB is a treatable disease.

4.1.2.13 Knowledge of Tuberculosis and Diabetes Co-Morbidity among Diabetics

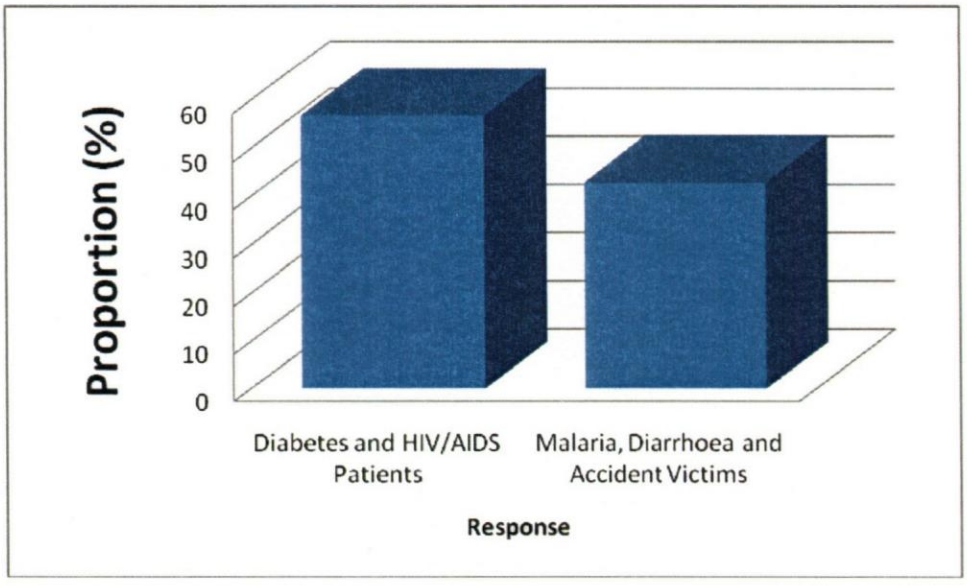


(Source: Field Survey, October 2014).

Figure 4.8: Knowledge on Whether a Diabetic can Contract Tuberculosis

Figure 4.7: indicates the responses of one hundred and eighty seven (187) respondents on whether diabetes and TB can co-exist or not. Only twenty percent (20%) said that diabetes and TB can co-exist, whiles the majority (80%) did not know that diabetes and TB can co-exist and even influence the incidence rate of one another.

4.1.2.14 Knowledge of Categories of Individuals More Exposed to Tuberculosis



(Source: Field Survey, October 2014).

Figure 4.9: Responses of Respondents on People at Risk of Getting Tuberculosis

Figure 4.9: indicates the responses of one hundred and eight (187) diabetic patients on the kind of people who are more exposed to TB. Of the one hundred and eighty seven (187) respondents, eighty respondents (80) representing 43% did not know that diabetes and HIV/AIDS patients are more exposed to TB than malaria, diarrhoea and accident victims. The majority (57%) of respondents believed diabetic or HIV/AIDS patients are more exposed to TB than any other group of persons.

4.1.2.15 Knowledge of Diabetes and Tuberculosis Co-morbidity, Age and Education

The responses of the one hundred and eighty seven (187) respondents on their TB screening status were as follows; 16% (29) of them have been tested for TB, and the majority (85%) of them claimed they have never ever been tested for TB.

Also the 69% which forms majority of those tested or screened for TB were greater than or equal to forty one (≥41) years old and the remaining 31% were less than or equal to forty one

(≥ 41) years old. Of the one hundred and eighty seven (187) respondents, 36% of those who know that diabetes could predispose a person to TB were less than or equal to forty (≤ 40) years old and the majority (68%) were greater than or equal to forty one (≥ 41) years old. More so, 15% of those who did not know that diabetes can predispose a person to TB were less than or equal to forty (≤40) years old and the majority, 85% were less than or equal to forty one (≥ 41) years.

Again, of the twenty nine (29) respondents who were screened for TB, the majority (52%) had no formal education, 45% had at least primary education with the secondary and tertiary education contributing more than the primary education whilst Technical and vocational education contributed the least (3%). Similarly of the majority (158) who were not screened, 58% had no formal education at all, 38% had at least primary education and 4% for the others such as technical and vocational education. Of those who believe that diabetes can co-exist with TB, 53% of respondents had no education, 45% had at least primary school education and 2% had other form of education like vocational and technical education. In addition, 59% of those who did not know that diabetes could co-exist with TB had no formal education, 37% had at least primary school education and 4% had other forms of education.

4.1.2.16 Knowledge of the Risk of Getting Tuberculosis, Age, Sex, and Education

Of the one hundred and six respondents (106) representing 24% of those who believe diabetes and HIV/AIDS patients are more predisposed to TB were less than or equal to forty (≤ 40) years old and 76% were greater than or equal to forty one (≥41) years old. Eighty five percent (85%) of those who did not believe diabetes and HIV/AIDS patients are predisposed to TB were greater than or equal to forty one ≥ 41 years old.

Of the one hundred and six (106) respondent who believe people with diabetes and HIV/AIDS are more exposed to TB than malaria, diarrhoea and accident victims, the majority

(69%) were females; 57% of them are people who have not been to school; 40% had at least education up to primary level and 4% had other forms of education. Of those who did not know that diabetes and HIV/AIDS are risk factors for TB, the majority (80%) were females; 58% have no formal education and 42% had at least education up to the primary level.

4.1.3 Responses of Respondents on Receiving Education against Tuberculosis Infection

Regarding the responses of one hundred and eighty seven (187) respondents on education against TB infection; the majority (71%) of respondents indicated that they have never been educated against TB and only 29% of them had received education on TB infection. The majority (60%) of those who did not receive education on TB infection have had no formal education at all. Thirty eight percent (38%) of respondents had education up to primary level and 2% had technical and vocational.

Table 4.1: Outcomes of Diabetes Patients Screened for Tuberculosis

Outcome of TB test	Frequency	Percent	Cumulative Percent
Positive	5	17.2	17.2
Negative	24	82.8	82.8
Total	29	100.0	100

(Source: field survey, October 2014)

Table 4.1 indicates that of the twenty nine (29) respondents who reported to have been screened for TB, five (5) were positive and by implication 2.67% (5/187) of the registered diabetic patients are living with the disease.

4.1.4 Registered Diabetic Patients Living Tuberculosis per Education, Sex, Age, Religion

Results from the study indicates that sixty percent (60%) of the diabetic patients who tested TB positive had no formal education; eighty two percent (82%) were females and 18% male; 63% were greater than or equal to forty one (≥41) years and above; 55% were Muslims; 55% being farmers and traders; 46% earned between GH₵20-50 per month and 46% were from Tamale and it surroundings whiles the rest were from other communities across the region and beyond. Of those who were tested negative, 77% were females; 57% had no formal education and 43% had at least primary school education.

About eighty percent (80%) of those who have been tested positive said they have been kept on TB treatment drugs and 88% were reported to have been treated. The majority, 71% of those who have been treated were forty (≥41) years and above old, while about 86% of them were females with 79% of them having no formal education at all.

4.1.5 Diabetic Patient's Frequency of Testing for Tuberculosis

It was also observed that, there was a schedule in the number of times those tested positive for TB were screened.

Table 4.2: The time lapse before realizing TB infection after diabetes

Period (years)	Frequency	Valid Percent	Cumulative Percent
4 years	1	20.0	20.0
3 years	1	20.0	40.0
2 years	2	40.0	80.0
1 year	1	20.0	100.0
Total	5	100.0	

(Source: field survey, October 2014)

Table 4.2 indicates the period taken before the 2.67% individual diabetic patients realized they had also developed TB infection after having been clinically confirmed of diabetes. The majority (40%) of those with positive TB test results realized their infection status after two years of diabetes. The mean (standard deviation) period for TB infection after diabetes is three years plus or minus two years (3±2.4).

4.2 Results on Care Providers Questionnaire Interview

4.2.1 Socio-Demographic Characteristics of Care Providers

Of the thirty (30) care providers who participated in the study, 53% were staff nurses, 34% enrolled nurses and 13% clinicians. Also, 37% of them were between 21-30 years old, 17% were between 31-40 years old, 33% were between 41-50 years old, and 13% (4) were above 51 years old. Thus a mean (standard deviation) age of forty one (41) years old plus or minus three years and two months (± 3.2).

It was observed that more than half (63%) of the respondents were females and 37% males. Also 63% of them were married, 27% never married, 7% divorced and 3% widows. The

study further showed that 36% of the respondents were Dagombas, 17% Gonjas, 10% Manprusis, 3% Nanumbas and 32% were tribes other than those mentioned earlier. The result further revealed that 3% of the respondents are from Bimbila, 7% each from Damongo and Walewale, 27% from Tamale and its surroundings, and more than half (57%) were from other towns and villages across the region and beyond with the majority of them (93%) being Ghanaians. On religious denomination, fifty three percent (53%) of respondents were Christians and 47% Muslims. All the respondents have had education up to the tertiary level with 90% of them earning a monthly income between six hundred to one thousand Ghana Cedis and above (600 – 1000+).

4.2.2 Knowledge of Care Providers on Diabetes and Tuberculosis

About 83% of the care providers believed diabetes is a life style disease and as important as TB and HIV, while 17% did not believe diabetes is a lifestyle disease and as important as TB and HIV. It was also observed that 80% of care providers believe the incidence of diabetes is equally high and deadly when compared with HIV and TB; As to the reason why diabetes is as important as TB and HIV/AIDS, 67% of care providers believe diabetes is non-communicable and life style disease that has a very high morbidity and mortality rates with high economic burden.

It was also noted that a significant number (40%) did not know that type 2 diabetes is a disease for people of all ages and not a disease for only old age people. The study revealed that, 67% of care providers did not know that even though young people usually develop type 1diabetes, it does occur among adults as well.

It was further noted that clinicians form a smaller percentage (5%) of the care providers who are of the view that diabetes has a very high morbidity and mortality rates; 53% of the respondent believe there is treatment for diabetes and 47% believe there is no treatment for

diabetes for now. Of those who believe diabetes can be treated, 6% were clinicians, 63% staff nurses and 31% enrolled nurses. With those who believe diabetes cannot be treated, 21% were clinicians, 43% staff nurses and 36% enrolled nurses. About 77% believe only older people be screened for diabetes, 13% of the respondents believe all patients with the specific symptoms of diabetes be screened and 10% believe everybody visiting the hospital or clinic be screened.

Table 4.3 Care Providers Knowledge on People at the Most Risk of Diabetes

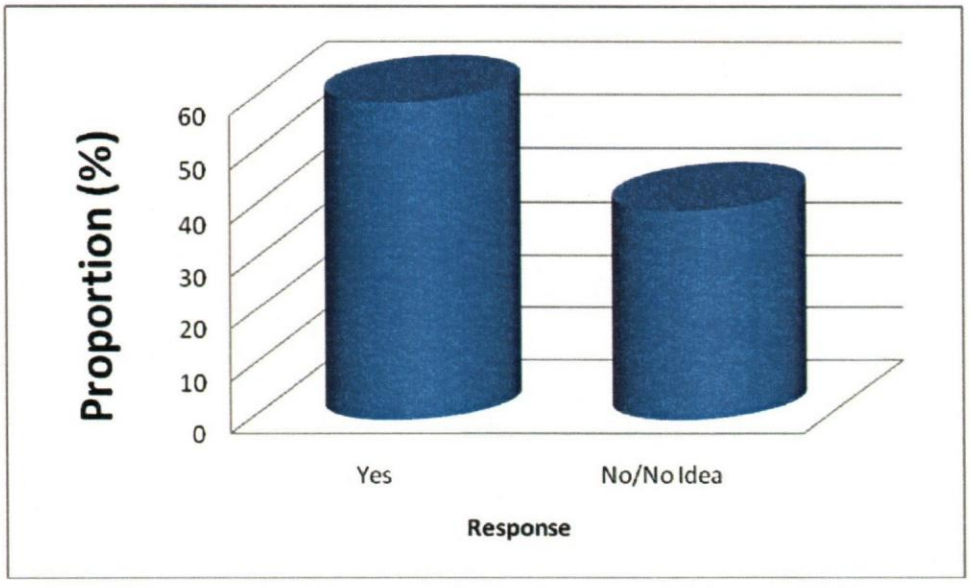
Patient type	Frequency	Percent
Malaria infected patients	22	73.3
Viral infected patients	5	16.7
People whose parents are diabetic	3	10.0
Total	**30**	**100.0**

(Source: field survey, October 20104)

Table 4.3: indicates the responses of the care providers on their knowledge of the group of patients at the most risk of diabetes. The majority (73%) of respondents believe malaria infected patients were the group of patients mostly at risk of diabetes than any other group of patients. Seventeen percent (17%) believe viral infected patients are at most risk while 10% believed those whose parents are diabetic were those at most risk of diabetes.

Also on the responses of care providers on whether there are some diseases that can predispose a patient to diabetes, 87% showed no knowledge of such disease(s) and only 13% believed there are such disease conditions that can predispose a person to diabetes. Of the 13% who believed there are disease conditions that can predispose a person to diabetes, 29% of them believed one of such predisposing diseases is HIV/AIDS.

4.2.3 Care Providers' Knowledge on Reducing the Incidence of Diabetes



(Source: Field Survey, October 2014)

Figure 4.10: Responses of Care Providers on the Possibility of Reducing the Incidence Rate of Diabetes in the Region.

Figure 4.9, above indicates responses of care providers on the perception of the possibility of reducing the incidence rates of diabetes in the region. About 60% (18) believed is possible to reduce diabetes in the region and 40% (12) of them did not believe so. On the possible measures of reducing diabetes in the region, the majority (83%) of the respondents believes early screening of suspects and taking steps to manage the condition at inception could be the best possible measure.

Again, on the way forward to ensure that the incidence rate of diabetes is reduced to the barest minimum, 50% of the care providers believed it would be possible if early screening of suspects and steps taken to manage the condition at inception are encouraged. About 20% believed the best measures are to screen all patients reporting at the health facilities while 30% believed that good eating habit is the best way to reduce the incidence rates of the

condition. Also on the reason why they stated these measures, the majority (97%) believed the number of predisposed people would have reduced if early screening of suspects is encouraged; good eating habit is adopted couple with steps taken to manage the condition at inception. On the respondents' knowledge on the kind of persons to be suspected and screened for diabetes, 87% (26/30) of them did not know the specific group of people to be suspected and screened for diabetes. In addition, on people at most risk of diabetes 90% (27/30) did not know the group of people who are at the most risk of diabetes and only 10% believed people who were at most risk of diabetes were people whose parents are diabetic.

4.2.4 Knowledge of Respondents on Diabetes and Tuberculosis Co-morbidity, and Management

Thirty two percent 32% of respondents believe there is some relationship between diabetes and TB, and that diabetes is a predisposing factor for TB, while 68% believed there is no relationship between the two disease conditions. Relating to this assertion, 84% of those who believe there is some relationship between diabetes and TB believe the best way of reducing the susceptibility of diabetic patients to TB is by early screening of diabetic patients' for TB and proceed with necessary actions such as education and treatment.

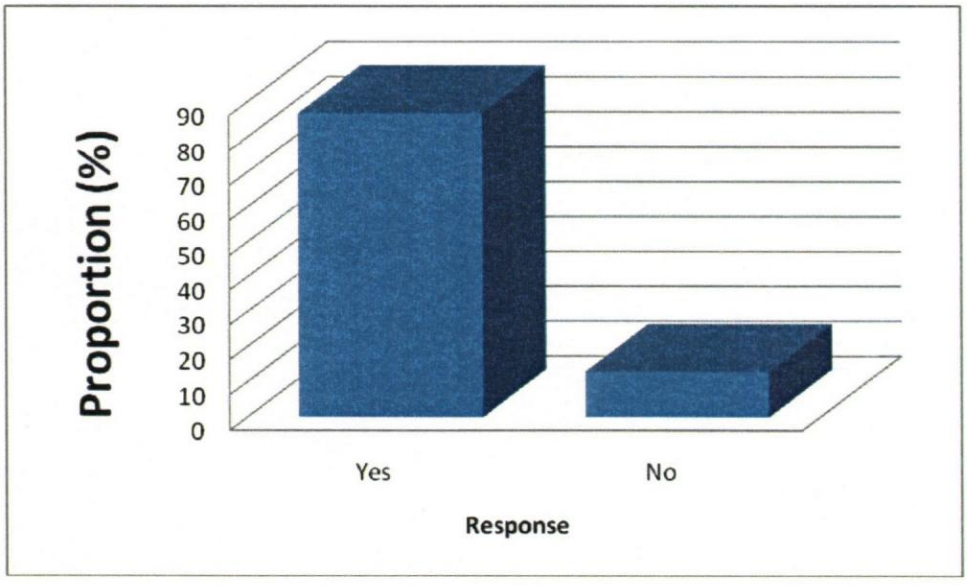
On whether most diabetic patients resident in the region were aware of the consequences of having diabetes to acquiring TB, the majority (82%) did not believe that most residents do know the consequences of having diabetes to acquiring TB. It was also observed that 72% of care providers believed it is possible to reduce the incidence of TB by reducing the incidence rate of diabetes. An attempt to find out the reason why the reduction in incidence of diabetes could influence the incidence of TB, 92% of them said a reduction in the incidence of diabetes would mean that the number of predisposed people would have reduced hence the

possibility of getting TB infection after developing diabetes would have also reduced considerably.

Furthermore, 83% of the care providers believed most practical measures to reduce TB attributable to diabetes include awareness creation, effective public education, professional support, research and policy compelling clinicians to request TB test for diabetic patients.

On the need for policy to compel all government's own health facilities to screen suspected diabetic patients for TB as it is done for TB in HIV/AIDS, 90% (27/30) of them believed there is the need for such a policy. Finally, 19% believed such action should start from the Ministry of health level, 26% believed it should start from the Ghana Health Service level and 56 % believed it should start from the Regional Health Directorates level.

4.2.5 Knowledge on Tuberculosis Relationship with Diabetes in Different Ethnic Groups and Location



(Source: Field Survey, October 2014)

Figure 4.11: TB and Diabetes Relationship in Different Ethnic Groups or Geography

Figure 4.10 indicates the responses of respondent on their perception on whether differences exist in TB attributable to diabetes in different ethnic groups or geography. About 87% (26) did not believed that difference do exist in TB relationship with diabetes in different ethnic groups or location.

4.2.6 Knowledge of Respondents on Life Style Characteristics and Diabetes Management

Knowledge of respondents on the diet type that is not advisable for diabetics to eat e.g. bread, potatoes or pasta in their day to day dealings with diabetic patients, 53% of care providers are aware that diabetics can eat all kinds of food like non-diabetic persons, except that they should eat certain foods in moderations while 47% did not know.

The study further revealed that 63% of care providers did not know that diabetics 'diet is not necessarily different from non-diabetics diets. It was also observed from this study that, 30% of them did not know that practically eating sugar do not lead a person to becoming diabetic, while the majority (70%) knew that practically eating sugar do not lead a person to becoming diabetic. It also came to light through this study that 83% of the care providers believed most residents were unaware of what the actual disease diabetes was before being admitted to the facilities while 17% of care providers believed most residents were aware of what the actual disease diabetes was.

The majority (90%) of the care providers believed it is not true that people with diabetes should not do exercises while only 10% believed it is advisable for diabetic patients not to exercise. Furthermore, 93% believed that high blood sugar levels are a sign of diabetes for all persons, thus it is possible to deduce blood sugar levels without testing. On the practical measures to reduce the incidence of TB attributable to diabetes, 77% of the care providers

believed policy formulation and awareness creation among clinicians to request TB screening for all diabetic patients is the best way to go.

4.2.7 Knowledge on Diabetes and Tuberculosis Co-morbidity and Profession

Of those who believed people whose parents are diabetic are at the most risk of diabetes, 33% were clinicians, 33% were staff nurses and 34% enrolled nurses. Interestingly, of the 13% who believed there are some disease conditions that can predispose a person to diabetes, 50% were staff nurses and 50% enrolled nurses; 75% were between 21-30 years old and 25% between 31-40 age brackets. Also of those who believe awareness creation, effective public education, professional support and research/ policy compelling clinicians to request TB test for diabetic patients, 12% were clinicians, 56% staff nurses and 32% enrolled nurses. Of those who believed giving education and professional support to all clients visiting the health facilities, 20% were clinicians, 40% each for staff nurses and enrolled nurses.

CHAPTER FIVE

DISCUSSION

5.0 Introduction

Discussion of the results of the study is presented in this chapter. Findings have been discussed in relation to the objectives and literature in similar studies.

5.1 Socio-Demographic Characteristics of the Respondents

It was observed that 3.7% of the respondents (diabetics) were between 10-20 years old and 8% were between 21-30 years old which is consistent with findings of Mugusi et al., (1990) where it was observed in Dar es Salaam, Tanzania that prevalence was greater in young Africans with low body mass index (BMI) patients with insulin dependent diabetes mellitus (IDDs) as compared to those with non-insulin-dependent diabetes mellitus (NIDDs) (9.0% vs. 2.7%). The implication is that diabetes is a disease for all ages and therefore all age groups can develop the condition.

Ghana Statistical Service (2008) found that the proportion of women who reported ill and consulted a health practitioner on one national holyday, 45% were women from rural savannah. In the current study, 74% of the diabetic patients were women. This indicates a higher percentage compared to that of GSS (2008). This implies that women are either predisposed to diseases (e.g. diabetes) than men or reported ill than men. This also implies that women consulted health care providers more frequently than their male counterparts and should be targeted for public health intervention.

An average of 31% of all adults in Ghana has never been to school as per the Ghana Living Standard Survey of 2008 compared to 57% of the current study. This indicates that education in the Tamale Metropolis in Northern Region is much lower compared to the most parts of the country. The national average for married men and women stood at 58.5% and 51% for

rural Savannah zone (GSS, 2008) compared to 50% of the current study. The rural savannah and national averages as per GSS (2008) are higher than that of the current study because of the low sample sizes of this current study.

Apart from the Northern Region, Upper East and Upper West regions are dominated by Christianity with more than 70% followers (GSS, 2008). The current study is similar to that of (GSS, 2008) where 67.9% of diabetic patients were Muslims, 29.9% Christians and A.T.R were less than 3%.

The diabetic patients were engaged in different economic activities. About 39.85% of the female respondents were traders compared with 31.3% of females found to engage in trading activities by the 2010 Population Census, and about 18.18% of the respondents were farmers. This is lower compared to the findings of the (GSS, 2008) which observed that 76.2% of all Ghanaians are engage in agricultural activities. The percentage of farmers in the current study is lower than that of the (GSS, 2008) because people who engage in agricultural activities are always involved in regular physical activities and for that matter stand the lowest chance of developing diabetes.

BeLue et al., (2009) observed that the risk groups for non-communicable diseases such as diabetes in SSA are due to certain factors (such as poverty, lifestyle and cultural factors) and this is in consistent with the current study where 30% of the respondents earn monthly incomes between GH₵ 20 and GH₵ 50. Again GH₵ 20 to GH₵ 50 earnings by the diabetic patients in this current study is much lower compared to an average of GH₵132 as monthly cash received among the employed (in Ghana) aged 15 years and older (GSS, 2008). This is evident in Northern Region during the dry season where most people are not working and exhibit sedentary life style and hence the development of diabetes.

5.2 Knowledge of Diabetic Patients and Care Providers on Diabetes and Tuberculosis

An appreciable percentage (37.4%) of the diabetic patients in Tamale never heard of diabetes before they were clinically diagnosed to have diabetes upon an ailment and this is higher than that of Restrepo et al (2011) in Mexico and Texas, where only 4% of TB patients were aware they had diabetes in Mexico and 19% in Texas before the study. It implied that if many people were not aware of diabetes in Tamale, then much public education has not been done so far on diabetes and its related complications.

Assayed et al (2013) observed that, symptoms and the onset of diabetes may be more insidious and may not be noticed. Moreover, in line with this finding, 83.3% of care providers were of the view that most of the diabetic patients did not know what the actual disease diabetes was before they were admitted to the clinic. This implies that many of the diabetic patients did not take early management measures to protect themselves against diabetes and its complications. It is important to note that awareness of early symptoms and management of the disease is recommended to avoid complications (WHO, 2014).

Young et al., (2009), observed that the cause of diabetes could be blamed on geographic and epidemiological transitions as well as urbanization and aging population. Again, CDC (2011) argued that, persons with diabetes might have developed the condition because their immune system destroyed the insulin-producing beta cells, and that a diet high in calories, which can make people overweight/obese, raises the risk of developing the condition, especially if there is a history of diabetes in one's family. However, 54.1% of the diabetic patients and 16.7% of care providers in the current study did not know the causes of diabetes and therefore related it to either the consumption of too much sugar or is ordained by God. This means that early professional education and support for diabetic patients and care providers will be of paramount importance to preventing and reducing incidence of diabetes.

WHO (2013), observed that, diabetes is generally treatable but may last a lifetime because there is no known cure to the condition. However, diabetes can be managed through physical exercises, dietary therapy and excellent body weight control to get rid of symptoms in the absence of medication (WHO, 2014). This view that diabetes is treatable is supported by 65.8% and 56.7% of the care providers and the diabetic patients respectively that diabetes is a treatable disease. This implies that more and more people are encouraged to adopt the strategies of WHO (2014).

Oputa et al., (2013), observed that there is a genetic component to diabetes but the cause is yet to be identified. About 61% of diabetic patients on one hand and 60% of the care providers on the other hand in the current study did not believe diabetes can be genetic. Most importantly 39% of diabetic patients and 40% of care providers respectively did not know that a diabetic patient cannot pass diabetes to his or her neighbor. This lack of knowledge by implication is the reason why public health interventions are needed within the shortest possible time.

It is observed from the literature that, heavy body weight, poor cardiovascular health, poor mood, poor blood sugar control, offspring of diabetic patients and people who are stressed up are more prone to diabetes than people without such conditions (CDC, 2011). Surprisingly, 90% of care providers and 86.7% of diabetic patients did not know that there are groups of persons who are more prone to diabetes than others and therefore need to be suspected and screened for diabetes. This implies that children of diabetic patients in Northern Region are at risk of developing the condition since the care providers who are responsible for educating the diabetic patients are themselves not aware that persons whose parents are diabetic are more prone to developing diabetes than persons of non-diabetic parents.

The study further revealed that 46.5% of diabetic patients and 40% of care providers believed that diabetes is a disease for only older people. This finding is not consistent with other studies. For example CDC (2011) observed that a growing number of children and teenagers are developing diabetes. CDC (2011) related this to childhood obesity, poor diet, and physical inactivity. This believe implies that many children with diabetes will not be detected and treated early since close to half of the care providers believed it is a disease of the aged.

Again the study showed that 33% of the diabetic patients and 63.3% of the care providers believed diabetic patients' diet should be different from non-diabetic people's diet. This finding is not consistent with the findings of CDC (2010) which observed that, diabetes diets are not different from other peoples' diet and explained that the diets doctors and specialized nutritionists recommend for diabetic patients are healthy foods for everybody.

Finally, this study showed that, 32.6% of diabetic patients believed that fat people eventually develop DM. A believe that did not conform to the findings of Oputa et al., (2013) who noted that, diabetes is due to poor diet and physical inactivity of its victims. This implies that if public education is not done only fat people are likely to visit health facilities to voluntarily ask for screening on diabetes and if care is not taken many slim people may suffer diabetes related complications.

5.2.1 Knowledge of Diabetic Patients and Care providers on Tuberculosis

The study revealed that, 71.1% (133/187) of the diabetic patients did not know what causes TB and therefore related it to either viral or genetic infection. This finding is not consistent with other studies such as WHO (2011) which related the causes of TB to *Mycobacterium tuberculosis* bacteria, which is contracted when tiny droplets of bacteria are inhaled usually from the coughs, sneezes, talk, or spit of an infected person. This low knowledge level can

play a role in increasing TB infection in such individuals and consequently affect the rate of transmission.

The study showed that an appreciable number, 34.2% (64) of diabetic patients did not believe TB can be treated. This finding is not consistent with Nunn et al, (2013) who observed emphatically that even though TB bacteria are very hard to kill, it is treatable with the standard WHO regimen, which is a combination of four first-line drugs taken for six months. Again, 81 cases of positive TB were recorded and a total number of 33 were cured in 2007, eighty eight (88) positive TB cases were recorded and 80 were cured in 2008 and 60 cases were reported and 56 were cured in 2009 (TMHD, 2010). This lack of knowledge on the treatment of TB could discourage TB patients from early reporting, diagnosis and prevent patients from following prescriptions as required.

5.2.2 Knowledge of Diabetic Patients and Care Providers on Life-Style Characteristics that Contribute to the development of Diabetes

The study showed that, 69% of diabetic patients and 10% care providers believed developing diabetes does not depend on whether one does an activity or not but it depends on what has been ordained to happen. WHO, (2011) however, reports that physical activity is recommended for diabetics as it is for everybody else. The implication of this finding is that most respondents lack knowledge and may not be willing to take measures to protect themselves against diabetes and consequently TB, and these kind of behavior could affect TB control interventions. Also Assayed et al (2009), observed that, good control of blood sugar is the key to avoiding diabetic complications and these include physical activity.

5.2.3 Knowledge of Diabetic Patients and Care Providers on Diabetes as a Risk Factor for Tuberculosis

Several studies have presented convincing biological evidence in support of the causal relationship between DM and impaired host immunity to TB. For example: a study reveals that neutrophils from people with diabetes had reduced chemo taxis and oxidative killing potential than those of non-diabetic controls, and leukocyte bactericidal activity was reduced in people with diabetes, especially those with poor glucose control. The study however showed that, 43% of the diabetic patients and 73% of care providers did not know the kind of disease that can easily predisposes a person to TB. Again this low knowledge level can play a role in increasing TB infection in such individuals and consequently affect the rate of transmission.

The growing burden of diabetes is contributing to sustained high levels of TB in communities, and the proportion of TB cases attributable to diabetes globally is likely to increase over time (WHO, 2011). Young et al, (2009) also observed that the increase in prevalence of diabetes may hinder efforts at TB control, and may also increase the number of susceptible individuals in populations where TB is endemic, thereby making successful treatment difficult. However, the current study further showed that 80% of the diabetic patients did not believe that diabetes and TB can co-exist and even influence the incidence of one another.

The study showed that 71% (132) of the diabetic patients have never been educated on TB since they were admitted to the diabetic clinic. This finding of the study implies that less education on TB is given by health care providers and health authorities in the region. This low level of education is corroborated by Dery, (2013), who observed that TB creates serious psychological problems for many patients in the region as they are discriminated against. The

cause of TB patients failing to report at health facilities for early detection and treatment in the region is as a result of discrimination (Dery, 2013).

5.2.4 Knowledge of Diabetic Patients and Care Providers on the Measures of Reducing the Incidence of Diabetes and Tuberculosis

To improve TB outcomes is to have regular TB tests, if one work or live in a high risk environment (CDC, 2011). The majority of the diabetic patients (62%) and care providers (60%) also share similar view as CDC, that, there is the need to screen all diabetic patients for TB. This belief is positive for improved TB case search, detection, diagnosis and treatment.

Addo et al, (2010) observed that, the laboratory is the cornerstone of any TB control programme and that the continuous training and re-training of laboratory personnel on sputum smear microscopy (SSM) and quality assurance (QA) at regular intervals do play an important role for effective and efficient TB control programme. The majority of the diabetic patients (76.7%) share similar views with Addo et al., (2010), some of which are policy formulation and awareness creation among care providers to request TB screening for all diabetic patients.

5.3 Tuberculosis and Diabetes Co-Morbidity in Tamale compared to Ghana and other parts of the world

The studies through the folder opening survey showed that, 1.07% of diabetic patients were positive for TB and that of the questionnaire administration showed that 2.7% of the diabetic patients were positive for TB. About 1.07% and or 2.7% is significant in relation to the number of positive cases per one hundred and eighty seven (187) population compared to the national (Ghana) prevalence of 0.17% (172 per 100, 000 population) in 2005 (WHO, 2010). A research conducted by WHO in 2011 revealed incidence of TB to be 0.012% (12 cases per

100,000 populations) lower than 1.07% and 2.7% of the current study. Another research conducted by WHO in the same year (2010) revealed similar low incidence of TB to be 0.04% (40 per 100,000 populations) in different geographical locations in the UK compared to the current study.

Tuberculosis incidence recorded among DM patients in this study is lower (1.07% and 2.7%) compared to a study by Sulaiman et al., (2013), where 26.7% per 338 populations had concurrent TB-DM infection. Also, the results of this current study are relatively high compared to that of the National Tuberculosis Control Programme-Ghana (82 per 100, 000 population) in (2014) probably due to the low suspicion rate on the part of care providers in this research. In other words, the incidence of TB among diabetic patients is higher in Northern Region compared to the national average and the UK. Again incidence of TB is lower (1.07% and 2.7%) compared to that of Sulaimanet al (2013) in Malaysia, probably due to low incidence of TB among diabetic patients in Northern Region than in Malaysia.

Similarly, a study by Restrepo et al (2011), found that the prevalence of diabetes among TB patients was 39% in Texas and 36% in Mexico. The seriousness of diabetes as a predisposing factor to TB is shown by the fact that diabetes contributed 25% of the TB cases studied, whereas HIV infection contributed 5% or fewer. The results of this current study are lower compared to the study result by Restrepo et al (2011), probably due to the fact that incidence of TB in Mexico-Texas border are higher than that of Northern Region, Ghana where prevalence is 1.07% and 2.7%.

Furthermore, the results of this study (1.07% and 2.7%) are lower compared to that of South Africa and Addis Ababa-Ethiopia where prevalence is 6.1% per 66 populations and 16.5% per 431 populations (Rao et. al., 1999). Again, the results of this study are lower compared to

the research conducted in South Africa and Addis Ababa-Ethiopia probably due to higher incidence in both countries than in Northern Region-Ghana.

CHAPTER SIX

KEY FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.0 Summary of Key Findings

The main objective of the study was to assess the knowledge/awareness on diabetes and tuberculosis and the co-morbidity of the two disease conditions among diabetes and care providers in the Northern Region.

The specific objectives of the study were;

1. Determine knowledge levels of diabetic patients and care providers in Tamale Metropolis of the Northern Region.

2. Determine the knowledge levels of diabetic patients and care providers on diabetes as a risk factor for TB in Tamale Metropolis of the Northern Region.

3. Determine the percentage of diabetic patients who were suspected for TB in Tamale in Northern Region.

4. Determine the prevalence of diabetic patients living with TB in Tamale Metropolis of the Northern Region.

The findings of the study include;

- A substantial percentage (37%) never heard of the disease diabetes till they were diagnosed of it and 83.3% of care providers believed the diabetic patients are not aware of what the actual disease diabetes is
- The majority (60%) of the diabetic patients and 72% of care providers believed it is possible to reduce incidence rate of TB by reducing the incidence rate of diabetes.
- Twenty three percent (23%) of the diabetic patients did not know that diabetes can be passed on from parents to their offspring.

- Over seventy one percent (71%) of the diabetic patients did not know what causes TB; 75% did not know that diabetes can predispose a person to TB; 71 % of the diabetic patients have never received education against TB while 80% of diabetic patients and 68.4% of care providers did not know that diabetes and TB can co-exist.
- Whiles the incidence of TB is about 1.07% and 2.7% per 187 registered diabetic patients, the mean (standard deviation) period for TB infection after diabetes is about three years plus or minus two years four months i.e. 3(±2.4 years).

6.1 Conclusion

In conclusion, the Millennium Development Goal(6); halving TB prevalence and death rates by 2015 will not be met since the knowledge levels on diabetes, TB and the co-morbidity of the two disease conditions is not good among care providers and diabetic patients. More so there is evidence to suggest that diabetes and TB co-exist among diabetics but suspicion rate for TB among diabetics is very low in Northern Region.

6.2 Recommendation

Based on the findings of this study, the following recommendations are made;

1. There is need for the MOH to educate care providers and diabetic patients on tuberculosis/diabetes and the co-morbidity of the two disease conditions
2. MOH should institute a policy that will compel care providers to request TB test for all diabetic patients after three years-four months of exposure to diabetes and diabetes for all TB patients.
3. There is the need for future researchers to do an extensive research with a larger sample size covering two to three years period.

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APPENDIX A

UNIVERSITY FOR DEVELOPMENT STUDIES
SCHOOL OF MEDICINE AND HEALTH SCIENCES
DEPARTMENT OF ALLIED HEALTH SCIENCES, TAMALE CAMPUS
PROGRAMME (COMMUNITY HEALTH AND DEVELOPMENT)

I am.....

This data collection tool is aimed at obtaining information on diabetes-tuberculosis co-morbidity in your facility. The data is meant for the partial fulfillment of my MSc degree in community health and development as a requirement by the university.

This facility has been attending to you and clients with tuberculosis infection and you could therefore be a good source of information that will help policy makers and implementers fine-tuned policies and strategies that will be effective for caring for patients with either of the conditions or both.

It is my humble promise that the information you give would be kept confidential, private, sacred and for academic use only. You have the option to take part in the research as a respondent or otherwise.

I therefore want to find out from you, are you willing to take part in the research as a respondent? Yes or No

INSTRUCTION TO COMPLETE FORM

Kindly Choose one of the Options provided after each Question: you may answer Yes or No, true or false and or write out where necessary depending on the particular question, as provided below.

BACKGROUND CHARACTERISTICS

1. Age: a. 10-20 [ ], b. 21-30 [ ], c. 31-40 [ ] d. 41- 50 [ ], e.51-60+ [ ]
2. Sex: a. Male [ ] b. Female [ ]

3. Ethnicity: a. Dagomba b. Gonja c. Manprushi d. Nanumba e. Others

4. Marital status: a. Married b. Never married c. Divorced. e.Widow

5. Home town/Village.....

6. Nationality.....

7. Religious Affiliation: a. Muslim b. Christian c. African Traditional Religion, d. Buddhism e. Others…….

8. Formal Educational Status: a. No Education [ ], b. Primary Education [ ], c .Secondary Education [ ] d. Tertiary Education [ ] e. Others specify……

9. Occupation: a. Farmer [ ], b. Trader [ ], c. Formal Sector Employee [ ] d. Not Employed/Retired [ ] e. Others

10. Income per month in Ghana Cedis: a. 20-50 [ ], b. 60-100 [ ], c. 150-500 [ ] d. 600-1000+ [ ] e. Others specify……

AWARENESS/KNOWLEDGE OF DIABETIC PATIENTS ON DIABETES

1. Have you ever heard of the term diabetes before you were diagnosed as a diabetic patient? a. Yes [ ], b. No [ ] c. No Idea
2. Which of these is the cause of diabetes? a. witches and wizards [ ] b. Eating too much Sugar [ ], c. Failure of the body to produce and regulate sugar [ ] d. Curse [ ] e. Others
3. Is there any treatment for diabetes? a. Yes [ ] b. No [ ], If yes or no, then specify...
4. Do you think diabetes can be prevented a. Yes [ ], b. No [ ] c. No Idea Do you
5. Do you think there are a group of people who are at the most risk of diabetes? a. Yes [ ], b. No [ ] c. No Idea. If yes or no, then specify.....
6. Is diabetes having genetic relevance anyway? a. Yes, b. No c. No Idea
7. If yes in question 6, what should be done to prevent the offspring's of diabetic patients from developing the condition? a. Early life education [ ], b. should not share

food with parents [ ], c. should not eat sugar at all [ ] d. should be isolated from Parents [ ] e. Others

8. One person can transmit diabetes to another person, a. True [ ], b. not true [ ] c. No Idea
9. Diabetes is a disease for all ages a. true [ ] b. not true [ ] c. No Idea
10. Diabetics diets are different from other people's a. true [ ], b. not true [ ] c. No Idea
11. Fat people always develop type 2 diabetes eventually a. true [ ] b. not true [ ] c. No Idea
12. People with diabetes should not exercise a. Yes [ ], b. No [ ] c. No Idea
13. It is possible for one to determine the rise or fall in his/her blood sugar levels without testing a. true [ ] b. not true [ ].If true specify how.....
14. High blood sugar levels are fine for some, while for others they are a sign of diabetes a. true [ ], b. not true [ ] c. No Idea

KNOWLEDGE/AWARENESS OF DIABETIC PATIENTS ON Tuberculosis

15. What is the cause of TB? a. Bacterial infection [ ], b. Viral infection [ ], c. Genetic [ ] d. Witches and wizards [ ] e. No Idea
16. Is there any treatment for TB? a. Yes [ ], b. No [ ] c. No Idea
17. Which of these people do you think will be more expose to TB if they live closely or share household equipment's with TB patients? a. Diabetic or HIV/AIDS patient [ ], b. Malaria patients [ ], c. Accident victims [ ], d. Diarrhoea patients [ ] e. Others Specify...

KNOWLEDGE OF TB /DIABETES CO-MORBIDITY

18. Do you think TB has a link with diabetes in anyway? a. Yes [ ] b. No [
19. Do you have tuberculosis infection? a. Yes [ ] b. No [ ]

20. If yes in 19, have you been put on treatment? a. Yes [ ] b. No [ ]

21. If yes in 20, have you been treated? a. Yes [ ] b. No [ ]

22. Diabetes can predispose a person to Tuberculosis? a. Yes [ ] b. No [ ]

23. Have you ever been told that once you have diabetes you should protect yourself against tuberculosis (TB) infection? a. Yes [ ] b. No [ ]

LIFE-STYLE CHARACTERISTICS

24. Have you ever been screened for TB? Yes [ ] b. No [ ]

25. If yes in question 24, what was the result a. positive, b. Negative

26. If positive in question 19, how long was it after you have been confirmed as a diabetic patient? Please specify.....

27. How often in a year do you do TB screening? a. Once [ ], b. Two times [ ], c. Others specify with reason.....

28. Are you conscious of what you eat and what you drink [ ]? a. Yes [ ] B. No [ ] c. No Idea

29. If yes in question 28 then why?

30. Do you eat late into the night? a. Yes [ ] b. No [ ], if yes then why?

31. Does inactivity predisposes one to diabetes? a. Yes [ ] b. No [ ] c. No Idea

MANAGEMENT OF DIABETES

32. What can we do to reduce the incidence of diabetes TB all together?

33. Should all diabetic patients be screened for TB? a. Yes [ ], b. No [ ] c. No Idea

34. Do you know of any policy compelling clinicians to request TB test for diabetic Patients? a. Yes [ ], b. No [ ] c. No Idea. If yes is it necessary?

This is the end of the interview, thank you very much for taking part in the study

APPENDIX B

UNIVERSITY FOR DEVELOPMENT STUDIES
SCHOOL OF MEDICINE AND HEALTH SCIENCES
DEPARTMENT OF ALLIED HEALTH SCIENCES, TAMALE CAMPUS
PROGRAMME (COMMUNITY HEALTH AND DEVELOPMENT)

I am……...

This data collection tool is aimed at obtaining information on diabetes-tuberculosis co-morbidity in your facility. The data is meant for the partial fulfillment of my MSc degree in community health and development as a requirement by the university.

Your facility has been operating a diabetic clinic and also attending to clients with tuberculosis infection and could give good information that will help policy makers and implementers fine-tuned policies and strategies for implementation for caring for patients with either of the conditions or both.

It is my humble promise that the information you give would be kept confidential, private, sacred and for academic use only. You have the option to take part in the research as a respondent or otherwise.

I therefore want to fine out from you, are you willing to take part in the research as a respondent? Yes or No

INSTRUCTION TO COMPLETE FORM

Kindly Choose one of the Options provided after each Question: you may answer Yes or No, true or false and or write out where necessary depending on the particular question, as provided below.

BACKGROUND/SOCIO-ECONOMIC CHARACTERISTICS

1. Age: a. 10-20 [ ], b. 21-30 [ ], c. 31-40 [ ] d. 41- 50 [ ] e.51-60+ [ ]

2. Sex: a. Male [ ] b. Female [ ]

3. Formal Educational Status: a. No Education [ ], b. Primary Education [ ], c. Secondary Education [ ] d. Tertiary Education [ ] e. Others specify.....

4. Occupation: a. Farmer [ ], b. Trader [ ], c. Formal Sector Employee [ ], d. Not Employed/Retired [ ] e. Others Specify.....

5. Position.....

KNOWLEDGE/AWARENESS OF HEALTH PROVIDERS ON DIABETES

6. What is diabetes? a. Life style disease [ ], b. Infectious disease [ ] c. Communicable disease [ ], d. Transmissible disease [ ] e. Others specify…

7. Is diabetes as important as TB and HIV/AIDs? a. Yes [ ], b. No [ ] c. No Idea

8. If Yes in question 7, then why? a. TB and HIV/AIDs are communicable [ ], b. Diabetes is Non-communicable or life style disease [ ], c. The incidence of Diabetes, can't be reduced [ ] d. Diabetes is difficult to treat [ ] e. Others specify…….

specify……

9. If No in question 7, then why? a. Diabetes, TB and HIV/AIDs have very high economic burden [ ], b. diabetes is non-communicable disease that lucks funding unlike TB and HIV/AIDs [ ], c. TB and HIV/AIDs cannot be prevented [ ], d. TB HIV/AIDs are difficult to treat and e. If others specify…….

10. Who should be screened for diabetes? a. Everybody visiting the hospital or clinic [ ], b. All patients with the specific symptoms of diabetes [ ], c.Only older people [ ] d. Only younger men and women and e. Others specify……

11. Which group of people is at the risk of developing diabetes? a. Malaria infected patients [ ], b. Viral infected patients [ ], c. People whose parents are diabetic/people with poor life style [ ], d. If others specify….

12. Do you think the exposure to some disease conditions can predispose a person to diabetes? a. Yes [ ] b. No [ ] if No skip 19

13. If Yes in question 12, which of these a. TB [ ], b. HIV/AIDS [ ], c. Malaria [ ], d. Diarrhoea [ ] e. If others specify……

14. If you choose 'b' in question 12, then why? a. diabetes is synonymous to HIV/AIDs [ ], b. HIV/AIDs weakens the immune system [ ], c. Some anti-retroviral drugs predisposes patients to diabetes [ ], d. None of the above [ ] e. If others specify……

15. If you choose 'c' in question 14, what should be done? a. Screen all HIV/AIDs patients for diabetes [ ], b. Stop given HIV Patients anti-retroviral drugs [ ], c. Both option 'a' and 'b' [ ], d. none of the above e. If others specify……

DIABETES/TUBERCULOSIS CO-MORBIDITY

16. By practice, do you think there is any link between diabetes and tuberculosis? a. Yes [ ],b. No [ ] No Idea

17. If Yes in question 16, then how? a. Diabetes predisposes a person to TB [ ], b. TB predisposes a person to diabetes [ ], c. Diabetes predisposes a person to TB and vice versa [ ], d. Diabetes is parallel to TB infection [ ] e. If others specify….

18. If you choose 'a' in question 17, then how should diabetics be manage to minimize susceptibility to TB? a. Screen every diabetic patient for TB and proceed with necessary action [ ], b. Stop diabetic patients from talking to TB patients [ ], c. Give

every diabetic patient TB treatment [ ], d. None of the above [ ] e. Others specify…… And if No end session.

19. By practice, do you think it is possible to reduce the incidence rate of diabetes in northern region? a. Yes [ ] b. No [ ]. If No skip question 27
20. If Yes in question 4, then how? a. Early screening of suspects and taking steps to manage the condition at inception [ ], b. Screening of all patients reporting at the health facilities [ ] c. Eat only when we are hungry [ ], d. Eat only homemade foods [ ] e. If others specify……..……..
21. By practice, do you think reducing the incidence rate of diabetes in northern region will go alone way to reduce the incidence rate of TB? a. Yes [ ] b. No [ ]. If No skip question 7
22. If Yes in question 6, then how? a. It will mean that the number of predisposed people would have reduced [ ], b. It will mean that the number of predisposed people would have increased [ ], c. It will mean that more people have been treated [ ], d. All of the above [ ] e. Others specify……..
23. What can we do in practice to reduce the incidence of TB attributable to diabetes? a. Awareness creation, effective public education, professional support and research/ policy compelling clinicians to request TB test for diabetic patients [ ], b. Given education and professional support to only clients visiting the health facilities, c. Both 'a' and 'b' [ ], d. None of these [ ] e. If others specify…….
24. By practice, do you think there is the need for policy to compel all government's own health facilities to screen all suspected diabetic clients for TB as is done for HIV/AIDs and TB? a. Yes [ ], b. No [ ] c. No Idea

25. If yes to question 9, what level should it start? a. Ministerial level [ ], b. Ghana Health Service level [ ], c. Regional Health Directorates [ ], d. DHMT and hospital or health facility level [ ] e. All of the above
26. By practice, is there any difference in TB attributable to Diabetes in different ethnic groups/geography? a. Yes [ ], b. No [ ] c. No Idea
27. By practice, a diabetic patient can transmit diabetes to a non-diabetic person; a. true [ ], b. not true [ ] c. No Idea
28. By practice, only older people develop type 2 diabetes a. true [ ], b. not true [ ] c. No Idea
29. By practice, only younger people develop type 1 diabetes a. true [ ], b. not true [ ] c. No Idea
30. By practice, it is not advisable for diabetics to eat bread, potatoes or pasta a. true [ ], b. not true [ ] c. No Idea
31. By practice, it is advisable that diabetes diets are different from other people's a. true [], b. not true [ ] c. No Idea
32. Practically eating too much sugar can lead a person to diabetes a. true [ ], not true [ ] c. No Idea
33. As a medical practitioner do you agree to the assertion that Children can outgrow diabetes a. true [ ], not true [ ] c. No Idea
34. As a medical practitioner do you agree to the assertion that Fat people always develop type 2 diabetes eventually? a. true [ ], b. not true [ ] c. No Idea
35. As a medical practitioner do you agree to the assertion that people with diabetes should not exercise? Yes [ ], b. No [ ] c. No Idea

36. By practice is it possible for one to know when his/her blood sugar levels are high or low without testing? a. true [ ], b. not true [ ] c. No Idea
37. Do you agree to the assertion that high blood sugar levels are fine for some, while for others they are a sign of diabetes?a. true [ ], b not true [ ] and c. No Idea
38. Do you agree to the assertion that if one has to go on insulin, this must mean ones diabetes is severe? a. true [ ], b. not true [ ] c. No Idea
39. By practice if a person has diabetes he/she cannot eat chocolates or sweets. a. true [ ], b. not true [ ] c. No Idea
40. Is it practically true that most residents of northern region are aware of what the actual disease diabetes is? a. true [ ], b. not true [ ] c. No Idea
41. If yes in question 40, do they know the consequences of having diabetes to acquiring TB? a. true [ ], b. not true [ ] c. No Idea
42. If No in question 41, what can be done practically about TB attributable to diabetes? a. policy formulation and awareness creation among clinicians to request diabetes screening for all TB patients [ ], b. Nothing can be done because diabetes is different form TB and HIV/AIDs [ ], c. Nothing can be done because of resource constrains [ ], d. None of the above [ ] e. Others specify……..
43. What other alternatives can you think about? a. Staff training/motivation [ ], b. Employ more human resource [ ] c. Increase the salaries of workers [ ], d. Screening should be made optional [ ] e. Others specify……

This is the end of the interview, thank you for taken part in the research work.

APPENDIX C

Table for Determining Sample Size from a Given Population

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364

120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note - N is population size

S is the sample size