UNIVERSITY FOR DEVELOPMENT STUDIES

DETERMINING TUBERCULOSIS (TB) TREATMENT OUTCOME AND FACTORS INFLUENCING THE TB TREATMENT OUTCOME IN THE OBUASI MUNICIPALITY OF THE ASHANTI REGION OF GHANA

ADJEI FRANK

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A THESIS SUBMITTED TO THE DEPARTMENT OF PUBLIC HEALTH, SCHOOL OF ALLIED HEALTH SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY IN COMMUNITY HEALTH AND DEVELOPMENT.

OCTOBER, 2018

DECLARATION

Student

I hereby declare that excluding precise references which have been duly acknowledged, this thesis is the result of my own original work towards an MPhil in Community Health Development and that to the best of my knowledge, it contains neither materials previously published by another person nor materials which have been presented or accepted for any other degree in this university or elsewhere.

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ABSTRACT

Tuberculosis (TB) is one of the world's most deadly communicable diseases that threatens public health globally and mostly affects persons in their productive lives. The burden of tuberculosis and its determinants are key identifiers to a successful TB management system. Retrospective study using both primary and secondary data was conducted to determine the TB case profile and factors that influence TB treatment outcome in the Obuasi Municipality from 1st January 2009 to 31st December 2014 to inform on case characteristics to improve on TB management. A total of 1,347 registered tuberculosis cases were reviewed in three (3) treatment centres in the Obuasi municipality from 2009 to 2014. The male to female ratio was 3:1 with 95.6% (1288/1347) of the cases being pulmonary and 4.4% (59/1347) extra-pulmonary tuberculosis. The pulmonary tuberculosis cases consisted of 58.9% (759/1288) and 41.1% (529/1288) sputum positive and sputum negative respectively. The treatment evaluation of the cases showed that 573 (42.5%) were cured, 441 (32.7%) completed treatment, 115 (8.5%) defaulted treatment, 110 (8.2%) died, 87 (6.5%) were transferred out, 3 (0.2%) had treatment failure and 18 (1.3%) were not evaluated. This then gave a treatment success rate of 75.2% (1014/1347). The treatment success rate of 75.2% was lower than the Ghana average for 2011 of 86.5% and WHO target of 85%. For the study involving the use of data, a total of 243 respondents were interviewed, giving a response rate of 84.7% (243/287). Of the 243 respondents, (74.9% male, 25.1% female) and 159 (65.4%) of them were treated as smear positive pulmonary TB, 78 (32.1%) were treated as smear

negative pulmonary TB and 6 (2.5%) were treated as extrapulmonary TB. The treatment outcome of the 243 respondents showed that 132 (54.3%) were cured, 87 (35.8%) completed treatment and 24 (9.9%) defaulted treatment. Respondents travelled between 5km to 20km to access TB services and collect TB drugs. Of the respondents, 134 (55.1%) had treatment supporters and 109 (44.9%) did not have treatment supporters. Also, the respondents spent between GHS 1 to GHS 30 or more any day they (patient or treatment supporter) visited the treatment centres for TB drugs as transportation and other related cost. TB treatment should be decentralized to many of the health facilities and community levels to avoid long travelling distances. All TB patients must be encouraged to have treatment supporters' especially encouraging families to support the TB patients during their treatment to ensure compliance to treatment. Health education on emphasis for treatment compliance and treatment duration should be encouraged and must be done to the level of the patients for easy understanding and compliance. Supervision and contact tracing must be enhanced to improve on case detection and treatment success.

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DEDICATION

This work is dedicated to my beloved wife, Mary Owusu, and my son, Frank Adjei Junior and my mother, Madam Ama Amankwaa.

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ACRONYMS AND ABBREVIATIONS

AFB	-	Acid-Fast Bacilli
AGA-H	-	Anglo Gold Ashanti Hospital
AIDS	-	Acquired Immunodeficiency Syndrome
ART	-	Antiretroviral Therapy
BMH	-	Bryant Mission Hospital
CDC	-	Centers for Disease Control and Prevention
CHPS	-	Community-based Health Planning and Services
DOT	-	Directly Observed Treatment
DOTS	-	The Internationally agreed strategy for TB treatment
DR-TB	-	Drug-Resistant Tuberculosis
E	-	Ethambutol
ECDC	-	European Centre for Disease Prevention and Control

Epi Info	-	Statistical Software Developed by CDC for Epidemiology
EPTB	-	Extrapulmonary Tuberculosis
GAC	-	Ghana AIDS Commission
GHS	-	Ghana Health Service
GSS	-	Ghana Statistical Service
H	-	Isoniazid
HBC	-	High Burden Country
HIV	-	Human Immunodeficiency Virus
ISTC	-	International Standard for TB Care
Km	-	Kilometre(s)
MDG	-	Millennium Development Goals
MDR-TB	-	Multi-drug Resistant Tuberculosis
MoH	-	Ministry of Health
NGO	-	Non Governmental Organization
NTP	-	National Tuberculosis Control Programme

OGH	-	Obuasi Government Hospital
OMA	-	Obuasi Municipal Assembly
PAHO	-	Pan American Health Organization
PTP	-	Pulmonary Tuberculosis
R	-	Rifampicin
S	-	Streptomycin
SPSS	-	Social Package for Social Sciences
TB	-	Tuberculosis
TB/HIV	-	HIV-related TB
UN	-	United Nations
UNAIDS	-	Joint United Nations Programme on HIV/AIDS
WHA	-	World Health Assembly
WHO	-	World Health Organization
Z	-	Pyrazinamide

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This study aims to find out number of TB patients who received TB treatment and explore factors that influence TB treatment outcome. The purpose of this introductory chapter is to provide an overview of the study. Again, the chapter introduces the problem of TB globally, in Africa and in Ghana. It states the aim, research objectives and conceptual model defining the study and how significant this study will be. Finally this chapter presents a brief overview of how the chapters are presented in the thesis.

1.1 Background to the study

Tuberculosis (TB) is a contagious airborne disease caused by the bacillus *Mycobacterium tuberculosis and Mycobacterium africanum.* It typically affects the lungs (pulmonary TB) but can also affect other organs of the body (extra pulmonary TB). In the case of Pulmonary tuberculosis (PTB), the disease can spread through air when an infected person expels the bacterium through cough, sneezing or spitting (Konstantinos, 2010; WHO, 2012a). TB remains a major global public health problem and persists as a major cause of human mortality and morbidity, affecting almost a third of the world's population (Dooley et al., 2011; WHO, 2002b). The World Health Organization (WHO) in 1993 declared TB a global emergency in recognition of the disease as a public health problem (Yahaya et al., 2014).

Tuberculosis (TB) continues to surge worldwide even after the availability of effective drugs for the treatment of the disease. The WHO estimates that in 2011, almost 8.7 million new TB cases occurred with 1.4 million mortality from the disease in the same year (WHO, 2012a). The consequences of TB on patients, families and communities through cost incurred on diagnosis, treatment, and transport to and from treatment centres and time lost from work cannot be under estimated (Barter et al., 2012; Ukwaja et al., 2013).

Global efforts to control TB were revived in 1991; this was as a result of the World Health Assembly's (WHA) recognition that TB is a major global public health problem (WHO, 1991). For effective TB control, the WHA subsequently sets global targets as part of its resolutions to include detection of at least 70% of new smear positive pulmonary TB cases and successful treatment of 85% of such cases, by the year 2000. The target date was later, revised to 2005 (WHO, 1991, 2002a, 2009b, 2009d) when it became clear that the WHA targets would not be met by 2000. The achievement of these targets would have resulted in the reduction of the prevalence, incidence, transmission and drug resistance to TB.

In 2006, progress in meeting the target numbers was substantial as case detection reached 59% (more than 57 countries met the case detection target), and treatment success reached 84% (more than 60 countries met the treatment target). Global TB epidemic declined by late 2006, however, only 25 countries have reached both the 1991 WHA targets for TB control with problem of low treatment success rates reported from Africa (72%) and Europe (75%) (Laserson & Wells, 2007; van Hest et al., 2013; WHO, 2006b). Notwithstanding the fact that the Millennium Development Goals (MDG) Report (2015) indicated declining TB incidence in all regions since 2000, the rate of decline is rather slow. The significant reduction in TB incidence with consequence reduction in the spread of the disease was expected to occur in all TB endemic areas by the year 2015. Globally, the number of people receiving tuberculosis treatment increased from 2.9 million in 1995 to 5.8 million in 2012, with treatment success rate improving each year. Indeed many developing countries exceeded in six succession years the target of 85%, set in 1991 (UN, 2015).

The low TB case detection and undesirable treatment outcomes (default, treatment failure, death and lost to follow up) threatened the success of the global TB control programme and Ghana in particular. This is because drug resistant TB continuous to be on the increase with patients spreading the infection (Namukwaya et al., 2011). Currently, the TB treatment success rate is classified as one of the indicators for the performance of many national TB control programmes. Several factors that may affect the likelihood of treatment success include the severity of disease due to delay between disease onset and initiation of treatment, co-infection with HIV, multidrug resistance, malnutrition mostly due to poverty and lack of support to patient to ensure that they complete their treatment.

The burden of TB cannot be under estimated, as it remains a major public health problem in the world. It causes ill health among millions of people each year and ranks only second to HIV/AIDs as cause of death from infectious disease (WHO, 2012a). Statistics indicate that, there were about 9 million new cases in 2011 and 1.4 million TB deaths (990,000 among HIV-negative people and 430,000 HIV-associated TB deaths) (WHO, 2012a). This occurred notwithstanding the availability of effective treatment for the diseases. TB kills more youths and adults than other infectious diseases in the world (WHO, 2008b). The disease mostly affects the poor in the society. It also affects more males than females (WHO, 2013b).

Geographically, the burden of TB is highest in Asia and Africa. South-East Asia and Western Pacific regions account for 60% of total TB cases in the world. The African region has 24% of the world's cases and the highest rates of cases and deaths per capita. The WHO has also revealed that 3.7% of all new cases and 20% of previously treated cases were estimated to have multi-drug resistance tuberculosis (MDR-TB) worldwide (WHO, 2012a). The African region has approximately one quarter of the world's cases, and the highest rates of cases and deaths relative to population (WHO, 2012a). TB was declared an African emergency in August 2005 by WHO (Yahaya et al., 2014). Out of the 22 high TB burden countries in the world, nine are in Africa (WHO, 2012a). Almost 80% of TB cases among people living with HIV reside in Africa (WHO, 2012a). Africa carried the most severe burden with 281 cases per 100,000 population in 2014 compared with global average of 133 per 100,000 population (WHO, 2015a, 2016a, 2016b).

Although Ghana is not one of the world's high-burden TB countries, the disease still remains a major cause of morbidity and mortality in the country (Dodd et al., 2014; WHO, 2012a). It is estimated that Ghana has 86 smear positive pulmonary TB cases per 100,000 population and 101 of all types of TB cases per 100,000 populations (WHO, 2012a). Over 46,000 new cases of TB are estimated annually for the country (Addo et al., 2010). WHO further estimated the mortality rate to be 75/100,000 (WHO, 2012a).

The Ghana's National TB Control Programme (NTP) adopted the global targets of detecting 70% of estimated TB cases, and curing 85% of the detected cases using the Directly Observed Treatment Short-course (DOTS) strategy. However, one major challenge facing the National TB Control Programme (NTP) is low case detection due partly to under reporting from health facilities and the issue of unsuccessful treatment outcomes (treatment failures and defualts) (Acquah et al., 2012).

1.2 Problem statement

Globally, the incidence of TB is on the increase thereby making TB still a major public health problem. Factors that account for the increase in TB cases include: poor TB case detection rate, patients' noncompliance to treatment, and multidrug resistance to TB among others. Additionally, inappropriate treatment prescribed by clinicians resulting from wrong diagnosis equally contributes to treatment delay and increase the risk of drug resistance.

The adoption of DOTS strategy is expected to result in reduced rate of treatment failure, relapse and drug resistance. However, due to non-compliance to treatment, the expected impact of the DOTS strategy in reducing the incidence of TB has become rather limited (Gebrezgabiher et al., 2016; Tessema et al., 2009). In countries where DOTS has had little impact on TB control, poor or non-compliance to self-administered TB treatment is common and has been identified as an important cause of failure of initial treatment, leading to relapse (Shargie & Lindtjorn, 2007). Several factors also determine the level of compliance at the individual level and may be variable due to several socio-economic reasons. Tuberculosis treatment outcomes are important indicators in the evaluation of the effectiveness and performance of any Tuberculosis control programme (WHO, 2012a). The WHO has set a global target in line with the Millennium Development Goals (MDG's) to achieve a successful treatment outcome of 85% and reduce mortality rates by 50% by the year 2015 (WHO, 2012a). Lower treatment success rates indicate high rates of unsuccessful treatment outcomes (default, treatment failure and death) among clients on treatment. This situation threatens the effectiveness of TB control programmes with consequences such as multiple drug resistance development which leads to prolonged treatment periods and increased cost, increased rate of transmission of the bacteria and high incidence of morbidity and mortality (WHO, 2009b).

In order to assess the factors that influence TB treatment outcome, a study was conducted in the Obuasi municipality of the Ashanti region of Ghana. The Obuasi municipality, which is characteristically commercial, has one of the highest prevalence of TB in Ghana probably due to illegal mining and congestion. The TB programme in the municipality records high number of new cases annually. From 2009 to 2014, the TB programme in the municipality registered a total of One thousand three hundred and forty-seven (1,347) TB patients, of which one thousand two hundred and forty-seven (1,247) were new TB cases. Over the years, many of these patients were successfully put on the DOTS strategy with variable outcome in the treatment regimen. While several studies on the factors associated with unsuccessful treatment outcomes have been carried out worldwide and in Sub-Saharan Africa (Ayisi et al., 2011; Datiko & Lindtjorn, 2009), not much is known in Ghana and hence this study.

1.3 Research questions

1. How many patients were put on the TB treatment from 2009 to 2014 (6 years) in the Obuasi municipality?
2. What was the outcome of TB treatment in the municipality?
3. What were some of the factors that determine the TB treatment outcome in the municipality?

1.4 Objectives of the study

1.4.1 General objective

The main objective of the study is to determine the number of TB patients who received TB treatment and factors that influence TB treatment outcome in the Obuasi municipality of the Ashanti Region of Ghana.

1.4.2 Specific objectives

1. To determine the number of patients who were put on the TB treatment from 2009 to 2014
2. To determine the TB treatment outcome among patients who received treatment
3. To determine the factors that influence TB treatment outcome

1.5 Conceptual model

A conceptual framework is an interconnected set of ideas about how a particular phenomenon operates or relates to its parts. It serves as the foundation for understanding the causal or correlational patterns of interconnections across events, ideas, observations, concepts, knowledge, interpretations and other components of experience and also assists the researcher in deciding the types of data to collect and the variables to examine (Svinicki, 2010)

Considering the level of resource investment in the TB control programme, it is appropriate to ensure the achievement of the programme objectives. The success of every programme depends on certain components. The components include inputs (resources), activities, outputs and outcomes. Programme activities or processes are things you plan to do on daily basis to ensure that the objectives of the programme are met. Outputs are tangible things or results obtained from the activities carried out and finally outcomes are the changes in persons or entire communities that results from the activities carried out.

This study adopts the management model for evaluating TB programmes by the Centres for Disease Control and Prevention (CDC). The CDC logic model for evaluating TB programmes links the above mentioned inputs, activities, outputs and outcomes as a series of if-then statements. ***If*** certain inputs were provided, ***then*** specific activities could be performed. ***If*** those activities are performed, ***then*** outputs will result. ***If*** outputs are produced, ***then*** outcomes will be achieved (CDC, 2006).

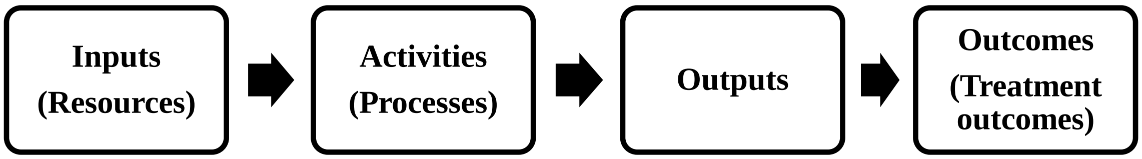


Figure 1. 1: Management model for evaluating TB programmes adopted from CDC, 2006

The CDC logic model is elaborated with respect to the Obuasi municipality TB control programme as:

Inputs or Resources: These are both human and other resources invested in the TB control programme that enables the TB programme to carry out certain activities. Typical inputs or resources provided at the municipality included: TB programme staff, funds from the NTP and partners, TB DOTS centres at the Obuasi Government Hospital (OGH), AngloGold Ashanti Hospital (AGA-H) and Bryant Mission Hospital (BMH), laboratories for sputum examination, microscopes and x-ray facilities.

Activities: TB programme activities are interrelated as changes in one activity will likely have influence on other activities. Some of the activities that was carried out are: identifying persons who have clinically TB, providing laboratory and diagnostic services, identifying and managing persons infected with *Mycobacterium tuberculosis*, providing training and education to patients and treatment supporters and collecting and analysing TB data.

Outputs: These are means to ends as outputs are noticeable things or capacities that arose from the programme activities. Outputs do not necessarily provide success programmes.

Outcome or Treatment outcomes: These are the changes in TB patients that results from TB programme activities. For example, an increase in TB patient compliance to TB treatment or changes in TB patients or care providers knowledge, attitudes, believes or behaviour. The treatment outcomes could be desirable (cured or completed treatment) or undesirable (default, died, treatment failure, relapse or transferred out) or at worse not evaluated.

1.6 Significance of the study

Tuberculosis (TB) is declining slowly each year and it was estimated that 37 million lives were saved between 2000 and 2013 through effective diagnosis and treatment. Notwithstanding, given that most TB deaths are preventable, the death rate from the disease is still too high and all efforts to combat it must be accelerated to meet the 2015 global targets which has been set within the context of the Millennium Development Goals (MDGs) (WHO, 2014b). Incidence, prevalence and mortality rates are all falling in Africa, but not fast enough to meet global targets (WHO, 2014b).

This study determined the treatment outcome of patients who sought TB treatment at the Obuasi municipality during from 2009-2014 and the associated factors that influence treatment outcomes.

These findings of the study are expected to provide a guide to programme implementers (Health Directorates, the National Tuberculosis Control Programme (NTP), Non-Governmental Organizations (NGOs) and the Ministry of Health) in adopting innovative strategies to improving the TB control programme in the Obuasi Municipality and Ghana as a whole. Again, it is hoped that the findings of the study would not only guide Ghanaian programme implementers and policy makers alone but to other setting that may be facing similar problems regarding TB control.

Lastly, it is expected that the findings from this study become a challenge for further studies and a guide for academics interested in the theme.

1.7 Justification

The past two decades have seen remarkable gains in the fight against TB. An estimated 41 million people have been successfully treated, and 6 million deaths have been averted (Ditiu, 2011). However, there still remains serious challenges to reach all people who need quality TB care. Every year as many as 4 million people with TB fail to receive such care, and their illness is never documented, and also 400,000 MDR-TB cases do not have access to proper diagnosis and treatment (Harries, 2003; WHO, 2011a). TB case-detection rates are below the WHO established targets in high-burden countries. Evaluation of national TB control programmes of adherence to widely endorsed standards of TB care might facilitate improved case finding and successful treatment outcomes (Davis et al., 2011).

According to the World Health Organisation (WHO), a TB control programme is considered effective if it ensures that at least 70% sputum smear positive patients are detected and at least 85% of newly detected patients who are microbiologically confirmed for the presence of the mycobacterium in the sputum are put on treatment (Siemion-Szczesniak & Kus, 2009). Similarly, a good programme should ensure TB treatment success rates of more than 95% and a reduction in treatment failure to 5% or less (WHO, 2012a).

This study therefore aimed to determine the number of patients put on TB treatment between 2009 and 2014 and also to determine the outcome of treatment in Obuasi municipality**.** This would contribute to the existing body of knowledge on factors associated with unfavourable TB treatment outcomes. The findings from the study would also benefit patients in the future as the results may be used to formulate strategies to improve the quality of care.

1.8 Definition of key concepts

Bacteriologically confirmed TB case: Is a patient from whom a biological specimen is positive by smear microscopy, culture or WHO-approved rapid diagnostic test.

Clinically diagnosed TB case: Is a patient who does not fulfil the criteria for bacteriologically confirmed TB but has been diagnosed with active TB by a clinician or cases diagnosed on the basis of x-ray abnormalities or suggestive histology and extrapulmonary cases without laboratory confirmation.

Pulmonary TB case: Is any bacteriologically confirmed or clinically diagnosed case of TB involving the lung.

Smear positive pulmonary TB case: A patient with one or more initial sputum smear examinations (direct smear microscopy) AFB-positive; or one sputum examination AFB positive plus radiographic abnormalities consistent with active pulmonary TB as determined by a clinician.

Smear negative pulmonary TB case: A patient with two sputum smear examinations negative for AFB but radiographic (X-ray) suggests TB and a decision by a clinician to treat with anti-tuberculosis chemotherapy.

Extrapulmonary TB case: Is any bacteriologically confirmed or clinically diagnosed case of TB involving organs other than the lungs, e.g. abdomen, genitourinary tract, joints and bones, lymph nodes, meninges, pleura, skin.

New TB case: Is a patient who has never been treated for TB or has taken anti-TB drugs for less than one month.

Retreatment TB case: Is a patient who has been treated for one month or more with anti-TB drugs in the past.

Relapse: A TB patient who have previously been treated for TB, were declared cured or treatment completed at the end of their most recent treatment and are now diagnosed with a recurrent episode of TB.

TB/HIV co-infection: A patient who is infected with both TB and HIV.

DOTS: Is an internationally recognized strategy adopted for the implementation of the national tuberculosis control programme (NTP). The DOTS strategy has five main components, namely: case detection, directly observed treatment of patients with drugs, continuous supply of drugs, case (contact) tracing and recording systems and research.

Treatment supporter: Is a person selected by TB patients and who is trained to supervise the patient to take his or her TB drugs on daily basis. The role of the treatment supporter is to make sure the TB patient takes his or her drugs daily and regularly for the required treatment duration. Sometimes, the treatment supporter collects the TB drugs from the health facilities for the TB patients.

Cured: A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear-negative or culture-negative in the last month of treatment and on at least one previous occasion.

Completed treatment: A TB patient who completed treatment without evidence of failure but with no record to show sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are not available.

Died: A patient who died from any cause during treatment.

Treatment failure: A TB patient who was sputum smear positive at the beginning of treatment and who remained sputum smear or culture positive at month 5 or later after starting treatment.

Default or Lost to follow-up: A TB patient who was registered but did not start treatment or a TB patient whose treatment was interrupted for at least two consecutive months or more after initiation of treatment. In this study a defaulter is a TB patient who was registered at the TB treatment centre and put on treatment but interrupted treatment for at least two months.

Not evaluated: A TB patient for whom no treatment outcome is assigned. This includes transferred out TB patients.

Successful outcome: If TB patients were cured (negative smear microscopy at the end of treatment and on at least one previous follow-up test) or completed treatment with resolution of symptoms.

Unsuccessful outcome: If treatment resulted in treatment failure (remaining smear-positive after 5 months of treatment), defaulted (patients who interrupted their treatment for two consecutive months or more after registration), or died.

Complete data: Where all information needed to be retrieved on TB cards are available.

Incomplete data: If any one of the information which will be retrieved on TB cards (e.g. age, sex, disease classification, smear results, treatment outcome) is missing (Gebrezgabiher et al., 2016; WHO, 2009c, 2010d, 2013a, 2013b).

1.9 Structure of the thesis

The study is compiled into a six-chapter MPhil thesis. Chapter one is the introduction and addresses issues concerning background information of the study. The chapter also looks at the problem statement, the study research questions and objectives, conceptual model of the study, significance and justification.

In Chapter two, relevant literature from peer reviewed journals and other official documentation concerning this study is reviewed in line with the research questions to expose gaps that this study addressed and also emphases on the historical and epidemiological perspective of tuberculosis (TB). Again, factors that influence compliance to TB treatment have also been reviewed and presented as well in the chapter two.

The chapter three addresses issues of the research methodology used in this study. This chapter describe the background of the study area, study type and design, population, study variables data collection procedure and data analysis. This chapter also looks at quality control and ethical considerations.

In chapter four, a presentation of the study results or findings both from the field and data review are presented in two parts; the first part presents the results of the retrospective review of the TB treatment programme while the second part presents the interview results of TB patients in the Obuasi Municipality.

Chapter five involves discussions of results in relation to existing literature from other studies on the study subject and in chapter six, the summary of the findings, conclusion and recommendations are presented base on several issues that have being discussed.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In accordance with the aim of this study, namely to determine the number TB patients who received TB treatment and factors that influence TB treatment outcome in the Obuasi municipality of the Ashanti Region of Ghana, this chapter reviews relevant literature from previous related studies on TB all over the world, mainly on TB treatment issues.

A literature review is an organised and systematic presentation of what has already been studied and published on a particular subject, with the purpose of informing the researcher on what is already known about that subject (Burns & Grove, 2005) and avoid unnecessary replication which wastes resources.

2.1 Definition, causes, symptoms and transmission of tuberculosis (TB)

2.1.1 Definition and causes of TB

Tuberculosis (TB) is a contagious and airborne disease caused by the bacillus *Mycobacterium tuberculosis (M. tuberculosis)* (Udwadia, 2012; WHO, 2012a). In a study, Konstantinos defined TB as a disease caused by *Mycobacterium africanum (M. africanum) (Konstantinos, 2010).* There are other related infectious mycobacterial species

(M. bovis, M. microti, M. caprae, M. pinnipedii, M. canetti and M. mungi) which together form the *M. tuberculosis complex*, and most but not all of these species have been found to cause diseases in humans (CDC, 2013). The most frequent organism involved in human disease is the *Mycobacterium tuberculosis* (*M. tuberculosis*). Some studies conducted in Burkina Faso and Cameroun associate *M. tuberculosis* species as the main causative agent of pulmonary tuberculosis (Godreuil et al., 2007). Similarly, some studies conducted in Ghana have shown that *M. tuberculosis* accounted for about 73% of pulmonary tuberculosis cases whilst *M. africanum* and *M. bovis* accounted for about 23% and 3% respectively (Addo et al., 2007; Addo et al., 2010). People infected with TB bacilli may be asymptomatic yet may still require treatment to prevent TB disease from developing in the future (CDC, 2016). The main cause of infection is untreated smear-positive pulmonary tuberculosis (PTB) patient discharging the bacilli (WHO, 2012a). The disease most commonly affects the lungs (PTB), but sometimes affects other parts of the body (EPTB) (CDC, 2005a). An individual only needs just a small amount of bacilli to be infected with TB. Although WHO (2013) asserts that TB is preventable and curable, the disease is still a major public health problem since its re-emergence in the 1990s and still persist as a major cause of human mortality and morbidity (Garrido et al., 2012; WHO, 2002b). It is postulated that if stringent control measures are not implemented, approximately 1 billion people will become infected, 150 million will become symptomatic and 36 million will die from TB between 2002 and 2020 (Chung et al., 2007). A comparatively small proportion of people infected with *Mycobacterium*

tuberculosis will develop TB disease and the probability of developing TB is much higher among people infected with the human immunodeficiency virus (HIV) according to the WHO, (2012). It is also the position of the WHO that the disease is also more common among men than women, and affects mostly adults in the economically productive age groups; around two-thirds of cases are estimated to occur among people aged 15–59 years (Chennaveerappa et al., 2011; WHO, 2013b).

2.1.2 Signs and symptoms of TB

Although one's body may be able to harbour the TB bacteria, individual's immune system can prevent him or her from getting TB. This makes the onset of TB gradual. Signs and symptoms of TB may last for several weeks if not treated and it can progress to a severe disease and may cause death. The signs and symptoms of TB infection includes low grade fever, chronic cough lasting for three or more weeks (with or without blood), chest pain, unintentional weight loss, fatigue, chills, night sweats and loss of appetite (Chris & Peter, 2005; Ninet et al., 2011).

2.1.3 TB transmission

TB is airborne and hence TB is transmitted from person to person in the air when people who are sick with pulmonary TB expel the bacteria either by coughing, sneezing, laughing or singing. The infection is transmitted when the other person breathes in these droplets containing bacilli (WHO, 2012a, 2013b, 2014b). Once infected with

Mycobacterium tuberculosis, the infected person stays infected for life. However, this certainly does not mean that the person is ill. This is because most people have strong immune systems to fight and overcome the infection. Nonetheless, some of these infected people may develop symptoms of TB at any time. Patients with weakened immune systems, including those with HIV infection, diabetes, malnutrition, people at the extreme age brackets and health workers taking care of TB patients are at greater risk of developing TB (CDC, 2016; WHO, 2016b).

2.2 Risk factors

Risk factors are those that predispose persons to TB. Anyone is at risk of TB infection, however, TB mostly affects adults in their most productive years (CDC, 2016; WHO, 2016b). When an individual is infected with the TB bacilli, he or she has a higher chance of getting the disease if the person has compromise medical conditions such as HIV & AIDS, diabetes, and other unhealthy lifestyles such as alcoholism and drug use (CDC, 2005a) and also people who have recently been infected with the TB bacteria in the last two years, persons who were not treated correctly for TB in the past, children younger than 5 years of age and certain occupations such as health workers who works with TB patients (CDC, 2016; WHO, 2016b).

2.2.1 HIV and AIDS

TB is the most frequent AIDS defining disease and in many African countries more than half of the TB patients are diagnosed with HIV when active TB is detected (Taarnhoj et al., 2011).

There is a complex interaction that exists between TB and HIV infection. TB due to *Mycobacterium tuberculosis* and Human Immunodeficiency Virus (HIV) disease have been inextricably linked from the earliest years of the HIV/AIDS (Acquired Immunodeficiency Syndrome epidemic (Quinn et al., 2001). Their dangerous synergy affects all aspects of both diseases, from pathogenesis and the epidemiologic profile, to clinical presentation, treatment, and prevention. This synergy also impacts larger societal issues with demographic, economic, and even political consequences (Friedland et al., 2007). HIV increases the risk of patients to TB infection. HIV & AIDS break down the immune system of infected persons. This situation can facilitate the reactivation of latent TB infection (LTBI) and increases the progression to active disease (Horsburgh & Rubin, 2011). TB can also affect HIV infection and is now the most common opportunistic infection in individuals being treated with antiretroviral therapy especially in the developing world. It may present as the first manifestation of HIV infection (Idemyor, 2007). Therefore, more efforts should be made to ensure an early and correct diagnosis, initiation of correct treatment and compliance to TB treatment to increase the chances of cure or treatment success (Bonilla et al., 2008).

People living with HIV who are also infected with TB are much more likely to develop TB disease than those who are HIV negative (WHO, 2012a). The annual risk of developing active TB is 5-15%, considerably higher in HIV positive individuals than those who are not infected. Among persons who are dually infected, the risk of active TB increases as the immune deficiency progresses (Idemyor, 2007).

TB-HIV co-infection has fatal consequences as TB becomes the leading cause of death in HIV infected individuals and patients with acquired immunodeficiency syndrome (AIDS). Death rates in TB patients from sub-Saharan countries where HIV is highly prevalent have risen substantially over the last few decades (Harries, 2000). A substantial amount of these deaths occur early in the course of treatment (Shaweno & Worku, 2012; Sileshi et al., 2013; Zachariah et al., 2002) which threatens the credibility of public health interventions to control TB in the eyes of the patients, health care providers, and the community. HIV affects the performance of TB control programmes by increasing the number of TB cases and as well compromises the treatment outcomes. HIV therefore creates a huge task to the already understaffed and overburdened health system in high burden countries. This then accounts for the high rate of treatment failures, defaulters and deaths, which in turn compromised the progress towards achieving the targets recommended for TB control under directly observed therapy short course (DOTS) strategy.

An issue of global concern now is the emergence of drug-resistant tuberculosis among TB/HIV infected patients which is on the increase in many countries worldwide (Sisay et al., 2014; WHO, 2012a; Woldeyohannes et al., 2011). At global TB control level, a better understanding needs to be developed on how HIV infection impacts the epidemiology of drug resistance TB in order that there will not be "a perfect storm" of a massive MDR TB/HIV co-epidemic (Suchindran et al., 2009).

Globally, there were an estimated 1.1 million (13.0%) of the 9 million people that developed TB in 2013 were co-infected with HIV (WHO, 2012a, 2014b). The African region accounted for about seventy nine percent (79%) of these TB-HIV co-infections occurred worldwide (WHO, 2012a, 2014b). Among the highest HIV/TB burden countries in Africa are Lesotho and Swaziland both with 74% (WHO, 2014b). The number of people dying from HIV-associated TB has been falling since 2004. However, globally in 2012, there were still 320000 deaths among people who were HIV-positive (WHO, 2013b) and 360000 deaths from HIV-associated TB in 2013 (WHO, 2014b) with approximately equal numbers among men and women. WHO, UNAIDS and the Stop TB Partnership have set a target of halving TB mortality rates among people who are HIV positive by 2015 compared with 2004 (the year in which TB mortality among HIV positive people was estimated to have peaked).

Preventing TB deaths among people living with HIV requires intensified scale-up of TB prevention, diagnosis and treatment interventions and early initiation of ART among people living with HIV and those with HIV-associated TB. There is both an epidemiological and clinical association linking the two diseases. Hence, TB-HIV collaboration is an appropriate intervention that can improve TB case finding in HIV infected individuals and reduce the risk of HIV infection in TB patients. People at the extreme age groups (children and elderly people) also have a much higher chance of getting TB disease due to the decrease body's defences mechanisms (CDC, 2005a). again, further scale-up of collaborative TB/HIV activities could be facilitated by joint TB and HIV programming, which would help to overcome constraints, promote synergies and achieve efficiency gains, especially between TB and HIV programmes (WHO, 2012b, 2014b).

It has been reported that patients with TB-HIV comorbidity are significantly more likely to default (Muture et al., 2011). However, there are some contrasting study from Nigeria which found no difference between HIV infected and non-infected TB patients with regard to treatment default (Amoran et al., 2011).

Although Ghana has a stable HIV epidemic, 23% of all TB cases are amongst persons living with HIV/AIDs (GAC, 2009). The Ghana AIDS Commission (GAC) further indicated that integration of HIV and TB services is good though difficult, and the idea of collaboration and providing both services together has already resulted in significant benefits.

2.2.2 Alcoholism, tobacco smoking and other substance abuse

There is scientific evidence indicating the relationship between addictive drugs abuse and increase susceptibility to infections. Drugs such as heroin, cocaine, marijuana and other substances such as alcohol alter the abusers neuropsychological and pathophysiological responses and also are capable of altering the immune system. Immune suppression caused by drugs may increase the individual substance abusers susceptibility to infections (Vassoler et al., 2014). People who misuse drugs or alcohol have a greater risk of contracting TB. Vassoler et al. (2014) also reported that 1 in 5 TB patients in the United States of America use illicit drugs or drink alcohol in an excess. This is because alcohol and drugs damage a person's body and weaken their immune defenses against illnesses such as TB. They may not eat a diet that provides all the nutrients they need to stay healthy, and may spend time in places where it is easier for TB to spread, such as crowded or poorly ventilated homes or social venues. They may be around other people who have infectious TB, but do not know it. The symptoms of TB can be concealed by drink and drugs and such patients may be less likely to seek early treatment. Also, substance abusers have a record of poor adherence to treatment which may cause the progression of latent TB infection to active disease. This means they then pose an increased risk of passing infectious TB on to others and/or developing drug-resistant TB.

It has also been reported that alcohol and other substance abuse are one of the reasons for poor TB treatment outcome. TB treatment can be complicated in people with drug and alcohol issues because: TB medication can lead to side effects such as liver toxicity, which is particularly dangerous for people who drink too much alcohol, for example excessive alcohol use is a significant predictor of TB drug induces liver injury (Thompson et al., 1995). Moreover, people who inject drugs are at risk of co-infection with viral hepatitis and/or HIV, which require careful monitoring and alternative drug-regimens. In other cases, substance and drug interactions may make drugs harmful or even toxic to the body. It may cause problems such as headache, drowsiness, nausea and vomiting among others which may be attributed to the drug as side effects. Another negative effect of smoking is the financial burden it puts on patients who smoke. This is against the background that TB is a poverty related disease and most patients are usually poor. Such patients may worsen their financial situation while they continue to smoke.

According to a study conducted by Mature et al., (2011), recurring use of alcohol is mostly associated with noncompliance with medication. When one is under the influence of alcohol s/he is likely to forget to take the medicines. According to a study conducted by Gelmanova et al (2013), substance abuse was associated with non-compliance to medication. The findings showed that substance abusers were about seven (7) times more likely not to comply to medication and two (2) times more likely to have poor TB treatment outcome (Gelmanova et al., 2007). This then indicates that TB programmes should also aim at improving compliance by diagnosing and treating substance abuse concurrently with standard TB therapy (Gelmomanova et al, 2007). Similarly, a study by Chiang et al., (2012) supports other findings that tobacco smoking is a risk factor to unsuccessful TB treatment outcome.

2.3 Type of disease

Tuberculosis (TB) disease is an infectious disease that can result from either rapidly progressive disease following recent infection with *Mycobacterium tuberculosis* or from reactivation of latent TB infection. However, reactivation of the disease predominates in countries that have achieved good control of transmission, but most disease in endemic countries is due to recently transmitted infection (Dye et al., 2002). The directly observed treatment short course (DOTS) TB control strategy initiated by the World Health Organization (WHO), aims to reduce the burden of prevalent smear-positive TB through prompt diagnosis and effective treatment of symptomatic patients with infectious disease (Dye et al., 2002). TB can be as pulmonary tuberculosis (PTB) and extra-pulmonary tuberculosis (EPTB).

2.3.1 Pulmonary tuberculosis (PTB)

Pulmonary tuberculosis (TB) remains an important public health problem with an estimated 9.27 million new cases worldwide in 2007 (Donald & van Helden, 2009). According to the current treatment guidelines, isolation of *Mycobacterium tuberculosis* from a sputum culture is still recommended to confirm the diagnosis of pulmonary TB (Blumberg et al., 2003). Pulmonary TB is curable with an early diagnoses and initiation of treatment. Pulmonary TB is classified into smear positive pulmonary TB and smear negative pulmonary TB. Both smear-positive and smear-negative patients are treated as pulmonary TB (PTB) (Sreeramareddy et al., 2008). Standard 2 of the International

Standards for TB Care (ISTC) states that all patients suspected of having pulmonary TB should submit at least two sputum specimens for microscopic examination in a quality-assured laboratory. Again, ISTC Standard 4 states that all persons with chest radiographic findings suggestive of TB should submit sputum specimens for microbiological examination (ISTC, 2009; WHO, 2009c). When people with PTB especially smear positive PTB, coughs, sneezes or spits, they propel the TB germs into the air (WHO, 2016b). Treatment of active pulmonary TB patients remains the most effective strategy to stop the spread of the disease (Ali & Prins, 2016; Muture et al., 2011).

Smear Positive Pulmonary TB

Smear-positive cases are the most infectious and most likely to transmit the disease into their surroundings. They are the focus for infection control measures (WHO, 2009e) and contact investigations (WHO, 2008c). Bacteriological monitoring of treatment progress is most feasible and practicable in these patients (WHO, 2009c).

Acid-fast bacilli (AFB) smear-positive sputum is usually an initial clue in the diagnosis of pulmonary tuberculosis (TB). A case of pulmonary TB is considered to be smear positive pulmonary TB if the TB patient had at least two sputum specimens which were positive for Acid Fast Bacilli (AFB) by microscopy at the start of treatment, or a patient with only one sputum specimen which was positive for AFB by microscopy, and chest radiographic abnormalities consistent with active pulmonary TB (Sreeramareddy et al., 2008; Tessema et al., 2009; WHO, 2002b).

Smear-Negative Pulmonary TB

Although, smear-negative TB are not infectious as smear-positive TB, it is also important to identify smear-negative cases especially in persons living with HIV for whom mortality is higher than in smear-positive pulmonary TB cases (WHO, 2007). A smear-negative pulmonary TB patient is one with symptoms suggestive of TB, with at least two sputum specimens which were negative for AFB by microscopy, and with chest radiographic abnormalities compatible with active pulmonary TB (including interstitial or miliary abnormal images), or a patient with two sets of at least two sputum specimens taken at least two weeks apart, and which were negative for AFB by microscopy, and radiographic abnormalities consistent with pulmonary TB and lack of clinical response to one week of broad spectrum antibiotic therapy (Sreeramareddy et al., 2008; Tessema et al., 2009; WHO, 2002b).

2.3.2 Extra-Pulmonary Tuberculosis (EPTB)

Extra-pulmonary tuberculosis (TB) includes tuberculosis of organs other than the lungs, such as lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges, etc. Diagnosis of EPTB should be based on at least one specimen with confirmed *Mycobacterium tuberculosis* or histological or biochemical analyses of cerebrospinal/pleural/ascitic fluid or strong clinical evidence consistent with active extrapulmonary tuberculosis, followed by a decision of a clinician to treat with a full course of anti-tuberculosis chemotherapy (Sreeramareddy et al., 2008; Tessema et al., 2009; WHO, 2002b, 2009c). Additionally, standard 3 of the ISTC states that for patients suspected of having EPTB, specimens should be obtained from the suspected sites of involvement and where available, culture and histopathological examination should also be carried out in addition to a chest X-ray and examination of sputum may be useful, especially in persons with HIV infection.

2.4 Distribution of the disease

2.4.1 Global

According to the 2015 global tuberculosis report, tuberculosis (TB) is a major global health problem (WHO, 2015a). It causes ill-health among millions of people each year and ranks alongside the human immunodeficiency virus (HIV) as a leading cause of death worldwide (WHO, 2015a). In 2014, there were an estimated 9.6 million new TB cases and there were also 1.5 million TB deaths (WHO, 2015a). Of the 9.6 million new TB cases in 2014, 58% were in the Southeast Asia and Western Pacific Regions. The African Region had 28% of the world's cases in 2014 (WHO, 2015a). Globally, TB prevalence in 2015 was 42% lower than that in 1990 (WHO, 2015a). The World Health Organization (WHO) declared TB a global public health emergency in 1993. Starting in the mid-1990s, efforts to improve TB care and control intensified at national and international levels. WHO developed the Directly Observed Treatment, Short-Course (DOTS) strategy and within a decade, almost all countries had adopted the strategy, and there was considerable progress towards global targets established for 2005 (WHO, 2012a).

The growing HIV epidemic represents a great challenge for the National Tuberculosis Programmes, which are seeing an increase in HIV infection among TB cases and the appearance of new TB cases among persons infected with HIV. This is compromising health system performance and National Tuberculosis Program efficiency due to increased TB incidence, case-fatality, treatment abandonment, and challenges for the comprehensive treatment of both diseases (PAHO, 2006). Globally, in 2014, there were an estimated 1.2 million new HIV positive TB cases and almost three-quarters of these cases were in the African Region (WHO, 2015a).

Despite the availability of effective drugs, tuberculosis (TB) is still a global emergency and one of the major public health problems in the 21st century (Santos, 2012). It is not only a public health problem, but also a socio-economic issue (Liu et al., 2005). According to the Global TB Report, in 2013 alone an estimated 9.0 million people developed TB and 1.5 million died from the disease, 360,000 of whom were HIV positive. Of the estimated 9 million people who developed TB in 2013, more than half (56%) were in the South-East Asia and Western Pacific Regions and 29% were in the African Region. The highest rates of cases and deaths out of the total population occurred in the African Region (WHO, 2014b). This occurred notwithstanding the availability of effective treatment for the diseases. TB is present in all regions of the world (WHO, 2014b, 2016b), however, geographically, the burden of TB is highest in Asia and Africa (WHO, 2012a, 2013b, 2016b).

The Global strategy for TB control has three main components with various activities to be accomplished after the year 2015. The various components and underlying activities are:

1. **Integrated, Patient-Centred Care and Prevention**

- Early diagnosis of tuberculosis including universal drug-susceptibility testing, and systematic screening of contacts and high-risk groups
- Treatment of all people with tuberculosis including drug-resistant tuberculosis, and patient support
- Collaborative tuberculosis/HIV activities and management of co-morbidities
- Preventive treatment of persons at high risk, and vaccination against tuberculosis

2. **Bold Policies and Supportive Systems**

- Political commitment with adequate resources for tuberculosis care and prevention
- Engagement of communities, civil society organizations, and public and private care providers

- Universal health coverage policy, and regulatory frameworks for case notification, vital registration, quality and rational use of medicines, and infection control

- Social protection, poverty alleviation and actions on other determinants of tuberculosis

3. **Intensified Research and Innovation**

- Discovery, development and rapid uptake of new tools, interventions and strategies

- Research to optimize implementation and impact, and promote innovations (WHO, 2013b, 2014a)

2.4.2 Sub-Saharan Africa

Tuberculosis (TB) was declared as an African emergency in August 2005 by WHO (WHO, 2005; Yahaya et al., 2014). Of the 22 TB "high burden" countries in the world which account for 81% of all the estimated TB cases worldwide in 2012, nine of these countries are from Africa (WHO, 2012a) but have been reduced to eight Africa (WHO, 2014b). The incidence of tuberculosis has increased about ten times in the Sub-Saharan Africa (SSA), even though the global incidence has been falling in many parts of the world (Barker, 2008). The WHO (2012) report also indicated that the African Region, has the highest rates of TB cases and contributes 24% overall of the world's TB cases.

The African Region accounts for about four out of every five HIV-positive TB cases and TB deaths. Africa carried the most severe burden with 281 cases per 100,000 population in 2014 compared with global average of 133 per 100,000 population (WHO, 2016a). Twelve out of the 15 countries estimated to have the highest TB incidence are in Africa; among them are Nigeria and Ethiopia (WHO, 2010b). However, Ghana is not among the most endemic TB countries (WHO, 2010b).

2.4.3 Ghana

According to the WHO (2010), there was an estimated 86 smear positive pulmonary TB cases per 100,000 population and 106 per 100, 000 of all types of TB cases per year in Ghana. This means a population of 24 million should expect about 26,000 TB cases annually, but only 15,800 cases were reported in the country in 2011 with 50% smear positive cases (Addo et al., 2010; NTP, 2012). Again, the National Tuberculosis Control Programme (NTP, 2012) training manual reveals that the reasons for low detection could be due to non-reportage of TB cases to health facilities, missed diagnosis and failure to conduct contact tracing and investigation routinely and non-capturing by the disease surveillance system.

Despite the fact that Ghana is not one of the high burden TB countries in Africa, it nevertheless considers TB as an important health challenge. Together with HIV, they account for about 7% of all deaths, the second after malaria (Dodd et al., 2014; GHS, 2010; WHO, 2010b, 2012a).

The NTP was established in 1994 and has implemented the WHO recommended DOTS Strategy since its inception. The NTP achieved 100% coverage countrywide within the public health sector by the year 2000 (NTP, 2011). Currently, the NTP is implementing the new Stop TB Strategy of WHO to achieve the 2015 TB related Millennium target (NTP, 2011). The NTP has attain a remarkable progress in terms of TB treatment success rate which has increased from 54% in 1995 to 86% in 2008 (NTP, 2011), however, TB mortality increased from 3.4% in 1996 to a high of 8.6% in 2004 (GHS, 2007; WHO, 2010b). Ghana has a low TB case detection rate which is currently estimated at 31% which is by far below the 50% African Average and 70% Global target (Acquah et al., 2012; NTP, 2011). Though the Ghanaian population comprises of more females (51%) than males, there are more male TB cases notified to the NTP than female and about 4% of notified TB cases are children aged below 15 years (GHS, 2010).

2.5 Impact of disease

Tuberculosis (TB) is a global disease that occurs in every part of the world. TB is the leading infectious cause of death worldwide and can be spread by coughing, sneezing or spiting into the air. The World Health Organization (WHO) in 2016 indicated that the largest number of new TB cases occurred in Asia, with 45% of new cases, followed by Africa, with 25% of new cases (WHO, 2016b). It is responsible for economic devastation and the cycle of poverty and illness that entraps families, communities and even entire countries. Among the most vulnerable are women, children, and those with HIV/AIDS.

Sputum smear microscopy remains the backbone in the diagnosis of pulmonary tuberculosis (PTB) in many developing countries including Ghana. Sensitivity (the probability of finding the acid fast bacilli if present) during sputum smear microscopy depends on many factors like quality of sputum obtained from patients, concentration of bacilli in the sputum, skill of the laboratory personnel in staining procedures, and duration between sputum sample collection and smear examination (Chinnakali et al., 2014; Sakundarno et al., 2009). However, grading of sputum smear microscopy in a patient population may differ due to difference in patient characteristics like the severity of disease, HIV status, and previous or current medication (Chinnakali et al., 2014; Elliott et al., 1993; Raviglione et al., 1992).

Grading of sputum smear can be used as crude indicator of transmissibility of tuberculosis from patients to household and other contacts (Chinnakali et al., 2014; Liippo et al., 1993; Tiwari et al., 2012). Low bacilli counts are more difficult to find in sputum microscopy examination compared to higher counts (grade) and thus are more likely to be missed (Ramsay, Bonnet, Gagnidze, Githui, Varaine, & Gu´erin, 2009). The frequency of low bacilli count grading results compared with high count grading has been considered as an indicator of the quality of sputum smear microscopy (Chinnakali et al., 2014). Hence periodic analysis of relative frequency of low count will improve the efficiency of sputum examination. Also, age and gender differences in grading of smears were reported in high HIV prevalence settings (Chinnakali et al., 2014; Rieder et al., 2009).

2.6 Management of the disease

Tuberculosis (TB) poses a serious threat to public health throughout the world as it remains the leading cause of death by infectious disease. Tuberculosis management refers to the medical treatment of the infectious disease, tuberculosis (TB). Efforts to eradicate it have been thwarted by poverty, lack of health care access, drug resistance, immunosuppressed populations (e.g. HIV-infected persons), and global migration (Sia & Wieland, 2011). Effective management requires prompt recognition using a combination of clinical, radiographic, microbiological, and histopathologic hallmarks and initiation of appropriate multidrug therapy. In addition to effective treatment of patients with active TB, public health management strategies include contact investigation and testing of persons who came into close contact with patients with active TB before initiation of therapy and reduction of the population-based burden of TB through targeted testing and treatment (Sia & Wieland, 2011).

It has been proven that effective treatment of TB patients has significant effect on the control of TB in a region or a country (WHO, 2009b). Almost 20 years after the WHO declaration of TB as a global public health emergency, major progress has been made towards 2015 global targets set within the context of the Millennium Development Goals (MDGs) (WHO, 2013b).

The aim of TB treatment according to the European Centre for Disease Prevention and Control (ECDC) is to cure the patient and achieve non-infectiousness, hence interrupting transmission of the disease, while avoiding the emergence of drug resistance (ECDC, 2010). However, WHO (2009) indicated that the aims of TB treatment are; to cure the patient and restore quality of life and productivity, to prevent death from active TB or its late effects, to prevent relapse of TB, to reduce transmission of TB to others and to prevent the development and transmission of drug resistance (WHO, 2009c). TB is treated with a standardized six-month course of four or five anti-tuberculosis drugs that are provided with information, supervision and support to the patient by a health worker or any selected treatment supporter. Without such supervision and support, treatment adherence can be difficult and the disease will persist (WHO, 2013a). The standardized regimens for anti-TB treatment recommended by WHO include five essential medicines designated as “first line”: isoniazid (H), rifampicin (R), pyrazinamide (Z), ethambutol (E) and streptomycin (S) (WHO, 2008c). The standard treatment for both categories of patients are in fixed dose combinations which are to be taken daily (Sterling T. R. et al., 2011; WHO, 2015b). It has also been established in another study that for early TB diagnosis and prevention people who are at risk should learn about TB transmission and prevention prior to contact with TB patients (Gibson et al., 2002). This idea about TB makes information dissemination about TB control, especially health education on the need for early reporting and prevention of TB an important component for the control of the disease. This can be made possible by training lay people, particularly, those who have recovered from TB, community volunteers, patient relatives or family members and community members to act as peer educators in the community (Gibson et al., 2002).

2.7 Prevention of the disease

TB prevention consists of several main parts. However, early diagnosis of Tuberculosis and effective treatment are key elements in reducing the transmission of infection and ultimately achieving elimination of the disease. Therefore, delay in reporting and late diagnosis may worsen the disease and enhance its transmission resulting in increased TB related morbidity and mortality (Sreeramareddy et al., 2009).

With proper and full compliance to TB treatment, an individual with TB will no longer be infectious and can no longer spread the disease to others. TB can be prevented by vaccinating infants and children with the Bacille Calmette Guérin (BCG) vaccine. Again, chemoprophylaxis or preventive treatment such as the Isoniazid preventive therapy (IPT) and antiretroviral therapy (ART) is also available for those at risk of TB such as health workers who take care of TB patients and people with a compromised immune system. However, there are other effective preventive measures which include; early diagnosis and prompt initiation of anti-TB drugs for treatment, provision of better housing, nutrition and reducing alcohol consumption as well as environmental control and improvement of socio-economic conditions which reduces the burden of the disease as TB is intimately associated with poverty and deprivation.

2.8 Control strategies

The World Health Assembly (WHA) in 1994 passed a resolution that recognized TB as a major global public health problem followed by the launch of DOTS as the internationally recommended TB control strategy (WHO, 2006d). Most National TB Control Programmes (NTCP) experienced major progress in TB control when they implemented the DOTS strategy (WHO, 2006d). The DOTS strategy was later expanded to form the Stop TB strategy, which seeks to build on the successes of the DOTS strategy (WHO, 2006d) and which will be discussed as a TB control strategy.

Treatment of patients with active TB is the top public health priority for TB control, followed by contact investigation of all persons who came into close contact with these patients before initiation of therapy. Such contact investigation is to be carried out on all TB patients with confirmed active pulmonary TB and on selected patients with suspected pulmonary TB before testing is complete (CDC, 2005b). Patients with extrapulmonary TB are generally not infectious; therefore, contact investigation is not indicated.

According to the target set by WHO, at least 70% of new smear-positive cases should be detected and treated in the Directly Observed Therapy-short course (DOTS) programme by 2015, and at least 85% of this number should be cured (Partnership, 2006). According to WHO, the incidence rate of TB has been falling since 2004, and the treatment success rate was 85% in 2006 (Partnership, 2006).

The Stop TB Strategy is WHO's approach to reduce the burden of TB according to the global targets. The strategy aims by providing universal access and high quality care for all people with TB, and to reduce the human suffering and socio economic burden associated with TB, to protect the vulnerable populations from TB /HIV and multi drug resistant tuberculosis, support development of new tools and enable their timely and effective use and as well protect and promote human rights in TB prevention, care and control by 2015 in line with Millennium Development Goals (MDG) (Ayisi et al., 2011; Partnership, 2006). Most of the successes in TB control globally have been attributed to the DOTS strategy, especially in high TB burden countries (WHO, 2006d). In order to address the remaining challenges, especially in areas where the TB epidemic has been worsening (such as sub-Saharan Africa and Eastern Europe), and to achieve the MDG and related Stop TB partnership targets by 2015, a new strategy was developed, namely the Stop TB Strategy (Dye & Weil, 2005; WHO, 2006d). Again, WHO DOTS as the central component, the Stop TB strategy set out steps which national TB control programmes, their partners and stakeholders needed to take to improve TB control (WHO, 2006d). The WHO expanded the DOTS strategy with six additional components, and these are described as follows:

Again, components of the Stop TB control strategy include: pursue high quality DOTS expansion and enhancement, address TB-HIV, MDR-TB, and the needs of poor and vulnerable populations, contribute to health system strengthening based on primary health care, engage all care providers, empower people with TB, and communities through partnership and enable and promote research (Partnership, 2006; WHO, 2006b).

2.8.1 Pursue high quality DOTS expansion and enhancement

To achieve effective TB control requires a comprehensive and persistent response that complements other measures aimed at addressing social and environmental factors that increase the risk of individuals to develop TB (WHO, 2006d). Strengthening of DOTS is further required in areas such as securing political commitment with adequate and sustained financing, ensuring early case detection and diagnosis through quality assured bacteriology, providing standardized treatment with supervision and support, ensuring effective drug supply and management as well monitoring and evaluating performance and impact assessment (WHO, 2006d, 2011b).

2.8.2 Address TB/HIV, MDR-TB and the needs of poor and vulnerable populations

Optimal control of TB in high-HIV burden areas requires implementation of collaborative TB/HIV interventions through a sound policy and programme environment that gives due consideration to the local context, the respective epidemiology of TB and HIV, as well as the health system infrastructure that determines service delivery models including community-based interventions (WHO, 2010c, 2011b). Addressing TB/HIV, MDR-TB and other challenges, it is imperative to scale-up collaborative TB/HIV activities, scale-up prevention and management of MDR-TB and address the needs of TB contacts and of poor and vulnerable populations (WHO, 2011b). The HIV epidemic has worsened the global burden of TB and increased the need to focus attention on strengthening the global TB and HIV programmes in order to tackle the two public health problems effectively (WHO, 2004b). TB has become the leading cause of death among people living with HIV, while infection with HIV is a large risk factor for latent and recent TB infection to convert to active TB disease (WHO, 2006a). The international standards for TB/HIV as set out by WHO are aimed firstly at decreasing the burden of TB among people living with HIV by strengthening intensive TB case finding, provision of Isoniazid preventive therapy (IPT) for TB/HIV co-infected patients and TB infection control in healthcare and congregate settings. Secondly, the standards aim at decreasing the burden of HIV among TB patients through offering them HIV counselling and testing, HIV prevention and Cotrimoxazole prophylaxis, and HIV care and support, including provision of ART for eligible patients (WHO, 2004b). It is therefore important that collaborative activities between the TB and HIV programmes using the above strategies be implemented as they can help control TB among HIV patients (Maher et al., 2002; WHO, 2006d). The WHO (2006d) describes MDR-TB as a threat to global TB control, worsened by inadequate treatment for those suffering from it; increase in MDR-TB patients due to misuse of second line anti-TB medicines; and absence of new effective anti-TB medicines. NTCPs should ensure early detection and correct treatment of all forms of DR-TB and patient adherence to this treatment (WHO, 2006c). TB control programmes also need to pay attention to special population groups such as prisoners, refugees and other high-risk groups associated with high TB transmissions due to overcrowding and poverty (WHO, 2006d).

2.8.3 Contribute to health systems strengthening based on primary health care

Improving access to quality healthcare services will benefit TB control, therefore TB control programmes should actively improve system-wide health policies, human resources development, financing, supplies, service delivery and information systems (WHO, 2006d). It is also imperative to strengthen infection control in health services and other households, upgrade laboratory networks and adapt successful approaches from other fields and sectors and actions on the social determinants of health (WHO, 2011b).

2.8.4 Engage all care providers

In many countries, a significant proportion of TB suspects and cases, including those from poor and vulnerable populations, present themselves to a range of public or private care-providers that are not linked to national TB control programmes (NTPs) (Uplekar, 2003; WHO, 2011b). These include informal and formal, commercial and non-profit, individual and institutional private sector care-providers such as traditional healers, pharmacists, general practitioners, private clinics and hospitals, NGOs and faith-based organizations (FBOs), and specialist public hospitals, academic institutions, prison and military health services. It has been confirmed that TB diagnosis and treatment practices of many non-programme care-providers are inappropriate and that care-seeking from diverse care-providers hampers access to quality TB care, causes delays in TB diagnosis and imposes financial burden on patients (Kemp et al., 2007; Uplekar, 2003). Many patients with early symptoms of TB do actually consult private healthcare providers first and many such providers diagnose and treat TB (WHO, 2006d). Evidence shows that TB diagnosis and treatment practices of many non-programme care-providers are inappropriate and that care-seeking from diverse care-providers hampers access to quality TB care, causes delays in TB diagnosis and imposes financial burden on patients (WHO, 2011b). The diagnosis of TB needs to be made without delay and once done the right treatment with adequate dosing needs to be instituted with proper follow up of such patients. Thus, engagement of all healthcare providers (both private and public) is of paramount importance. Evidence suggests that failure to engage all care providers used by TB suspects and patients hampers TB case detection, delays diagnosis, leads to incorrect diagnosis as well as inappropriate and incomplete treatment, increases drug resistance and places unnecessary financial burden on the patients and health systems (Uplekar et al., 2001). Involve all public, voluntary, corporate and private providers through Public-Private Mix approaches. Several Public-Private Mix (PPM) projects have demonstrated the feasibility, effectiveness, cost effectiveness and scalability of engaging nonprogrammer care-providers in TB care and control in diverse country settings (WHO, 2011b).

2.8.5 Empower people with TB and communities through partnership

To achieve greater commitment to fight TB, pursue Advocacy Communication and Social Mobilization (ACSM) embraces the following: advocacy to influence policy changes and ensure sustained financial and political commitment, facilitation of communication between health care providers, TB patients and their communities in order to improve knowledge of TB and subsequently compliance to treatment and social mobilization to engage the communities, partners and stakeholders in the fight against TB (WHO, 2006d, 2011b). Empowering people can also be done by fostering community participation in TB care, prevention and health promotion and as well promote the use of the Patients Charter for TB care (WHO, 2011b).

2.8.6 Enable and promote TB research

Despite international interest in operational research, very little research has been conducted or published from resource-limited settings where the greatest burden of TB occurs. Building and sustaining the necessary capacity to conduct operational research at country level is a primary aspect to be considered while projects are being developed (Lienhardt & Cobelens, 2011; WHO, 2011b). Conducting locally relevant operational research can identify challenges and practical solutions that can be tested in the field before scaling up the activities (Lienhardt & Cobelens, 2011; WHO, 2006d). National Tuberculosis Control Programmes (NTPs) can thus develop new and effective strategies for TB control. The WHO (2006d) as well as Lienhardt & Cobelens (2011) advocate that TB programmes to facilitate and actively support research to develop new diagnostics, drugs and vaccines.

2.9 Directly Observed Treatment, Short-course

Directly observed treatment short-course (DOTS) has been the foundation of the TB programme in Ghana after the establishment of the NTP in Ghana in the year 1994. The DOT is a comprehensive programme subscribed under the Stop TB strategy aimed to detect, treat and cure patients with tuberculosis. The goal of DOTS is to reduce TB morbidity and mortality and preventing the TB causing organism (*Mycobacterium tuberculosis*) from developing resistance to the TB drugs. For the DOTS, timely diagnosis and treatment of TB are two key fundamental elements for better treatment outcome. It is also fundamental that TB during their treatment under the DOTS strategy get close access to health facilities that provide TB services, however, many patients may find it difficult to access treatment even when such services are available (Volmink & Garner, 2007). Non-compliance to TB treatment among patients with TB has been documented widely as a major barrier to TB control (Adane et al., 2013). Non-compliance to TB treatment may result in increased transmission of the disease, relapses, drug resistance and death (WHO, 2003). The DOTS as part of the Stop TB strategy is a patient centred approach to reduce the burden of TB with provision of supervision and patient support based on effective two way communication between healthcare providers and the patient.

Both the Millennium Development Goal (MDG) six (6) and the Stop TB partnership aims at reducing to half the incidence of TB and TB death rates by 2015 (WHO, 2006d, 2008a, 2008c). These goals can be achieved through the five components of DOTS strategy stated as follows: political commitment with increased and sustained financing of TB programme, case detection through quality assured bacteriology, standardized treatment, with supervision and patient support, effective regular supply of drugs and management and monitoring and evaluation system (WHO, 2006b). The treatment duration under the DOTS is 6 months for new patients and 8 months for retreatment patients. However, low case detection, delays in seeking treatment and unsuccessful treatment outcomes (treatment defaults and treatment failure) are the two major challenges that TB programmes face (Shargie & Lindtjorn, 2007).

2.10 Case detection rates

One of the 5 components of WHOs recommended DOTS is to detect TB cases as early as possible. In Ghana, DOTS was adopted in 1994 and since then DOTS has been expanded to cover most public health facilities. The WHO (2012) reported a consistent increase in TB case detection rate in Ghana from 53% in 2007 to 78% in 2011. The WHO again indicated that Ghana's TB prevalence is estimated to be 72 per 100,000 population (WHO, 2012a). This therefore shows that Ghana has achieved the 70% case detection target as set by the World Health Organisation; however, most districts and regions are still reporting very low TB case detection rates.

TB case notifications - which continue to rely heavily on symptomatic individual's voluntarily seeking care at health facilities as advocated by the World Health Organisation, have stagnated. Several studies have revealed up to 50% of tuberculosis remains undiagnosed despite widespread implementation of DOTS (Chadha et al., 2012; Hoa et al., 2010; Obermeyer et al., 2008; Watkins et al., 2004). This passive facility-based case detection has proven inadequate to control TB (Obermeyer et al., 2008; WHO, 2012a). The difference existing between WHO strategies is to employ passive case finding as opposed to more resource-intensive active case finding s is very wide. In the case of active case detection, the health care workers actively search for the cases and help them to get treated as early as possible while with passive case detection, it is expected that the patients themselves will come to the health facilities when they become ill. The latter strategy depends on high awareness and early health care seeking behaviour of a given community; which is often weak in most developing countries. The weakness of this strategy is that if infectious patients do not come early or at all, or come only when severely ill, they remain a source of new cases among the community for months, or sometimes years (Golub et al., 2005; Murray & Salomon, 1998). This then causes a long delay between onsets of TB related symptoms and the time the TB suspects present themselves at health facilities, which could also be one of the causes of low cases detection. In as much as not recommended some patients have also reported to seek TB services from alternative sources such as traditional medicine practitioners, faith healers and chemical shop dealers before coming to the health facilities after those alternative sources have failed them (Lienhardt et al., 1998; Watkins et al., 2004). Therefore, there is the need for the NTP to regularly conduct active case findings to support the passive case finding as ascribed to by WHO in the DOTS strategy.

2.11Outcome of tuberculosis (TB) treatment

TB treatment outcomes are important indicators in the evaluation of performance of any TB control programmes (WHO, 2009c, 2012a), and monitoring and evaluation of treatment outcomes of TB patients is an integral part of the DOTS strategy (WHO, 2010a). and regardless of the number of reported TB cases in a setting, key treatment outcomes are expected to improve in line with WHO treatment outcomes benchmarks (Amo-Adjei & Awusabo-Asare, 2013). TB treatment outcome allows programme managers to measure the performance of TB services locally and also allows a review of where TB programmes failed to perform. The World Health Organization (WHO) has set a global target in line with the Millennium Development Goals (MDG's) to achieve a case detection rate of 70% of all forms of TB and successful treatment outcome of 85% and reduce mortality rates by 50% by the year 2015 (WHO, 2012a). These global targets are based on applying standard short course treatment protocols to all new sputum smear pulmonary patients. With international standard of evaluation for all countries, there are several studies that has reported that despite availability and supply of TB drugs and improved infrastructure, most countries including developed countries have not reached the targets set by WHO (WHO, 2014b). The main reasons for this include high rates of death, TB-HIV co-morbidity and TB treatment defaults. Defaults and incomplete treatment increase the risk of developing drug resistance and continues spread of the disease the susceptible in the population.

Even though free medications are available for TB treatment, many patients are not successfully treated. Low treatment success rates mean high rates of unsuccessful treatment outcomes (default, treatment failure and death) among patients on treatment. This circumstance threatens the effectives of TB control programmes with consequences such as multi-drug resistance which leads to prolonged treatment and increased cost, increased rate of transmission of the bacteria as well as high incidence of morbidity and mortality (WHO, 2009c, 2012a, 2013b). A study conducted in India and published in the Bulletin of the World Health Organization reported that TB treatment default and failures are risk factors to TB deaths (Kolappan et al., 2006). It Kolappan et al., (2006) further stated that about 18% and 30% of patients die as a result of treatment default and failure respectively. Additionally, the diagnostic category (pulmonary or extra-pulmonary) and type of patient (new, return of default, relapse, retreatment, and treatment failure and other) could affect TB treatment outcomes. Adverse drugs reaction and treatment duration are other factors. The age, sex, distance of patient's place of residence during treatment to DOTS centre could also affect the treatment outcome (Kolappan et al., 2006).

The proportion of cases with successful outcome is therefore a key indicator to assess the effectiveness and performance of any Tuberculosis Control Programme. In treatment outcome monitoring, the denominator for calculating group outcomes includes all patients who have been diagnosed with TB and who were registered for treatment during the specified time period. The WHO defines TB treatment outcome as follows; Cured, Treatment completion, Failed, Defaulted Died and Transfer out (WHO, 2013b). Treatment outcome of a patient can also be classified as treatment success or successful treatment (cure or treatment completion) or adverse outcome or unsuccessful treatment (default or treatment failure or death). Transfer out is where a patient is transferred to another treatment centre while still on treatment and whose treatment outcome is unknown. The TB treatment outcome may vary from one region to another and possibly from one institution to the other (WHO, 2010b).

The NTP policy demands that all TB cases are diagnosed and treated in health facilities and that all the facilities offering TB treatment must adopt DOTS strategy, the internationally adopted standardized TB treatment regimen. Based on the DOTS strategy, the NTP policy provides free TB services. In Ghana, with the DOTS strategy, sputum smear microscopy is the basis of case finding and diagnosis in TB control activities. In this case, all sputum-positive patients are registered and put on treatment immediately. However, those with sputum negative smears, of which clinicians still suspect of having TB, undergo chest radiography for further confirmation. On this basis, diagnosis of smear negative pulmonary TB is made by the clinician on the basis of radiological abnormalities of the lungs and clinical features. All smear positive and smear negative patients are registered in the TB register, and have a tuberculosis treatment card, which is maintained at the TB treatment Centre. New TB patients are treated with a combination of TB drugs, also known as the fixed dose combination therapy made up of rifampicin, isoniazid, ethambutol, and pyrazinamide daily for 2 months (intensive phase). Those smear positive patients with a negative sputum smear at 2 months receive a further 4 months of treatment with isoniazid and ethambutol daily (continuation phase). If a patient is smear positive at 2 months, the intensive phase of treatment is continued for the third month, followed by a 5 month continuation phase. All drugs are provided free of charge to the patient. Each new sputum smear positive patient undergoes a sputum smear examination at the end of the intensive phase (at 2 months), during the continuation phase (at 5 months), and at the end of the continuation phase (at 6 or 8 months). Patients who are smear positive at 5 months are considered treatment failures and receive the retreatment regimen. However, those patients who were smear negative do not undergo sputum examination at the end of the intensive phase or continuation phase.

Final treatment outcomes after treatment period are defined according to recommendations issued by the WHO. A set of six possible and mutually exclusive treatment outcome categories are being used. These categories are cured; completed treatment, treatment failure, death (died), default and transfer out. However, recently, a seventh treatment category “not evaluated” is emerging through many NTP.

The WHO definitions of categories of treatment outcomes are as follows:

- Cure: Patient who had completed full TB treatment and was bacteriology negative at the end of the treatment.
- Completed Treatment: Patient who had completed the full duration of TB treatment, but final bacteriology results at the end of treatment.
- Treatment failure: Patient who remained sputum smear positive at months 5 despite correct intake of TB medication.
- Default: Patient who had interrupted their treatment for two consecutive months or after registration.
- Died: Patient who died from any cause during the cause of TB treatment.
- Transferred out: Patient whose treatment results are unknown due to transfer to another health facility
- Not Evaluated: Patient who had not been assigned any of the above treatment outcomes but has completed the entire treatment.

2.12 Factors that affect treatment and control

TB remains a major source of morbidity and mortality throughout the world. Despite the best efforts of health systems, about one third of people who develop TB globally are still either not diagnosed, or their cases are not reported. Information about the factors associated with the disease could help identify individuals who are at high risk so that targeted interventions can be implemented to improve TB treatment (WHO, 2008b).

Difficulty in accessing health facilities is one of the reasons why people with TB may not be diagnosed, and can also have a negative impact on treatment compliance. Access to health care can be affected by social factors (such as stigma and discrimination) and economic barriers (for example, the cost of transport). The role that factors affecting TB treatment and control play in contributing to TB prevention, diagnosis and treatment, especially where people with TB have poor access to formal health services, is therefore well recognized (WHO, 2015a).

Compliance to treatment occurs when the patient takes TB drugs without interruption and completes the course. However, non-compliance occurs when a TB patient interrupts treatment for more than two months. Compliance to TB treatment is one of the most important factors that determine the outcome of treatment, and the extent to which a patient's behaviour while on TB treatment agrees with advice prior to treatment(Pandit & Chaudhary, 2006).

There are other factors that contribute to unsuccessful TB treatment outcomes. These factors are commonly associated with the non-compliance to treatment. Non-compliance to TB treatment constitutes a big challenge to global TB control as it increases the risk of treatment defaulters, treatment failures, relapses and the emergence of drug-resistant TB (van den Boogaard et al., 2011). Although the problem is widely acknowledged, there is still no clarity about the exact impact of different levels and patterns of non-compliance on treatment outcome. This affects the provision of adequate advice to patients and clinicians. In TB treatment perspective, compliance to treatment is the extent to which clients/patients follows the treatment regimen that has been prescribed by the TB programme. Similarly, non-compliance is the situation whereby patients are not able to follow the medication schedules or discontinue treatment prematurely before the entire duration of the prescribed treatment regimen.

Socio-demographic factors including gender, age and residence of the patients and the form of TB have been reported to affect the treatment outcome and performance of DOTS services in some studies (Ditah et al., 2008; Dodor & Afenyadu, 2005; Muture et al., 2011). Analysis of factors affecting treatment outcomes may help to improve performance of DOTS services and provide useful evidence for decision making in disease control programmes (Dangisso et al., 2014). However, other studies including one conducted in Madagascar found a contrasting view that there was no relationship between a TB patient's age and defaulting from treatment (Rakotonirina el et al., 2009)

2.12.1 Socio-demographic, economic and cultural factors

Tuberculosis (TB) is closely related to social and economic problems. Persons who are mostly affected live in densely populated areas, their income is poor, and they mostly lack or have little knowledge about TB (Hossain et al., 2012). Globally, there are various studies that have emphasized the close relationship between poverty and TB. These studies have suggested poverty, poor nutritional status, homelessness and crowded living conditions increases the risk of TB and as well linked them (Lutge et al., 2013).

Differences exist as to whether employment and socio-economic status are contributory factors to patient TB treatment compliance (Pandit & Chaudhary, 2006). Findings of some researches has reported that being employed may be associated with better socio-economic status, which enables one to afford cost of transport and healthcare fees, increasing the chances of treatment compliance (Hasker et al., 2008; Okanurak et al., 2008; Tissera, 2003). Nonetheless, an India study did not find socio-economic status to be significantly associated with TB treatment compliance (Pandit & Chaudhary, 2006).

The association between poverty and TB exist over the entire course of the disease. Ultimately, the adverse effects of TB are at its maximum for poorer people because their income depends on physical labour. Although effective treatment for the disease exist and provided free of charge at all public and also mostly at designated private health facilities across the country, there are findings of studies showing that the negative effect of poverty on TB treatment outcome is partly due to the cost of accessing TB treatment services in the form of transport fares from patients place of residence to TB treatment centres (Hossain et al., 2012; Xu et al., 2010). Lutge et al. (2013) indicated that the poor nutritional status which usually accompanies poverty is not just a risk factor for the advancement of the TB disease, but also it undermines the TB treatment outcomes.

A study by Xu and the colleagues identified that patient's socioeconomic status is a key determinant of TB treatment success. The study further indicated that high socio-economic status of patients, particularly high income levels was associated with successful TB treatment outcome (Xu et al., 2010). The study again showed a plain relationship between treatment outcomes and patient's financial situation, indicating that patients with low or no income tend to have poor treatment outcomes and also spend much of their little income on medical care as a result of treatment failure. The research also revealed that financial burden was the main reason for failure of patients to seek care and complete treatment.

Similarly, a study conducted in Bangladesh acknowledged the association between poverty and TB. According to the study, poverty influences all aspects of the TB disease process from exposure to infection, disease progression, delay of health care seeking and above all poor treatment outcomes (Hossain et al., 2012). Hossain et al. also stated in their studies that TB brings a lot of negative consequences on patients and this makes the poor poorer, as a result of poverty related physical illness, malnutrition and decreased resistance due to a weakened immune system. It is as a result of the high interrelationships between TB and poverty where one triggers the other, for this reasons, diagnosis of TB and its entire treatment made free of charge.

However, despite TB services made free of charge, many TB patients go undetected in our health facilities and communities and those detected and put on treatment also finds it difficult to come to DOTS centres for their medication because of lack of transportation cost since patients travel a distances from the place of residence to the TB DOT centres for services. This situation brings about indirect cost to the patients and most may be unemployed they are not able to afford the cost of transportation for health care and provision of other essential services like food. A study conducted in South Africa found that limited financial resources served as a barrier to treatment compliance and the same study also quoted the need to use public transports to travel to TB DOTS centres and this has an associated financial burden and this affected the access of regular health care (Rowe et al., 2005). Several studies conducted worldwide, in Nepal (Bam et al., 2005), in Uzbekhistan (Hasker et al., 2008), in Malaysia (O'Boyle et al., 2002), in Swaziland (Pushpananthan et al., 2000) and in Zambia (Needham et al., 1998) reported that transportation cost is the main reason for non-compliance to TB treatment, most especially when the patient start feeling better. Again, it is revealed in other studies that some TB patients lost job opportunities because they absented themselves from work and others became weak as a result of the disease. All these may put some financial difficulties on the patients and it could make it difficult for them to transport themselves to health facilities for their drugs or even purchase food. In the same vain, a study conducted in Ethiopia (Berhe et al., 2012) found significant associations existing between unemployment and unsuccessful treatment outcome and could same study concluded that unemployed TB patients were 3 times more likely to have unsuccessful TB treatment outcome.

There are cultural factors that in enviably also influence TB and its management. Culture is set of shared standards, codes and believes systems that groups with common identity use to interact among themselves. Culture has become an integral component in defining and maintaining the health of the people both physically and spiritually. Hence, culture has defined individual's knowledge about diseases and health seeking behaviours. Several studies including Li et al., (2013) have reported the practice of seeing a traditional medical care provider, self-medication and spiritual interventions which supports patient delays in seeking and receiving TB diagnosis and treatment (Li et al., 2013). The study underscore that seeing herbalist or traditional medicine providers, spiritualist for prayers and self-medication before seeking care at a conventional health facility for TB services results in delay in diagnosis and treatment and this may also lead to poor treatment outcome in situations where patients' conditions deteriorate. Again, most TB patients failed to recognize their symptoms as due to TB, because of the stigma attached to the disease in society. The way people treat those with TB, especially close contacts is also a source of worry to the patients. This may lead to delay in reporting to the hospital and consequently increase mortality from the disease. It may also make it difficult for the patients to comply with the long duration of TB treatment (Dodor, 2012).

2.12.2 Age of patients

Tessema et al., (2009) reported that age of patients is associated with some unsuccessful treatment outcome. Similarly, a study conducted in India by Ananthakrishnan et al., (2013) found that the death rate of patients increased with increase in age of TB patients. The death rate increased from 4.6% in the age group 0-14years to 10.1% in the age group 65 and above. This then associate poor TB treatment outcomes with increasing age of patients (Ananthakrishnan et al., 2013). However, a contrast view was found in a study conducted in Brazil which stated that older people TB patients were less likely to default from TB treatment and added each year of life reduce noncompliance rate by 2% (Garrido et al., 2012).

2.12.3 Educational level

Education is a fundamental cause of good health (Link & Phelan, 1995). Education increases physical functioning and subjective health and decreases the age-specific rates of morbidity, disability, and mortality (Crimmins & Saito, 2001; Singh-Manoux et al., 2004). There are several studies that have tried to look at the relationship of the patient's educational level to their health status, seen as important to gain a better understanding of the causes associated with unsuccessful treatment outcomes, identifying patients at risk of such unsuccessful treatment outcomes and subsequently developing appropriate interventions (Dewalt et al., 2004). Similarly, Mirowsky and Ross (2005) stated in their study "education, learned effectiveness and health" that Education forms a unique dimension of social status, with qualities that makes it especially important to health. It stated further that educational status of individual influences their health seeking behaviour and substantially influences other social statuses including occupation, earnings, personal and household income, wealth as well as freedom from economic hardship (Mirowsky & Ross, 2005). In effect educational background is amongst the most important determinant of socio-economic status hence it develops the individual which enables self-direction toward any and all values sought including health.

A study conducted in Bangkok, Thailand aimed at determining the patient factors predicting successful treatment outcome. Out of the 1,241 patients studied, it was reported that 81% with higher educational levels and knowledge of tuberculosis were successfully treated, the argument being that these factors are associated with better compliance to TB treatment and subsequently treatment success (Okanurak et al., 2008). Similarly, there are several other studies that have demonstrated educational levels of TB patients as significant predictors of treatment compliance (Balasubramanian et al., 2004; Date & Okita, 2005; Johansson et al., 1999; Mishra et al., 2005). However, it was also reported in a Malaysian study that, among other factors, non-compliance was associated with completed secondary education (O'Boyle et al., 2002). On the contrary, a study conducted in Zambia, found that age, marital status, and educational levels were not significantly associated with compliance (Kaona et al., 2004).

2.12.4 Patients knowledge about TB

Although TB is curable and preventable, approximately 2 million people die from the disease annually (WHO, 2010b). Lack of knowledge about TB makes the condition a serious public health issue, which need greater attention. Treatment literacy refers to providing accurate information about the science behind the disease and treatment so that the patients can be more responsible for their own care and be able to demand their rights when proper care is not provided (Dewalt et al., 2004). A TB patient knowledge about the signs and symptoms could prompt early care seeking. The patient has been identified in several studies as a factor affecting noncompliance to TB treatment (Dodor & Afenyadu, 2005; Munro et al., 2007). A person's lack of knowledge about signs and symptoms, the mode of transmission and methods of prevention of the disease will help them to take measures to protect themselves and others from contracting the disease. Again, Lack of awareness of the curability of TB and the duration of treatment was noted as a major risk factor for treatment default (Muture et al., 2011). Muture et al., (2011) further stated lack of patient knowledge on the benefits of completing TB treatment as a risk factor for patients defaulting treatment. Similarly, according to DeWalt et al., (2004), lack of treatment literacy is associated with poor health outcomes and conversely treatment literacy improves health outcomes and compliance. In Botswana, research found that compliance to treatment was related to the availability of information, material and emotional support from family members (Kgatlwane et al., 2005).

According to a study by Smart (2010), knowledge and attitudes about TB and its treatment vary widely due to different cultural, religious or traditional beliefs, and access to education and information about the disease. Again, it was further stated that patients lack of knowledge of TB symptoms or failure to recognize them results in delays in seeking healthcare (Smart, 2010). Denial may be high due to stigmatization amongst misinformed communities. The above become barriers to early diagnosis and treatment, resulting in increased risk of transmitting TB to other close contacts and the general community, as well as poor health outcomes for people with the disease (Afari-Twunamasi, 2005).

Several documented studies reported in India, Indonesia and, Russia (Woith et al., 2009), Kenya and Tanzania (Wandwalo & Morkve, 2000) and South Africa (Afari-Twunamasi, 2005), have shown that knowledge of TB is generally low in many settings, even among healthcare workers. The study in India (Singla et al., 1998) surveyed 200 nurses and found that only 40% of TB nurses and 10% of general hospital nurses had a satisfactory knowledge of TB, and only 56% of general nurses knew that TB was caused by mycobacterium TB. About 36% thought TB was caused by a virus, while in the Indonesian study only 40% of nurses knew its cause (Wahyuni et al., 2007), The study conducted in Kenya (Ayaya et al., 2003) showed that most private medical practitioners were unaware of the correct methods of diagnosing TB and most used treatment regimens not recommended by the National TB Programme (NTP).

Since most people with TB and their families get to know about TB from their healthcare providers, such poor knowledge of it among the providers will translate to lower knowledge among the patients themselves (Afari-Twunamasi 2005).

2.12.5 Stigmatization and discrimination

Studies have reported the effects of stigma on TB treatment. The presence or perceived presence of stigma and discrimination in a community may act as barriers to patients disclosing their disease to family or community members, who may provide the much needed psychosocial support to the patient (Eastwood & Hill, 2004). Stigma leads to a situation where TB patients receive ill treatment from community members and sometimes even from health care workers. It is common for people affected by TB to suffer from discrimination both in the developed and developing world as a result of the stigma and myths that surround the illness. The WHO reported in 2004 that in some cultures, TB is associated with witchcraft and can be considered a 'curse' on a family, as the illness often affects multiple generations (WHO, 2004a). It is now known that this is simply because TB is an airborne illness, which is more likely to be spread among people living in close proximity. Often, TB is associated with factors that themselves create stigma: HIV, poverty, alcohol and drug abuse, homelessness among others.

Individuals being discriminated against may be isolated socially, especially in small communities, where entire families may be avoided. In most African societies, TB and HIV are associated with immoral behaviour and patients suffering from these conditions would be hesitant to disclose their status to their family members, a situation which may result in these patients not complying with their treatments as they do not want to be seen taking the medicines (Kaona et al., 2004). Unconventionally, women are often blamed to be the source of TB, and those women affected with TB may be divorced or considered unworthy of marriage. This assertion has been confirmed by a study conducted by Ahorlu and Bonsu (2013) which found that people accuse women as being the source of the infection with TB disease.

Stigma is said to be a social determinant of health and it is an attribute that discredit and that reduces the bearer from a whole and usual person to a tainted, discounted one (Goffman, 1963). Labelling, isolation, loss of status and discrimination can all occur at the same time and can be considered components of stigma. Goffman (1963) distinguished three types of stigma. The first type of stigma is "stigma of physical deformity", which is the deficit between the expected norm of perfect physical condition and the actual physical condition of a deformity on a person. It can take the form of any physical impairment. Many chronic diseases create changes in physical appearance or functions. These changes often create difference in people. Goffman's second type of stigma is "stigma of character blemish". This may take the form of dishonesty, unemployment and addiction. It may occur in individuals with sexually transmitted infections such as HIV/AIDS, alcoholism and TB. These individuals face stigma because many believe that the individuals who are infected could have controlled the behaviour that resulted in the disease. The third type of stigma according to Goffman is "tribal in origin". This type of stigma occurs when one group perceives features of a race, religion or nationality of another group as deficient compared with their own socially constructed norms. A study concluded that stigma and discrimination towards TB and HIV patients results in patients delaying seeking testing and treatment and thus poorer health outcomes (Hodgson et al., 2004).

The complexity of stigma stems from institutions, communities as well as inter and intra personal attitudes. Hence the community and individual norms that promote stigmatization of TB hinders the progress of the TB control programme. Mostly the fear of infection is one of the major reasons for stigmatizing TB patients. Because of this stigma brings about delay in seeking TB care leading to treatment noncompliance (Somma et al., 2008). In a study conducted by Somma et al., (2008), stigma was reported as a common experience among patients who reported being avoided by others. Such findings confirm peoples fear of the disease, no or inadequate knowledge about TB and its treatment as well as support for TB patients (Somma et al., 2008).

Tuberculosis is seen as a discriminatory disease partly due to the fact that TB is associated with HIV. Many TB suspects had seen other TB patients and HIV patients suffering from stigma and discrimination in their communities and feared that the same might happen to them. These raise an important point for delays in care seeking of TB patient or even adhering to treatment. This then make many patients who have been diagnosed of TB hide their diagnosis and seeking TB treatment in their locality being difficult (Dodor, 2012; Gebremariam et al., 2010; Somma et al., 2008).

The impact of stigma no doubt delays health care seeking, making it much more likely that TB suspects will become seriously ill and infect others. Similarly, stigma related to TB can also make people reluctant to follow their treatment regimen for the fear of been seen by others and this will result in irregularly taking of TB medications and interrupting treatment which could be a possible risk of developing drug resistance.

2.12.6 Availability of treatment supporter

TB treatment lasts for period of 6 to 8 months and requires that patients take their drugs on a daily basis for the entire treatment period. Based on this, patients are required to self-nominate someone to support them throughout the entire treatment duration. Treatment supporters are expected to play the role of a DOT supporter and supervising patients to take their medication on a daily basis. TB treatment supporters are also required to collect patient's medication from the health facility whenever patients are unable to do that by themselves. However, some of the supposed treatment supporters do not live with the patients assigned and therefore does not play the required role of observing the patient take his or her drugs.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents a full account of how the study was conducted. It covers the profile of the study area and also describes the methods and materials used for the research, including the study area, study design/type, study population, quality control, ethical issues, methods used in collecting data and tools for data analysis and presentation.

3.1 Background of the study area

The study was conducted in the Obuasi Municipality of the Ashanti region of Ghana. The Obuasi Municipality was established by Legislative Instrument (L.I.) 1795 of 17th March 2004. It was carved out of the former Adansi West District. The Municipality is divided into five (5) Zonal Councils and further sub-divided into 38 electoral areas for administrative purposes.

The Obuasi municipality is located in the Southern part of Ashanti region and has an area of about 162.4 square kilometres. It shares boundaries with the Adansi North district to the North, the Adansi South district to the East and South and the Amansie Central district to the West. Obuasi, the municipal capital is located sixty-four (64) kilometres to the southwest of Kumasi, the Ashanti regional capital. The municipality has 63

Communities, 48 of which have populations above 5,000 thus making them urban settlements (OMA, 2014).

Currently, the population of the municipality is estimated at 211,587 from the 2010 Population Census with annual growth rate of 4.0%. Females constitute 52% while males constitute 48% of the population. The high annual growth rate is partly due to large influx of people from other parts of Ghana and beyond in search of jobs in the mining and related industries (GSS, 2014; OMA, 2014).

Source of water supply in the municipality is variable. While about 33 communities in the municipality have access to pipe borne water, 30 communities access water from either boreholes or hand dug wells. However, utilization of the pipe borne water is very low and only limited to washing and other domestic uses and is unsafe to drink due to pollution by mining activities especially illegal mining and domestic waste (OMA, 2014).

About fifty (50) percent of houses in the Municipality have access to domestic private toilets. The rest use seventy (70) public toilets in the Municipality or resort to open defecation especially those communities in the rural parts of the municipality (OMA, 2014).

Health facilities in the municipality consist of seven (7) hospitals, two (2) health centres, eight (8) clinics, four (4) maternity homes and one (1) CHPS Centre. But for one hospital, all health centres, CHPS compounds and the rest of the six hospitals are privately owned.

Lack of residential accommodation for health staff is one of the main problems confronting the health sector (OMA, 2014).

3.2 Study type

A quantitative, cross-sectional, descriptive and comparative study of TB patients who started TB treatment between January 2009 and December 2014 in the Obuasi Municipality was conducted. The study reviewed secondary data for the six (6) years (i.e. from January 2009 to December 2014). Additionally, primary data was collected from some selected TB patients who had undergone treatment in the municipality.

3.3 Study design

A retrospective study using both primary and secondary data was employed in order to determine the number of TB patients who received TB treatment, and their treatment outcome and factors that influenced the TB treatment outcome in the Obuasi municipality of the Ashanti region of Ghana for a period of six (6) years (i.e. from January 2009 to December 2014).

3.3.1 Retrospective study using secondary data

This part of the retrospective study involved the review of TB patients' treatment cards and data captured in the municipal TB register. All TB treatment cards of patients that were captured and recorded in the TB register in the municipality within the period under review were reviewed for information on TB diagnosis and treatment and met the inclusion criteria was included. Also, the outcome of TB treatment (cured, treatment completed, defaulter, treatment failure and died) was assessed. The data reviewed also determine whether the TB patients reported routinely for their TB medications as well as laboratory investigations at the regular intervals provided in the TB treatment regimen especially for smear-positive patients.

3.3.2 Retrospective study using primary data

In order to determine factors that influenced TB treatment in the municipality, a retrospective study using primary data was conducted. With this, data was collected form some selected TB patients who underwent TB treatment during the period under review (January 2009 to December 2014). All those who underwent TB treatment and were declared cured, treatment completed, default and treatment failure qualified to be included in this part of the study. The selected TB patients were traced to their various houses using the addresses indicated in their records and those who only had telephone numbers recorded on their treatment cards and TB register were contacted on phone and arrangement made to visit them in the house. The sample size of TB patients used for the study was calculated using Epi Info 7 StatCalc taking into consideration the total number of persons registered in the municipal TB register and having TB treatment cards for the six-year period with confidence level of 95%, expected frequency of 50% and confidence limit of 5%. To ensure the same level of chance for each patient to be picked, simple random sampling was done using Statistical Package for Social Sciences (SPSS) version

21 to randomly select the TB patients to be interviewed. The process was repeated to select participants to replace those who had died or moved out of their addresses.

The selected TB patients interviewed were traced to their various houses using the addresses that were provided in the TB register and TB treatment cards. Those patients who had only telephone numbers in the TB registers or treatment cards were contacted on phone for directions and appointments to their homes for the administration of questionnaires presented as appendix I.

Inclusion criteria

All TB patients whose records were captured in the TB register for the period January 2009 – December 2014 were eligible to be included in the study.

Exclusion criteria

Patients whose medical records (TB treatment cards) could not be obtained or had incomplete data were excluded from the retrospective study and also patients who died or could not be traced were excluded from the prospective study.

Treatment outcome definition

Treatment success and poor outcomes were defined according to the WHO criteria (WHO, 2013b).

Successful treatment outcome was defined as follows:

a. ***Cured:*** A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear-negative or culture-negative in the last month of treatment and on at least one previous occasion.

b. ***Completed treatment:*** A TB patient who completed treatment without evidence of failure but with no record to show sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are not available.

Unsuccessful treatment outcomes were defined as follows:

c. ***Died:*** A patient who died from any cause during treatment period.

d. ***Treatment failure:*** A TB patient whose sputum smear or culture is positive at month 5 or later during treatment.

e. ***Default or lost to follow-up:*** A TB patient who did not start treatment or whose treatment was interrupted for two consecutive months or more.

f. ***Not evaluated:*** A TB patient for whom no treatment outcome is assigned.

3.4 Study variables and data sources

A variable is a property that can accept different values base on specific definitions. Both primary and secondary data was collected for the study. Primary data such as patients' demographic and socio-economic variables including age, sex/gender of patients, occupation and income status were assessed. Also, patients residence, distance to health facilities, transportation cost, disease classification, availability of treatment supporters and treatment outcomes was also assessed. Secondary data was gotten by reviewing TB treatment registers from 2009 to 2014.

The table below presents the various variables of the study and what each variable means according to the perspective of this study.

Table 3. 1: Study variables

VARIABLES	**DEFINITION**
Age group	The age group in which a TB patient fall within with reference to his or her date of birth
Sex/Gender	It refers to male or female
Marital status	The status of respondents expressed in terms of married, single, divorce, widow/widower etc.
Occupation	This is the usual work done on the daily basis by patients
Educational level	The level of education completed by a patient in terms of primary, JHS, SHS etc.
Knowledge level TB	The ability of TB patients to identify the cardinal signs and symptoms of TB and being able to know the duration of treatment.
Income level	The amount of money a respondent gets either daily, weekly or monthly calculated per annum as annual

	income
Place of residence	This refers to the community where patients stay
Distance to health facility	The distance from community where patients reside to the health facility where patients access TB care services expressed in kilometres (km)
Transport cost	The amount of money paid by the patient or treatment support from the place of residence to the TB care health facility
Treatment outcome	The status of TB patient after the entire treatment duration. The treatment outcome can be cured, completed treatment, default, treatment failure, transferred out or died. The treatment outcome could be successful (cured and completed treatment) or unsuccessful (treatment failure, default, transferred out and died)
Disease classification	This is the diagnosis assigned to a TB patient. That is a TB patient could diagnosed as smear positive pulmonary TB, smear negative pulmonary TB or extra-pulmonary TB.

Treatment supporter	This is a person who supports, guides and observes a TB patient throughout his/her treatment period. The person could be a relative, health worker etc. as chosen by the TB patient.

3.5 Data analysis and presentation methods

For the retrospective study using secondary data, Excel 2010 was used for the data entry and analysis. Excel 2010 was used to enter the number of TB patients that was registered among the three TB DOTS centres from 2009 to 2014. Numerical data was entered as numbers and for the nominal data values were entered as words (e.g. male/female) and in some instances words were abbreviated (e.g. m/f). Some functions in Excel 2010 such as COUNT, COUNTIF and SUM were used to analyse data entered to determine the number of patients registered and also to estimate how many of the TB patients males and females were, how many of the patients were diagnosed as pulmonary positive, pulmonary negative and extra-pulmonary TB patients among others. Again, data cleaning and analysis were done using both Statistical Package for Social Sciences (SPSS) software version 21.0 for windows software and Microsoft Excel 2010 (MS Excel 2010). The statistical analysis was conducted using SPSS and MS Excel in order to describe the data and identify any significant differences between the two groups. Descriptive summary statistics and graphical summaries in tables and charts were presented.

For the retrospective study using primary data, data was coded, entered and analysed using the SPSS version 21.0. The questionnaires were coded into different variables in the SPSS and data was entered using defined variables. Multivariate was done and summary output tables with frequencies and figures of percentage distribution were produced and the results were interpreted descriptively.

3.6 Quality control

A number of measures were taken to ensure quality in the study. Some of these measures were taken before, during and after data collection.

3.6.1 Measures before field work

The questionnaires were formulated to address the objectives of the study. This took into consideration the individual specific variables in order to achieve the study specific objectives. Research assistants were recruited and trained to be equipped with the requisite knowledge and skills for accurate data collection. Questionnaires were pretested in the Adansi North district whose geographical and demographic characteristics are similar to that of the Obuasi municipality.

3.6.2 Measures during field work

The research assistants were once again taken through what they have been taught to ensure that, the right entries were made on the questionnaires. They were for instance prompted to explain to the respondents the meaning of the questions and also ensured that the right translations were given on the questionnaires. The respondents were not forced to respond to the questionnaires but rather the respondents were given the freedom to be part of the study. Permissions to conduct the study was obtained from the Ashanti regional Health directorate; the Obuasi municipal health directorate and the management of the DOTS centres were data was collected. At the individual level, informed consent was obtained from patients before interviews were conducted and only those who agreed to be part of the study were included.

3.6.3 Measures after field work

At the end of each day, all filled questionnaires were double-checked for errors. Finally, the data that were collected was cleaned from all kinds of misrepresentations to ensure right data were analysed.

3.7 Ethical issues

Written approval was obtained from Ghana Health Service Obuasi Municipal Health Directorate to use the Municipal TB registers and tuberculosis patients treatment cards (TB 01) from January 2009 to December 2014. The names of respondents were not mentioned but level of education, rank and occupation were used.

Informed consent was sought from each respondent before the start of the questionnaire administration. Confidentiality of information from each of the respondents was maintained and respondents were informed that their responses would not be given to any third party outside this study. Again, respondents were told no personal identifications would be used in the study or for publication and they were further informed that they could opt to be interviewed as the questionnaires are being administered.

CHAPTER FOUR

RESULTS AND INTERPRETATION

4.0 Introduction

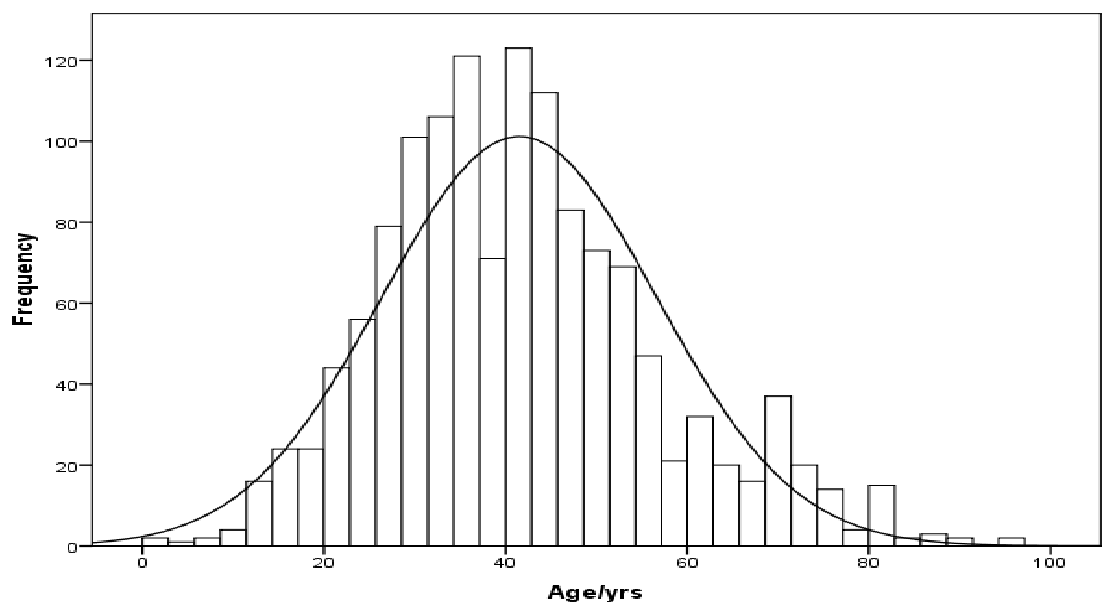
This chapter presents the results and findings of the study. The findings are presented based on the specific objectives of the study, namely: determine the number of patients who were put on the TB treatment from 2009 to 2014, determine the TB treatment outcome among patients who received treatment and determine factors that influence TB treatment outcome.

The sample size for the retrospective study using primary data was two hundred and eighty seven (287) respondents, of which 255 (146 cured and 109 completed treatment) were classified as successfully treated and 32 (31 defaulters and 1 treatment failure) were classified as unsuccessful treatment. All the study respondents were followed to their individual communities and homes with a compiled list of all sampled respondents with their contact information such residential addresses and telephone numbers. Of the 287 sampled study respondents, 243 (84.7%) of the respondents could be found and questionnaires administered. The remaining 44 were difficult to trace as some had left the municipality, others gave wrong residential addresses at the time of registration whilst others were also reported to have died. Again, for the retrospective study using secondary data, all the 1,347 patients that met the inclusion criteria of the study were included.

4.1 Number of tuberculosis patients put on TB treatment in the Obuasi municipality

4.1.1 Socio-demographic characteristics of tuberculosis patients

From 1st January 2009 to 31st December 2014 (6 years) 1,347 TB patients were registered across all the TB treatment centres in the Obuasi Municipality of which males constituted 989 (73.4%) and females constituted 358 (26.6%). Their ages ranged from 1 year to 95 years with a median age of 40 years and Inter-Quartile Range (IQR) of 31 to 50 years. Fig. 4.1 shows a normal age distribution curve for cases registered across treatment centres.



Source: Field survey, 2016

Figure 4. 1: Age distribution curve of patients

By age group analysis, the least number of cases (7) were registered for the age group 1-10 years and increased across the age groups to 378 cases for the age group 31-40 years and from then, the number of cases decreased to 13 cases for those aged 80 years and above as shown by table 4.1. Gender comparison showed that with the exception of age group 1-10 years, proportionately more males were more affected than females for all other age groups (table 4.1).

Table 4. 1: Gender and age group distribution of TB cases

	Male		**Female**		**Total**	
Age group	**N**	**%N**	**N**	**%N**	**N**	**%N**
1-10	2	28.6	5	71.4	7	0.5
11-20	42	51.9	39	48.1	81	6.0
21-30	167	68.2	78	31.8	245	18.2
31-40	287	75.9	91	24.1	378	28.1
41-50	245	76.6	75	23.4	320	23.8
51-60	142	83.5	28	16.5	170	12.6
61-70	62	78.5	17	21.5	79	5.9
71-80	35	64.8	19	35.2	54	4.0
>80	7	53.8	6	46.2	13	1.0
Total	**989**	**73.4**	**358**	**26.6**	**1347**	**100.0**

Source: Field survey, 2016

4.1.2 Tuberculosis cases registered by year

The number of cases registered per year is presented in Table 4.2 and it showed that more cases of 264 (19.6%) were registered in the year 2012 and the least, 189 (14%) in 2010. Overall, for the entire period under review, significantly more PTB cases were registered compared to EPTB cases (95.6% vs. 4.4%, $p < 0.001$). This was similar across all years (table 4.2).

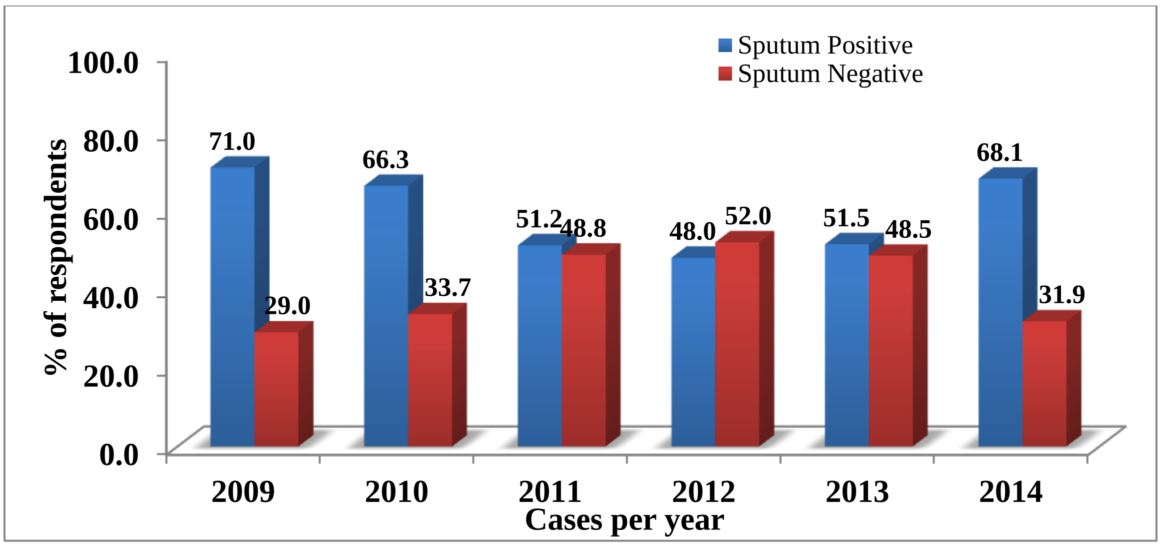
Table 4. 2: Number of TB cases registered by year

	Pulmonary TB		Extra Pulmonary TB		Total	
Year	**N**	**%N**	**N**	**%N**	**N**	**%N**
2009	210	92.9	16	7.1	226	16.8
2010	181	95.8	8	4.2	189	14.0
2011	211	95.9	9	4.1	220	16.3
2012	254	96.2	10	3.8	264	19.6
2013	206	95.8	9	4.2	215	16.0
2014	226	97.0	7	3.0	233	17.3
Total	**1288**	**95.6**	**59**	**4.4**	**1347**	**100**

Source: Field survey, 2016

4.1.3 Pulmonary tuberculosis (PTB)

Of the 1,347 TB cases registered, 1,288 (95.6%) were clinically diagnosed as Pulmonary TB (PTB) and of this 759 (58.9%) were confirmed positive cases by sputum microscopy while 529 (41.1%) were diagnosed as sputum negative cases. For the years 2009, 2010 and 2014 higher proportion of cases were confirmed by sputum microscopy whereas for the years 2011 to 2013, the proportion of confirmed and unconfirmed cases were similar as shown by fig. 4.2.



Source: Field survey, 2016

Figure 4. 2: PTB cases registered by year

By age group analysis, only 5 cases were registered for the age group 1-10 years and this increased to 362 cases for the age group 31-40 years and from then, the number of cases decreased to 13 cases for those aged 80 years and above. Gender comparison showed that although overall, significantly more males were affected compared to females (73.5% vs. 26.5%, $p < 0.001$), for the age group 1-10 years, more females were affected than males whereas for those aged groups 11-20 years and older than 80 years, the proportion was similar for both sex (fig 4.3)

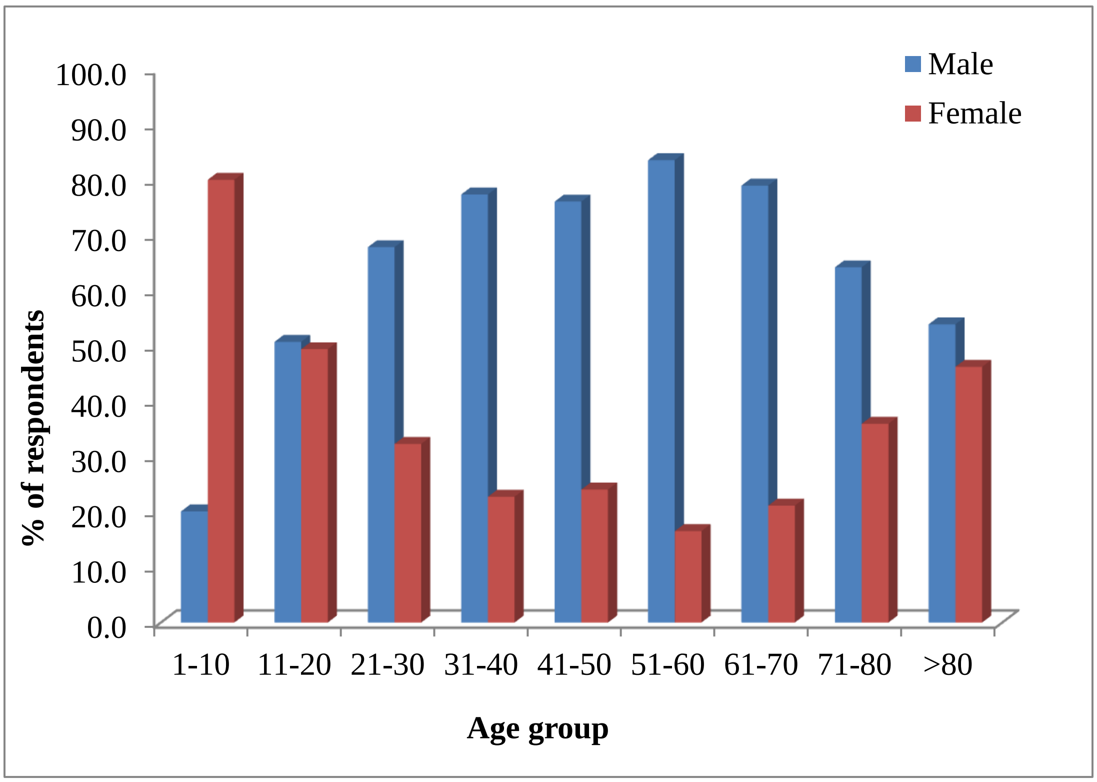


Figure 4. 3: PTB cases by gender and age group

Source: Field survey, 2016

4.1.4 Intensity of PTB Infections

For the 1,288 PTB cases, sputum microscopy confirmed 762 giving a total positivity of 59.2% and low grade positivity of 17.9%. The bacilli count of the positive cases showed scanty count (1-9 AFBs/100HPF) in 6.8% of cases; 1+ count (10-99AFBs/100HPF) in 23.5% of cases; 2+ counts (1-10AFBs/50HPF) in 32.7% of cases and 3+ counts (1-10AFB/1HPF) in the 37.0% of cases.

Of the sputum positive cases, positive smears from males from low to high grade were higher 571 (74.9%) compared to that of females 191 (25.1%). For the various bacilli count categories, the gender disparity was similar. With respect to age groups, the bacilli count for the extreme age categories was low with no case at all registered for the age group 1-10 years as shown in table 4.3.

Table 4. 3: Intensity of Infection with Respect to Gender and Age Group

	Total		**Scanty**		**+1**		**+2**		**+3**	
Sex										
Male	571	74.9	38	73.1	127	70.9	181	72.7	225	79.8
Female	191	25.1	14	26.9	52	29.1	68	27.3	57	20.2
Total	**762**	**100**	**52**	**100**	**179**	**100**	**249**	**100**	**282**	**100**
Age group										
1-10	0	0	0	0	0	0	0	0	0	0
11-20	55	7.2	2	3.8	11	6.1	25	10.0	17	6.0
21-30	161	21.2	12	23.1	35	19.6	45	18.1	69	24.5
31-40	225	29.5	12	23.1	65	36.3	66	26.5	82	29.1
41-50	169	22.2	10	19.2	31	17.3	65	26.1	63	22.3
51-60	88	11.5	8	15.4	18	10.1	34	13.7	28	10.0
61-70	34	4.5	5	9.6	7	3.9	7	2.8	15	5.3
71-80	26	3.4	1	1.9	12	6.7	7	2.8	6	2.1
>80	4	0.5	2	3.8	0	0	0	0	2	0.7
Total	**762**	**100**	**52**	**100**	**179**	**100**	**249**	**100**	**282**	**100**

Source: Field survey, 2016

4.2 Tuberculosis treatment outcome in the Obuasi municipality

4.2.1 Treatment Outcome of PTB Infections

With regards to the PTB patients, TB case category was determined for 1,117 patients of which 1,026 (91.9%) were newly diagnosed, 5 (5.0%) were relapse, 27 (2.4%) return cases after default, 2 (0.2%) were treatment failure cases and only 1 (0.1%) was transferred into the municipality (table 4.4). Majority (94.3%) of the cases were put on category 1 regimen combination therapy [Rifampicin (R), Isoniazid (H), Pyrazinamide (Z), Ethambutol (E)] while 5.4% was put on category-2 regimen [*RHZE+ Streptomycin (S)*] and 0.3% on category 3 [*RHZ+RH+E*] regimen therapies for 9 months. Treatment compliance was evaluated for all 1,271 patients put on treatment. For 401 patients, treatment was completed but the outcome was not confirmed for 784 cases treatment outcome was confirmed. Overall, 572 (73.0%) patients were completely cured, 104 (13.3%) defaulted and discontinued treatment, 3 (0.3%) had treatment failure while 105 (13.4%) patients died in the course of treatment (table 4.4).

Table 4. 4: Type of TB case, Treatment Category and Treatment Outcome

	N	%N
Type of Case		
New Case	1179	92.8
Previous Treatment	27	2.1
Treatment Relapse	56	4.4
Return after default	5	0.4
Treatment failure	2	0.2
Transfer In	1	0.1
Total	**1270**	**100**
Treatment Category		
Category 1	1197	94.3
Category 2	69	5.4
Category 3	4	0.3
Total	**1270**	**100**
Treatment Outcome		
Cured	572	45.0
Treatment completed	401	31.6
Default	105	8.3
Died	104	8.2

Transfer out	85	6.7
Treatment failure	3	0.2
Total	**1270**	**100.0**

Category 1: (RHZE)

Category 2: RHZE+ Streptomycin (S)

Category 3: (RHZ)

Rifampicin (R), Isoniazid (H), Pyrazinamide (Z), Ethambutol (E)

Source: Field survey, 2016

4.2.2 Impact of Treatment

Follow-up evaluation of the impact of treatment on the bacilli count was carried out at month 2, 5 and 6 after treatment was started and the results presented in table 5. At baseline, 526 (40.8%) were treated as sputum smear negative cases, while 762 (59.2%) were treated as sputum smear positive cases. After two months intensive phase of treatment, 94.8% were diagnosed sputum negative by microscopy while 5.2% were still sputum positive. At 5 months and 6 months after treatment, only 6 and 2 cases were still sputum positive respectively. Intensity of infection at baseline and at each of the follow-up evaluation is shown in table 4.5.

Table 4. 5: Impact of Treatment on Bacilli Count

Bacilli Count	Baseline		Treatment Follow-ups					
			2 Months		5 Months		6 Months	
	N	**%N**	**N**	**%N**	**N**	**%N**	**N**	**%N**
0	526	40.8	1029	94.8	997	99.2	933	99.8
Scanty	52	4.0	34	2.1	2	0.2	1	0.1
+1	179	13.9	23	3.1	4	0.4	0	0
+2	249	19.3	0	0	1	0.1	1	0.1
+3	282	21.9	0	0	1	0.1	0	0.0
Total	**1288**	**100**	**1086**	**100**	**1005**	**100**	**935**	**100**

Source: Field survey, 2016

4.2.3 Extra Pulmonary Tuberculosis

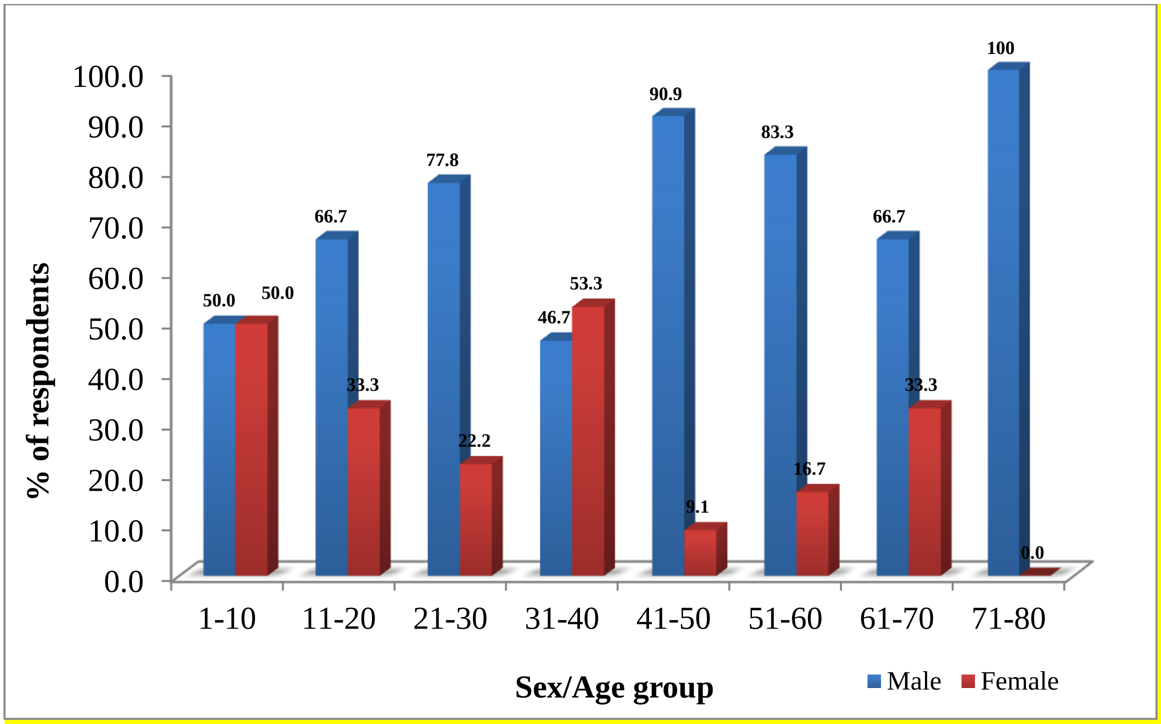
Of the 1,347 TB cases registered, 59 (4.4%) were diagnosed as Extra-Pulmonary Tuberculosis (EPTB). The maximum number of cases, 16 (27.1%) were recorded in the year 2009 while the least of 7 (11.9%) were recorded in 2014 (table 4.6).

Table 4. 6: Number of Cases Treated as Extra Pulmonary Tuberculosis per Year

YEAR	N	%N
2009	16	27.1
2010	8	13.6
2011	9	15.3
2012	10	16.9
2013	9	15.3
2014	7	11.9
Total	**59**	**100**

Source: Field survey, 2016

By age group analysis, only 2 (3.4%) cases were registered for the age group 1-10 years and this increased across all age group to 15 (25.4%) cases for the age group 31-40 years and from then, the number of cases decreased to 1 case for those age group 71-80 years and no case for those 80 years and above. Gender comparison showed that although overall, significantly more males were affected compared to females (71.2% vs. 28.8%, $p < 0.001$), for the age group 1-10 year, males and females were equally affected whereas for the age group 71-80 years, no female was affected (fig 4.4).



Source: Field survey, 2016

Figure 4. 4: EPTB cases by gender and age group

4.2.4 Treatment Outcome of EPTB Infections

Overall, 58 (98.3%) of the cases were put on category-1 regimen [Rifampicin (R), Isoniazid (H), Pyrazinamide (Z), Ethambutol (E) combination therapy] for 6 months while 1 (1.7%) case was put on category 2 regimen [*RHZE+ Streptomycin (S)*] for 8 months. On completion of treatment at the end of 6th and 8th months, treatment compliance was evaluated for all 59 patients. For 40 (67.8%) of the patients where treatment was completed, only 1 (1.7%) was declared cured, 10 (16.9%) defaulted and discontinued treatment, 2 (3.4%) patients were transferred out of the treatment centre and 6 (10.2%) of them died in the course of treatment (table 4.7).

Table 4. 7: Treatment Category and Outcome of EPTB cases

	N	**%N**
Treatment Category		
Category 1	58	98.3
Category 2	1	1.7
Total	**59**	**100**
Treatment Outcome		
Cured	1	1.7
Treatment completed	40	67.8
Default	10	16.9
Died	6	10.2
Transfer out	2	3.4
Total	**59**	**100.0**

Category 1: (RHZE)
Category 2: RHZE+ Streptomycin (S)
Rifampicin (R), Isoniazid (H), Pyrazinamide (Z), Ethambutol (E)

Source: Field survey, 2016

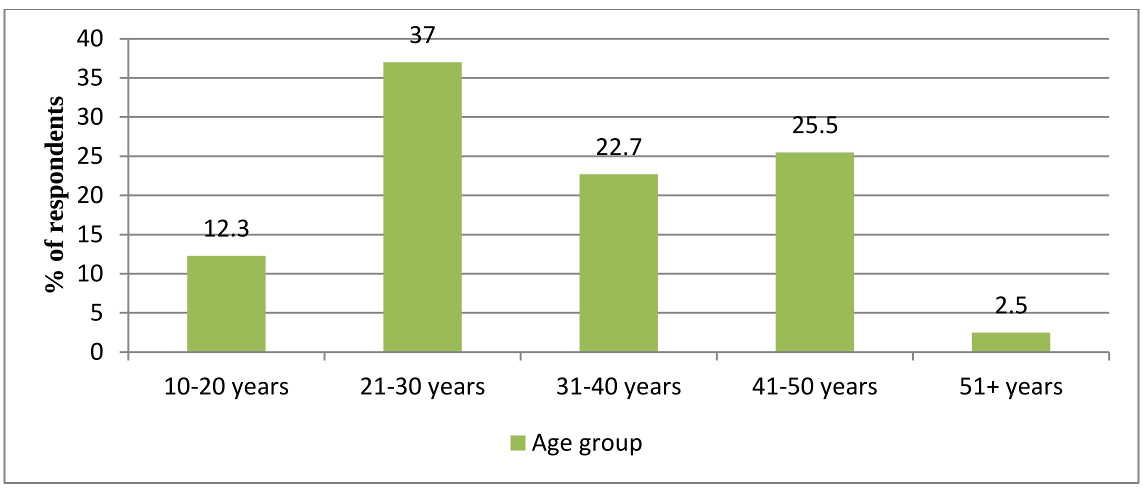
4.3 Factors that determine TB treatment outcome in the municipality

4.3.1 Demographic factors

The demographic characteristics of the study included age group of respondents, sex, educational level, marital status and religion. A total of two hundred and forty-three respondents were used. These respondents comprised of 60 defaulters, 81 treatment completed and 102 cured patients.

Majority, 145 (59.7%) of the respondents were between the ages of 21 – 40 years whilst those at the extreme ages were few 30 (12.3%) and 6 (2.5%) for age groups 10-20 years and 51 years and above respectively (fig. 4.5). The figure also shows that 34 (56.7%) of the defaulters were also found within the age group of 21-40 years.

4.3.1.1 Distribution of respondents by age groups



Source: Field survey, 2016

Figure 4. 5: Age group distribution

Table 4. 8: Sex distribution of respondents

Sex	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
Male	77 (75.5)	44 (73.3)	62 (76.5)	183 (75.3)	0.986	1.125	0.340	0.014
Female	25 (24.5)	16 (27.7)	19 (23.5)	60 (24.7)				
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				

Source: Field survey, 2016

Of the 243 study respondents, there were 183 (75.3%) males and 60 (24.7%) females (table 4.8). Sex of the respondents was not significantly associated with any of the treatment outcomes (p=0.34).

4.3.1.2 Marital status of respondents

Respondent's marital status was also assessed. More than half of the respondents were married, 126 (51.9%). Also, only a few of them, 4 (1.6%) were either a widow or widower. Marital status of the respondents was statistically significant with treatment outcomes (p=0.044).

4.3.1.3 Religious background of respondents

The study respondent's religious background was also assessed. This was possible because this can influence the health seeking behavior of individuals. Majority of the respondents were Christians 152 (62.5%), 69 (28.4%) were Muslims and 22 (9.1%) were traditionalist. Religious background of the participants was not significantly associated with any of the treatment outcomes (p=0.267).

4.3.1.4 Ethnic background of respondents

The dominant ethnic group in the study was Akan's, 102 (42.0%), followed by the Dagartis, 40 (16.5%). In addition, 23 (9.5%) were Ewe's and Gonja's respectively whilst the least of the respondents were Nzema's. The Akan's dominated throughout the three treatment outcomes with 35 (34.7%), 26 (43.3%) and 40 (49.4%) being cured, treatment default and treatment completed respectively. There was no statistical significant association between ethnicity and treatment outcomes (p=0.925).

4.3.1.5 Employment history of respondents

Table 4. 9: Occupational status of respondents

Occupational status	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
Unemployed	35 (34.3)	20 (33.3)	27 (33.3)	82 (33.7)				
Miner	17 (16.7)	12 (20.0)	16 (19.8)	45 (18.5)				
'Galamsay'	25 (24.5)	15 (25.0)	14 (17.3)	54 (22.2)				
Farmer	7 (6.9)	8 (13.3)	16 (19.8)	31 (12.8)	0.914	1.428	0.128	0.029
Fisherman	4 (3.9)	0 (0.0)	1 (1.2)	5 (2.1)				
Trader	14 (13.7)	5 (8.3)	7 (8.6)	26 (10.7)				
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				

Source: Field survey, 2016

With regards to the employment history of respondents, over 60% of participants could count on what to depend on for living even though some respondents were involved in illegal mining ("galamsay"). However, almost 35% of respondents interviewed were unemployed (table 4.9). The study however did not find any statistically significant association between respondents occupational status and their treatment outcome (p=0.128).

4.3.1.6 Annual income level of respondents

Table 4. 10: Annual income of respondents

Annual income (GH¢)	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
100-1000	34 (33.3)	19 (31.7)	27 (33.8)	81 (33.3)				
1100-2000	41 (40.2)	29 (48.3)	32 (40.0)	102 (42.0)				
2100-3000	19 (18.6)	6 (10.0)	12 (15.0)	37 (15.2)				
3100+	4 (3.9)	1 (1.7)	3 (3.8)	8 (3.3)				
Don't know	4 (3.9)	5 (8.3)	6 (7.5)	15 (6.2)	0.972	0.558	0.879	0.009
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				

Source: Field survey, 2016

Based on the annual income levels, the study found that 183 (75.3%) of respondents reported an annual income ranging from GH¢ 100-2000 which can be translated to an average monthly income of GH¢ 175 (table 4.10). The table above also shows that 35 (15.2%) of the respondents earn an amount between GH¢ 2100 and GH¢ 3000 whilst only 8 (3.3%) earn an amount above GH¢ 3100. Some respondents, 15 (6.2%) however could not indicate their annual income because they were unemployed and could not quantify what they get in a year. The annual income level of respondents did not account for a significant difference between the treatment outcome groups (p=0.0879).

4.3.2 Patient related factors

4.3.2.1 Patients knowledge about TB and Clinical Presentation

Patients' knowledge of the clinical presentation of type of illness was assessed. Majority of respondents 87 (35.8%) considered their condition as ordinary cough. However, 61 (25.1%) thought they were suffering from fever.

Similarly, knowledge about the cause of their illness was assessed. This is due to the fact that the knowledge of the cause of one's illness would define the health seeking behaviour of the individual. Participants responds to the cause of their illness was varied, ranging from witch craft, got it through sex, it is through a curse, got it through an infected neighbour and got the disease from the work side. Some of the respondents however did not know the cause of their illness as they gave other reasons. Patients who believed they acquired the disease from an infected neighbour constituted 32.5% of respondents, 18.9% and 18.5% felt they got it through curse or from their work side respectively. However, 16.5% believed they had the disease through sex whilst, 9.5% of respondents attributed the cause of their illness to witch craft and 10.1% did not know the cause of their illness.

4.3.2.2 Patients health seeking behaviour

Table 4. 11: Patients first point of call for health care

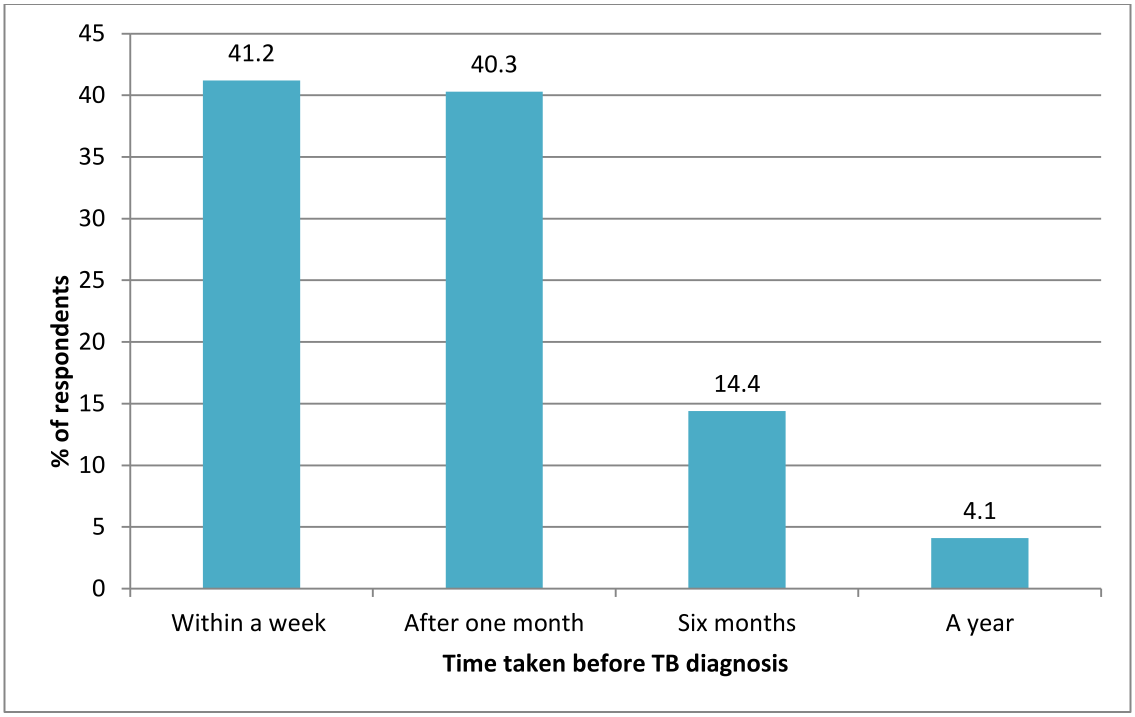
First point of call by patients	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
Herbalist	10 (9.8)	6 (10.0)	10 (12.5)	26 (10.7)				
Prayer camp	1 (1.0)	3 (5.0)	1 (1.2)	5 (2.1)				
Chemical shop	29 (28.4)	25 (41.7)	27 (33.3)	81 (33.3)				
Health facility	62 (60.8)	20 (33.8)	42 (51.9)	124 (51.0)	0.875	2.686	0.002	0.043
Traditionalist	0 (0.0)	6 (10.0)	1 (1.2)	7 (2.9)				
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				

Source: Field survey, 2016

Before the individual condition was diagnosed as TB, most patients initially sought treatment from multiple sources including chemical shops, prayer camps, herbalist and health facilities (CHPS centres, health centres and hospitals). Approximately, half of the respondents, 124 (51.0%) visited the health facility for medical attention, however, a good number of the respondents 81 (33.3%) first visited the chemical shops to buy drugs for their illness (table 4.11). Again, 26 (10.7%) went to herbalist whilst 7 (2.9%) and 5 (2.1%) visited traditionalist and prayer camps respectively. The type of facility visited by patients prior to their diagnosis determined the treatment given to them and this influenced their TB treatment outcome. The study found statistically significant association between patients first point of care and their treatment outcome (p=0.002).

4.3.2.3 Time taken for patients to report to health facility to be diagnosed with TB

The fig. 4.6 below depicts that majority of the respondents 100 (41.2%) and 98 (40.3%) reported for medical attention within a week and after one month respectively of onset of signs and symptoms of their conditions. The time spent at home or used to visit other places before reporting to the health facility to be diagnosed of TB and initiate TB treatment was not significantly associated with treatment outcomes (p=0.122).



Source: Field survey, 2016

Figure 4. 6: Time taken for patients to report to facility

4.3.2.4 Respondents who had TB treatment supporter

Table 4. 12: Patients with treatment supporters

Treatment supporter	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
Yes	96 (94.1)	4 (6.7)	63 (77.8)	163 (67.1)				
No	6 (5.9)	56 (93.3)	18 (22.2)	80 (32.9)	0.435	103.576	<0.001	0.565
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				

Source: Field survey, 2016

With regards to the NTPs policy that every TB must have a treatment supporter, majority, 163 (67.1%) had treatment supporters when they were on TB treatment and 80 (32.9%) did not have (table 4.12). Most of the TB treatment defaults, 56 (93.3%) and treatment complicated 80 (32.9%) TB patients did not have treatment supporters whilst on treatment. There was a statistical association between not having a treatment supporter and TB treatment outcome (p<0.001).

Table 4. 13: Treatment supporters role in TB treatment as reported by respondents

	Frequency	**Percent**
Role		
No support	6	3.7
Reminded me on my medication daily	132	81.0
Collected medication from the health facility for me	25	15.3
Total	**163**	**100**

Source: Field survey, 2016

The role of treatment supporters as reported by participants include; reminding them to take their medication 132 (81.0%) and collecting drugs from the treatment centre for patients 25 (15.3%). A few of the patients however reported that their supposed treatment supporters did not play any role during their TB treatment, 6 (3.7%) (table 4.13).

4.3.3 Health system factors

The study also assessed the health system related factors take can also influence TB treatment outcome. This took into account distance from patients' home to treatment centres, transport cost, convenience of treatment centres, the attitude of health workers towards TB patients during visits and how health education was given to respondents.

4.3.3.1 Distance from patients home to treatment centres

Table 4. 14: Distance travelled by patients to TB treatment centre

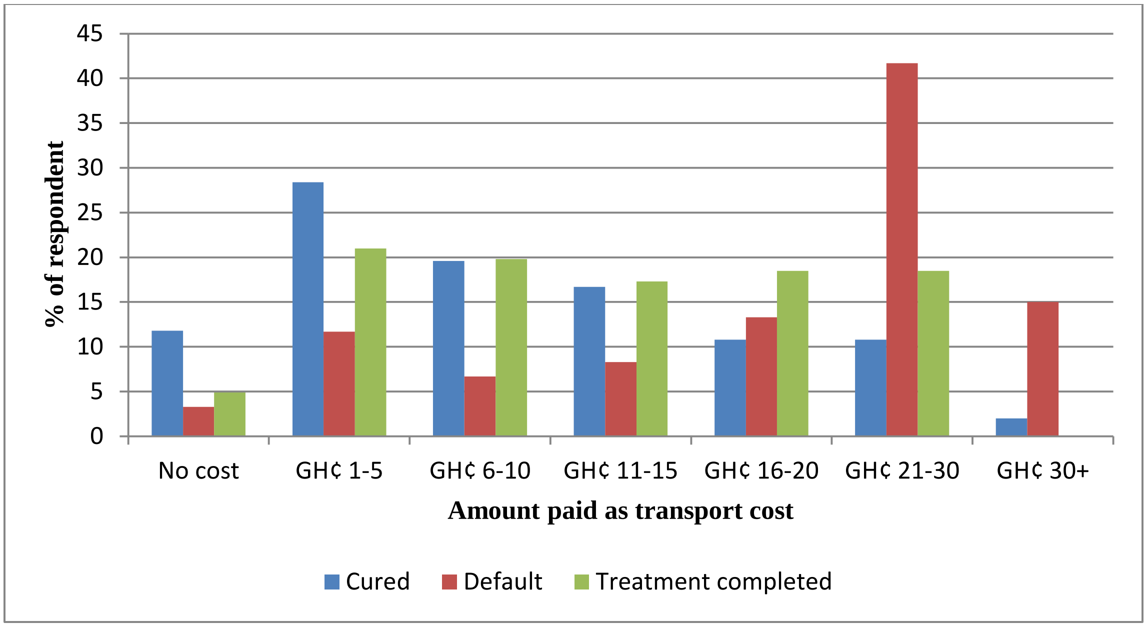
Distance travelled (km)	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
<5	40 (39.2)	8 (13.3)	23 (28.4)	71 (29.2)				
5-10	29 (28.4)	5 (8.3)	16 (19.8)	50 (20.6)				
11-15	7 (6.9)	6 (10.0)	15 (18.5)	28 (11.5)				
16-20	15 (10.8)	15 (25.0)	15 (18.5)	45 (18.5)				
>21	11 (10.8)	26 (43.3)	12 (14.8)	49 (20.2)				
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				
					0.813	4.242	<0.001	0.064

Source: Field survey, 2016

With regards to distance travelled from patients' residence to TB treatment centres, majority of the respondents 71 (29.2%) travelled less than 5 kilometers to the treatment center for their drugs. However, 94 (38.7%) of respondents travelled 16 kilometers or more to treatment centers for their TB drugs monthly (Table 4.14). Some respondents in the treatment default group travelled over 21 kilometers, 26 (43.3%) to the treatment center. The distance travelled to the treatment center for TB drugs was statistically significant to TB treatment outcome ($p<0.001$).

4.3.3.1 Transport cost during travel to treatment centres

Study respondents indicated the amount of money they spend on transportation at each visit to the treatment centre for their TB drugs. The transport cost also involved those respondents who used motor bikes and had to buy in fuel in order to travel. Majority of respondents 53 (21.8%) and 51 (21.0%) spent an amount between GH¢ 1-5 and GH¢ 21-30 respectively. Again, cumulatively, majority of respondents 110 (45.3%) spent an amount between GH¢ 6-20 whilst 11 (4.5%) paid above GH¢ 31. However, 18 (7.4%) of respondents did not make any transportation expenses as their homes were walking distance to the treatment centre (fig. 4.7).



Source: Field survey, 2016

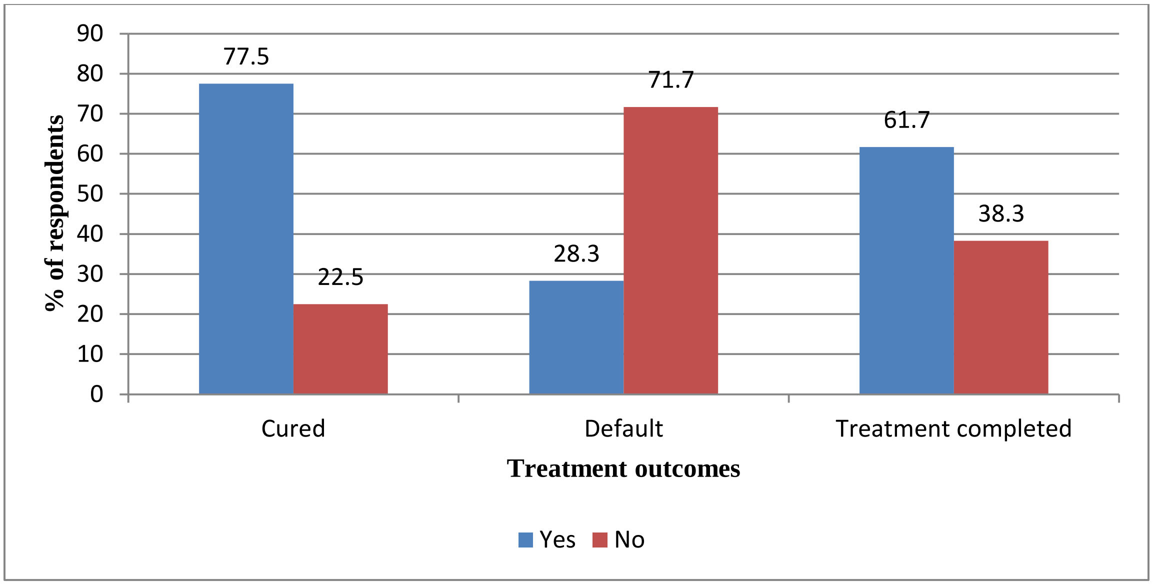
Figure 4. 7: Cost of transportation to treatment centre

4.3.3.2 Patients waiting time at the treatment centres

Time spent at the treatment centre by respondents before being attended to was determined. Of the 243 respondents, 103 (42.4%) said they waited for 1-2 hours before they were attended to by health workers, 85 (35.0%) waited for more than 2 hours before attended by health workers whiles 55 (22.6%) waited for less than an hour before been attended. Of those who had unsuccessful treatment outcome (treatment defaulters), 45 (75.0%) waited for more than 2 hours whilst 11 (18.3%) waited between 1-2 hours before been attended to. Patients who wait for a longer time at a health facility may consider the facility unfriendly and are likely to stop going for their monthly supply of TB drugs. The length of time spent at the treatment center by TB patients before been attended had statistical significant impact on their treatment outcome ($p<0.001$).

4.3.3.3 Convenience of treatment centres to respondents

The fig. 4.8 below depicts the study respondents view about the convenience of the treatment centre assigned to them during their treatment. Of the total 243 respondents, 146 (60.1%) indicated the treatment centre was convenient for them (fig. 4.8). However, 97 (39.9%) of the respondents thought otherwise due to long distance, high transport cost, delay at facility and unfriendly health workers. Of the 60 respondents whose treatment was defaulted, 43 (71.7%) said the treatment centre was not convenient to them. Convenience of treatment center to TB patients was significant with treatment outcome ($p<0.001$).



Source: Field survey, 2016

Figure 4. 8: Respondents view of convenience to treatment centre

4.3.3.1 Educating patients on drugs and treatment duration

Table 4. 15: Education to patients prior to TB treatment centre

Education to patients	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
Yes	89 (87.3%)	38 (63.3)	62 (76.5%)	189 (77.8%)				
No	13 (12.7%)	22 (36.7%)	19 (23.5%)	54 (22.2%)	0.947	4.496	0.004	0.053
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				

Source: Field survey, 2016

Majority of the respondents, 189 (77.8%) believed they were given enough health education about their condition, the drug and duration of treatment. However, 54 (22.2%) of them felt they were not given enough education as they expected. With regards to the duration of treatment, all the 243 respondents said they were told when they will complete treatment; however, the actual duration differed among them. Most of the respondents 223 (91.8%) indicated they were told that treatment would last for 6 months whiles 15 (6.2%), 3 (1.2%) and 2 (0.8%) indicated treatment duration of 4 months, 8 months and 2 months respectively. Educating TB patients after diagnosis and prior to initiating TB treatment about the condition, drug and treatment duration was significantly associated to various treatment outcomes (p=0.004)

4.3.3.4 Attitude of health workers towards TB patients

Table 4. 16: Attitude of health workers towards TB patients at treatment centre

Attitude of health workers	Cured n (%)	Treatment Defaults n (%)	Treatment completed n (%)	Total n (%)	Wilks' Lamba	F	P-value	Partial Eta Squared
Poor	5 (4.9)	29 (48.3)	16 (19.8)	50 (20.6)				
Good	64 (62.7)	25 (41.7)	36 (44.4)	125 (51.4)				
Very good	33 (32.4)	6 (10.0)	29 (35.8)	68 (28.0)	0.801	9.292	<0.001	0.105
Total	**102 (100)**	**60 (100)**	**81 (100)**	**243 (100)**				

Source: Field survey, 2016

The attitude of health workers towards patients at the treatment center was rated by respondents. The rating ranged from poor to very good. Of the 243 respondents, the rating was as follows: 125 (51.4) good, 68 (28.0%) very good and 50 (20.6%) as poor. Only 5 (4.9%) of those cured rated the health workers attitude to be poor. However, majority of patients in the default group, 29 (48.3%) rated the attitude of the health workers towards them as poor (table 4.16). There was statistical association between the health workers attitude and TB treatment outcome ($p<0.001$)

CHAPTER FIVE

DISCUSSION OF RESULTS

5.0 Introduction

This chapter presents the discussion of the study results and findings. The discussion is centred on the research objectives of the study while comparing the findings of the study with other literatures. This study conducted in the Obuasi municipal was purposed to determine the number of TB patients who received TB treatment and factors that influence TB treatment outcome in the Obuasi municipality of the Ashanti Region of Ghana.

5.1 Registration at the TB Centres in the Municipality

A significant number of patients data, 60 (4.3%) were incomplete especially on disease classification, type of patient, smear results and treatment outcome. This is notable and could be mainly as a result of gaps and inconsistent documentations and patients follow-up services by health workers. This observation points to an urgent need to improve TB programme documentations and follow up procedures by health workers who are responsible for TB care in the TB treatment centres in order to minimise treatment default and the spread of drug-resistance TB. Similarly, an earlier study conducted in the Limpopo province, South Africa to determine factors affecting treatment outcomes reported that 15% of data were incomplete as a result of inadequate follow ups of TB patients in the province (Gafar et al., 2014). The number of TB patients registered at the DOTS centres in the municipality over the period increased consistently year by year with a drastic decrease in the year 2013. However, the number of patients rose again in 2014. This could be as a result of ineffective health education and promotion programmes on TB prevention and control in the municipality.

Notwithstanding, the Ghana Health Service (GHS) report in 2010 on the prevalence rate of TB in Ghana demonstrated a downward trend of cases from 311 per 100,000 population in 1990 to 106 per 100,000 population in 2010 and this was attributed to the implementation of multiple interventions (GHS, 2011). This suggests that the municipality must intensified health education and promotion activities to ensure patients comply with treatment and avoid patients defaulting treatment. This is because noncompliance to TB treatment is associated with continuous transmission of the disease, development of drug resistance, increased cost of treatment and death.

In this study, a total of 1,347 patients met the inclusion criteria. Of the total registered patients, majority, (56.3%) were smear positive pulmonary TB, 39.3% were smear negative pulmonary TB and 4.4% were extra-pulmonary TB. The high percentage of smear positive pulmonary tuberculosis in this study was the contrast of other studies where smear negative pulmonary TB cases were higher (Gebrezgabiher et al., 2016; Tessema et al., 2009).

5.2 Types of TB in the Municipality

The Obuasi Municipality has been recording all types of TB (pulmonary and extra-pulmonary tuberculosis). However, pulmonary tuberculosis (PTB) is more dominant as compared to the extra-pulmonary tuberculosis (EPTB). This is based on the fact that, of the 1347 registered TB patients in the municipality in this study, 95.6% were PTB compared to the 4.4% EPTB cases. This is consistent with others where PTB has dominated in most reported studies all over the world (Sreeramareddy et al., 2008; Tessema et al., 2009; van den Boogaard et al., 2009), however, in a retrospective study conducted at the Felege Hiwot Referral Hospital, Northwest Ethiopia, 56.2% of EPTB patients were registered (Biadglegne et al., 2013)

5.3 Age and gender relations with TB Infections

5.3.1 Age

Although the majority of respondents were in the 31-40 age groups, the ages of the TB patients involved in this study ranged from 1 to 95 years with the Inter Quartile Range (IQR) of 31-50 years. The study showed that the number of TB patients was high and increasing between the age groups of 21-30 (18.2%), 31-40 (28.0%) and 41-50 (23.8%). This study noted that the age groups (21-50) years were the economically productive age groups. This finding was consistent with the position of Ahlburg (2000) and a study conducted in Malaysia (Ahlburg, 2000; Nik et al., 2011) in which the age of patients in the region of 21-50 years were found to be economically productive and also associated with treatment noncompliance. The World Health Organization (WHO) also recognizes that TB affects mostly adults in the economically productive age groups (WHO, 2013b). This burden of tuberculosis incidence and mortality in adults of economically productive age of the society such as parents, workers, community leaders etc. is due to the economic dependence of family which makes them involve themselves in earning and get exposed to other cases in community. This fact noted by this study is supported by the study conducted in India (Chennaveerappa et al., 2011).

The majority of the patients were males, which was also recognized in the findings of other studies (Ferreira et al., 2005; Gebrezgabiher et al., 2016; Paixao & Gontijo, 2007) and in contrast to similar studies done in Gondar (Tessema et al., 2009) and Gambella (Sisay et al., 2014). This might own to underutilization of the DOTS service by females or due to higher number of males being exposed to the infection in the municipality. Similarly, a study conducted in Bangladesh (Begum et al., 2001) finds that women appear to have less access to TB diagnosis and treatment than men.

5.3.2 Gender

There were more males (73.4%) than females (26.6%) in this study. The females, most of whom are unemployed and housewives do not have money on their own to go to the health facility for care and these females who suffer from TB may not also want to lose the activities that the woman routinely performs in the household: childcare, cooking, cleaning, and managing the activities of the household which results to underutilization of the TB DOTS services by females. In other words, it could also be as a result of higher proportion of males being exposed to the infection in the area. This finding of the study is consistent with the findings of Ahlburg (2000) which stated that women who suffer from TB are often less likely to be detected and treated than men. The finding is also consistent with WHOs position which indicated that TB is more common among men than women (WHO, 2013b) and a studies conducted by Gebrezgabiher and colleagues in Southern Ethiopia (Gebrezgabiher et al., 2016), in Brazil (Ferreira et al., 2005; Paixao & Gontijo, 2007). However, the study finding is in contrast to those studies conducted in Gondar (Tessema et al., 2009) and Gambella (Sisay et al., 2014) where more females were affected with TB than men. The gender disparities found in this study could also be due to accessibility and stigmatization. A study conducted in Bangladesh and Nepal found that women have poorer access to public outpatient clinics than men (Begum et al., 2001) and women are exposed to stigma in seeking for TB services (Holmes et al., 1998).

5.4 Intensity of TB Infections

The intensity of PTB is determined with acid fast bacilli (AFB). When AFB is seen in a smear they are counted and graded. According to the number of acid fast bacilli seen, the smears are classified as 4+, 3+, 2+, 1+ or scanty. The greater the number AFBs seen in a patients smear, the more infectious the patient. This study found that, there was 59.2% positivity with bacilli counts ranging from scanty to 3+ counts with sputum sero-conversion rates of 94.8%, 99.2% and 99.8% respectively at the 2nd, 5th and 6th months of sputum examination. This finding of the study (59.2%) positivity is consistent to the revised definition of a new sputum smear PTB case which is based on the presence of at least one acid fast bacillus (AFB+) in at least one sputum sample in countries with a well-functioning external quality assurance system (Odubanjo & Dada-Adegbola, 2011). The 59.2% sputum smear positivity as seen in this study is significantly lower than the 86.3% and 67.0% positivity reported in Nigeria (Duru et al., 2016; Egbewale et al., 2007; Omotosho et al., 2014) but higher than 44.1% reported South Eastern Nigeria (Adinma et al., 2015) and 0.8% been reported in (Getahun et al., 2013). This study found that the number of cases increased with intensity and this could pose a threat as many of the TB patients were infectious and could transmit the TB infection to others.

There were more males (74.9%) with sputum smear positive than females. This gender differences could be due to fear of social stigma and the impact of disease on marital point of view which makes female tends to overlook their disease status to taking care of the household. This reason is supported by other studies (Gosoniu et al., 2008; Somma et al., 2008). Again, a previous study had reported that quality of sputum provided by female TB suspects are poor (Khan et al., 2007). However, for the various bacilli count categories, the gender disparity was similar. Sputum smear microscopy remains the backbone in the diagnosis of pulmonary tuberculosis in many developing countries including Ghana. However, there are gender imbalances in TB bacilli counts, as bacteria counts are much higher in males than females. Some studies assert that there is less access to health care for women and therefore more unreported TB cases in females has been mentioned in many countries (Karim et al., 2007; Nansera et al., 2010; Uwizeye et al., 2011). There is less sensitive screening and diagnosis strategies for women and this has led to underestimation of TB in women (Uwizeye et al., 2011). Other studies also posited that the low TB bacilli counts in females are as a result of high prevalence of HIV among women in many countries. The study asserted that the paucibacillary nature of pulmonary TB that is common in high HIV prevalence settings leads to an increased proportion of microscopy smear negative results and this are likely to be reflected in TB detection because of the association of HIV with a reduced performance of TB diagnostic tests, especially microscopy (Ramsay, Bonnet, Gagnidze, Githui, Varaine, & Guerin, 2009). The World Health Organization (WHO) has also reported that men seem to be more affected than women, with a male/female ratio of 1.9±0.6 for the worldwide case notification rate (WHO, 2009a).

Smear positivity varied grossly by gender or sex, as males had significantly higher sputum positivity rate than females. In this study, males had higher sputum positivity rate of 59.2% as against 40.8% sputum positivity for females. This support the findings of a study in India where males had higher sputum positivity rate of 18.5% as compared to 5.2% to females (Chinnakali et al., 2014). The frequency of low-count grading results compared with high count grading has been considered as an indicator of the quality of sputum smear microscopy.

TB suspects of 1 – 10 years of age and 55 years or more had significantly higher low positivity TB bacilli counts compared to other age groups. This could be caused by no extensive lesions among extremes of age group (Chinnakali et al., 2014). Similar findings of high low bacilli counts in the extreme age groups were also reported in studies from some African countries (Lawson et al., 2010; Rieder et al., 2009). In this study, the proportion of scanty smears (bacilli counts) was found to be 4.0% and low grade positive smears (scanty and 1+) were 17.9%. The high smear positive sero-conversion rates as reported by this study has also been reported elsewhere in other studies (Duru et al., 2016; Egbewale et al., 2007).

5.5 Outcome of TB Treatment

The control of TB mostly relies on how successful patients are treated. The global target for TB treatment success in line with the MDG's is 85%. This target also serves as a standard for assessing the performance of tuberculosis control programmes worldwide (WHO, 2012a).

In this study, the cure rate was 42.5% and overall treatment success rate (the total proportion of patients that were cured and those that completed treatment) was 75.2%. This was lower than Ghana's success rate of 86.5% for 2011 (NTP, 2011) and 84% success rate for new and relapse TB cases in Ghana in 2012 (WHO, 2014b). This 75.2% treatment success rate could be as a result of the high default rate (8.3%), death rate (8.2%) and transferred out (6.7%) recorded in the study. This finding is consistent with unpublished study conducted in Ketu South Municipality by Azagba (2013) to determine treatment outcomes using treatment supporters which reported a similar success rate (79.6%) and attributed it to problems with using treatment supporters (Azagba, 2013). The 75.2% treatment success rate reported in this study, though lower, is better than what has been reported in studies conducted in the Gondar University Teaching hospital in Northwest Ethiopia that showed only 29.5% success rate (Tessema et al., 2009), Felege Hiwot Referral Hospital, Northwest Ethiopia which reported 26.0% treatment success (Biadglegne et al., 2013) and Yaounde Central Hospital, Cameroon that reported 21.1%

treatment success (Agbor et al., 2014). Tessema et al., (2009) attributed the low success rate to high transferred out rate (42%), default rate (18.3%) and death rate (10.1%).

The 8.3% patients who defaulted treatment are more than the WHO target of less than 5% default rate. This study's default rate was also higher than the average 6.2% among the 22 high burden countries (HBCs) reported by the WHO (WHO, 2005), 7.0% in Sweden (Romanus et al., 2000), 6.6% in Malawi (Harries et al., 1999) and the 3.2% in Tigray (Berhe et al., 2012). This could be due to the inadequate number of DOTS centres in the Obuasi municipality which brings about issues of accessibility and patients have to travel about 20 kilometres from their homes to any of the three TB DOTS centres assigned to them for services and it could as well be due to patients travel related costs. On the other way, the high default rate in this study could suggest that measures used by the municipal TB control programme to improve compliance to TB treatment may not be enough or recommendations on treatment monitoring by WHO which aim to improve TB patients' compliance were not optimally implemented. Therefore, monitoring strategies such as contact tracing of patients should be improved to help reduce the high default rate.

However, a study conducted in Ghana by Dodor and Afenyadu (2005) reported a high default rate of 13.9% and attributed it to old age and stigma associated with TB disease. Also, other studies on factors that influence default in different parts of the world, particularly in the sub-Saharan Africa region have demonstrated that a male gender, ignorance on the need for treatment compliance and disease stigma have an association with treatment default (Muture et al., 2011; Tessema et al., 2009). Similarly, the death rate among the unsuccessful TB treatment outcome was 8.2%, which was also higher than the death rate of 3.9% from Tigray region in Ethiopia (Berhe et al., 2012). This high death rate in the municipality could be attributed to the HIV co-infected TB patients as the municipality is a mining and commercial town and HIV/AIDS infection is on the increase and increase in illegal mining also exposes the patients to other infections. The variations could be as a result of differences in DOTS performance and the use of health workers in contact tracing and follow-up of TB patients in Tigray regions of Ethiopia (Mengiste, 2005).

The overall unsuccessful treatment outcome rate of this study was 23.4%, which was remarkably higher than the 16.7% and 14.8% reported in Southern Ethiopia (Gebrezgabiher et al., 2016; Munoz-Sellart et al., 2010) and 11.3% in Arsi Zone of Oromia (Tekle et al., 2002). This could be due to difference in study settings, sample size and period or duration of study and DOTS performance.

Majority, (58.9%) of the patients in this study had smear positive TB. These patients were more likely to achieve treatment success compared to participants with smear negative TB. A similar finding has been reported in a study in Benin attributing smear negative patients unsuccessful treatment outcome compared with smear positive patients owing to death and loss to follow ups of the patients (Ade et al., 2013). But a contrasting finding where smear negative patients had better treatment outcome than smear positive

TB patients has been reported in Andhra Pradesh (Srinath et al., 2011). Therefore, diagnostic procedures should be strengthened to improve TB diagnosis and as well strengthen continuous health education programmes to improve patients' compliance to treatment regimen.

5.6 Factors affecting TB Treatment Outcome

243 tuberculosis (TB) patients who underwent TB treatment were interviewed to assess some factors that influenced the outcome of TB treatment in the Obuasi Municipality. The TB patients who had completed their TB treatment from 1st January 2009 to 31st December 2014 were selected and interviewed.

Non-compliance to TB treatment has been recognized as one of the major challenges in achieving the worldwide targets of TB control. Some of the most often cited factors contributing to non-compliance in developing countries include age, sex, educational level, marital status, ethnicity and religion (O'Boyle et al., 2002). Others factors are TB treatment illiteracy, patient feeling better, medicinal side effects, income levels of patients, distance travelled to treatment centres and transport challenges and attitude of health workers (Needham et al., 1998; O'Boyle et al., 2002; Pushpananthan et al., 2000) .

From this study, it can be construed that the contributing factors that affected treatment outcome were marital status, patients first point call for health care, lack of treatment supporters, distance travelled to DOTS centres, patient waiting time, convenience of treatment centres, education to patients prior to treatment and attitude of health workers.

5.6.1 Demographic characteristics

The socio-demographic factors considered in this study included age, sex, educational level, ethnicity, religion and occupational status of respondents. There were more males 183 (75.3%) than females 60 (24.7%) in the study. Similarly, the males dominated in the treatment outcome groups 77 (75.5%) cured, 44 (73.3%) default and 62 (76.5%) treatment completed. The finding of this study supports the finding of a study conducted by Norgbe et al., (2011) which reported that treatment default was associated with males than females. Similarly, a study conducted in Turkey by Babalik, et al., (2013) and Kenya by Muture et al, (2011) also associated the male sex to adverse treatment outcomes than the females. However, the study did not find any statistical significance, indicating a relationship between sex to compliance or non-compliance with treatment (p=0.583).

Although majority of the study respondents were in the 21-50 age group, participants in the 21-30 age group, 22 (36.7%) defaulted TB treatment more than the other age group. This conforms to the findings of a study conducted in Egypt by El-Din et al., (2013) which reported that patients aged less than 30 years were more likely to default from treatment. The study did not show any significant association between age and non-compliant with TB treatment (p=0.597). This finding is also consistent with a study by Modise (2011) which reported that age of patients was not found to be associated with treatment non-compliance. In this study, both compliance and non-compliance to TB treatment was higher amongst married and single respondents. Of the 126 married participants 92 (73.0%) had successful treatment outcome (cured and treatment completed) whilst 34 (27.0%) were unsuccessful (default). Similarly, 66 (78.6%) and 18 (21.4%) of the 84 single participants had successful and unsuccessful treatment respectively. Marital status of respondents was significantly associated with TB treatment (p=0.044). This finding of the study however contradicts the findings of a study conducted by Kaona et al. (2004) in which marital status was not found to be associated with treatment outcome.

Majority of the study respondents (42.0%) were Akan's followed by the Dagarti's (16.5%). Similarly a greater proportion of the defaulters were also Akan's (43.3%) and Dagartis (18.3%). Statistically, there was no association between the treatment outcomes and ethnicity of patients (p=0.925). A greater number of respondents (38.3%) have had formal education up to the Junior High School (JHS) or Middle School. However, most of the defaulters educational level was Primary education (46.7%). The study finding is in contrast with the findings by Gad et al. (1997) which reported an association between low educational levels to treatment outcomes. Educational level was not statistically significance to the treatment outcomes (p=0.583).

Occupation and income status of respondents which could influence TB treatment compliance was assessed. Majority of the respondents (66.3%) had regular income as some were miners (18.5%), farmers (12.8%), traders (10.7%), fishermen (2.1%) and majority being illegal miners ("galamsay") (22.2%). Not having a regular household income is closely associated with poor treatment outcomes. However, the majority of defaulters (non-compliance) of TB treatment were unemployed (33.3%) and did not have regular income for living. This finding of the study was consistent with other studies conducted in Georgia (Djibuti et al., 2014) which found that low household income linked to unemployment was associated with poor treatment outcomes and another study conducted in Kenya (Muture et al., 2011) which stated that low income of patients was a risk factor for TB treatment default. The participants of this studies admitted skipping scheduled meetings for their TB drugs due to distance and transport cost. This has a great impact on the effectiveness of the TB treatment since TB patients was not able to afford the transportation cost to the health facilities for their TB medications and also provide good meals for themselves or their dependants during the treatment period. This results, was consistent with studies conducted in Estonia in 2005 which found that unemployment was a significant predictor of TB-related deaths (Kliiman & Altraja, 2010) and a similar study in Germany in 2001 which reported that homelessness and unemployment was strongly associated with non-cure of TB (Diel & Niemann, 2003). Many other studies reported elsewhere indicated that unemployment is an important risk factor for TB. Many others studies in Poland (Przybylski et al., 2014) and Croatia also reported unemployed people as a risk to treatment outcome (Jurcev-Savicevic et al., 2013). However, this study did not find any statistical association between occupation and employment status (p=0.128) and annual income (p=0.879) and treatment outcomes.

5.6.2 Patient related factors

Patients related factors to successful treatment outcome assessed in this study include patient's knowledge about TB, patients' first point of call for health care, time spent before being diagnosed as TB and availability of treatment supporter.

Patient knowledge about their disease and its treatment will immensely enhance treatment compliance. The patient's knowledge of symptoms of TB was very high as all respondents were able to identify persistent coughing, coughing up blood, chest pains, loss of weight and night sweats as presenting symptoms of TB. Knowledge of TB symptoms was however not associated with any significant difference between the compliant and non-compliant groups.

In this study, patient's knowledge about the cause of ill-health was poor. The place of first visit by clients to seek for health care for their condition was influenced by the patient's perception about the type of illness and the cause of the illness. Even though 67.5% did not know the cause of their illness, some of them attributed the cause to witch craft, curse and work, whilst others believed it was a sexual transmitted disease. However, 32.5% of the respondents thought they acquired the disease from an infected neighbour they had close contact with. This made patients to go to the nearest chemical shops to buy cough medicine to treat their condition. Similarly, those patients who believe in traditional medicines also resorted to the herbalist and traditionalist for herbal medicines or spiritual remedies to cure them of their illness whilst others visited health facilities for care. This finding of the study supports the findings of Dodor (2012) which reported that patients recognized the signs and symptoms of their condition as malaria or ordinary cough rather than TB. Also, a study by Mature et al., (2011) showed that majority of patients did not suspect their condition to be TB or were just unaware what they were suffering from before they visited the health facilities. This is why it is important to educate patients on their condition, the drug and treatment duration after being diagnosed of TB to ensure compliance to treatment. Although, majority of respondents (51.0%) first visited the health facility others (49.0%) visited other or multiple sources based their perception of the cause. This finding is consistent with that of Ahorlu and Bonsu (2013), where respondents attributed the cause of TB to a wide range of things including sex and evil spirits or gods. Patients' first point of call for care for their illness was strongly associated with their treatment outcome (p=0.002). Lack of health education may result in patients not understanding the importance of complying with treatments and the consequences of not completing their treatments. It is important for all patients who have been initiated on TB treatment to complete treatment as prescribed by the health worker according to the NTPs guidelines. Failure to do so is associated with treatment failure and development of drug resistance.

Majority of the respondents of the study were diagnosed of TB within a week (41.2%) or after one month (40.3%) of onset of sign and symptoms including cough, headache and weight loss. Some of these patients visited different sources for care whilst others visited health facilities on several occasions before they were finally diagnosed of TB. However, time taken before being diagnosed with was not statistically significant to treatment outcome (p=0.122).

Treatment supporters are very essential in TB treatment. Directly Observed Treatment Short-course (DOTS) is a globally recommended treatment strategy for TB patients and for their continuous follow-up during the treatment (WHO, 2004c). The DOTS policy depends on suspected individual's self-referral to health facilities. Providing treatment support for TB patients involved several tasks which is mostly carried out by the treatment supporters (Muncz & Bergestrom, 2002). Treatment supporters are very essential in TB treatment. They are selected to support TB patients on anti-tuberculosis drugs in order to help them complete the full course of the medications.

In this study, over sixty seven percent (67.1%) of the respondents had treatment supporters when they were on treatment. Again, a good number (32.9%) of the study participants did not have treatment supporters when they were on TB treatment. The treatment supporter is envisaged to play a critical role as a DOT observer at the patient's home, reminding the TB patient to take their daily medications and as well collect medications from the TB DOTS centres for patients when patients are unable to go to facility themselves for the medications. This is supported by a study which reported that treatment supporters were collecting TB drug for their patients monthly and were giving it to them daily (Ali, 2008). The World Health Organization (WHO) also in 2009 stated that a suitable and acceptable treatment supporter for the patient is the key to success for DOTS and is mandatory for the whole duration of treatment (WHO, 2009c). This position of WHO makes the presence of a treatment supporter an essential in ensuring that patients comply with their treatment regimen. Yet, the status quo was different in the municipality as some patients who claim to have treatment supporters did not even live with them.

Of the total patients who had treatment supporters 6 (3.7%) of the respondents indicated that their supposed treatment supporters did not play any role in their treatment. This is because their supposed treatment supporters were not staying at the same place or community with them or they travelled out of the community. This 67.1% of patients having treatment supporters in this study was far below what was reported in Pakistan by Soomro et al., where 89.6% of patients were provided with TB treatment supporters (Soomro et al., 2012). This success in Pakistan could be due to the various treatment supporter options available to TB patients to choose from and being documented on the TB01 form with their addresses and also TB coordinators being available to explain and convince patients on the need for treatment supporters. Unlike in Ghana or the Obuasi municipal, these options are not available and documentation of treatment supporters is rarely done. Again, of those patients who did not have treatment supporters, (32.9%) did not want anybody to know of their TB status, (22.0%) said they were not told to select treatment supporter, (19.3%) of them said they did not want a treatment supporter, and (13.8%) gave the reason that nobody agreed to be their treatment supporter. Be not in a position to declare ones TB status and refusing to be a treatment supporter to a TB patient or not wanting a treatment supporter may be attributed to the stigma associated with TB disease as well as patients lack of knowledge about TB. This finding was consisted with the reasons cited in a study conducted in Ethiopia for those patients who did not have treatment supporters (Abebe et al., 2010). Not having a treatment supporter associated with noncompliance to treatment and this accounts for the lower cure rate of 42.5% and overall treatment success rate of 75.2% of this study. The study also finds that of the 60 patients who defaulted, 56 (93.3%) did not have treatment supporter. This study therefore find statistically significant association between having treatment supporters and having a successful treatment (cured or treatment completed) (p=<0.001).

5.6.3 Health system factors

On the health system factors, the study looked at distance traveled by patients to treatment centres, patient waiting time at health facilities, patients' convenience of the facility, appropriate health education to patients and health workers attitude as factors that can affect TB treatment compliance and its outcome.

Accessibility to health facility and cost of transportation are significant factors that could affect TB treatment outcome. Therefore information on the distance from place of residence of patients to treatment centre was retrieved to determine its association with treatment success. It has been proven by studies that patients who lived more than 5km during treatment were less likely to have treatment success as compared with those who lived less than 5km. This may be as a result of the proximity to the treatment centre and reduced transportation cost. The place of residence for most of the TB patient's during treatment was far away from the treatment centre. Some patients came from neighbouring districts. This could be as a result of the limited number of TB treatment centres in the study area. The Obuasi municipality has only three TB treatment centres situated at the Obuasi Government Hospital (OGH), AngloGold Ashanti Hospital (AGA-H) or Bryant Mission Hospital. This three TB DOTS centres is woefully inadequate for a municipality with an estimated population of 211,587.

In this study, 70.8% of the patients travelled from 5 kilometers (km) to 20 km and footed transport cost ranging from GH¢ 1 to over GH¢ 31 per every visit they made to collect their TB medications. Travelling about 20kms to TB treatment centre for medication is associated with noncompliance of treatment and unsuccessful treatment outcome. This finding of the study was consistent with findings of other studies where long distance travelled (more than 5 kilometers) by TB patients from home to treatment centre was associated with unsuccessful treatment outcome (Ai et al., 2010; Ali & Prins, 2016; Bam et al., 2005; Boateng et al., 2010; Erhabor et al., 2000; Jaiswal et al., 2003; Muture et al., 2011). Similarly, a study conducted in Nigeria and Indonesia reported similar findings to this study where long distance to health facilities and cost involved in transportation to collect TB drugs were deemed as risk factors for noncompliance to TB treatment (Ibrahim et al., 2014; Widjanarko et al., 2009). Travelling long distance over 5km to the treatment center for medication was significantly associated with treatment default ($p<0.001$). This was also similar to the finding of Mature et al., (2011), Bagoes et al., (2009) and Ibrahim et al., (2014).

Although, majority of the respondents 60.1%) felt the treatment centre was convenient for them despite the long distances they have to travel but because of their privacy. Among the patients who thought the various treatment centres assigned them were not convenient, 43 (71.7%) were defaulters out of the total 60 defaulters. Those who indicated the facility was not convenient, over 65% based their argument on the distance they travel to the center and the high cost of transportation. The respondents suggested they would have preferred to go to the nearest health facilities in their various communities for their medication since that could have helped to save their transportation cost and time for travelling. Therefore, decentralizing the TB treatment by stocking TB drugs at all health facilities in the municipality may be necessary. Patients convenience of the treatment centres were statistically associated with their treatment outcome ($p<0.001$). Majority of the patients (77.8%) said they were given some form of information concerning the disease and how to take the medicines. However, 22.2% of the respondents said they were not given enough education on the disease and especially the drug. Of the 54 respondents who felt there was not enough education, 22 (36.7%) defaulted from treatment. This could be actually true that such patients were not told the need for treatment compliance. Among the consequences of unsuccessful treatment is treatment failure which may lead to drug resistance TB and increase cost for the TB programme. Not successfully completing treatment may cause deterioration of patients' condition which may lead to death, including the high financial burden on families to cater for such patients. Inadequate health education on TB to patients was significantly associated with treatment (p=0.004).

Again, there are supposed to be good interaction between patients and health care workers especially when patients are on treatment to ensure effective compliance. However, some health workers harass patients and are unfriendly to might make patients feel threatened and unwelcome leading to treatment interruption. Notwithstanding, majority (79.4%) of the respondents rated the health workers attitude from good (51.4%) to very good (28.0%). However, a good number of the respondents (20.6%) rated the attitude of the health workers as bad. More than half (51.7%) of respondents who rated the attitude of health workers as good did not complete their TB treatment. This finding of the study is consisted with that of Annan et al. (2013) but however differs from that of Bernard et al. (2011) which reported the attitude of the health care workers as unfriendly, unsympathetic and lack of dignity. The health workers attitude as reported by study respondents was statistically significant with the treatment outcomes ($p<0.001$).

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter presents the summary, conclusion and recommendations of the study based on the findings and analysis.

6.1 Summary

- Data was reviewed in Obuasi Government Hospital, Bryant Mission Hospital and AngloGold Ashanti Hospital treatment centres involving 1347 TB patients
- Of the 1347 TB patients, 1288 (95.6%) were diagnosed PTB while 59 (4.4) were diagnosed EPTB
- Out of the 1288 PTB patients, 759 (58.9%) were diagnosed smear-positive, 529 (41.1%) were smear-negative TB.
- The ages of the TB patients registered ranged from 1 to 95 years
- The most affected patients were between 21-50 years of age
- Majority of patients (73.4%) were males while females constituted only 26.6%
- Positivity with bacilli count was 59.2%

- The AFB counts ranged from scanty and 1+ (low grade positive smears) to 3+ (high grade positive smears

- The number of TB cases increased with intensity of the bacilli counts

- The bacilli counts were much higher in males than females

- The bacilli counts were lower at the extreme age groups

- Cure rate was 42.5% and overall treatment success rate was 75.2% which was lower than internationally accepted cure rate sanctioned by WHO.

- There were 8.3% default rate, 8.2% death rate, 6.7% transferred out and 0.2% treatment failures

- TB treatment outcome in the municipality was affected by marital status, occupational status, patients' first point of call for health care, availability of treatment supporters, distance travelled by patients to treatment centre, patient waiting time at treatment centre, convenience of treatment centre, health education on condition and treatment duration and attitude of health workers.

6.2 Conclusion

6.2.1 Main conclusion

The results of this study conclude marital status, occupational status, patients' first point of call for health care, availability of treatment supporters, distance travelled by patients to treatment centre, patient waiting time at treatment centre, convenience of treatment centre, health education on condition and treatment duration and attitude of health workers influenced treatment outcome in the Obuasi municipality.

6.2.2 Sub-conclusions

- The study found that from 2009 to 2014 a total of 1347 TB patients were registered and put on treatment.
- It was found that the cure rate was 42.5% and overall treatment success rate was 75.2%. Additionally, it was found that the default and death rate was high at 8.3% and 8.2% respectively.
- TB treatment outcome in the municipality was affected by marital status, occupational status, patients' first point of call for health care, availability of treatment supporters, distance travelled by patients to treatment centre, patient waiting time at treatment centre, convenience of treatment centre, health education on condition and treatment duration and attitude of health workers influenced treatment outcome in the Obuasi municipality

6.3 Recommendations

In relation to the findings from this study, the following recommendations are made:

1. Health workers should provide health education to all TB patients and their treatment supporters on the drugs, expected side effects and treatment duration before treatment is started, and also at each visit to the facility for services. The education should be centred on the signs and symptoms, duration of treatment, and emphasise on free TB treatment and the need for seeking early treatment. The health education should be provided at the level of the patients and treatment supporters understanding for easy assimilation and compliance to help prevent treatment default and further spread of the disease.

2. Health workers at the DOTS centres should follow the NTP policy on treatment supporters, and ensure that each diagnosed TB patient must choose reliable treatment supporter before treatment is initiated to ensure compliance to treatment.

3. Consider expanding the TB DOTS facilities and decentralize TB treatment to at least all health centres as approved by the NTP. This will go a long way to improve on accessibility and hence bring TB services closer to the patients and then reduce the long distance patients had to travel to the current DOTS centres

for their drugs. When this is done it will again reduce the indirect cost incurred by patients in the form transportation cost to and from treatment centres.

4. Health workers should be assigned to TB patients. This will help health care providers to enhance supervision and assist patients during treatment to improve treatment success and avoid defaulters. This could also help to improve defaulter tracing.

5. Health workers should also make sure to properly fill all patient details in the TB 01 and treatment cards to enhance documentation. When this is accurately done, the information could be used for follow-up and defaulter tracing and could also be used to find out the progress of the patient on treatment since TB01 and the TB treatment card has a column for telephone numbers of patients and treatment supporters as well as residential addresses.

6.4 Limitation(s) of the Study

Limitations are weaknesses found in a study that may compromise the results to be generalized. This study like other studies was not devoid of limitations. It was retrospective using both primary and secondary data. The part of the study that used secondary data reviewed available data on TB registers and patients treatment cards from the three DOTS centres in the municipality. At the time the data were being extracted, some of the records were incomplete and there could be underestimation of the actual treatment outcomes. Again, for the part where primary data was collected, the estimated sample size was 287 TB patients but ended up with 243 respondents. This could have affected the findings of the study. There could also have been the likelihood of recall bias on the part of respondents because retrospective study sought to ask questions on events that happened years back.

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APPENDIX I - QUESTIONNAIRE

INSTRUCTIONS TO COMPLETE FORM

Please circle appropriate response for questions with options and fill in space provided for questions without options.

DEMOGRAPHIC INFORMATION

1. Name of community: ....

2. Place of residence: ……………………………………………………………

3. Sex

(a) Male

(b) Female

1. Age in years..

2. Education Level

(a) No Education

(b) Primary

(c) JHS/Middle school

(d) SHS

(e) Tertiary (College, Polytechnic & University)

3. Marital status

(a) Single

(b) Married

(c) Co-habitation

(d) Divorced

(e) Widowed/widower

4. Religion

(a) Christian

(b) Islam

(c) Traditionalist

(d) Others (specify)..

5. Ethnicity…………………………………………………………..……………

6. Occupation

(a) Unemployed

(b) Miner

(c) Small scale miner (galamsay)

(d) Farmer

(e) Fisherman

(f) Trader

(g) Formal (civil servants, public servant & NGO workers)

(h) Others (specify)..

7. Annual income level of patient or care taker of patient? GH¢..

8. During the period you were on treatment, can you tell me how having TB affected your daily life? Example your Work and family-life ....

....

....

....

9. What type of tuberculosis did the patient been interviewed had?

(a) Smear positive pulmonary TB

(b) Smear negative pulmonary TB

(c) Extrapulmonary TB

10. What was the treatment outcome of the patient been interviewed?

(a) Cured

(b) Defaulter

(c) Treatment failure

(d) Treatment completed

PATIENTS' KNOWLEDGE AND PERCEPTION OF TB SERVICES

11. Can you tell me when you felt the first signs of being ill? ....

....

12. What signs/symptoms did you notice that prompted you to seek for treatment?

(a) Chronic cough

(b) Night sweats

(c) Fever

(d) Weight loss

(e) Coughing up blood

(f) Others (specify)..

13. How long did it take you to seek medical treatment after the first signs/symptoms?

(a) Within a week

(b) After one month

(c) After six months

(d) A year

(e) Others (specify)...

14. What did you think you were suffering from?

(a) Did not know

(b) Fever/malaria

(c) Cough

(d) Others (specify)...

15. Where did you go first to seek for care when you first felt ill and why?

(a) Herbalist

(b) Prayer camp

(c) Chemical shop

(d) Health facility

(e) Others (specify)...

16. What treatment did you receive from **Q*15*** *above*?

(a) Herbal medicine

(b) Prayers

(c) Cough medicine

(d) TB treatment

(e) Others..

17. How long were you told you would take the medicines?

(a) 2 months

(b) 4 months

(c) 6 months

(d) 8 months

(e) When patients feels better then he/she stop on their own

(f) Others (specify)...

18. How do you think you got this condition?

(a) I was bewitched

(b) Through sex

(c) Curse

(d) I got it from my work

(e) From an infected person I stayed with

(f) Others (specify)..

19. Did you have a treatment supporter when you were on treatment?

(a) Yes

(b) No

20. If **Yes to Q19**, what role did the supporter play in your treatment?

(a) No support

(b) Reminded me on my medication daily

(c) Collected medication from the health facility for me

(d) Others (specify)..

21. If **No to Q19**, why?

(a) I did not want a treatment supporter

(b) I did not want anybody to know that I have the disease

(c) Nobody agreed to be my treatment supporter

(d) I was not told to choose a treatment supporter

(e) Others (specify)..

FACTORS INFLUENCING TB TREATMENT OUTCOME

22. Where were you collecting your TB medicines (drugs) from?

Name of facility: ....

23. How did you come to the health facility for your medication?

(a) By car

(b) On motorbike

(c) On bicycle

(d) By foot

24. What distance (km) do you travel to the nearby health facility to collect your TB medicines?

(a) <5km

(b) 5-10km

(c) 11-15km

(d) 16-20km

(e) >20km

25. How much did it cost you to get to the health facility anytime you go for your TB drugs? (GH¢)..

26. Was the place where you took your drugs from convenient for you?

(a) Yes

(b) No

27. If **Yes to Q26**, why?

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

28. If **No to Q26**, why?

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………………..

29. Did you skip any of your monthly schedules to collect your TB drugs?

(a) Yes

(b) No

30. If **Yes to Q29** why? ………………………………………………

31. Were you given enough information about your condition including how to take the drug?

(a) Yes

(b) No

32. Were you told the disease you are suffering from?

(a) Yes

(b) No

33. If **Yes to Q32,** what disease did they say you were having?

………………………………………………………………………………………

34. Did you receive your monthly stock of medicines for each visit to the health facility?

(a) Yes

(b) No

35. If **No to Q34,** why?

(a) No medicines

(b) No staff to service me medicines

(c) TB clinic closed

(d) Others (specify)...

36. How much time do you usually spend at the facility before being attended to?

(a) <1hr

(b) 1-2 hrs

(c) >2hrs

37. How would you describe the attitude of the health workers towards you when attending to you?

(a) Poor

(b) Good

(c) Very good

(d) Others (specify)..

38. Did any of the above issues affect your ability to take your medication?

(a) Yes

(b) No

39. If **Yes to Q38,** how did it affect you? ....

....

....

....

40. Who supervised you when you were taking your TB medicine? (DOT Status)

(a) No one

(b) Health worker at the facility

(c) Family member

(d) Community member

(e) Health Volunteer

(f) Others (specify)..

41. Did you experience any side effects when you were taking the TB treatment?

(a) Yes

(b) No

42. If **Yes Q41** above, which side effects did you experience? **Tick all that apply**

(a) Diarrhoea & Vomiting

(b) Loss of appetite

(c) Skin rashes

(d) Fever lasting for 3 or more days

(e) Headaches and dizziness

(f) Numb feet or hands

(g) Yellow eyes and skin (jaundice)

(h) Painful limbs

(i) Other (specify)..

43. Did your experience of the side effects in **Q41** affect how you took the medication?

(a) Yes

(b) No

44. If **Yes Q43 above** how did it affect how you took the medication?

(a) I stopped taking the medicine

(b) I reduce the quantity of tablets that I usually take for a day

(c) Others (specify)..

45. Did you complete your TB treatment?

(a) Yes

(b) No

46. If **Yes to Q45**, what motivated you to complete your treatment? ....

....

....

47. If **No to Q45**, what were the reasons that did not make you complete your treatment?

(a) Side effects

(b) Feeling well

(c) Too many tablets

(d) Stigma from community members

(e) Long distance to treatment centre

(f) Cost of travel to treatment centre

(g) Lack of family support

(h) No food

(i) Inadequate supply of medicines

(j) Medicine not working

(k) Not feel better on medicines

(l) Other reasons (specify)..

48. Did you receive any support from the facility during your treatment?

(a) Yes

(b) No

49. If **Yes to Q48**, what kind of support did you receive?

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………………..

50. What would you have done to make sure that all the patients completed their treatment if you were in-charge of treating patients?

....

....

....

This is the end of the interview. I thank you for your time and the responses offered.

APPENDIX II – PATIENT CONSENT FORM

STUDY TITLE: DETERMINE THE NUMBER OF TUBERCULOSIS (TB) PATIENTS WHO RECEIVED TB TREATMENT AND FACTORS THAT INFLUENCE TB TREATMENT OUTCOME IN THE OBUASI MUNICIPALITY OF THE ASHANTI REGION OF GHANA

I am Adjei Frank, an MPhil student of University for Development Studies. I am conducting a research to "Determine the number of TB patients who receive TB treatment and factors that influence TB treatment outcome in the Obuasi municipality of the Ashanti Region".

This data collection tool is aimed at soliciting from you information about the TB treatment and its challenges in this municipality. You have under gone TB treatment and possess good information that may help officials of the TB control programme improve upon how to handle other people including your relatives who may develop the disease.

I assure you that all information you provide would be kept confidential. You have the liberty to participate in this research as a respondent or otherwise.

On this note, I want to find out from you, are you willing to participate in the research as a respondent? **Yes or No**

Personal Identification Number ……………...…… Date of Interview ……………..