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# FACTORS ASSOCIATED WITH TB TREATMENT OUTCOMES IN PATIENTS WITH TB IN RIDGE HOSPITAL

**BY**

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## DECLARATION

I hereby declare that apart from specific references, which have been duly acknowledged, this study is my own work put together. I also declare that this dissertation has not been presented elsewhere, either in part or in whole for another degree

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(ACADEMIC SUPERVISOR)

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SIGNATURE

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DATE

## DEDICATION

This work is dedicated to my mom (Gertrude Dogbey) and dad (George Hayibor) for their immeasurable support and encouragement.

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I give thanks to the Almighty God for seeing me through this course successfully.

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## ABSTRACT

**Introduction:** The convergence of TB and HIV dual epidemics are major public health challenges in Ghana as well as many developing countries. Globally, the TB epidemic is fuelled by the HIV epidemic. The chances of death in TB-HIV co-infected patients are higher than TB only patients as reported by most studies. Treatment outcome monitoring is a vital part of the surveillance needed to successfully eliminate TB.

**Aim:** The study was conducted to determine the factors associated with TB treatment outcomes in patients with TB-HIV co-infection and TB only infection in the Ridge Hospital.

**Method:** This was a retrospective cross sectional study carried out at the Ridge Hospital. It involved review of TB treatment cards of patients who received treatment for tuberculosis in the DOT center of the hospital from 2008-2016. Data on age, sex, distance from place of residence to DOTS center, type of patient, treatment supporter, diabetes, diagnostic category, duration of treatment, adverse drug reactions and treatment outcome were extracted on TB only infected and TB/HIV co-infected patients. Chi square test, binary and multiple logistic regression models were used to assess factors associated with adverse treatment during treatment.

**Results:** Out of the 758 patients with complete records that were analyzed in this study, 45.6% (346/758) were cured, 42.5% (322/758) completed treatment. About 11.8% (90/758) of the patients had an adverse outcome which comprises of treatment outcomes; treatment failure, defaulting and death. Overall treatment success for all TB patients was 88.2% (668/758). TB-HIV co-infected patients treatment success was 77.6% (136/668). TB only patients' treatment success was 91.3% (532/668). The prevalence of HIV among the TB cases was 23.2% (176/758). Independent predictors of adverse treatment were found to be; being HIV positive (AOR: 3.85, 95% CI: 2.19-6.75; p <0.01); aged 65 and above (AOR-1.76,

95% CI 1.44-1.54; p-0.01); previously failed TB treatment (AOR: 5.02, 95% CI 2.09-28.87; p <0.01).

**Conclusion:** The 23.2% prevalence rate of HIV among TB cases confirms a report issued by the Ghana Aids Commission in 2009. The overall treatment success in this study is higher than Ghana's success rate for 2011 of 86.5% and 84% success rate for new and relapse TB cases in Ghana in 2012. Patients who are advanced in age (>65 years), patients co-infected TB-HIV, and patients who have previously failed treatment, patients who reacted to anti-TB drugs were more likely to experience adverse treatment outcomes.

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| AIDS | Acquired Immuno-Deficiency Syndrome |
| CDC | Centers for Disease Control and Prevention |
| DOTS | Directly Observed Treatment Short course |
| EDR TB | Extensively Drug Resistant Tuberculosis |
| EPTB | Extra-pulmonary Tuberculosis |
| GHS | Ghana Health Service |
| HAART | Highly Active Antiretroviral Therapy |
| HIV | Human Immunodeficiency Virus |
| KM | Kilometer |
| LTBI | Latent Tuberculosis Infection |
| MDG | Millennium Development Goals |
| MDR TB | Multidrug resistant tuberculosis |
| NTP | National Tuberculosis Control Program |
| SSA | Sub-Saharan Africa |
| TB | Tuberculosis |
| WHA | World Health Assembly |
| WHO | World Health Organisation |

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background

Tuberculosis (TB) is an airborne curable contagious disease mainly caused by *mycobacterium tuberculosis* (Getahun, Gunneberg, Granich, & Nunn, 2010). TB mostly affects the lungs but can affect other parts of the body such as the abdomen lymph nodes, kidneys, and the spinal cord; when it affects the lungs it is called a pulmonary infection, it is referred to as extra-pulmonary infection when it affect any other part aside the lungs (Getahun et al., 2010).

HIV/AIDS is another infectious disease caused by human immunodefiency virus (HIV), however it is a non-curable (Bliven-Sizemore et al., 2012). It is transmitted by way of body fluids; blood, vaginal fluids and seminal fluids. It compromises an individual's immune system making it vulnerable to other infections and diseases over time (Bliven-Sizemore et al., 2012).

Globally TB infects one-third of the world's total population and claims 2 million lives each year (WHO, 2015). Cobelens et al., (2008) indicates that TB still remains an important global health problem responsible for an estimated 1.7 million deaths every year. The total estimated number of Multi-Drug Resistant Tuberculosis (MDR-TB) cases worldwide in 2006 was 489,139 (4.8% of all TB cases).

In Sub-Saharan Africa (SSA), the TB incidence has increased about ten times even though the incidence has been falling in many parts of the world (Barker, 2008). In 2012, the WHO indicated that, the African Region has the highest number of TB cases and deaths; 24% of the TB cases were from the region (WHO, 2012).

The incidence rate of TB in Ghana in 2015 was 160 per 100,000 population and 22.5% of the TB patients are co-infected with HIV (WHO, 2015). Eighty-three percent of the TB case

notifications are people with known HIV status. The National Tuberculosis Control Program (NTP) in 2014 reported that, the actual TB burden in the country is 3 times more than what was reported that particular year.

The Ridge Hospital, for instance, is the best reporting hospital in the Greater Accra Region on TB with records well archived. In 2011 and 2012, the hospital recorded 117 and 120 TB cases respectively. The hospital has registered over 2000 HIV cases over the past 10 years.

The convergence of TB and HIV dual epidemics are of great public health challenges in Ghana as well as many developing countries. Worldwide, the TB epidemic is fueled by the HIV epidemic (Ofoegbu & Odume, 2015). TB is the leading cause of death among HIV patients making it the single most common opportunistic infection in these patients (Shastri, Naik, Shet, Rewari, & De Costa, 2013). Due to the high risk associated with the progression of TB among prevalent HIV infections, TB incidence would still increase even if all new HIV infections were prevented (King, Munsiff, & Ahuja, 2010). HIV-TB co-infection rates are higher in SSA compared to industrialize or developed countries where the rates are much lower.

There is a bidirectional and synergic interaction between HIV and TB in co-infected person; HIV-related immunodeficiency is worsened by active TB infection and on the other hand HIV-1 infection predisposes to the development of active TB (Ofoegbu & Odume, 2015). With the rise of the number of individuals co-infected with TB and HIV, early recognition, diagnosis, prophylaxis, treatment and prevention of TB has become more challenging (Ofoegbu & Odume, 2015)

In 1995, the WHO developed a Directly Observed Therapy Short Course (DOTS) strategy for the prevention and control of TB. The DOTs strategy has helped to significantly reduce TB incidence and deaths in developing countries and it is one of the effective and sustainable health interventions (WHO, 2013). The first time the strategy was initiated in some areas of East and Southern Asia Region, the strategy raised the case detection and treatment success

rate by folds. However, TB morbidity and mortality is still high in the region and it accounts for a third of institutionalized patients death in the region (Datiko & Lindtjorn, 2010).

The DOTS strategy is to help detect the disease and offer treatment, but delayed detection for treatment, incomplete treatment or poor adherence as well as default or treatment interruption, relapse, and death are the major challenges that TB programmes face in low resourced countries (Papathakis & Piwoz, 2008)

Treatment outcome monitoring is a vital part of the surveillance needed to successfully eliminate TB. It also serves as a tool to assess the TB treatment quality provided by the health care system (WHO, 2009). The WHO categorizes TB treatment outcomes into cured, treatment complete, defaulted, failed, transferred out and death. The successful TB treatment in a facility is the sum of the patients who are cured and those who have completed treatment under the DOTS strategy.

The chances of death in HIV-TB co-infected patients are much more higher than TB only patients as reported by most studies. Studies done in Eastern and Western regions in Ghana showed poorer TB treatment outcomes in patients co-infected with HIV and TB compared to those with on TB infection (Ansa, Walley, Siddiqi, & Wei, 2012). Studies done in Nigeria (Ofoegbu & Odume, 2015) and Ethiopia (Teklemichael Gebru, 2015) were not different in results as the ones conducted in Ghana. Identified factors responsible for these poor outcomes in these studies included; delayed presentation, low CD4 counts and limited availability of health care services including the highly active antiretroviral therapy (HAART). The major cause of treatment failure, relapse and drug resistance in patients on anti-tuberculosis drug therapy is poor adherence.

Early detection and diagnosis of TB and effective treatment are important in reducing the transmission of infection and ultimately achieving elimination of the disease. Delay therefore in reporting and late diagnosis may aggravate the disease and enhance its transmission

resulting in increased TB related morbidity and mortality (Sreeramareddy, Panduru, Menten, & Van den Ende, 2009).

The advent of HIV and TB collaborative activities and treatment is reported to improve survival among patients co-infected with both diseases (Ryan, 2008). To some extent this benefit of TB/HIV concomitant therapy can be explained by DOT support (Ciglenecki, Glynn, & Mwinga, 2007), sensitivity of TB strain to the drugs used for treatment (Gandhi et al., 2009) and HIV stage of the person on treatment (Ciglenecki et al., 2007). TB treatment outcomes are improved in people who take the therapy under the support of DOT (Gandhi, Moll, Lalloo, & Pawinski, 2009), with 84% of people taking TB/HIV treatment reported to have completed treatment (N. Gandhi et al., 2009).

An HIV-infected person's risk of both primary and progression of latent TB to active TB increases with depletion of CD4+ cells with this also come increase in mortality (Morris, Crothers, Beck, & Huang, 2011). HIV-positive persons are fifty times more likely to develop active TB when exposed to persons infected with TB in their lifetime than people who are HIV-negative (WHO, 2013).

This study reported on socio-demographic and clinical characteristics, and short-term treatment outcomes of TB patients registered and treated in Ridge Hospital. Furthermore, TB treatment outcomes in patients co-infected with HIV are compared with those non HIV-infected TB patients. The study also reported on independent predictors of adverse treatment outcomes.

**1.2 Problem statement:**

TB remains a threat to public health in Ghana, developing countries in Sub Saharan Africa (SSA) and worldwide. The epidemic has put pressure on health care managers, especially those in the developing countries to seek innovative ways of delivering effective treatment to

TB patients. HIV was identifified as a risk factor to TB and largely contributes to poor treatment outcomes and fueling of the TB epidemic.

Ridge Hospital, which is, one of the best referral centres in the country relatively records high numbers of TB clients. The number of TB cases have considerably reduce from the year 2012 to 2016, 120 to 57 TB cases respectively. However treatment success have only increased marginally from 81% in 2012 to 84% in 2016.

One of the main factors that have been identified in the hospital contributing to not reaching the target is HIV status of the client. The hospital has registered over 2000 HIV cases over the past 10 years. Other factors includes socio-demographic factors; sex, age, level of education, occupation, distance to the hospital and type of residence, treatment related factors; availability of treatment supporter, category of patient, type of patient, duration of treatment, and some general characteristics such as presence of diabetes, hypertension, alcoholism and adverse reactions or complications that might develop during the course of treatment.

The challenge of meeting the global target is not only a problem perculiar to the hospital but nationwide. One of the strategies employed is DOTS for all TB patients where they are supervised during the TB treatment regimen (Kironde & Bajunirwe, 2003).

If the factors influencing treatment outcomes are identified and addressed, treatment outcomes in the Ridge Hospital where DOT strategy is being practiced could improve.

**1.3 Conceptual framework;**

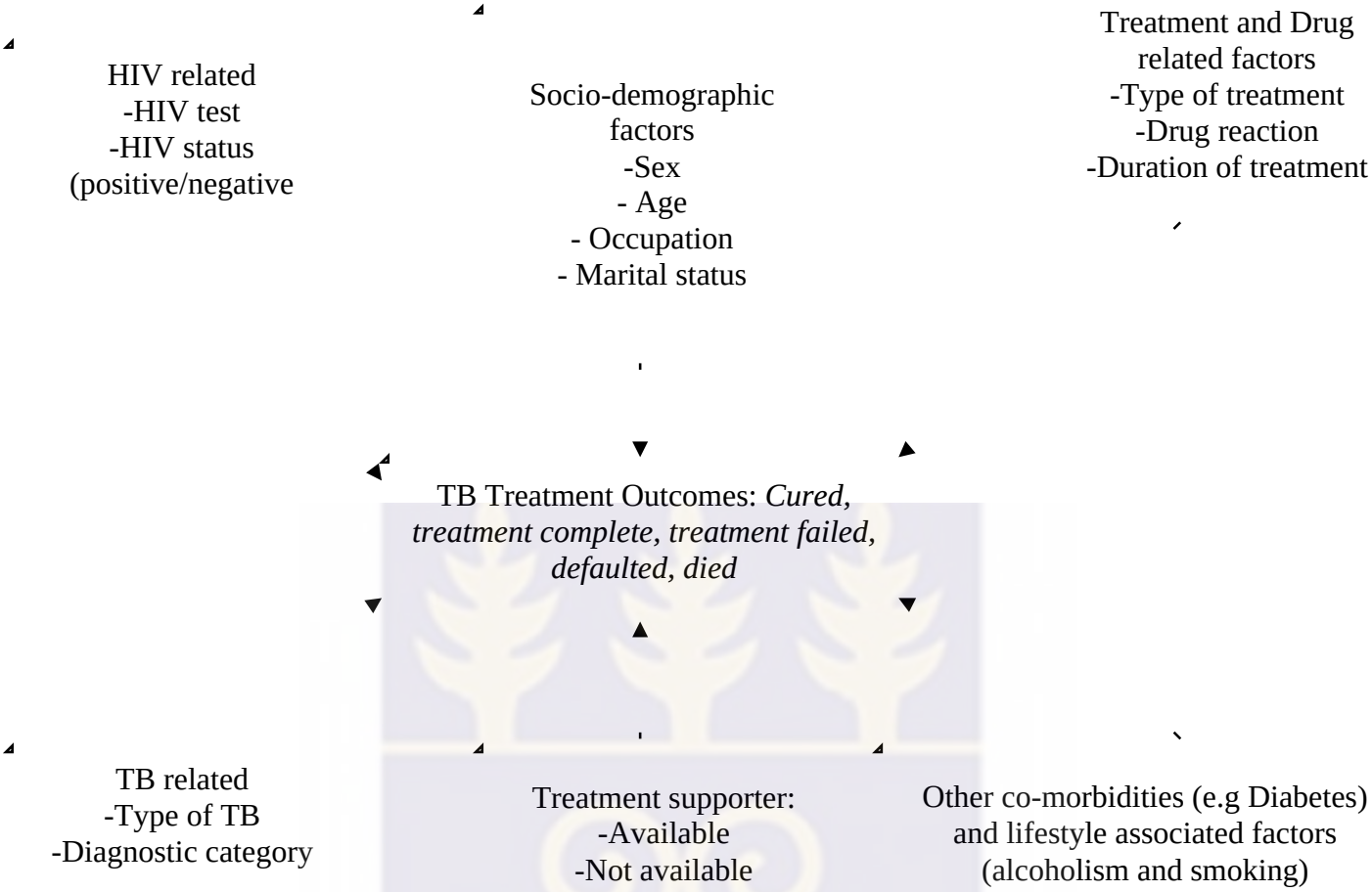


**Figure 1 Conceptual Framework on factors associated with TB treatment outcomes**

Figure 1 is a conceptual framework illustrating factors associated with TB treatment outcomes. TB treatment outcome is the end result of TB treatment according to the WHO (WHO, 2012). Treatment outcome can be any of the six categories. The patient may be cured, completed treatment, die, fail treatment, default or transferred out to another treatment unit for which the outcome may be documented.

There are six categories in literature and practice that have been stipulated to affect the treatment outcome. HIV is one of the factors that greatly affect TB patients and their treatment outcomes. HIV is separated from other comorbidities because of its great effect on TB. Other comorbidities such as diabetes and lifestyle factors such as smoking and

alcoholism weakens the already immune-compromised TB patient and the TB treatment outcome.

Socio-demographic factors such as age and sex in particular are reported to tremendously influence TB treatment outcomes. The type of treatment, duration and adverse drug reactions are other factors. Disease presentation factors such as type of infection; pulmonary or extra-pulmonary) and type of patient; new, return of default, relapse, retreatment and treatment failure and other could affect TB treatment outcomes.

**1.4 Justification**:

Mortality from TB is largely preventable. The mortality rate associated with the infection is still very high and efforts to combat it must be accelerated if the post-2015 targets are to be achieved. The vision for the post-2015 global tuberculosis strategy is "a world free of tuberculosis", also expressed as "zero deaths, disease and suffering due to tuberculosis". The goal is to eradicate the TB disease globally.

HIV status plays a crucial role in TB clients achieving a successful treatment outcome (completing treatment or cured). Evidence abounds from literature that HIV impacts negatively on TB treatment outcome. This prompted the integration of TB and HIV activities in major health facilities in the country including the Ridge Hospital. The integration was done after the adoption of fixed-dose combination drug treatment by the NTP in 2007 to ease the dosage burden on patients. However despite these measures treatment outcomes are still below the global target.

The Ridge Hospital is one of the leading referral hospitals in the country. The hospital has a very functional and fully equipped DOTS clinic for the effective treatment and management of TB patients. The Ridge hospital has done no study in the hospital on factors that contributed to inability to meet the targets.

The findings from this study will help improve TB patient care management through the following;

- Ascertain whether TB status impacts the treatment outcomes of the TB clients in the hospital.
- Help the hospital management to mitigate the challenges that hampers TB clients from achieving good treatment success
- This research will also add to existing knowledge on the use of treatment supporters in TB-DOTS strategy

**1.5 General objective**

To determine the factors associated with TB treatment outcomes in patients with TB-HIV co-infection and TB only infection in Ridge Hospital from 2008-2016.

**1.6 Specific** objectives

- To determine the prevalence of TB-HIV co-infection in Ridge Hospital
- To determine the TB treatment outcomes of HIV/TB co-infection and TB only patients in Ridge hospital
- To determine factors associated with TB treatment outcomes among TB patients in the hospital.

# CHAPTER TWO

# 2.0 LITERATURE REVIEW

## 2.1 Introduction

TB and HIV are infectious communicable diseases of major public health importance. The dual epidemics are closely related with each disease influencing the epidemiology, natural history, clinical presentation and treatment outcomes of the other (CDC, 2013). Many researches have been conducted on factors that affect TB treatment outcomes. Although the literature covers a wide variety of such factors, this review focused on five main areas. These areas were; TB and HIV aetiology and pathogenesis, TB and HIV epidemiology, global TB control, TB treatment rates and/or proportions, socio-demographic, disease presentation and treatment factors that influence TB treatment outcomes.

## 2.2 Tuberculosis aetiology and pathogenesis

TB is a respiratory airborne disease caused by *Mycobacterium tuberculosis (M. tuberculosis).* *M. tuberculosis* and seven very closely related mycobacterial species; , *M. pinnipedii M. bovis, M. canetti, M. africanum, M. microti, M. caprae, and M. mungi,* together comprise what is known as the *M. tuberculosis complex.* Most, but not all, of these species have been found to cause diseases in humans (Centers for Disease Control and Prevention (CDC, 2013). In Ghana, *M. tuberculosis* causes majority of the TB cases followed by *M. africanum* and *M. bovis. M. africanum* and *M. bovis* are mainly found in West Africa.

A study done in Burkina Faso and Cameroun implicate *M. tuberculosis* species as the main causative agent of pulmonary tuberculosis *(*Godreuil, Torrea, Terru, Chivenet, Diagbouga, Supply,…..&Banuls, 2007*).* Another study conducted in Ghana have shown that *M. tuberculosis* accounted for about 73% of pulmonary tuberculosis whilst *M. africanum* and *M.*

*bovis* respectively accounted for about 23% and 3% *(*Addo, Owusu –Darko, Yeboah –Manu, Caulley, Minamikawa, Bonsu, Lienhardt, Akpedunu, &Ofori- Adjei, 2007*)*

*M. tuberculosis* is one of the most pernicious human pathogens (Russell, Vanderven, Lee, Abramovich, Kim, Homolka,…. & Rohde, 2010). When a person inhales droplet nuclei containing *M. tuberculosis* and the nuclei reaches the alveoli of the lungs TB infection occurs. The host's defense system engages alveolar macrophages that ingest the *M. tuberculosis*. These mechanism leads to the inactivation and inhibition of the majority of these bacilli. A few of the *M. tuberculosis* may multiply intracellular and are released when the macrophages are overwhelmed. These bacilli if alive may disseminate via through the bloodstream or lymphatic channels or to more far away tissues and organs from the lungs (including areas of the body in which TB disease is most likely to develop: apex of the lung, regional lymph nodes, brain, bone and kidneys,). A systematic response is initiated by the immune system after this process of dissemination.

A person may have *M. tuberculosis* in their bodies but may not have TB disease and cannot transmit the infection to other people. A person with this type of TB infection is known as Latent Tuberculosis Infection (LTBI). A person with LTBI is not regarded or documented as having or suffering from TB. Whenever the immune system of the host breaks down or fails to contain the organism, active disease then results (Christopher, &Bosede, 2010).

If a person with active TB case is left untreated, the person will infect about 10-15 persons every year (WHO, 2014). A person may experience progression from LTBI to TB disease at any time, from soon to many years later.

Some *M. tuberculosis* may pass into the hilar lymph nodes causing enlargement of the lymph node and also into bloodstream or the lymphatic system, leading to serious complications such as renal, joint and bone tuberculosis, and meningitis (Nascimento et al., 2014).

Symptoms associated with active disease include loss of appetite, cough, and increased night sweats, malaise and anaemia, chest pains and productive purulent sputum (Chris, & Peter, 2005)

### 2.3 Tuberculosis epidemiology

One of the all time global most deadly communicable diseases is TB according to WHO (WHO, 2014). After HIV, which is the first, TB ranks as the second leading cause of death from an infectious disease worldwide. In 2014, the WHO reported that there were 9.0 million new TB cases in 2013 and 1.5 million TB deaths (of which 0.4 million were co-infected with HIV) (WHO, 2014).

The number of mortalities resulting from TB is unacceptably high given that a huge number could be prevented (WHO, 2013). The TB infection can be found in all regions of the world (WHO, 2014). In 2013 among the estimated TB cases of which more than half (56%) was in these 2 main regions; South-East Asia and Western Pacific. Again, 80% of the worldwide burden of TB is accounted for by 22 countries and first to fifth highest ranking countries being India, China, South Africa, Nigeria, and Indonesia (WHO, 2010). Out of the 22, eight countries are from Africa (WHO, 2014). India accounts for 24% and China also accounts for 11% of total cases. Four out of every five HIV- TB co-infected cases and TB deaths are from the Africa region (WHO, 2014). Ghana is not among the most endemic countries, however, 12 of the 15 countries estimated to have the highest TB incidence are in Africa; among them are Nigeria and Ethiopia (WHO, 2010). Persons living with HIV/AIDS have an increased risk of developing active TB between 26 and 31 times compared to HIV negative persons (WHO 2010).

### 2.4 HIV aetiology and pathogenesis

HIV infection is caused by a lentivirus of the retrovirus family (Novitsky et al., 2002). The virus was first obtained from patients with lymphadenopathy by culturing T lymphocytes of these patients (Gallo & Montagnier, 2003). Two main HIV viruses, HIV-1 and HIV-2 have been found in humans, however, HIV-1 is the aetiological agent of most cases of HIV infection worldwide and HIV-2 is mainly confined to West Africa (Robertson, Anderson, Bradac, Carr, Foley, Funkhouser, Hahn, Kalish, Kuiken, Learn, Leitner, McCutchan, 2000).

The virus is made up of an RNA framework that consists of a core protein enclosed in gag protein, p24. Enzymes responsible for the viruses' replication, RNA reverse transcriptase and HIV-specific protease can all be found in the viral structure. There is the gp 120 antigen which can be found in the viral envelop, responsible for interaction with CD4 protein in the T-cellls (Weber, 2001). The virus causes a decline in CD4 T-cells; the CD4 contains receptors for HIV antigen, the chemokine receptors of CCR5 and CXCR4. The HIV virus causes a decline in the CD4 cells by using HIV-infected macrophages to attract T-cells and bring them in close contact with the HIV virus (Weber, 2001)

### 2.5 TB and HIV co-infection

TB is still the leading killer of HIV-infected people (WHO, 2014), however TB infection in most HIV patients is treatable (Agarwal, Dipanjan, & Chauhan, 2004). Globally, the HIV pandemic has triggered an increase in the number of TB cases (WHO, 2012). HIV and TB infections are common co-occurring conditions, forming a deadly combination, each accelerating the other's progress, and resultant increase in mortality (WHO, 2012). HIV infection leads to a decrease in immunity of an individual and speeds up the progression from LTBI to active TB, and on the hand TB accelerate the progress of HIV infection (Mayer, 2010).

The co-epidemics of tuberculosis and HIV require serious efforts to handle. This is very

essential due to the nexus between these two diseases. A joint effort from both TB as well as HIV/AIDS control programmes is of urgent need with complementary strategies to control these diseases. The best approach to handle the HIV epidemic has been mainly based on preventive interventions since a cure is not yet available, but tuberculosis is curable including the HIV infected patients (Agarwal et al., 2004).

About 40%-80% of TB patients co-infected with HIV have extra pulmonary disease, compared with 10% to 20% of TB only patients (Sterling, Pham, & Chaisson, 2010). TB is one of the gravest health threats of the world presently (Medicins Sans Frontieres Crisis Alert, 2014).

An emerging issue of global concern is drug-resistant tuberculosis among TB-HIV co-infected patients that are on the rise in many countries (WHO, 2012; Woldeyohannes, Kebede, Erku, &Tadesse, 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, 2009).

In 2013, of the 9 million people who developed TB, an estimated 1.1 million (13%) were HIV positive. The African region accounted for 78% of the estimated 1.1 million HIV positives. Among the highest HIV/TB burden countries in Africa are Lesotho and Swaziland both with 74% (WHO, 2014). The prevalence of HIV-TB co-infection in DebreMarkos Referral Hospital in Northwest Ethiopia, one of the most endemic areas was 44% in 2012 (Esmael, Tsegaye, Wubie, & Endris, 2013).

Patients with HIV-TB co-infection were significantly more likely to default (Muture et al.,

2011). In contrast, a study from Nigeria found no difference between HIV infected and non-infected TB patients with regard to treatment default (Amoran, Osiyale, &Lawal, 2011).

Although Ghana has a stable HIV epidemic, 23% of all TB cases are amongst persons living with HIV/AIDs (Ghana Aids Commission, 2009). Integration of HIV and TB services is good though difficult; the idea of collaboration and providing both services together has already resulted in good treatment outcomes and patient management. In 2012, WHO claimed that 900,000 lives had already been saved over six years by early detection and treatment of TB from people living with HIV (WHO, 2012).

**2.6 TB Control**

Control and treatment of patients with TB depends significantly on the control of TB programme in a region or a country (WHO, 2009). After a period of prolonged global neglect, WHO declared TB was declared as a global public health emergency in 1993 (WHO, 2014). In the same year (1993) there was a launch of the treatment strategy called Directly Observed Treatment, Short course (DOTS). Subsequently TB-related indicators were included in the Millennium Development Goals (MDG); development and implementation of a of strategy that supports the Global plan "Stop TB Strategy" to Stop TB 2006–2015. The control and prevention of MDR-TB have become an issue of concern to extent that the World Health Assembly adopted a resolution during their 62$^{nd}$ meeting in 2015. The resolution has helped accelerate tuberculosis care and control globally.

The DOTS strategy was the first recommended internationally strategy for TB treatment, control, and prevention. The DOTs strategy has helped to significantly reduce TB incidence and deaths in developing countries and it is one of the effective and sustainable health interventions (WHO, 2013). The 5 main components of DOTS:

- Sustained governmental and financial support.
- Enhancing case detection by ensuring quality sputum-smear microscopy.
- Use of treatment supporters and short course of anti-TB treatment was standardized.
- Constant availability of high quality anti-TB drugs
- Standardization of reports.

The STOP TB was later developed to help reduce the TB burden globally by 2015. The strategy was implemented together with the Millennium Development goals. The strategy provided universal access and high quality care for TB infected persons. It also helped reduce the suffering and socio economic burden associated with TB as well as to provide a means by which the vulnerable person is treated for free (Ayisi, Hoog, Agaya, Mchembere, Nyamthimba, Muhenje, & Marston, 2011). The Stop TB strategy expanded DOTS and enhanced treatment for all patients including those co-infected with TB-HIV and persons infected with MDR strains. The strategy also mediated needs of poor and vulnerable populations, improved primary care by strengthening the health care system; engaged private care providers; empower people with TB by dealing with stigmatization, and communities through partnership and enable and promote research (The Lancet, 2014).

MDG 6, Target 8 was developed to compliment the DOTS strategy is “Halt and begin to reverse the incidence of TB by 2015.” (Babatunde, 2013; Maher, 2006). It was estimated that at least 70% of new smear-positive cases should be detected and treated in the Directly Observed Therapy-short course (DOTS) program by 2015, sputum smear positive TB diagnosis in people will be at least 75%, and treatment success should be at least 85% (Maher, 2006).

The STOP TB goal and target (MDG 6 Target 8) have been achieved, according to WHO, since 2004 the incidence rate of TB has been falling, the case detection rate reached 63% in

2007 and the treatment success rate was 85% in 2006 (Maher, 2006).

The End TB strategy is the latest strategy for tuberculosis control and prevention (WHO, 2014). The vision for the End TB strategy is "a world free of tuberculosis", also expressed as "zero deaths, disease and suffering due to tuberculosis". The overall goal of the strategy is to "End the global tuberculosis epidemic by 2035". This new strategy is ambitious yet feasible, the global targets are; achieving a 95% decline in TB related mortality and reaching a 90% reduction in tuberculosis incidence from the 110 cases/100 000 in 2015 to 10 cases/100 000 or less by 2035 (WHO, 2014).

Globally, thirty seven million lives have been saved since 2000 by TB control programs, there has been forty five percent decrease in global TB mortality rate since 1990, however, the increasing rate of multiple drug resistant TB crises coupled with inability to reach about three million people worldwide who still suffer of TB annually for care are serious challenges facing the world TB control program (WHO, 2014).

**2.7 TB treatment outcome rates and/or proportions**

Treatment outcome is the end results of TB treatment. According to WHO (2012), there are six possible TB treatment outcomes, the patient may be cured, completed treatment, or die. The patient may also have treatment failure and default. The last treatment outcome is that, the patient may be transferred out to another reporting unit for which the specific outcome may be unknown. Certain factors can affect these outcomes differently.

Worldwide, TB associated mortality in HIV-TB co-infected patients is three times higher than mortality among TB only patients (WHO, 2010).

A study done by Chanda & Gosnell, (2006) indicated that, the goal of tuberculosis programme includes a case detection of 70% and a cure of 85% worldwide. The case detection in Ghana stands at a total of 14,999 out of which 14460 were new and relapse (WHO-Ghana, 2016).

The World Health Organization (WHO) indicates that about 30 million people have been treated with the five-elements of DOTS resulting in a cure of more than 80% and less than 10% default (Frieden & Sbarbaro, 2007).

In a five year retrospective study by Mohammed, Daniel, Helamo, & Leta (2017) treatment outcomes of TB patients in Nigist Eleni Mohammed General Hospital, Ethiopia. Of the 768 TB patients were registered at the hospital during the study period; 249 (32.4%) completed the treatment, 84 (10.9%) cured, 11 (1.4%) defaulted, 397 (51.7%) were transferred out to other health facility, 23 (2.9%) died and 4 (0.5%) failed the treatment regimen. The overall treatment success of TB in the Mohammed, Daniel, Helamo, & Leta (2017) study was 333 (43.3%) as compared to their counterparts, 435 (56.7%). The prevalence of TB HIV co-infection was 16.4%, and these patients were more likely to develop risk of poor treatment outcomes as compared to their counterparts TB only patients.

In a study in Karnataka, India, a similar treatment success was reported among co-infected TB patients compared to those with only TB. Death from TB was expectedly more in the co-infection HIV-TB patients. On the other hand, default and treatment failure rates were higher among TB only patients (Shastri et al., 2013). Other studies in the country have also reported similar observations (Ambadekar, Zodpey, Soni, & Lanjewar, 2015; Jain, Desai, Solanki, & Dikshit, 2014; Karanjekar et al., 2014).

A study conducted in Addis Ababa health centers among 6580 registered tuberculosis patients (3147 males and 3433 females) showed the following treatment outcomes: 18.1%

cured, 64.6% completed treatment, 3.7% died during follow-up, 5.1% defaulted, 0.4% failed the treatment and 8.2% were transferred out to another health institution. Enrollment was significantly associated with treatment success in the year the study was conducted (Tolosie & Sharma, 2014).

In a study conducted in Nigeria by Ofoegbu & Odume in 2015, 48% of the study population were cured. Those that completed treatment was 17.0% however, the overall treatment success rate was 68.5%. Twenty-seven (6.9%) failed treatment, 102 (26.2%) defaulted and 4 (1.0%) of the cases died (Ofoegbu & Odume, 2015).

In another study in Ibadan, Nigeria, 76.6% were cured, 8.1% failed treatment, 6.6% defaulted, 4.8% were transferred out, and death 1.9% died. In this study the mean age of cured patients was found to be 31.2±3.1 years, and this was significantly lower than the mean age of those who experienced an adverse outcome (Njepuome & Odume, 2009).

In Addis Abba, there were several studies that were conducted on TB patients on the DOT strategy of the WHO. In one of the studies, which was a five-year retrospective study on childhood TB or category III TB, out of the 95.2% of the children whose treatment outcomes were documented 85.5% achieved a good treatment outcome. The mortality rate and default rates were very low 3.3% and 3.8% respectively while (Hailu, Abegaz, & Belay, 2014).

Ansa, Walley, Siddiqi, & Wei, (2012) evaluated TB treatment outcomes before integration of TB and HIV activities and after. Before the TB and HIV collaborative activities began, integration, 97% of the cases were registered, out of this a cure rate was 50%. Thirty-three percent experienced adverse treatment outcomes and the rest were transferred out after treatment initiation. After the integration of the TB-HIV collaborative activities, 69% of the cases at the facility experienced treatment success, less than 1% defaulted and cases

transferred out also reduced to 9%. Even after integration deaths remained high at 18%. Treatment success outcomes have increased significantly from 50% before, to 69% after integration. TB patients without HIV treatment success was 72%, as compared to HIV-positive cases 64%, Mortality rates were still at 25% in HIV-positive cases, as compared negative cases 9.8%. Receiving an antiretroviral therapy was identified to influence the treatment outcomes, co-infected patients on antiretroviral therapy were 75% and those not on any therapy though co-infected was 61%.

In a study conducted in Mizan Aman hospital in India, among 2043 TB patients, male patients were 58% (1185/2043). The following observations were made in this study: 3.87% (79/2043) were cured, 0.20% (4/2043) defaulted, 76.99% (1575/2043) were transferred out to other treatment centers, and 1.22% (25/2043) died (Mohammed et al., 2017).

A Uganda study revealed that patients lack of knowledge about the disease resulted in very high rate mortality and defaulter rates. In this study a total of 657 TB patients' records were reviewed. 49.6% (349/657) of the patients interrupted treatment for more than 2 times. 29.1% (95/657) were in the intensive phase, 25.2% (82/657) were in continuation phase and 45.1% (149/657) interrupted their treatment in both phases (Bulage, Sekandi, Kigenyi, & Mupere, 2014).

In a cohort analysis by Jemal et al., (2015), TB patients whose smear results were negative formed majority of those who defaulted and mortality rates were also high among this group. In Peltzer & Louw (2014) study, majority of those who completed treatment were females and adverse treatment outcome was very high among the men. In this same study drug resistant TB was very high and it contributed to majority of the adverse treatment outcomes. However most of the patients who defaulted came back for retreatment.

### 2.8 Demographic factors associated with TB treatment outcomes

Socio-demographic factors strongly influences the number of TB infected and TB–HIV co-infection individuals and these have bearing effect on the treatment outcomes (Nascimento et al., 2014). In HIV-infected and non-infected persons; age, Body Mass Index (BMI), low level of haemoglobin, sex and more advanced clinical stages of HIV at baseline were reported to be predictors of TB mortality (Ciglenecki et al., 2007; Moore et al., 2007).

HIV/TB co-infection is commonest among the youth who are usually very sexually active age group. In a Ofoegbu & Odume, (2015) study, co-infection was highest in age group 30-49 years.

In Sub-Saharan Africa (SSA), gender inequality is the main driver of the HIV infection, this accounts for 60% of the epidemic (UNGASS, 2008). Women in many parts of the world (both developed and developing countries) have an increase likely of developing the infection because they are less likely to decide how, where and sex takes place (Njepuome & Odume, 2009).

Adverse treatment outcomes were also reported among male patients in the age group 25-34 years (Jemal et al., 2015), however there was generally no disparity on the outcomes of TB treatment between males and females in study by Nsubuga et al., (2002).

In South Africa (Agincourt), a study was conducted from 1992 to 2000 reported higher PTB/HIV death rate for males than females for all ages combined (Zwang et al., 2007). This was not true for all ages as female mortality was not different from male mortality before age

25 years, however males above the age of 25 experienced high mortality rates. The median age at PTB/HIV deaths among males was 38 years.

Associations between TB mortality and increased age, treatment delay, and defaulting treatment in HIV-infected persons were reported in a study conducted in Ghana (Ansa et al., 2012). In this study, mortality was associated with increased age, residence in a deprived area, smear-negative TB, lengthy symptom duration prior to initial diagnosis, and defaulting treatment. The study concluded that HIV is strongly associated with TB mortality in persons with co-infection, however, increased age, residence in rural area, sputum smear-negative disease, more prolonged symptom duration prior to initial diagnosis and defaulting treatment causes increased TB mortality in HIV-infected persons.

In a study by Osei, Der, Owusu, Kofie, & Axame, (2017), With regards to TB classification, smear negative pulmonary TB patients were 84% more likely to be HIV than smear positive pulmonary TB patients.

Jaiswal et al., study in (2003) in India revealed that patients that take alcohol were more likely to default treatment. It was found out that, poor patient provider interaction was a major barrier to treatment compliance.

**2.9 Treatment and drug related factors that influence TB treatment outcomes**

A study by Nascimento et al., (2014) revealed that, pulmonary and extrapulmonary TB infection are most commonest in TB-HIV co-infected patients. These persons are also more likely to show a chest x-ray suggestive of TB likewise any histopathologic examination.

Dodor and Afenyadu (2005), assessed associated factors responsible for TB treatment default and completion at a Ghanaian hospital; Effia-Nkwanta Regional Hospital. The factors

significantly associated with treatment default included low level of income, cost of transport, unavailability of treatment supporters and stigmatization by family members.

In a study by Shastri et al., (2013) 73% of all HIV-TB co-infected infected patients had a pulmonary TB and suggestive chest x-rays

A study by Ambadekar et al., in 2015 reported that patients who defaulted and are re-treated had a lower chance of achieving treatment success. The studies suggested that problems such as inadequate treatment, unsupportive family members or ineffective treatment supporters were the main cause of high default rates or failure.

Several studies found out that early detection of TB in HIV patients and early initiation of ARTs usually during the intensive phase of anti-TB therapy drastically reduces the mortality rates among these patients.(Abdool Karim et al., 2010; Blanc et al., 2011; Domingos, Caiaffa, & Colosimo, 2008; Manosuthi, Chottanapand, Thongyen, Chaovavanich, & Sungkanuparph, 2006)

A national retrospective case control study was carried out in South Africa to identify risk factors associated with TB treatment default and adherence by Finlay, Lancaster, Holtz, Weyer, Miranda, & Van der Walt in 2012. The factors that were identified included changing of residence during TB treatment, inadequate knowledge on the disease and how to properly take the anti-TB medication. New patients were more likely than those in the return after group to report having no education on the disease, stigmatized because of the infection and inadequate counseling about their treatment. The new patients also were found to be mostly drinking any alcohol and seeing a traditional healer during TB treatment.

In the group that returned after default, the risk factors identified included they are mostly

likely to stop treatment again because the felt better and lack of support to complete the treatment (Finlay, Lancaster, Holtz, Weyer, Miranda, & Van der Walt, 2012).

In Hlabisa (South Africa) a directly observed treatment have shown to be effective for all categories of patients including those co-infected with HIV. At six months of follow-up; 71% of participants were cured, 3% completed treatment without being cured, 2% transferred out and only 2% treatment failure was reported. The study also concluded that giving rifampicin containing drug regimen given cures most patients who adhere to the treatment whether they are co-infected or not (Davies et al., 2005).

Monitoring tuberculosis treatment outcome and research into the factors that influence the outcome of treatment is an important part of tuberculosis control programmes. It guides policy makers to tailor effective measures in a direction that can reduce the disease burden.

# CHAPTER THREE

## 3.0 METHODS

### 3.1 Study type

This was a retrospective cross-sectional study using routine data collected from the DOT centre of the Ridge Hospital. It involved a retrospective review of TB treatment folders and cards of patients available from January 2008 to December 2016. Data retrieved were on age, sex, place of residence, HIV and AIDS status, duration of treatment, and types of patient (new patient, treatment failure, relapse, transferred in and return after default). In addition, data on adverse drug reaction, disease classification (sputum smear positive or negative pulmonary TB or extra-pulmonary TB) and treatment outcomes were extracted from the treatment cards.

### 3.2 Study area

The study was conducted at the Ridge Hospital, the Greater-Accra Regional Hospital. The hospital is located within the Osu Klottey submetro of the Accra Metropolitan area. It is one of the major referral centers in the Greater Accra Region. The hospital serves the whole of the region, however, suburbs such as Nima, Maamobi, Kanda, Accra New Town, Kotobabi, Osu, La, Adabraka, Airport Residential Area, Legon, Achimota and Accra Central are within the immediate catchment area of the hospital.

The Ridge Regional Hospital is accredited by the Medical and Dental Council for Ghana for the training of House officers in Medicine, Surgery, Obstetrics and Gynaecology, Dentistry and also training of post graduate Residents in Paediatrics, Obstetrics and Radiology. There are 90 doctors and 250 nurses at the hospital.

The hospital has a DOTS centre and a dedicated TB laboratory for TB cases diagnosis, treatment and monitoring according to NTP guidelines and protocols. The clinic day of the TB patients is Thursday, where they are examined. The hospital also has an ART centre

where HIV patients are monitored. About 20 cases of TB and 50 cases of HIV are seen on clinic days.

### 3.3 Study variables

- **Independent variables**

Socio-demographic factors; age, sex, distance to treatment centre, type of residence

Treatment related factors; TB classification and category, type of entry, duration of treatment, availability of treatment supporter, HIV status and ART treatment.

- **Dependent variables**

Treatment outcomes: Cured, treatment completed, failure, defaulted and death.

**Table 1 Definition of variables and scale of measurement**

| **Variable** | **Operational Definition** | **Type of Variable** | **Scale of measurement** |
|---|---|---|---|
| Cured | A patient who was initially smear-positive and became smear-negative in the last month of treatment and on at least one previous occasion. | Dependent | Binary<br>- Yes<br>- No |
| Treatment complete | A patient who tested smear negative at the onset of treatment, completed treatment by taking all the prescribed doses and remained smear negative at the end of treatment. | Dependent | Binary<br>- Yes<br>- No |

| | | | |
|---|---|---|---|
| Treatment Failure | A patient who remains smear positive at month five of treatment regardless of the fact that the correct doses of medication were taken | Dependent | Binary<br>- Yes<br>- No |
| Treatment Default | A patient who interrupted treatment for two consecutive months or more after initiation of treatment | Dependent | Binary<br>- Yes<br>- No |
| Death | Patients who died from any cause during the course of treatment for TB. | Dependent | Binary<br>- Yes<br>- No |
| Treatment success | It includes patients with Cured and those with Treatment completion outcomes | Dependent | Binary<br>- Yes<br>- No |

| | | | |
|---|---|---|---|
| Adverse treatment | It includes patients with default, treatment failure and died outcomes | Dependent | Binary<br>- Yes<br>- No |
| TB classification | This is defined as whether a patient is diagnosed with smear positive TB, smear negative TB or extra- pulmonary TB | Independent | Categorical<br>- Smear positive pulmonary TB<br>- Smear negative pulmonary TB<br>- Extra pulmonary TB |
| Type of entry | Describes patient's TB status before | Independent | Categorical<br>- New patient |

| | | | |
|---|---|---|---|
| | therapy initiation | | -Relapse<br>-Transferred in<br>- Treatment failure<br>- Return of default<br>- Other |
| Treatment duration | The duration of tuberculosis treatment in months | Independent | Binary<br>- < 6 months<br>- > 6 months |
| Treatment supporter | This is a person who supports and guides a patient throughout the period of treatment. The person could be a relative or a health professional | Independent | Binary<br>- Yes<br>- No |
| Age | Age in years of a patient treated for TB | Independent | Ordered categorical |
| Sex | Sex of respondents | Independent | Binary<br>- Male<br>- Female |
| Distance from Treatment facility | This is the distance from where the patient stays or lives at the time of treatment to the DOTS treatment Centre. | Independent | Binary<br>- <5 km<br>- >5 km |
| Adverse drug reaction | This is where a patient experiences an unpleasant effect of anti-TB drugs. | Independent | Binary<br>- Yes<br>- No |
| Diabetes | Patient has a documented history of being diagnosed with diabetes | Independent | Binary<br>- Yes<br>- No |

| | | | |
|---|---|---|---|
| Alcohol | Patient has a documented history of being alcoholic | Independent | Binary<br>- Yes<br>- No |
| HIV status | Result of HIV/AIDS test done | Independent | Binary<br>- Positive<br>- Negative |
| Drug addict | Patient has a documented history of being a drug addict | Independent | Binary<br>- Yes<br>- No |

### 3.4 Study population

All patients who were registered, attended, initiated and received treatment at the DOT centre at the Ridge Hospital and their records were available from 2008 to 2016.

### 3.5 Sample size and sampling method

#### 3.5.1 Sample size

All records of patients who received treatment for tuberculosis in the period under study (January 2008 to December 2016) were used. Although all medical records of patients who were treated in the period were used, the minimum sample size needed to carry out the required sub-analysis was calculated using Cochran formula as cited in (Puszczak& Fronczyk, 2013). Because the proportion of TB prevalence in the Municipality is unknown, 50% was assumed and subtituted in the formula and the sample size was calculated as follows:

$$N = \frac{(z^2)(p)(q)}{d^2}$$

Cochran (1963:75)

Where N=the desired sample size; z=the standard normal deviation; p=the proportion in the

target population estimated to be 50 % (0.50) ; q=1.0-p; d=degree of precision desired at 0.05

N= ((1.96)2*(0.5)(0.5))/(0.05)2

N=384.16

### 3.5.2 Sampling method

Data were collected using an abstraction form. Data was collected from all available medical records on patients treated for TB from January 2008 to December 2015. All the patients completed their treatment regimen by the 3rd quarter of the year 2016. The treatment cards of the patients who registered and received treatment at the DOT centre are kept in the records section of the unit. TB treatment cards of patients who went through treatment from 2008-2016 were obtained. The data that were captured from the tuberculosis treatment card included age, sex, address of patient and treatment supporter details.

In addition, data on HIV voluntary counselling and testing, HIV status, ART treatment, disease classification, duration of treatment and treatment outcome were captured on this card. Data comprising all the study variables were retrieved from the TB cards and entered into a data abstraction form purposely designed for the study. The extracted data were cross checked using the TB register, which was also kept in the public health unit. At the end of each day of data collection, I double-checked the data collected and the treatment cards from which data were retrieved kept safely in a cabinet. This was done until all the needed information had been retrieved.

### 3.6 Quality control

The following measures were put in place to ensure that the data collected was of quality: two research assistants were recruited and trained to assist in data collection for the study. The principal investigator supervised and also took part in the record review.

The data collected were critically examined at the end of each day. The principal investigator for consistency and completeness cross checked data handled by the research assistants by verifying from the source records (TB cards). Research assistants also double-checked data gathered by the principal investigator with the aim to achieve accuracy.

### 3.7 Data processing and analysis

I cross checked the completed abstraction forms. To ensure that data entry into the computer was accurate, the research assistants and I independently cross checked each entry.

Data were coded, entered and cleaned using Microsoft Excel 2016 and imported into Stata 14 for analysis.

Descriptive statistics was used to describe the frequencies and percentages for sex, age, distance of place of residence to DOTS centre, type of resisdence (urban, periurban and rural), HIV status, ART regiment of HIV patients, type of patient (new patient, treatment failure, relapse, transferred in, other and return after default), treatment supporter, and diagnostic category (sputum smear positive or negative pulmonary TB or extra-pulmonary TB).

A chi square test of association was used to determine significant differences among the different variables. Firstly, between treatment outcomes and demographic variables (sex, age and distance of place of residence to DOTS center) and secondly, treatment outcomes and other variables: type of TB, treatment supporter, other co-morbidities (eg. diabetes mellitus),

diagnostic category, duration of treatment and adverse drug reaction. Statistical significance was set at a p-value of 0.05.

Binary logistic regression models were fitted to examine the relationship between the background and disease presentation characteristics, and treatment outcome, taking into account all the potential confounders such as HIV status and age.

Multiple logistic analysis for adjusted odds ratio was done with 95% confidence interval.

### 3.8 Pretest of data collection tools

Pretesting was done at Adabraka Polyclinic, which serves communities with similar characteristics as those treated at the Ridge hospital. It was done with research assistants to evaluate the time needed to complete each abstraction form, and also evaluate the training received by the research assistants

### 3.9 Ethical issues

Ethical approval was sought from Ethical Review Committee of Ghana Health Service, Research and Development Division in Accra.

Permission was sought from the Central Administration and the Deputy Director of Nursing Service (DDNS) in-charge of the DOTS centre at the Ridge Hospital. A room was solicited from the hospital authority to conduct the study to ensure privacy and confidentiality. The TB cards from which the data were retrieved were kept under lock where access limited to research assistants, my supervisor and I. No identifying information such as names was captured from the records. Data collected were solely used for research purpose.

To ensure confidentiality, anonymity was maintained from data entry into the data collection book and into the computer before data analysis. No information that could reveal the patient's identity was captured.

# CHAPTER FOUR

## 4.0 RESULTS

### 4.1 Background characteristics of TB patients by their HIV status in the Ridge Hospital, 2008-2106.

A total of 761 TB patients were registered during the period 2008-2016. Out of this, 3 patients treatment outcomes were not documented (patients were transferred out to other treatment centers). Seven hundred and fifty-eight (758) patients completed records were therefore used in the analysis.

Table 2 shows the background characteristics of TB patients by their HIV status in the Ridge Hospital, 2008-2016. Most of the patients with TB-HIV co-infection were in the age group 35-44. The difference among the age groups between the two categories of patients was statistically significant ($p<0.01$). Males were more than female in both TB-HIV and TB only patients. There was an evidence of statistical difference between males and females ($\chi 2 = 33.7$, $p<0.01$). Most of the TB-HIV and TB only patients reside in the urban center than the rural centers ($\chi 2 = 0.97$, $p<0.01$). With respect to distance, most of the TB-HIV and TB only patients stayed less than 5km away from the hospital in both TB-HIV and TB only patients. The patients who took alcohol were TB only patients. TB only patients with documented as addicted to drugs were more than TB-HIV patients.

**Table 2 Background characteristics of TB cases according to HIV status in the Ridge Hospital 2008-2016**

| Characteristic (758) | TB-HIV n (%) | TB only n (%) | $X^2$ | p-value |
|---|---|---|---|---|
| Age | | | 57.08 | <0.001 |
| < 15 | 29(45.3) | 35(54.7) | | |
| 15-24 | 9(9.9) | 82(90.1) | | |
| 25-34 | 37(21.6) | 134(78.4) | | |
| 35-44 | 57(32.4) | 119(67.6) | | |
| 45-54 | 36(27.9) | 93(72.1) | | |
| 55-64 | 6(8.5) | 65(91.5) | | |
| > 64 | 2(3.5) | 55(96.5) | | |
| Sex | | | 33.67 | <0.001 |
| Male | 92(17.7) | 434(82.3) | | |
| Female | 85(36.6) | 147(63.4) | | |
| Area of residence | | | 0.97 | <0.001 |
| Urban | 135(23.2) | 448(76.8) | | |
| Periurban | 41(23.4) | 134(76.6) | | |
| Distance to hospital | | | 0.51 | 0.43 |
| < 5 km | 135(22.9) | 459(77.1) | | |
| ≥ 5 km | 41(25.3) | 123(74.7) | | |
| Diabetes | | | 1.07 | 0.30 |
| Yes | 8(32) | 17(68) | | |
| No | 168(22.9) | 565(77.1) | | |
| Alcoholism | | | 3.09 | 0.08 |
| Yes | 0 | 10(100) | | |
| No | 176(23.5) | 573(76.5) | | |
| Drug addict | | | 0.98 | 0.32 |
| Yes | 3(14.3) | 18(85.7) | | |
| No | 172(23.3) | 565(76.7) | | |

### 4.2 Disease presentation and treatment characteristics of TB cases according to HIV status in the Ridge Hospital.

Table 3 shows the disease presentation and treatment characteristics of TB cases by their HIV status in the Ridge Hospital from 2008 to 2016. New TB cases were reported more among TB only group (75.1%) than the TB-HIV group (24.9%). None of the TB-HIV patients defaulted during treatment. A greater proportion of the patients presented with smear positive in both categories of patients ($\chi 2$ =30.25, p-value <0.001). Most of patients (both TB-HIV and TB only) chest x-rays were suggestive of TB. Most of the patients received treatment for 6 months and above. Out of the 15 patients that there was no treatment supporter, 14 of them were TB only patients. Most of the patients that experienced adverse drug reactions were in the TB-HIV patients (62.5%). Majority of the TB-HIV patients were on anti-retroviral therapy.

**Table 3 Disease presentation and treatment characteristics of TB cases according to HIV status in Ridge Hospital, 2008-2016**

| Characteristic (758) | TB-HIV (%) | TB only (%) | $X^2$ | p-value |
|---|---|---|---|---|
| Type of entry | | | 6.16 | 0.29 |
| New | 143(24.9) | 431(75.1) | | |
| Relapse | 5(26.3) | 14(73.7) | | |
| Defaulter | 0 | 12(100) | | |
| Failure | 1(25) | 3(75) | | |
| Undefined | 28(18.9) | 120(81.1) | | |
| TB classification | | | 30.25 | <0.01 |
| Smear Positive | 74(16) | 388(84) | | |
| Smear Negative | 68(38.6) | 108(61.4) | | |
| Extra-pulmonary | 36(20.8) | 137(79.2) | | |
| Chest X-ray | | | 3.41 | 0.07 |
| Suggestive | 61(15.3) | 33.8(84.7) | | |
| Not suggestive | 117(32.3) | 245(67.7) | | |
| Duration of treatment | | | 0.68 | 0.17 |
| < 6 months | 15(21.4) | 55(78.6) | | |
| ≥ 6 months | 163(23.6) | 528(76.4) | | |
| Treatment supporter | | | 2.39 | 0.12 |
| Yes | 177(23.7) | 569(76.3) | | |
| No | 1(6.70 | 14(93.3) | | |
| Adverse treatment reaction | | | 6.90 | 0.01 |
| Yes | 5(62.5) | 3(37.5) | | |
| No | 173(23) | 580(77) | | |
| Patients receiving ART* | | | | |
| Yes | 137(77.0) | - | | |
| No | 41(23.0) | - | | |

ART*- Antiretroviral therapy

### 4.3 TB cases by HIV status at the Ridge Hospital 2008-2016

Figure 2 shows TB cases by HIV status at the Ridge Hospital. The highest number of TB cases over the period was 120, which were recorded in 2012, and the lowest was in 57 in 2016. The prevalence of HIV among TB cases over the period was 23.1% (175/758). In 2011, 19% (33/117) of the cases recorded were HIV-positive making it the year with the highest number of co-infected cases.

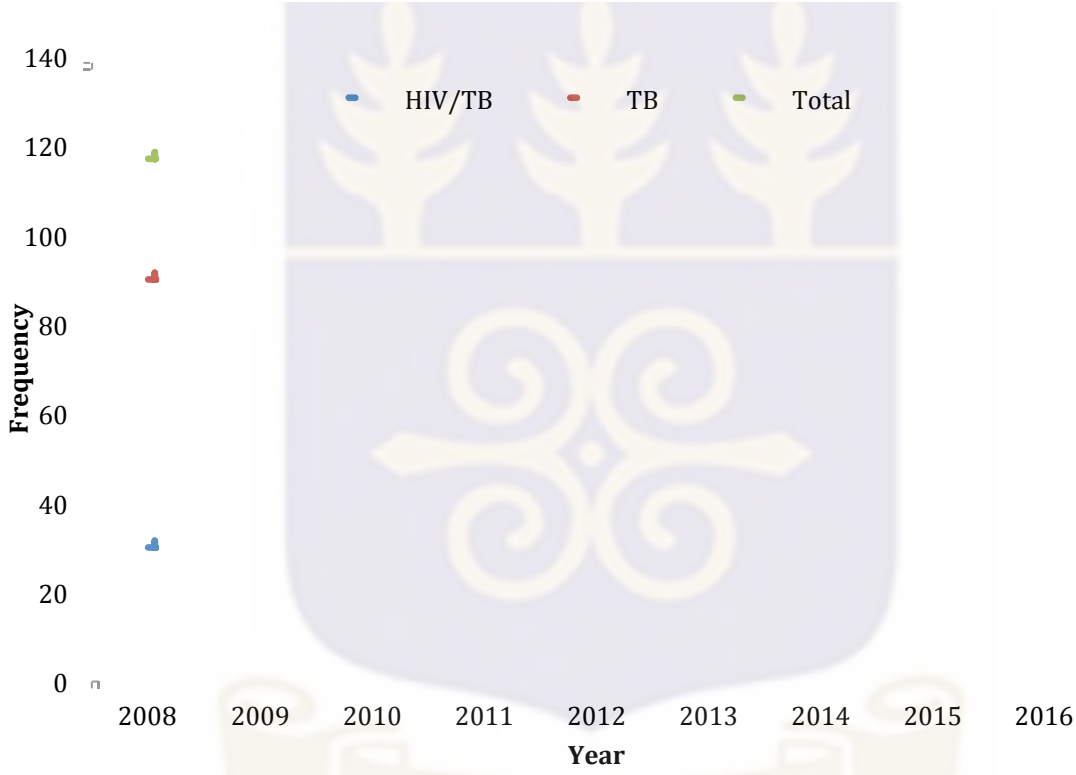


**Figure 2 TB cases by HIV status at the Ridge Hospital, 2008-2016**

### 4.4 Treatment outcomes of TB cases according to HIV status at the Ridge Hospital, 2008-2016

Table 4 shows the treatment outcomes of TB cases according to HIV status at the Ridge Hospital, 2008-2016. Out of the 758 patients with complete records that were analyzed in this study, 45.6% (346/758) were cured, 42.5% (322/758) completed treatment. The overall treatment success was 88.2% (668/758). Twelve percent (90/758) of the patients had an adverse outcome which comprised of treatment outcomes; treatment failure, defaulting and death. TB-HIV who patients achieved treatment success was 77.6% (136/668). TB only patients who achieved treatment success were 91.3% (532/668).

**Table 4 Treatment outcomes of TB cases according to HIV status at the Ridge Hospital, 2008-2016**

| Variable | TB-HIV | TB only | Total (%) |
|---|---|---|---|
| Treatment outcome | | | |
| Cured | 59 (33.91) | 287 (49.14) | 346 (45.6) |
| Treatment completed | 77 (43.6) | 245 (42.1) | 322 (42.5) |
| Treatment failure | 2 (1.2) | 5 (0.9) | 7 (0.9) |
| Died | 34 (18.9) | 42 (7.4) | 76 (10) |
| Defaulted | 4 (2.3) | 3 (0.5) | 7 (0.9) |
| Overall treatment outcome | | | |
| Treatment success | 136 (77.6) | 532 (91.3) | 668 (88.2) |
| Adverse treatment | 40 (22.4) | 50 (8.7) | 90 (11.8) |

### 4.5 TB patients background characteristics and treatment outcomes

Table 5 shows TB patients background characteristics and treatment outcomes. The age groups 15-24, 24-34,35-44,45-54, had 54.9% (50/91), 54.4% (93/171), 50.5% (89/176), 54.2% (70/129) of their patients cured respectively. However 76.5% (49/64) of those below 15 years had completed treatment, but this age group also had the highest number of patients who defaulted. There was significant difference in treatment outcomes among the age groups ($X^2$=111.19, p<0.001).

Six males experienced treatment failure as compared to 1 female. Forty-nine percent (259/526) of males were cured as compared to 37.5% (87/232) females. There was a significant difference in treatment outcomes in males and females ($X^2$=10.92, p=0.028).

Patients without diabetes had a better treatment outcome compared to those with diabetes; 88% (649/733) vs. 76% (19/25) respectively. There was a significant difference in treatment outcomes in diabetics and non-diabetics ($X^2$=19.08, p<0.001).

Seven of none drug users died compared to 1 drug user, 7 non-drug users defaulted compared to no drug user defaulting. There was also a significant difference in treatment outcomes among those addicted to drugs and those who were not ($X^2$=12.66, p=0.013). Among alcoholics and non-alcoholics there was no difference in their treatment outcomes.

**Table 5 TB patient's background characteristics and treatment outcomes**

| Variable | Treatment outcome N (%) | | | | | |
|---|---|---|---|---|---|---|
| | Cured | Treatment Completed | Treatment Failure | Died | Defaulted | $X^2$ (p-value) |
| Age | | | | | | 111.19 (<0.01)* |
| < 15 | 3 (4.7) | 49 (76.6) | 0 | 8 (12.5) | 4 (6.3) | |
| 15-24 | 50 (55.0) | 36 (39.6) | 1 (1.1) | 4 (4.4) | 0 | |
| 25-34 | 93 (54.7) | 56 (32.9) | 1 (0.6) | 18 (10.6) | 2 (1.2) | |
| 35-44 | 89 (58.6) | 70 (39.8) | 1 (0.6) | 16 (9.1) | 0 | |
| 45-54 | 70 (54.3) | 49 (38.0) | 2 (1.6) | 7 (5.4) | 1 (0.8) | |
| 55-64 | 27 (38.0) | 35 (49.3) | 1 (1.4) | 15 (26.3) | 0 | |
| > 64 | 14 (25.6) | 27 (47.4) | 1 (1.8) | 15 (26.3) | 0 | |
| Sex | | | | | | 10.92(0.03)* |
| Male | 259 (49.2) | 210 (39.9) | 6 (1.1) | 47 (8.9) | 4 (0.8) | |
| Female | 87 (37.5) | 112 (48.3) | 1 (0.4) | 29 (12.5) | 3 (1.3) | |
| Area of residence | | | | | | 6.08(0.19)* |
| Urban | 261 (44.8) | 255 (43.7) | 5 (0.9) | 59 (10.1) | 3 (0.5) | |
| Periurban | 85 (48.6) | 67 (38.3) | 2 (1.1) | 17 (9.7) | 4 (2.3) | |
| Distance to hospital | | | | | | 6.56(0.16)* |
| < 5 km | 273 (46.1) | 255 (43.0) | 6 (1.0) | 56 (9.4) | 3 (0.5) | |
| ≥ 5 km | 73 (44.2) | 67 (40.6) | 1 (0.6) | 20 (12.1) | 4 (2.4) | |
| Diabetes | | | | | | 19.08(<0.01)* |
| Yes | 13 (52.0) | 6 (24.0) | 2 (8.0) | 3 (12.0) | 1 (4.0) | |
| No | 333 (45.4) | 316 (43.1) | 5 (0.7) | 73 (10.0) | 6 (0.8) | |
| Alcoholism | | | | | | 8.08 (0.09)* |
| Yes | 9 (90) | 1 (10) | 0 | 0 | 0 | |
| No | 337 (45.1) | 321 (49.9) | 7 (0.9) | 76 (10.2) | 7(0.9) | |
| Drug addict | | | | | | 12.66(0.01)* |
| Yes | 16 (76.2) | 3 (14.3) | 1 (4.8) | 1 (4.8) | 0 | |
| No | 330 (44.8) | 318 (43.2) | 6 (0.8) | 7 (10.2) | 7 (1.0) | |

*p-value was a fisher's exact test

### 4. 6 TB patients disease characteristics and treatment outcomes

Table 6 shows TB patients' characteristics and treatment outcomes in the Ridge Hospital 2008-2016. Patients in the entry category; new, relapse, failure, defaulted, had 54.5% (312/573), 77.8% (14/18), 50% (6/12), 75% (3/4) of their patients cured respectively. There was a significant difference in the treatment outcomes in this category. There was a significant difference in the treatment outcomes in TB patients classification (smear positive, negative and extra-pulmonary) and chest x-ray; suggestive or not.

**Table 6 TB patient's disease characteristics and treatment outcomes**

| Variable | Treatment outcome N (%) | | | | | $X^2$ (p-value) |
|---|---|---|---|---|---|---|
| | Cured | Treatment Completed | Treatment Failure | Died | Defaulted | |
| Type of entry | | | | | | 163.04(<0.01)* |
| New | 312 (54.5) | 203 (35.4) | 5 (0.9) | 49 (8.6) | 4 (0.7) | |
| Relapse | 14 (77.8) | 2 (11.1) | 0 | 2 (11.1) | 0 | |
| Defaulter | 6 (50) | 2 (16.7) | 1 (8.33) | 3 (25.0) | 0 | |
| Failure | 3 (75.0) | 0 | 1 (25) | 0 | 0 | |
| Undefined | 11 (7.4) | 112 (75.7) | 0 | 22 (14.9) | 3 (2.03) | |
| TB classification | | | | | | 449.17(<0.01)* |
| Smear Positive | 328 (79.8) | 49 (11.9) | 6 (1.5) | 281 (6.8) | 0 | |
| Smear Negative | 8 (4.6) | 140 (80.5) | 1 (0.6) | 21 (12.1) | 0 | |
| Extra-pulmonary | 10 (5.8) | 133 (76.9) | 0 | 27 (15.6) | 0 | |
| Chest X-ray | | | | | | 43.63 (<0.01)* |
| Suggestive | 167 (36.8) | 231 (50.9) | 3 (0.7) | 51 (11.2) | 2 (0.4) | |
| Not suggestive | 179 (58.9) | 91 (29.8) | 4 (1.3) | 25 (8.2) | 5 (1.6) | |
| Duration of treatment | | | | | | 1.18 (0.88)* |
| < 6 months | 34 (48.6) | 28 (40.0) | 0 | 7 (10) | 1 (1.43) | |
| ≥ 6 months | 312 (45.4) | 294 (42.7) | 2 (1.02) | 69 (10) | 6 (0.9) | |
| Treatment supporter | | | | | | 0.95 (0.92)* |
| Yes | 338 (45.5) | 317 (42.7) | 7 (0.9) | 74 (10.0) | 7 (0.9) | |
| No | 8 (53.3) | 5 (33.3) | 0 | 2 (13.3) | 0 | |
| Adverse treatment reaction | | | | | | 9.25(0.06)* |
| Yes | 1 (14.3) | 3 (42.9) | 0 | 3 (42.9) | 0 | |
| No | 345 (45.9) | 319 (42.5) | 7 (0.9) | 73 (9.7) | 0 | |

*p-value was a fisher's exact test

### 4.7 Binary logistic regression analysis of patients' characteristic associated with treatment success and adverse treatment.

Table 7 shows a binary logistic regression analysis to test the strength of association between patients' characteristics and treatment outcomes. Patients aged 15 to 64 were less likely to experience poor treatment success compared to those below age 15, however patients aged above 64 were 1.69 times more likely to experience poor treatment success compared to those age below 15 years (cOR-1.69, 95% CI 0.72-3.97;p-0.23).

Drug addict's odds of experiencing adverse treatment outcome are 0.20 times reduced compared to non-drug users (cOR-0.80, 95% CI 0.18-3.48;p-0.76).

The odds of patients co-infected with TB and HIV experiencing adverse treatment was 2.96 times compared to TB only patients. There was evidence of statistical difference in treatment outcome in relation to their HIV status (cOR-2.96, 95% CI 1.87-.4.70; p-<0.01).

**Table 7 Binary logistic regression analysis of patients' background characteristics associated with treatment success and adverse treatment**

| Variable | Treatment outcome | | cOR | 95%CI | p-value |
|---|---|---|---|---|---|
| | Trt. success N (%) | Adverse trt. N (%) | | | |
| Age | | | | | |
| < 15 | 52 (81.3) | 12 (18.8) | Ref | | |
| 15-24 | 86 (94.5) | 5 (5.3) | 0.25 | 0.08-0.76 | 0.01 |
| 25-34 | 150 (88.2) | 20 (11.8) | 0.58 | 0.26-1.26 | 0.17 |
| 35-44 | 159 (90.3) | 17 (9.7) | 0.46 | 0.21-1.03 | 0.06 |
| 45-54 | 119 (92.3) | 10 (7.8) | 0.36 | 0.15-0.90 | 0.03 |
| 55-64 | 64 (90.1) | 7 (9.9) | 0.47 | 0.17-1.29 | 0.14 |
| > 64 | 41 (71.9) | 16 (28.1) | 1.69 | 0.72-3.97 | 0.23 |
| Sex | | | | | |
| Male | 471 (89.5) | 55 (10.5) | Ref | | |
| Female | 200 (86.2) | 32 (13.8) | 1.37 | 0.86-2.18 | 0.19 |
| Area of residence | | | | | |
| Urban | 518 (88.9) | 65 (11.2) | Ref | | |
| Periurban | 153 (87.4) | 22 (12.6) | 1.16 | 0.68-1.92 | 0.61 |
| Distance to hospital | | | | | |
| < 5 km | 531 (89.5) | 62 (11.2) | Ref | | |
| ≥ 5 km | 671 (88.5) | 87 (11.5) | 1.53 | 0.93-2.52 | 0.10 |
| Diabetes | | | | | |
| No | 651 (88.7) | 83 (11.3) | Ref | | |
| Yes | 20 (80.0) | 5 (20.0) | 1.96 | 0.72-5.36 | 0.19 |
| Alcoholism | | | | | |
| No | 661 (88.3) | 88 (11.8) | Ref | | |
| Yes | 10 (100) | - | - | - | - |
| Drug addict | | | | | |
| No | 651 (88.3) | 86 (11.7) | Ref | | |
| Yes | 19 (90.5) | 2 (9.5) | 0.80 | 0.18-3.48 | 0.76 |
| HIV status | | | | | |
| No | 534 (91.4) | 50 (8.6) | Ref | | |
| Yes | 137 (78.3) | 38 (21.7) | 2.96 | 1.87-4.70 | <0.01 |

### 4.8 Binary logistic regression analysis of TB patients' disease characteristics associated with treatment success and adverse treatment.

Table 8 shows of patients' disease characteristics associated with treatment success and adverse treatment. Patients in the entry category; relapse, undefined, failure, transferred in, were more likely to experience adverse treatment compared to new patients. Smear negative and extra-pulmonary TB classified patients were more likely to experience adverse treatment compared to smear positive patients. Having a treatment supporter is protective of developing adverse treatment outcomes compared to those with no treatment supporters (cOR-0.85 95% CI 0.19-3.83;p-0.83). The odds of experiencing adverse treatment outcome in patients that experienced anti-TB reaction was 7.9 times that of patient treatment who did not experience any anti-TB reaction (cOR-7.94, 95% CI 1.94-32.34;p-<0.01).

**Table 8 Binary logistic regression analysis of TB patient's characteristics associated with treatment success and adverse treatment**

| Variable | Treatment outcome | | cOR | 95%CI | p-value |
|---|---|---|---|---|---|
| | Trt. success N (%) | Adverse trt. N (%) | | | |
| Type of entry | | | | | |
| New | 512 (90.3) | 55 (9.7) | Ref | | |
| Relapse | 124 (83.8) | 24 (16.2) | 1.81 | 1.08-3.03 | 0.03 |
| Undefined | 8 (66.7) | 4 (33.3) | 4.66 | 1.36-15.99 | 0.01 |
| Failure | 3 (75.0) | 1 (25.0) | 3.11 | 0.08-0.14 | 0.33 |
| Transferred in | 16 (88.9) | 2 (11.1) | 1.67 | 0.26-5.20 | 0.84 |
| TB classification | | | | | |
| Positive | 378 (92.0) | 33 (8.0) | Ref | | |
| Negative | 148 (85.1) | 26 914.9) | 2.01 | 1.16-3.48 | 0.01 |
| Extra-pulmonary | 145 (83.8) | 28 (16.2) | 2.21 | 1.29-3.79 | 0.04 |
| Chest X-ray | | | | | |
| Suggestive | 400 (88.1) | 54 (11.9) | 1.08 | 0.26-4.80 | 0.75 |
| Not suggestive | 271 (88.9) | 34 (11.2) | Ref | | |
| Duration of treatment | | | | | |
| < 6 months | 62 (88.6) | 8 (11.4) | Ref | | |
| ≥ 6 months | 609 (88.5) | 79 (11.5) | 1.00 | 0.46-2.18 | 0.99 |
| Treatment supporter | | | | | |
| Yes | 658 (88.4) | 86 (11.7) | 0.85 | 0.19-3.83 | 0.83 |
| No | 13 (86.9) | 2 (13.1) | Ref | | |
| Adverse treatment reaction | | | | | |
| Yes | 4 (50) | 4 (50) | 7.94 | 1.94-32.34 | <0.01 |
| No | 667 (88.8) | 84 (11.2) | Ref | | |
| Patients receiving ART* | | | | | |
| Yes | 108 (79.4) | 28 (20.6) | 2.43 | 1.49-3.99 | <0.01 |
| No | 563 (90.4) | 60 (9.6) | Ref | | |

*ART-Antiretroviral therapy

### 4.9 Multiple logistic regression analysis of TB patients' factors associated with treatment success and adverse treatment.

Table 9 shows the multiple logistic regression of TB patients' background and disease presentation characteristics associated with treatment success and adverse treatment. Independent predictors of adverse treatment were found to be; being HIV positive (AOR: 3.85, 95% CI: 2.19-6.75; p <0.01); aged 65 and above (AOR-1.76, 95% CI 1.44-1.54; p-0.01); previously failed TB treatment (AOR: 5.02, 95% CI 2.09-28.87; p <0.01).

**Table 9 Multiple logistic regression of TB patients' characteristics associated with treatment success and adverse treatment**

| Variable | Treatment outcome | | aOR | 95% CI | p-value |
|---|---|---|---|---|---|
| | Trt. success N (%) | Adverse trt. N (%) | | | |
| Age | | | | | |
| < 15 | 52 (81.3) | 12 (18.8) | Ref | | |
| 15-24 | 86 (94.5) | 5 (5.3) | 0.42 | 0.13-1.34 | 0.14 |
| 25-34 | 150 (88.2) | 20 (11.8) | 0.81 | 0.35-1.86 | 0.62 |
| 35-44 | 159 (90.3) | 17 (9.7) | 0.60 | 0.26-1.41 | 0.24 |
| 45-54 | 119 (92.3) | 10 (7.8) | 0.43 | 0.16-1.14 | 0.09 |
| 55-64 | 64 (90.1) | 7 (9.9) | 0.85 | 0.29-2.48 | 0.77 |
| > 64 | 41 (71.9) | 16 (28.1) | 1.78 | 1.44-9.54 | 0.01 |
| Sex | | | | | |
| Male | 471 (89.5) | 55 (10.5) | Ref | | |
| Female | 200 (86.2) | 32 (13.8) | 0.95 | 0.50-1.59 | 0.89 |
| Type of entry | | | | | |
| New | 512 (90.3) | 55 (9.7) | Ref | | |
| Relapse | 124 (83.8) | 24 (16.2) | 1.40 | 0.29-6.64 | 0.67 |
| Undefined | 8 (66.7) | 4 (33.3) | 2.00 | 1.15-3.48 | 0.01 |
| Failure | 3 (75.0) | 1 (25.0) | 5.02 | 2.09-28.87 | <0.01 |
| Transferred in | 16 (88.9) | 2 (11.1) | 1.67 | 0.26-5.20 | 0.84 |
| TB classification | | | | | |
| Positive | 378 (92.0) | 33 (8.0) | Ref | | |
| Negative | 148 (85.1) | 26 (14.9) | 1.40 | 0.75-2.59 | 0.29 |
| Extra-pulmonary | 145 (83.8) | 28 (16.2) | 2.21 | 0.62-5.31 | 0.28 |
| Adverse treatment reaction | | | | | |
| Yes | 4 (50) | 4 (50) | 4.22 | 0.84-21.22 | 0.08 |
| No | 667 (88.8) | 84 (11.2) | Ref | | |
| HIV status | | | | | |
| No | 534 (91.4) | 50 (8.6) | Ref | | |
| Yes | 137 (78.3) | 38 (21.7) | 3.85 | 2.19-6.75 | <0.01 |

# CHAPTER FIVE

## 5.0 DISCUSSION

This was a cross-sectional study involving the review of records on TB patients who sought care at the Ridge Hospital from 2008 to 2016. The purpose of the study was to determine the factors associated with TB treatment outcomes in patients with TB-HIV co-infection and TB only infection in the Ridge Hospital over the period. Out of the 761 records that were reviewed at the hospital, 758 had their treatment outcomes documented. Of the 758 records used in the analysis, 23.2% (176/758) of the patients were co-infected with HIV. Patients cured were 45.6% (346/758), 42.5% (322/758) completed treatment, 10% (76/758) died, 0.9% (7/758) failed treatment and 0.9% (7/758) defaulted.

Treatment outcomes of almost all TB cases diagnosed and managed in the hospital were documented; only 3 (0.4%) patients treatment outcomes were not documented. This shows that the DOT center of the hospital keeps good records of all the TB patients and it also demonstrates that, the HIV and TB services in the hospital are well integrated.

Over the 9 years records reviewed in the Ridge hospital in this study, 66 TB cases were recorded in 2008 and this increased to 120 in 2012. After 2012, the number decreased gradually year after year to 58 in 2016. This shows that there is a decrease in the number of people who are treated for TB in the hospital. The reduction in the numbers may be due to several reasons such as inactive search of cases, lack of screening programs to screen TB patient's contacts and the reduced sensitivity of the diagnosis tests.

In 2015, the National Control Program reported that, the number of TB cases recorded in the country is three times higher than what is reported by the WHO (NTP, 2015). This shows that

there are a lot of cases that are not being detected in the country or by the hospital. Therefore the case detection efforts by the control program and the hospital should be intensified. However, Ghana Health Service report on the prevalence rate of TB demonstrated a downward trend from 311/100,000 cases in 1990 to 106/100,000 cases in 2010 (GHS, 2011).

In 2009, according to a Ghana AIDS commission report, although Ghana has a stable HIV epidemic, 23% of all TB cases are amongst persons living with HIV/AIDs (Ghana Aids Commission, 2009). This study with a prevalence of 23% of HIV among TB patients confirms this. More needs to be done to bring the prevalence of both infectious diseases down. The prevalence of HIV among TB patients in many developed countries is on the decline. In the United States of America, HIV co-infection among TB cases has decreased from 34% to 13% since 1992. In a SSA country like Nigeria, the prevalence of HIV among TB patients in Nigeria increased from 2.2% in 1991 to 19.1% in 2001 and 25% in 2010. In another study done in Ghana, TB-HIV co-infection was higher, 27% by Opoku (2015) in a study conducted in Mampong at the Tetteh Quarshie Memorial Hospital. In studies done in Nigeria, one had the same prevalence as this study (Njepuome & Odume, 2009) and 47% in a study Ofoegbu & Odume (2015). This shows that HIV co-infection among TB patients is increasing and the collaboratively TB and HIV treatment activities in the hospital should be intensified to detect and treat any likely TB cases among the HIV infected persons.

The treatment success observed in this study shows that the hospital is edging closer to achieving the End TB partnership targets. The End TB partnership targets by 2030 are; 80% drop in new TB cases, 90% drop in people dying of TB and 100% of TB-affected families protected from catastrophic costs. The decrease in the number of TB cases recorded in the hospital from 2012 shows that the hospital is close to achieving the End TB partnership target before 2030.

In this study, the overall treatment success, which is the total of patients that were cured and completed treatment, is 88.2%. The overall treatment success is higher than Ghana's success rate for 2011 of 86.5% (NTP, 2011) and 84% success rate for new and relapse TB cases in Ghana in 2012 (WHO, 2014). The high success rate might be attributed to the integration of TB-HIV services and the massive campaign for early detection and cure of TB (Ansa et al., 2012).

In another study conducted study by Azagba (2013) to determine the treatment outcomes using treatment supporters in Ketu South Municipality, a success rate of 79.6% was recorded. He stated that most of the treatment supporters were not motivated.

The treatment success of TB-HIV patients in this study is 77.59% and that of TB only patients was 91.26%. This difference is statistically significant ($p<0.001$). Although some studies have reported no difference in the cure rates in both groups, (Bliven-Sizemore et al., 2012; Mohammed Mergni Gafar, Dambisya Co-supervisor, & Nyazema, 2013, Salgar, 2014) several studies have also reported lower cure rates in HIV positive individuals compared to negative ones (Amente Megersa & Phaladze, 2013; Njepuome & Odume, 2009 Ayeno, Regasa, Lenjisa, & Tesfaye, 2014). However, according to Collins (2012), being HIV seropositive was significantly associated with better treatment success rate and he attributed this to the variability in treatment protocols of HIV- TB patients and TB patents only. The marked difference in TB treatment success rate, in patients not HIV positive and those dually infected, reflects the enormous contribution that HIV co-infection has towards obtaining a low treatment success of anti-tuberculosis treatment.

A study by Salgar (2014), to determine treatment outcomes of TB patients in Azezo Health Centre, Ethiopia revealed a significant successful treatment outcome among HIV negative

and positive patients. Another study revealed that HIV negative patients on TB treatment were associated with better treatment success when compared with HIV positive patients (Ayeno, Regasa, Lenjisa, & Tesfaye, 2014).

In SSA, gender inequality is the main driver of the HIV infection, this accounts for 60% of the epidemic (UNGASS, 2008). Various reviews suggest that women in many parts of the developing world are less likely to control how, when and where sex takes place thereby increasing the likelihood of HIV infection (Njepuome & Odume, 2009).

In this study, males are more than females in both TB-HIV and TB only patients. This finding is in line with study conducted by Jemal et al., in 2015 & Zwang et al., in 2007). However females were likely to develop poor treatment outcomes compared to males. Studies conducted in Nigeria by Ofoegbu & Odume, (2015) did not find any difference in treatment outcomes by sex. The high number of males compared to females in this study may be a reflection of the increasing risky behavioral patterns in African men (Zwang et al., in 2007).

Most of the patients were between 15 and 54 years. This reveals that TB affects most people in their youthful ages. There was a statistical significant difference in age in HIV positive and negative cases in this study. In a study by Jemal et al., (2015), they observed that most of the patients were between 25-34 years. In the multivariate analysis of this study, patients aged above 64 were 1.78 times more likely to experience poor treatment success compared to those age below 15 years. A study on factors affecting treatment outcome for pulmonary TB in Istanbul, Turkey showed a significant association between adverse treatment outcome and age more than 65 years, especially those with other chronic condition like hypertension (Babalık, Kılıçaslan, Kızıltaş, Gencer, & Öngen, 2013). Another study by Chung, Chang, &

Yang, in 2007, in India, revealed that patients of advanced age were less likely to achieve treatment success and this was due to non-adherence to anti –tuberculosis treatment and advanced disease

In 2006, the WHO TB report revealed that treatment outcome in children are generally good, even in immune-compromised ones who are at a higher risk of disease progression, provided that treatment is initiated early (WHO, 2006). However, the findings of this study is contradictory to the WHO report, the highest number of those who defaulted was below 15 years. This may be due to the children refusing to continue treatment after an improvement in their condition. Treatment supporters of the children who are mainly their parents should be educated on the dangers of not completely taking the anti-TB medication.

Comparing HIV positive and negative cases in this study, there was in statistical difference in TB classification; smear positive, smear negative or extra-pulmonary. This finding was corroborated by studies by Karanjekar et al., (2014) with 67% and Osei et al., 2017 with 84% smear negative pulmonary TB patients were more likely to be HIV positive.

Distance from place of residence to the hospital was not statistically associated with treatment success and HIV status but patients who have to travel more than 5km to reach the hospital are 1.5 times more likely to experience poor treatment outcome compared to those who leave less than 5km away from the hospital. This may be as a result of increased transportation cost to those patients who leave far away from the hospital to bear. The country's (Ghana) policy on proximity to treatment facility is that a TB patient must not board more than 2 vehicles before getting to the treatment facility. Two other studies agree with this finding where long distance travelled by TB patients from home to treatment center was associated with adverse treatment outcome Ai et al., (2010) & Boateng, Kodama,

Tachibana, & Hyoi, (2010).

Patients who reacted to the anti-TB medication are 1.94 times more likely to experience poor treatment outcome compared to patients who did not experience any reaction and the difference was statistically significant. Adverse reactions associated with anti-TB are headaches, skin rashes and bodily weakness. A study in the New Juabeng municipality in Ghana found that treatment default was significantly associated with adverse effect of drugs (Boateng et al., 2010).

Treatment supporters play a crucial role in TB treatment. A treatment supporter can be a relative, health worker or a volunteer. Treatment supporters assist TB patients to complete their full course medications. In a study conducted by Ali in 2008, he demonstrated how treatment supporters influence treatment outcomes. In Ali's study, treatment supporters were collecting anti-TB drugs for their patients monthly and were giving it to them daily. Out of 71 patients under direct supervision of treatment supporters, 61 completed treatment. Although having a treatment supporter was not significantly associated with treatment outcomes in this study, having a treatment supporter is protective of developing adverse treatment outcomes compared to those with no treatment supporters.

**5.1 Limitations.**

It was a retrospective study and based only on data that were available on the patients' treatment cards. It was not possible to collect additional data on patient's background characteristics such as marital status, occupation, educational status and income level.

**5.2 Strengths**

Notwithstanding the above limitations, the length of the study period conferred rigor to the analysis and makes the inferences arising from it valid and relevant.

# CHAPTER SIX

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusion

This study identifies factors associated with TB outcome in the Ridge Hospital. The prevalence of HIV-TB co-infection among TB patients who sought care at the Ridge Hospital is 23.2% (176/758). The number of TB patients who sought care at the Ridge Hospital over the period of review increased gradually from 66 in 2008 to 120 in 2012 but decreased sharply to 58 in 2016. Treatment success for both TB-HIV co-infected patients and TB only patients is 88.2% and that of the co-infected patients 77.6%. Patients who are aged 65 years and above, patients co-infected with TB-HIV, and patients who have previously failed treatment, patients who reacted to anti-TB drugs are more likely to experience adverse treatment outcomes.

### 6.2 Recommendations

In order to improve cure of TB clients, the following recommendations are made:

#### 6.2.1 Ridge hospital

1. HIV patients should be critically monitored during treatment at the DOT center
2. Patients advanced in age should be supported to enhance their treatment success
3. Intensify education on the importance of completing the full course of treatment to the TB patients and their treatment supporters.

#### 6.2.2 Ghana Health Service/National TB control Program

Screening and reach-out campaign should be organized to actively search for TB cases to enhance the elimination proces

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**APPENDIX 1**

| **DATA ABSTRACTION FORM ON FACTORS ASSOCIATED WITH TB TREATMENT OUTCOMES IN PATIENTS WITH TB BY HIV STATUS IN THE RIDGE HOSPITAL** |
|---|
| This is a research on factors associated with TB treatment outcomes in patients with TB by their HIV status. The study tries to find out the various factors that associated with successful and unsuccessful treatment outcomes. Please fill in the details in the provided spaces |
| |
| DATE OF REVIEW……. |
| IDENTIFICATION NUMBER…….. |

| | QUESTIONS | CODING CATEGORIES | SKIP TO | CODES |
|---|---|---|---|---|
| | 1. **SOCIO-DEMOGRAPHIC FACTORS** | | | |
| a. | Sex | **Male……..….1**<br>**Female……...……2** | | SEX |
| b. | Age | …… | | AGE |
| c. | Distance of place of residence | **Less than or equal to 5km…….**<br>**More than 5 km……** | | DIST |
| | **2. HIV STATUS** | | | |
| d. | Patient received counselling for HIV testing | **Yes…….……1**<br>**No……...……...2** | | TRETF |

| | | | | |
|---|---|---|---|---|
| e. | HIV status | **Reactive……1**<br>**Non-reactive……..2** | If 2 skip to g | ALTT |
| f. | Are you taking HIV medication? | **Yes……..……1**<br>**No…..……2** | | TBHIV |
| | **3. LIFESTYLE FACTORS** | | | |
| g. | Patient history of smoking | **Never……1**<br>**Occasionally……..…2**<br>**All the time……...…3** | | SMOK |
| h. | Patient history of alcohol taking | **Never……1**<br>**Occasionally……..…2**<br>**All the time……...…3** | | ALCH |
| i | Does the patient have Diabetes. | **Yes……...……..1**<br>**No…….……2** | | TRAVM |
| | **4. CLINICAL FACTORS** | | | |
| j | Type of patient | **New…….……1**<br>**Relapse……...2**<br>**Transfer in……...…….3**<br>**Default …….……..4**<br>**Other ……...…5** | | TCATE |
| k | TB disease classification | **Smear Positive Pulmonary TB…1**<br>**Smear Negative Pulmonary TB..2**<br>**Extra-Pulmonary TB ..……3** | | TDCLA |

| | | | | |
|---|---|---|---|---|
| l. | Category of patient | **Category I……...1**<br>**Category II……2**<br>**Category III……...3** | | CONSF |
| j | Duration of treatment | **< 6 months……..……1**<br>**> 6months…….……..2** | | TDUR |
| k | Availability of treatment<br>Supporter | **Yes……..1**<br>**No……2** | | ASUPP |
| l | TB treatment outcome | **Cured……1**<br>**Treatment complete…….....2**<br>**Treatment failed……...3**<br>**Treatment default…….……4**<br>**Death…….....5** | | SUPPT |

**APPENDIX 2**

## GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

*In case of reply the number and date of this Letter should be quoted.*

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
*Tel: +233-302-681109*
*Fax + 233-302-685424*
*Email: ghserc@gmail.com*

*My Ref. GHS/RDD/ERC/Admin/App/17/434*
*Your Ref. No.*

Hayibor Kenneth Mawuta
University of Ghana
School of Public Health
Legon, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation c your Study Protocol.

| | |
|---|---|
| GHS-ERC Number | **GHS-ERC: 70/02/17** |
| Project Title | Factors Associated with Tuberculosis Treatment Outcomes in Patients with Tuberculosis by HIV Status in the Ridge Hospital |
| Approval Date | 10th March, 2017 |
| Expiry Date | 9th March, 2018 |
| GHS-ERC Decision | **Approved** |

**This approval requires the following from the Principal Investigator**

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report **after completion** of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra