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EVALUATION OF TIMELINESS OF TREATMENT INITIATION AMONG SMEAR POSITIVE PULMONARY TUBERCULOSIS PATIENTS IN BRONG AHAFO REGION

BY

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY IN APPLIED EPIDEMIOLOGY AND DISEASE CONTROL DEGREE

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DECLARATION

I, Charles Lwanga Noora, author for this thesis, hereby declare that apart from specific references which have duly been acknowledged, this research is my own independent work undertaken under the supervision of Dr. Ernest Kenu. I further declare that no part of this thesis, either in whole or in part has been submitted elsewhere for the award of another degree.

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Date: ....

DEDICATION

I dedicate this work to God Almighty, who by His abundant grace and mercies has led me thus far, mighty is His Name. I further dedicate this thesis to the entire Noora family of Jirapa.

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TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AFB	Acid Fast Bacilli
AFENET	African Field Epidemiology Network
AIDS	Acquired Immunodeficiency Syndrome
BAR	Brong Ahafo Region
BCG	Bacille Calmette-Guerin
CDC	Centre for Disease Control and Prevention
CHPS	Community Based Health Planning and Services
CI	Confidence Interval
DDHS	District Director of Health Services
DOTS	Directly Observed Treatment Short Course
EPDC	Epidemiology and Disease Control
EPTB	Extra Pulmonary Tuberculosis
ERC	Ethical Review Committee
GFELTP	Ghana Field Epidemiology and Laboratory Training Program
GHS	Ghana Health Service
HCP	Health Care Provider
HIV	Human Immunodeficiency Virus
IGRA	Interferon Gamma Release Assay
IQR	Interquartile Range
MDG	Millennium Development Goal
LPA	Line Probe Assay
MDR	Multi Drug Resistant
MTB	Mycobacterium Tuberculosis
NTP	National Tuberculosis Control Programme

OR	Odds Ratio
PLHIV	Persons Living With HIV
PT	Patient Timeliness
RHD	Regional Health Directorate
SSA	Sub Saharan Africa
TB	Tuberculosis
TIT	Treatment Initiation Timeliness
TST	Tuberculin Skin Test
WAHO	West African Health Organization
WHO	World Health Organization
+PTB	Smear positive pulmonary TB

DEFINITIONS OF TERMS

Term	Definition
Case of TB	A patient with *Mycobacterium tuberculosis* complex identified from a clinical specimen, either by culture or by a newer method such as molecular line probe assay (LPA)or a pulmonary case with one or more initial sputum specimens positive for acid-fast that there is functional external quality assurance with blind rechecking which a health worker (Medical doctor, or other Health service provider) has diagnosed TB and decided to treat the patient with a full course of anti-TB treatment.
Case of pulmonary TB	A patient with TB disease involving the lung parenchyma.
Smear-positive PTB	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 Medical doctor, or other Health service provider.
Smear-negative PTB	A patient with positive culture but negative AFB sputum examinations is also a smear-negative case of pulmonary TB.
Extra-pulmonary TB	A patient with TB of organs other than the lungs (e.g. pleura, lymph nodes, abdomen, genitourinary tract, skin, joints & bones, meninges).
New case of TB	TB patient who has never had treatment for TB or who has taken anti-TB drugs for less than one month.

Treatment failure	Patient whose baseline smear (or culture) was positive and remains or becomes positive again at 5 months or later during treatment.
Defaulter	A patient who completed at least one month of treatment and do not return after interrupting treatment for two months or more.
Treatment after default	A patient who completed at least one month of treatment and returns after interrupting treatment for two months or more.
Loss to follow-up	Patients who have previously been diagnosed with TB treated for TB and were declared ‘lost to follow-up at the end of their most recent course of treatment.

ABSTRACT

Introduction

Smear positive pulmonary tuberculosis (PTB+) remains the main contributor of total TB burden in Ghana. One untreated PTB+ patient can transmit infection to up to 15 persons in a year. However, the average duration between onset of symptoms and the initiation of TB treatment is unknown in the region though necessary to be targeted and reduced in an effort to reduce transmission of TB in our health facilities and community. The study evaluated the timeliness and factors that influence treatment initiation among smear positive Pulmonary Tuberculosis (PTB) patients.

Methods

A facility based cross sectional study was conducted in six primary health facilities in the Brong Ahafo Region (BAR) of Ghana, from November 2014 to May 2015. Median timeliness of symptoms, diagnosis, treatment initiation and reason for delay were assessed using structured questionnaire interviews and reviews of medical records. Patient delay was defined as presentation to a health care provider more than 21 days after onset of TB-related symptoms and treatment delay as therapy initiated more than 14 days after the first consultation for TB-related symptoms with a HCP. Descriptive statistics was used to determine patient symptoms and diagnosis, health facility and treatment initiation timeliness (delay). Multiple logistic regression analysis was used to identify factors associated with total delay.

Results

The median patient, health facility and total treatment initiation timeliness among 237 smear positive PTB patients measured in days were 30 (IQR 14, 60), 8 (IQR: 4, 10) and 36 (IQR: 25, 69) days respectively. More than half (58.7%) of patients delayed in seeking treatment. Total delay

was found to be associated with: unemployment [AOR = 7.4, 95% CI: 1.3–5.3], fear of losing job [AOR = 3.4, 95% CI: 1.3–8.5], patient first port of call was the traditional healer [AOR = 10.6, 95% CI: 13, 66.8] and initially being treated for HIV [AOR = 4.9, 95% CI: 1.6, 14.8].

Conclusion

The median number of days for treatment initiation among smear positive PTB patients in the study area was 36 days with about 60% of patients delaying in seeking treatment. The study revealed that, private sector including traditional healers were the first choice of treatment for more than two-thirds of the patients in the region. Therefore, a concerted effort should be made in order to improve health seeking behavior of the community on TB and to reduce delays from seeking care after experiencing TB symptoms.

CHAPTER ONE

INTRODUCTION

1.1 Background

Tuberculosis is a contagious infection caused by an airborne bacterium, *Mycobacterium tuberculosis* (MTB), (WHO, 2013). Tuberculosis (TB) can affect all parts of the body, but 80% of TB infect the lungs (Skolnik, 2008). Heymann describes the infectious agents for TB as a mycobacterium complex to include other mycobacteria; *Mycobacterium bovis* transmitted from cattle through unpasteurized milk, *M africanum* and *M canettii* responsible for small number of cases in Africa whiles *M microti, M caprae, M pinnipedii* also occasionally cause human disease (Heymann, 2008).

In humans, MTB is the major causative agent globally (Okeke *et al.,* 2014; Aliyu *et al.,* 2013; Alavi & Khoshkhoy, 2012). In the transmission cycle, droplet nuclei are generated when a person with pulmonary or high respiratory track tuberculosis forcefully exhales mostly via coughing, sneezing, singing or spitting, they propel the TB germs into the air. The droplets nuclei are inhaled by vulnerable contacts which mainly contain *M tuberculosis* into their pulmonary alveoli which will end up being eaten by the alveolar macrophages (Heymann, 2005). This action marks the beginning of a new infection cycle. However, a balance between number and virulence of the micro-organism as well as the bacteria activity of the alveolar macrophages will determine the individual's ability to either overcome the infection or develops the disease (Heymann, 2008). The risk of exposure and subsequent infection is associated with how close and the length of contact time with a case, the ventilation in the immediate environment with a case, and degree to how infectious the index case is. Once a person becomes infected with the TB bacilli, the minimum period of incubation is about 2 weeks but may take up to 10 weeks (Heymann, 2008). During this period the individual can show significant reaction to the tuberculin skin test (TST) or positivity to the interferon gamma release assay (IGRA). Even though there is no specific period IGRA appear in blood, it is expected to show after 10 weeks of incubation. About 10% of people infected with the TB bacilli will eventually develop TB in their life time (WHO, 2013). Out of the 10% about half will show progression of the disease within two years after first infection. Latent TB can persist for the entire life span of an infected person. However, when the immune system is lowered and in certain conditions such as HIV infection, diabetes mellitus, silicosis, children under five years, persons underweight, malnourished and some forms of cancers. These factors increase the risk of developing TB up to 50% among such individuals including people who abuse drugs, smoke or are alcoholics. For this risk group, the first 12-24 months constitute the period of greatest risk for developing clinical TB disease (WHO, 2013).

About one-third of the world's population has latent TB (CDC, 2014). A person living with HIV/AIDS is about 20 to 30 times more likely to develop active TB (WHO, 2014b). When a person develops active TB (disease), the signs and symptoms (cough, fever, night sweats, weight loss sputum with blood, chest pain, dizziness, tiredness, breathlessness and loss of appetite) may be mild for many months. These can affect the timeliness in seeking care, and results in transmission of the bacteria to others. People ill with TB can infect up to 15 other people through close contact over the course of a year. Without proper treatment, up to two thirds of people ill with TB will die (Skolnik, 2008).

1.2 Global burden of TB

Annually, between 8 to 9 million cases of TB occur in the world, this is contributing to the overall prevalence cases in the world which is averaged at 13 million. The WHO estimates an average global overall mortality from all causes to be between 1 and 3 million between 2008 and 2013.

1.3 TB burden in Africa

With over 2 million of the total global TB cases and between 250 to 400 thousand TB deaths, Africa is burdened with about 25% of total Global TB cases (WHO, 2013). The region is home to nine of the 22 high TB burdened countries. The incidence of TB in Africa remain the highest worldwide, the 2012 rate of new infections was 275 per 100,000 populations with total prevalence at 373 per 100,000 populations. These figures far outnumber the global figures that indicate total incidence and prevalence at 127 and 190 per 100,000 populations (WHO, 2014b). The region also has the highest TB/HIV burden, a major risk factor for the progression of the disease, thus a huge challenge to fighting the disease

1.4 TB Burden in Ghana

Though Ghana is not ranked among the top 22 countries with high TB burden worldwide, the disease affects many lives in Ghana. In 2012, it was estimated that more than 50,000 new cases of TB occurred with an average rate of infection at 72/100,000. The overall prevalence cases were 14,377 in 2012 and increase by 346 in 2013 (Ministry of Health, 2009). Though there are more females in Ghana, the numbers of TB cases are more in males according to the National TB control program. Total prevalence is 409 and 288 per 100,000 populations in males and females respectively. The prevalence is highest among person above 65 years. Even though Ghana achieved 85% treatment success in 2012, TB case detection is still a challenge, having declined from 40% in 2003 to 36% in 2007 far below the 50% global target for developing countries.

In Ghana, the National Tuberculosis Control Programme (NTP) is responsible for providing leadership and health sector response to fight TB disease. The main objective of the NTP is to achieve the 70% global target of detecting TB cases in communities and to reduce TB morbidity by 50% by 2015 (Ministry of Health, 2009). In the Brong Ahafo Region of Ghana, total TB treatment delays is unclear, however the national TB control program over the years has implemented various control strategies including expanding and enhancing high quality directly observed treatment strategy (DOTS), (Owusu-Dabo et al., 2006) via patient support and treatment, improving diagnosis. Despite these interventions, the burden of TB continues to increase and is not evenly distributed in the population, whether individually or geographically. Several reasons have been attributed to this including HIV/AIDS and factors affecting health seeking behavior of patients.

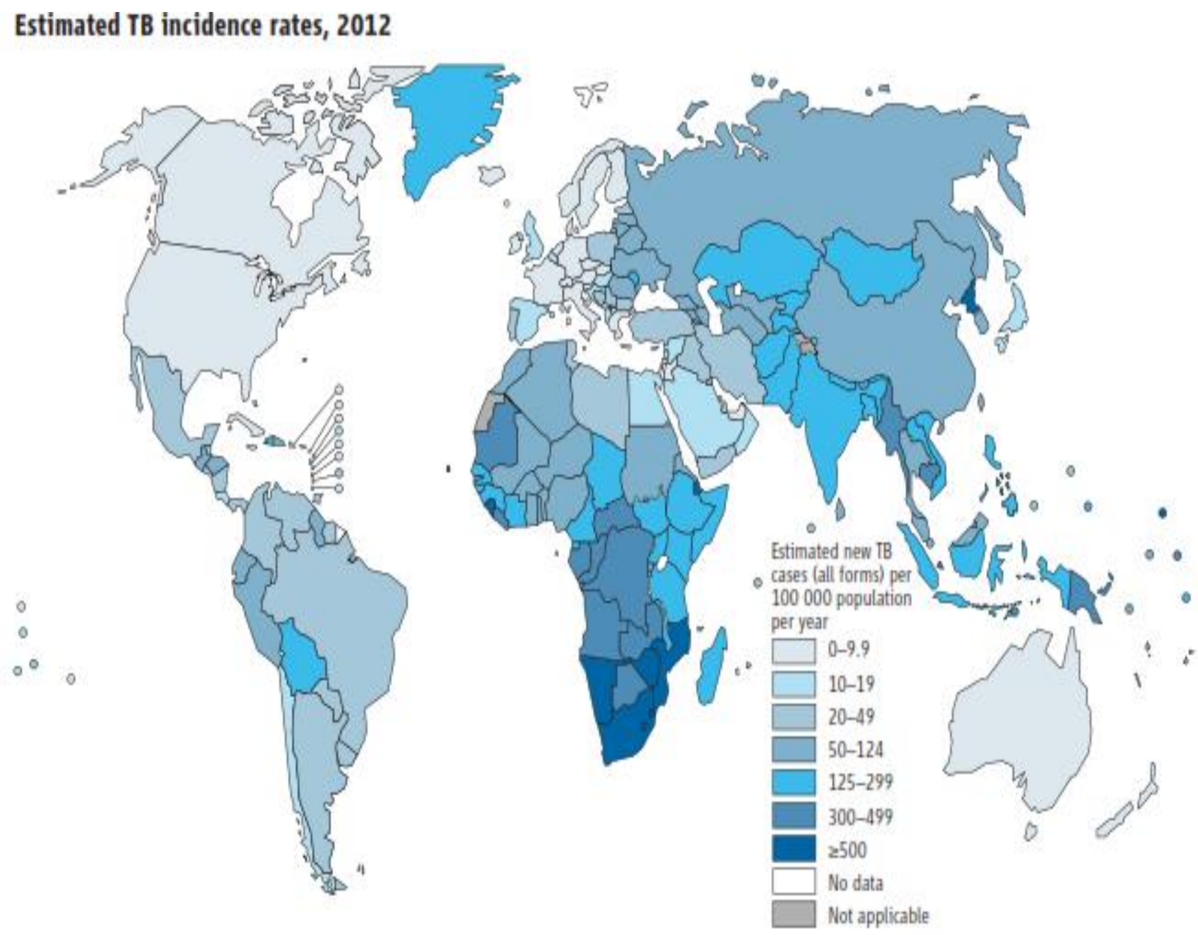

Figure 1: Estimated incidence rate of TB Globally, 2012
Adapted from Global TB report 2013

1.5 Problem statement

Smear positive pulmonary tuberculosis (+PTB) remains the main contributor to total TB burden in Ghana. In 2013, about 45% of total new TB cases were +PTB (NTP, 2013), despite the fact that the NTP is making efforts through the regions to provide equitable and high quality care for the disease. Nonetheless, large proportions of new PTB cases are being recorded every year which are not evenly distributed in the regions. Over 50% of TB case occur among people between 15 and 49 years who mostly live in poor and crowded homes (WHO, 2013). The Brong Ahafo Region on average is contributing about 8% to the total PTB+ cases in Ghana and incidentally has a higher proportion of PTB+ to total TB case ratio compared to national figures (NTP, 2013). Also, case detection rate in the region has remained consistently lower than the national averages for more than a decade (appendix VI).

Timely case detection and prompt treatment initiation are key as PTB+ cases remain the main source of active infection in our communities. Delay in treatment worsens the prognosis and increases the period of infectivity in the region (Sreeramareddy *et al.*,, 2009). In Ghana, more than 6 months of patient delay has been reported (Lawn *et al.*,1998). Meanwhile, a single untreated PTB patient can infect up to 15 persons in the community within a year (WHO, 2007). This suggests that the average six month of patient delay could potentially give rise to about 8 new cases of the disease even before first contact with a health facility. Access to health care, patient delay and associated factors, health facility factors including waiting time, referral delays, diagnostics delays, health practitioners' ability to suspect TB at first visits and diagnosed TB early are thought to affect the timeliness of TB treatment initiation among PTB patients visiting health facilities in BAR. Thus the increasing number of new PTB infections in the region is counteracting the expected improvement due to DOTS expansion and motivational packages initiated by the

National TB control program (NTP). Knowledge on average duration between onset of symptoms and the initiation of TB treatment may inform the implementation of measures for timely diagnosis and treatment initiation so as to reduce transmission of TB in health facilities and communities in the Region. However, this is not known hence the study

1.6 Conceptual framework

It is well known that most TB patients delay in treatment initiation especially among smear positive PTB patients (WHO, 2007). According to the WHO TB patients who report to health care facilities more than 21 days after onset symptoms are considered to have delayed in seeking treatment. When patients report at a health facility with symptoms suggestive of TB, it is expected that, diagnoses and initiation of treatment are done within two weeks. Periods beyond these time intervals are considered delayed. However, several factors shown in figure 2 affect the timeliness of treatment initiation including; patient level factors, health facility factors and program factors. For the purpose of this study, the focus is on patient and health facility timeliness and the associated factors.

Patient factors

Socio demographic factors: several studies have identified some demographic factors to be significantly contributing to delay in treatment initiation timeliness. They include age (Sultan *et al.*,2013), sex (Aliyu *et al.*, 2013; Kansiime *et al.*, 2013), education (Gebeyehu *et al.*, 2014), occupation and place of residence (Cambanis et al., 2005; Gebeyehu et al., 2014). Patient knowledge on TB (causes and transmission and prevention), (Gele *et al.*, 2009) have been identified through research to increase delay by patients in seeking TB treatment.

Socio cultural factors: similarly, some cultural and beliefs of people are known to influence the health seeking behavior of TB patients. These studies found religion , visits to traditional healers

(Tamhane *et al.*, 2012; Yimer *et al.*, 2005), and fear of stigmatization (Asefa & Teshome, 2014; Dodor *et al.*, 2009) to increase delay in TB treatment initiation.

Health facility level factors

Many factors may interplay to increase or reduce timeliness of TB diagnoses and subsequent initiation of treatment in health care facilities. Some studies have attributed longer delay in laboratory diagnosis (Yimer *et al.*, 2005), several visits to a health facility before diagnosis (Skordis-Worrall *et al.*, 2010), service delay , referral delay , place of visits (Sreeramareddy *et al.*, 2014),treatment delay , and patient delay (Asefa & Teshome 2014) to either increase or reduce significantly the time between patient first visit for consultation and initiation of treatment among smear positive PTB.

In both cases, adequate knowledge on TB is a pre-requisite for prevention and early treatment of TB disease. Lack of awareness of the causes, symptoms, diagnosis and outcomes of the disease could possibly result in disease progression with devastating consequences due to delay in treatment initiation. Identifying and addressing patient and health facility factors will ensure timely reporting and prompt initiation of treatment. These are necessary if we are to make major gains in reducing the burden of TB in Ghana

Figure 2 shows the relationship between the dependent (TB treatment timeliness) and the independent variables. The variables of interest have been **underlined in bold,** while the remaining variables aid to show how they contribute to the overall anti TB Treatment initiation timeliness.

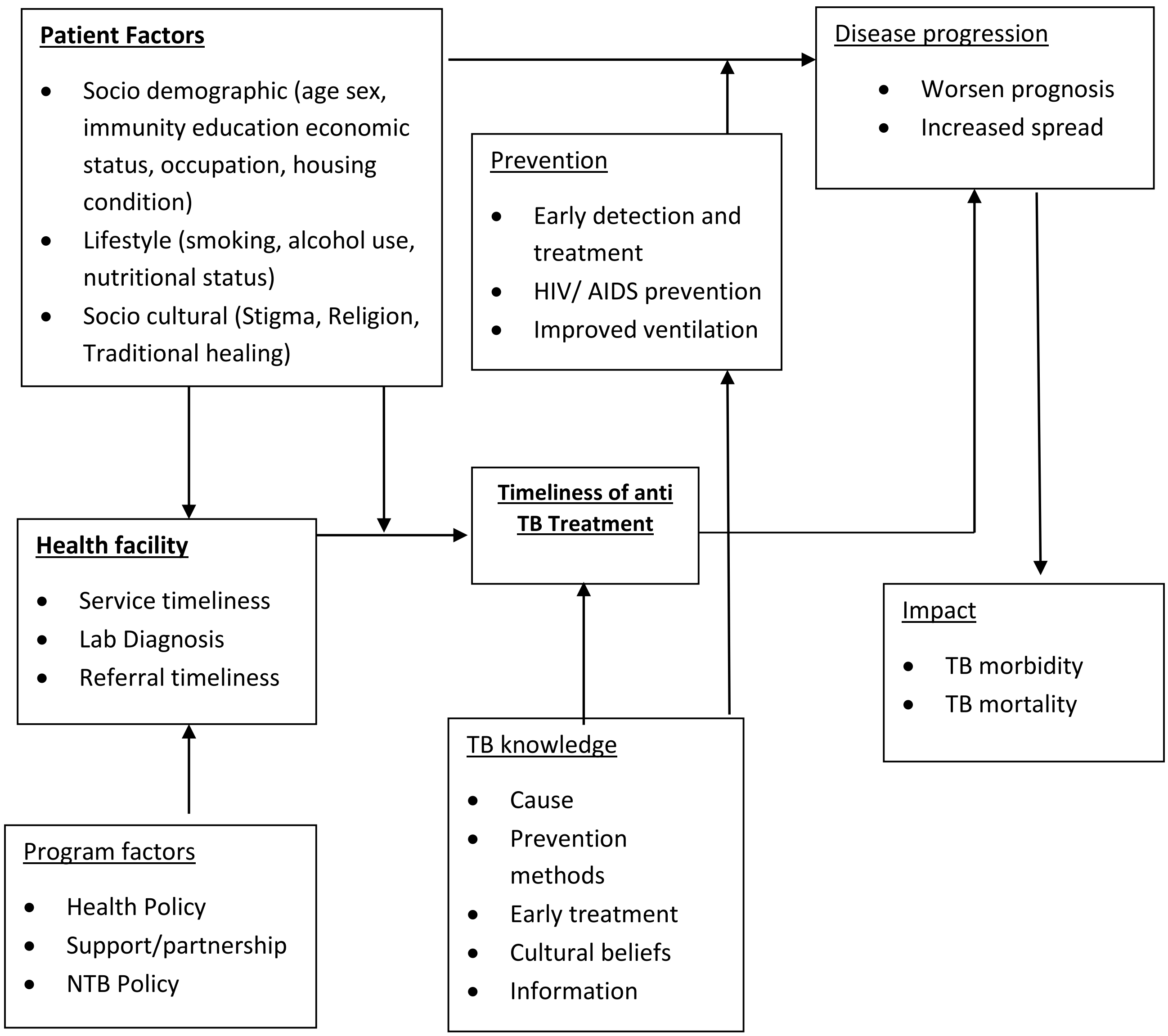

Figure 2: Conceptual framework

Definitions of timeliness

Figure 3: Shows the time between onset of symptoms, through diagnosis and when Anti TB treatment is initiated. It measures the average time spend by a PTB patient at home before first visiting a health facility. It also measures the total time spent through diagnosis before treatment begins.

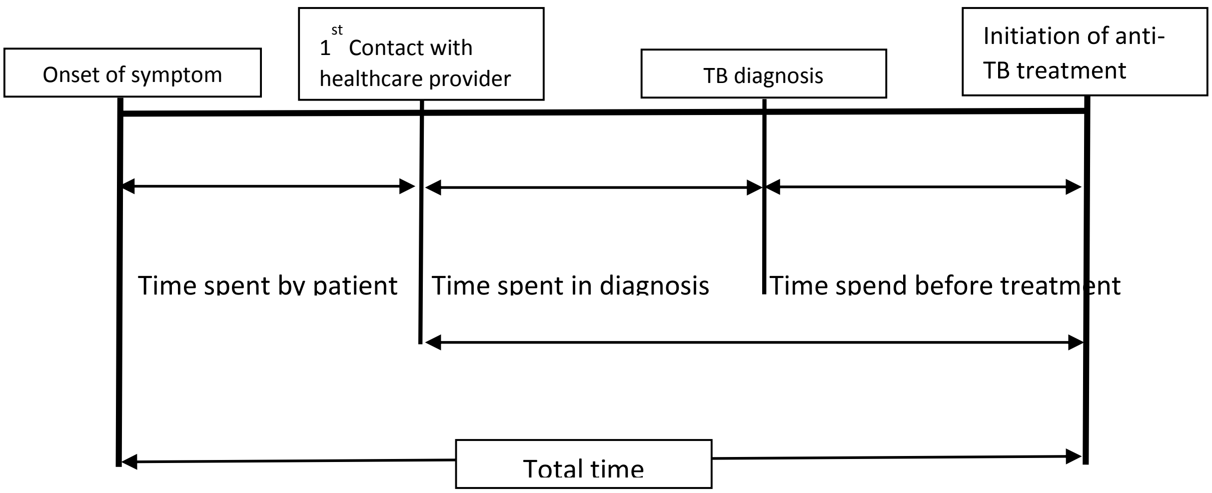

Figure 3: Diagram on definitions of timeliness

Total Time	average time interval between onset of symptoms and the actual start of anti TB treatment
Service time	Time interval between the date of patient presenting to a health care provider and the initiation of anti-tuberculosis treatment.
Diagnostic time	Time interval between the onset of symptoms and labeling of the patient as a tuberculosis patient (Lab diagnosis)
Referral time	Time interval between the date of patient presenting to first health care provider and getting assessed by a health provider.
Patient time	Time interval between onset of symptom and presentation to a healthcare provider

1.7 Justification

Information on the timeliness and associated factors identified will be used in addressing burden of new infections. Early care seeking and initiation of TB treatment will help reduce the period of infectivity and thus new infections up to 50% of the total TB burden in BAR and can be scaled up to the whole country.

The information generated in the study might help in further guiding managers of the NTP working to achieve MDG 6; to strengthen communities in addressing patient timeliness and also health facility timeliness in obtaining prompt diagnosis for sputum smear TB patients

In addition, policy making and health intervention planning are largely dependent on established knowledge; arguably there is no adequate information available on timeliness of initiation of Anti TB treatment among patients with PTB. Therefore a study on the timeliness of initiation of TB treatment among patients with PTB will provide a better view of the situation in the Brong Ahafo Region. The regional TB control program will use the findings for planning, controlling and outreach activities

1.8 Research Questions

1. What is the median duration between onset of symptoms and initiation of anti TB treatment?
2. What proportion of smear positive PTB patients delay in seeking TB treatment in the region?
3. What factors influence the timeliness of anti TB treatment initiation in PTB + patients in the region?

1.9 Objectives

1.9.1 General objective

To assess timeliness of treatment initiation among smear positive PTB patients in the Brong Ahafo Region

1.9.2 Specific objectives

1. To determine median duration between onset of symptoms and initiation of anti TB treatment
2. To determine proportion of smear positive PTB patients who delayed in seeking TB treatment in the region
3. To determine factors influencing timeliness of treatment initiation in PTB + patient in the region

CHAPTER TWO

LITERATURE REVIEW

2.1 Epidemiology of TB

TB remains a global public health problem and has a long standing history as an opportunist (Sutariya *et al.*, 2015; WHO, 2015), but timeliness of seeking TB treatment is still a debate in many cycles. What is not in doubt is that, majority of PTB patients delay in seeking TB treatment. This has serious consequences on both the individual who is at a higher risk of death, but also to the community in which these individuals reside probable giving rise to many of the new infections being reported. The World Health Organization (WHO) estimated that, 8.6 million new cases of the disease occurred in 2012, but a significant proportion (30%) of them were undiagnosed and untreated (WHO, 2015). Majority of these cases come from low and middle income countries including Africa (WHO, 2013). According to the global TB statistics report, Africa and South East Asia have the highest TB burden. There were 2.3 million and 3.4 million new infections in the two continents respectively in 2012 (WHO, 2013). Total prevalence during the same period was 2.7 million in Africa and 4.8 million in South East Asia compared to less than a million new infections in both Europe and the Americas combined. Of all the countries that report their TB statistics to WHO, there are 22 countries that are sometimes referred to as the TB "high burden" countries. These countries accounted for 81% of all estimated cases of TB worldwide in the year 2012, over 40% of these countries are in Africa (WHO, 2013). TB infection affects people of all ages and sex.

TB prevalence rates per 100 000 population aged ≥15 years old were estimated to be 318 (95% CI: 225-412) for smear-positive TB, and 524 (95% CI: 378−670) for bacteriologically confirmed TB. Smear-positive TB prevalence among men was 484 (95% CI: 333−635) per 100 000 population, and 198 (95% CI: 108-289) per 100 000 population among women (WHO, 2013).

Over 8 million new cases were recorded in 2012 with more than 1 million deaths from TB. Seventy five percent of all TB infections and deaths affect the most productive age group between 15 and 54 years (Skolnik, 2008). Among the new cases that occurred in 2012, 82% (771/940) were aged 15–64 years, 55% (517/940) were aged 15–45 years and 6% (56/940) were among children (<15 years); Majority of the adults within the productive age category in the six WHO regions were 70% more likely to be males (WHO, 2013). The situation is even now worsened by the increasing incidence of multi drug resistant (MDR) TB cases. Up to 450, 000 incident cases of MDR TB were recorded in 2012, accounting for 170,000 deaths among TB patients globally (WHO, 2013).

Generally, the world is on course of achieving the millennium development goal of reducing total deaths due to TB by half. However, achieving a 45% fall in the total TB death rates between 1990 and 2012 TB and the 2015 target is very likely to materialize, the rate of declined in recent years has been slow (2%) each year (WHO, 2013). Global TB incident cases increased from 9.3 million to 9.4 million between 2007 and 2009 but reduced to 8.6 million by 2013. Asia and Africa are worst affected of the total global burden with 55% and 30 % of all incident cases in 2009 and similarly in 2013. The net reduction of active TB disease worldwide has seen more than 37% reduction since 1990 (WHO, 2014b). The WHO recommends total treatment delays up to 3 weeks.

In the year 2013, the WHO reported some 9.0 million incident cases equivalent to 126/100,000 population, showing a 0.6% decline from the previous year. Most of the estimated cases occurred in Asia (56%) and Africa (29%) while small proportions were recorded in East Mediterranean Region (8%), 4% in the European Region and 3% in the Americas (WHO, 2013). The Top six of the 22 burdened countries in 2013 were India 2.0 million, China 0.9-1.1 million, Nigeria 370,000-880,000 cases, Indonesia and south Africa both had between 410,000-520,000 cases and Pakistan with 370,000 new cases (WHO, 2014a). Of the 9.0 million incident cases, about 14% included people living with HIV/AIDS, a higher proportion (34%) of these people co infected are in Africa (WHO, 2014a)

2.2 Transmission and presentation of TB

Pulmonary TB is an air borne infectious disease caused by the bacillus *Mycobacterium tuberculosis* (Heymann, 2008). It typically affects the lungs (pulmonary TB) but can affect other parts of the body as well (extrapulmonary TB). It is transmitted from people who are sick with pulmonary TB to a vulnerable susceptible individual when they forcefully expel the bacilli via coughing sneezing, singing or spitting. Persons with cavity lesions are particularly infectious because their sputum usually contains 1 to 100 million bacilli per milliliter (Heymann, 2008). Poor and vulnerable individuals who inhale the droplet nuclei which mainly contain *M tuberculosis* into their pulmonary alveoli. This is finally digested by the alveolar macrophages and infection occurs beginning with the swelling of endothelial cells and alveolocapillary dilation. This action results in alveolitis with the replication of the tubercle bacilli and the influx of polymorphonuclear leukocytes. However, a balanced between number and virulence of the microorganism as well as the bacteria activity of the alveolar macrophages will determine the individual's ability to either overcome the infection or develops the disease. The risk of exposure and subsequent infection is associated with how close and the length of contact time with a case, the ventilation in the immediate environment with a case, and degree to how contagious the index case is (Heymann, 2008). Once a person become infected with the TB bacilli, the minimum period of incubation is about 2 weeks but may be up to 10weeks (Heymann, 2008). During this period the individual can show significant reaction to the Tuberculin Skin Test (TST) or positivity to the interferon gamma release assay (IGRA). Even though there is no specific period IGRA appear in blood, it is expected to show after 10 weeks of incubation. About 10% of people infected with the TB bacilli will eventually develop TB in their life time (WHO, 2013). Out of the 10%, about half will show progression of the disease within two years after first infection (Heymann, 2008). Latent TB can persist for the entire life span of an infected person. However, when the immune system is lowered or in certain conditions such as in the case of HIV infection, diabetes mellitus, silicosis, children under five years, persons underweight, malnourished and some forms of cancers, it increases the subsequent risk of up to 50% progressive PTB or Extra Pulmonary Tuberculosis (EPTB) and reduce the interval for the development of TB diagnosis following an infection substance abusers (smokers and alcoholics) are also greatly at risk. The first 12-24 months constitute the period of greatest risk for developing clinical TB disease(WHO, 2013)

The diagnosis of PTB depends on the clinical presentation of symptoms and physical signs by patients being screened.

1. Major signs and symptoms include:
    - Persistent cough of 2 weeks or more or any duration if HIV positive
    - Fever for more than 2 weeks
    - Drenching night sweats
    - Unexplained weight loss (more than 1.5 kg in a month)
2. Physical signs:
    - Fever – the body temperature may be high or irregular (greater than 38.5 degrees Celsius)
    - Pulse – the pulse rate may be raised because of fever
    - Chest – there may be no abnormal signs, crackles in the lung apices more pronounced on deep breathing; localized wheeze in local obstruction or pressure; dullness where there is effusion and in chronic disease there may be extensive fibrosis with the trachea pulled to one side.

2.3 HIV and TB

The impact that HIV has on the pathogenesis of tuberculosis (TB) is clear. It is one of the most important risk factors associated with an increased risk of latent TB infection (LTBI) progressing to active TB disease (Liza & Sonal, 2006). The risk of developing tuberculosis (TB) is estimated to be between 26 and 31 times greater in people living with HIV than among those without HIV infection (WHO, 2015). Currently, approximately 34 million people are infected with HIV, and at least one-third of them are also infected with TB (USAID, 2014). In the year 2013, there were 9 million new cases of TB, of which 1.1 million were among people living with HIV TB is the most common opportunistic infection in people living with HIV worldwide(WHO, 2015). It is also the most common cause of death among HIV-positive adults living in developing countries, despite being a preventable and treatable disease (WHO, 2014a). In some countries in sub-Saharan Africa, up to 80% of individuals with active TB disease are also HIV-positive. According to USAID, the dual epidemics are also of growing concern in Asia, where two-thirds of TB-infected people live and where TB now accounts for 40% of AIDS deaths (USAID, 2014). Eastern Europe and the former Soviet Union have the fastest growing HIV epidemic in the world, a factor further exacerbating the expanding problem of the multidrug-resistant TB (MDR-TB) epidemic in these regions (USAID, 2014) . The overlap of TB-HIV co-infection with MDR-TB and extensively drug-resistant TB presents a tremendous challenge and threatens progress in controlling TB and HIV and AIDS and in eliminating the mortality associated with these diseases.

2.4 Timeliness of anti TB treatment initiation

Patient and health facility related factors affect timeliness in the initiation of TB treatment. For instance, some TB infected persons are unaware that they have TB symptoms or may not understand the disease could be very severe even though TB diagnosis and treatment are free in most countries., Also, many TB infected people may delay going to a health care facility because they cannot pay the transportation costs to the facility, which are usually far away from their home, or take time out of their day to visit a health care provider. Nonetheless, some provider related factors have also been reported to undermine timely initiation of TB treatment. An earlier study has reported that repeated consultations with the same or several healthcare providers without receiving a correct diagnosis as one of such health care related factors (USAID, TB CARE II, 2012).

Moreover late reporting by patient and certain factors in health facilities mostly result in delayed anti TB treatment initiation for person diagnosed as sputum smear positive PTB, yet only a little of this number is noticed and detected. More than 50% of TB cases goes undiagnosed and about 40% of all TB patients delay in seeking medical treatment (Tarimo, 2012; Sreeramareddy *et al.*, 2009; Lawn *et al.*, 1998). Several sources of delays accounts for the total delay in TB patient treatment including patients delay, health service delays, referral delay, diagnostic delay and treatment delay. (Sreeramareddy *et al.*, 2009) in their study found total TB treatment delays (total time spend between first signs and symptoms and TB treatment) up to 12 weeks in Ghana, Malaysia, Bolivia Botswana and Uganda. Health system delay alone in Ghana is estimated at 8 weeks (Lawn *et al.*, 1998), while in China, India, and Vietnam TB treatment delay is less than 33 days with an average health system delay of 7 days and patient delay as low as 7 days in Italy and Taiwan (Sreeramareddy *et al.*, 2009). Similarly, in Nigeria, treatment delays are reported by the same study to be up to 11 weeks with hospital delays at a minimum of 3 weeks. For a successful TB control program, early case detection and treatment is essential (WHO, 2007).

Delay in TB diagnosis and treatment worsens morbidity and mortality and increases transmission (Irani *et al.*,2008; Sreeramareddy *et al.*, 2009; Tarimo, 2012) as one untreated cases of TB has the potential of infecting up to 15 people in a year and over 20 people (WHO, 2007) in its natural course if untreated whiles late reporting can be very difficult to treat and manage with possibility of relapse following treatment and multi drug resistance. Therefore, early and prompt detection of infectious TB is crucial in the fight to reduce TB burden. In Ghana, TB detection is largely through screening of HIV/AIDS patients and passive case finding in local health facilities though in some areas active case finding is conducted periodically. Passive cases findings are based on patient demographics, socioeconomic status and their ability to access health facilities but also on the availability of trained and competent health staff and diagnostic equipment. Evidences suggest that patient delay in seeking treatment is a major setback in effort to improving TB case finding while others have demonstrated enough association between delay in seeking care and lack of awareness of TB, its signs and symptoms and transmission (Irani *et al.*, 2008).

2.5 Patient factors regarding timeliness of Anti TB treatment initiation

Timeliness of TB treatment initiation is affected by both Patient and Health facility. However late reporting by patient and certain factors in health facilities mostly affects the timeliness of anti TB treatment initiation resulting in delayed TB treatment initiation for person diagnosed as sputum smear positive PTB. Delays associated with PTB can either be patient delay or health system delay. While this study seek to determine both patient and health system timeliness, most quantitative studies have focused on either of the two types of delays (Finnie *et al.*, 2011).

In a meta-analysis on studies conducted on factors associated with delayed diagnosis and treatment of TB in high TB burdened countries, patient delays is defined as the patient's ability to remember his first onset of persistent cough and the health facilities record of him seeking consultation or taking treatment (Finnie *et al.,* 2011). In addition, the level of an individuals' knowledge on TB, the cost of transportation and total time spent determines if early treatment will be sought for TB or not. Geographic access to health facilities is a challenge for most TB patients seeking Western health care (Gele *et al.,*2010). In an Ethiopian study, Asefa and Teshome (2014) found that being a female, persons aged more than 20 years, sleeping in a single with more than 2 people and rural dwellings were associated with treatment delays. Other studies found that patients relied on allopathic health services other than western medicine in TB treatment. This may result in a competition for the patient's adherence and commitment to orthodox medicine and hence result in patient delay.

Another reason attributed to PTB treatment delay in sub Saharan Africa has been financial choices or priorities. In a study conducted by Mavhu and colleagues in Harare Zimbabwe, PTB patients described health seeking delays as a mechanism to place cost of care as less important and prioritize resources to attend to more pressing needs. In addition, these researchers found gender to be associated with treatment delays. Treatment delay was more in males because they mostly sought solutions from themselves in treating PTB (Mavhu *et al.,* 2010).

2.6 Social factors affecting patient timeliness

2.6.1 Patient delay

There is a negative effect of TB patients who delay to seek treatment on the community, as it increases the period of infectivity of the disease in the community. The disease also take a toll on the individual when s/he delays in seeking treatment including increase cost of care, difficult to treat and increase mortality. A cross sectional study on total delay in treatment among smear positive pulmonary tuberculosis patients in five primary health centers in Southern Ethiopia by Asefa et al (2014) show a median patient of 30 days after onset of symptoms. Makwakwa et al (2014) found that in Malawi, median patient delay is 14 days (interquartile range [IQR] 14–28). Studies (Sreeramareddy *et al.,* 2009) found median patient delay in a meta-analysis of time delays in diagnosis of pulmonary tuberculosis to be 32 days (25-185 days) in both low income and middle income countries similar to patient delays (25 days) in high income countries. The proportion of new TB patients with patient delay longer than 2 weeks was 45% in a Malawian study on patient and health system delays in the diagnosis and treatment of new pulmonary tuberculosis cases (Makwakwa *et al.,* 2014) while in Ghana, a meta-analysis data reveal 4 weeks of patient delay(Sreeramareddy *et al.*, 2014). In Tanzania, majority 125 (74.9%) of patients who admitted that they delayed in seeking care from health facilities said they thought the symptoms they were feeling would go away without medication or with some antibiotics they were using while 31 (18.6%) mentioned fear of being diagnosed with a more serious problem in case they go to the health facility (Tarimo, 2012).

2.6.2 Poverty

There exist a strong relationship between TB and poverty. Poor people are more vulnerable to tuberculosis due to their living conditions, living in houses with higher family size have been found to be a major factor associated with tuberculosis (Asefa, & Teshome, 2014). In a Meta analytic study on factors associated with TB patients and diagnostic delays China, Ying Li et al (2013) found that socio-demographic and economic factors, mostly poverty, rural residence, lack of health insurance, lower educational attainment, stigma and poor knowledge of TB were largely associated with TB. Global TB prevalence is particularly higher in poor and developing countries, Many of the 22 TB high burdened countries (HBCs) accounting for about 80% of the world TB cases are Low Middle income countries (LMICs) (WHO, 2014b). Delay in seeking TB treatment is also found to be more pronounced among poor patients, particularly males and the elderly in a stratified analytic study by Asefa and colleague. Similarly, in Rural Ethiopia residing in rural areas, transport time over 2 hours, overnight travel, transport cost, having sold personal assets prior to the visit in order to visit a facility, and use of traditional medicine were identified to be associated with over 4 weeks patient delay. In a case control study to determine the risk factors for pulmonary TB in Russia, low accumulated wealth, financial insecurity, consumption of unpasteurized milk, diabetes, living with a relative with tuberculosis, being unemployed, living in overcrowded conditions, illicit drug use, and a history of incarceration in both pretrial detention centers and prison were reported to be significantly associated with Pulmonary TB (Coker, 2006).

2.6.3 Accessibility to health facility

The health care seeking behavior by patients (with TB) is decided with consideration to accessibility to a facility. When there is a difficulty in accessing a health facility, it will inadvertently results in a delay in seeking care. A study in rural Ethiopia revealed that patients travelling over 120 minute to access medical care were more likely to delay in taking decisions to seek care (Cambanis *et al.,* 2005) while in China, lack of health insurance was reported to deter individuals from seeking TB care early (Li *et al.,* 2013). The type and design of the healthcare system whether vertical or horizontal as well as the infrastructure and financial factors may make healthcare services inaccessible to economically poor and hard to reach communities. In an in-depth analysis of the health seeking behavior of patients and health system response in seven countries of the eastern Mediterranean region by the WHO (WHO, 2006) found that in Islamic Republic of Iran and Syrian Arab Republic, around 90% of patients were living within half an hour of a health facility compared to around half of patients in Egypt, Somalia and Yemen. In contrast, almost two-thirds of patients were living more than one hour from a health facility in Iraq, and three-quarters of patients were within reach of a health facility within one-half to one hour in Pakistan. A tuberculosis clinic was located within 6–10 km for 44% of patients in Pakistan, while 27.7% patients had to travel a distance of 11–20 km before reaching a tuberculosis clinics. In some (5%) cases, the nearest tuberculosis clinic was as far as 30 km away, or more (WHO, 2006).

2.7 Heath facility factors regarding timeliness of TB treatment initiation

Health system delay (HSD) defined as the sum total of the time from first contacting the health facility to time of diagnosis (excluding patient delay) and the time from diagnosis to initiation of treatment (Van *et al.*, 2011). Factors relating to health service may limit patient's effort to attend TB services (Buu *et al.*, 2003). Edginton and colleagues found that patients with negative experience are likely not to comply to referrals to other health facilities (Edginton *et al.*, 2005). Other health system related factors are hospital admissions, delays in the receipt of sputum results and misinterpretation by health staff that negative smear results excludes TB (Squire *et al.*, 2005). In a population based medical record review the mean health care institution delays varied based on the level of health care facilities. Chest specialty hospital recorded the least mean delay followed by medical centers, regional hospitals and district hospitals. The chest specialty hospital also recorded the shortest mean laboratory diagnostic delay. The number of days between chest X-rays and hospital visits were however similar across all health facilities. With these results it is not surprising that the chest specialty hospital recorded the lowest mortality rates. The reasons given to the above observation was that district and regional hospitals were not as experienced as larger or specialty institutions. A cohort study on all residents diagnosed with TB from 1993-2005 in US defined treatment initiation delay as treatment initiation more than one week after sputum collection.

2.8 Diagnosis of TB in Ghana

In Ghana, TB cases are mainly found through passive case finding and all level of health care where patients present themselves to a health facility if they suspect they may have TB. This approach is dependent upon an individual with TB symptoms first recognizing that they have symptoms of tuberculosis, then making a decision to seek health care, and finally seeking care from a provider trained in the DOTS strategy who will follow approved standards for TB diagnosis and treatment. The guidelines for the clinical management of TB and HIV Co-infection in Ghana by the GHS (GHS, 2007) stated that, diagnosis usually consisted of clinical screening by assessment of symptoms and signs, followed with sputum smear microscopy. Other follow up diagnosis includes chest x-rays and sputum cultures carried at all regional hospital, teaching hospitals and public health reference laboratories. The cornerstone of diagnosis of PTB in both PLWHIV and non HIV individuals remains sputum smear microscopy. Unfortunately in Ghana, sputum microscopy is done at district and other hospitals with laboratory capacity to run these test. Thus more people are screened for TB at the district hospital than clinics, health centers and CHPS compounds due because there are no laboratory facilities at those levels.

The private sector including faith based organizations play a critical role in health care delivery in Ghana including TB diagnosis especially in hard to reach populations. Unfortunately, in scaling up health care interventions in areas of capacity development and resource allocation, there is often poor collaboration between government and the private sector.

CHAPTER THREE

METHODS

3.1 Study design

A cross sectional study was conducted among smear positive PTB patients in the Brong Ahafo Region of Ghana between November, 2014 and May 2015. The study was conducted in health facilities in six districts identified as having recorded the highest TB cases in the region. Data on patient demographics, duration of symptoms and health facility related factors were collected and analyzed to determine median timeliness and associated factors.

3.2 Study Area

The study was conducted in six selected districts in the Brong Ahafo Region (BAR) shown in figure 4, one of the ten administrative regions of Ghana. It lies between longitude 0^{o} 15 E and 3^{o} W and latitude 8^{o} 45 N and 7^{o} 30 S. The region with a territorial size of 39,557 square kilometers is the second largest in Ghana with an estimated population of 2.5 million (GSS, 2012). It shares boundaries with Northern region to the north, Volta and Eastern regions to the South East, Ashanti and western regions to the South and internationally with Cote d'lvoire to the West. The central point of the land mass of Ghana is located in the region in Kintampo North District. The Region is further divided into 22 administrative districts, which were increased to 27 in 2012 but the new districts do not have fully functional administrative structures, with Sunyani as its capital (GoG, 2015). There are two main ecological zones in the region; the forest and savanna transition zones. Each of the two ecological zones has 11 districts.

BAR like all regions in Ghana, runs a vertical public health service system from the community level to the regional level. The smallest health care unit at the community level is the community based health planning and services (CHPS) zones or compounds managed by community health nurses. The next level of care is the community clinics/health center run by Physician assistants (PA) and midwives and the highest level of care in the distinct is the district hospitals with facilities for emergency health care. There are 22 district hospitals in the region, nine of these hospitals are government own and the rest are mission hospitals. There is one Regional (referral) hospital located in Sunyani. There were 106 Medical officers, 2 dental surgeons, 97 pharmacists, 67 Biomedical Laboratory Scientists, 741 Nurses, 100 medical/physician assistants, 50 disease control officers and field technicians in 2010.

A large proportion of the inhabitants in BAR are migrants. The main occupation of the people is farming and the region is seen as the food basket of the country. It has one of the largest markets in the sub region located in Techiman. With people moving to and fro to the region, TB control could be a challenge. Meanwhile the region has had its fair share of the national DOTS program and currently has coverage of 80%. Free diagnosis and treatments are offered as part of the NTP together with enablers' package which involves transportation cost and feeding.

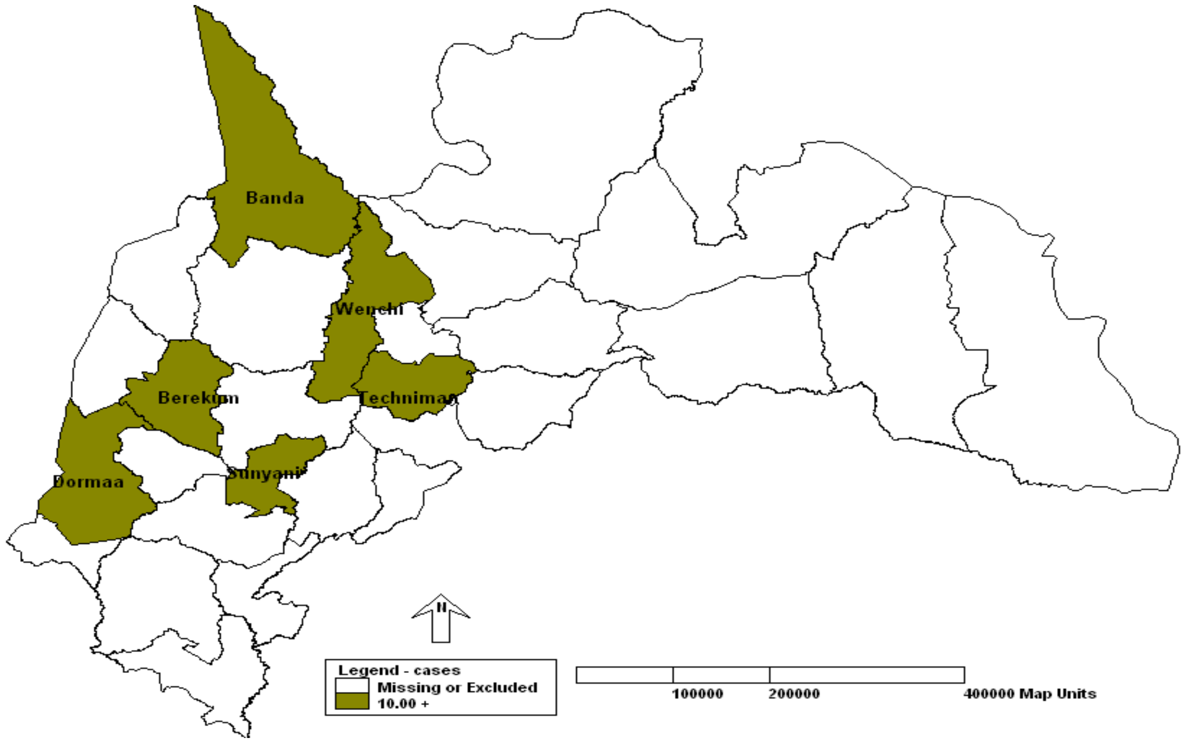

Figure 4: Map of study area, BAR

3.3 Study Population

The study population was made up of smear positive TB patients who attended any of the health facilities of the selected districts in the region and were diagnosed of PTB by a prescriber between November, 2014 and May 2015.

3.4 Inclusion criteria

All smear positive TB patients' including TB/HIV co infected individuals aged 18 years and above who attended any health facilities of the selected districts in the region and were newly diagnosed of PTB between November, 2014 and May 2015.

3.5 Exclusion criteria

Any smear positive PTB patient who has completed treatment, patients on follow up treatment, patients aged < 18 years, patient who have defaulted treatment and those known to have experience treatment failure were excluded from this study.

3.6 Variables

3.6.1 Dependent Variable

The main outcome variable is timeliness (in days); defined as time between onset of symptoms and anti TB treatment initiation among smear positive PTB patients.

3.6.2 Independent Variables

This will include the following:

- **Patient variables:**
    - Sex
    - Age
    - Settlement
    - Educational level
    - Occupation
    - Income
    - Distance to health facility
    - Knowledge on TB
    - Time elapse before first visit
- **Health facility variables:**
    - Duration between first consultation with a health facility to TB diagnosis (days)
    - How long did it take from the time you were informed you had TB to begin treatment? (in days)
    - Number of patient visits before diagnosis

Definitions of variables

Smear positive PTB patients: patients with one or more sputum smears which are positive for acid fast bacilli (AFB)

Treatment initiation timeliness: Time between onset of symptoms as reported by patients as their chief compliant(s) and anti TB treatment initiation with a binary outcome; early <30, delayed ≥ 30

Patient timeliness: Time interval between onset of symptom and presentation to a healthcare provider or facility

Health facility timeliness: Time interval between the date of patient presenting to a health care provider and the initiation of anti-tuberculosis treatment.

3.7 Sampling

3.7.1 Sample size determination

The minimum sample size was determined using an estimated proportion of 81.2% of total delay among smear positive PTB patients (Mesfin *et al.*, 2005), desired level of precision of +/- 5% and a desired confidence interval of 95%

The sample size was calculated using Cochran formula of $n=Z^2pq/d^2$

Where n = sample size, Z = z value for confidence interval set at 95%, p= proportion of smear positive PTB patients who start anti TB treatment on time

q= Estimated proportion of smear positive PTB patients who delay in starting TB treatment which was found to be 81.2% (Mesfin *et al.*, 2005)

d = margin of error set at 5%

Hence $n = (1.96)^2 * 0.812(0.188)/ (0.05)^2 = 234.6 \sim=235$

Finite population adjustment was not done because, the population of smear positive pulmonary tuberculosis patients in Brong Ahafo region was 528 (NTP, 2013) which is less than the required 10,000 population for finite adjustment.

This sample was proportionately allocated depending on the total number of TB patients on DOTS treatment at each of the selected districts in 2013. Specific numbers to each district was given using the formula nk=n/Nk*N, where nk is the number of subjects that were required for interview in district k, Nk number of TB patients on DOTS treatment in district k, N the total number of TB patients on DOTS treatment in all districts in 2013 and n is the required sample size for the study.

Table 1: Study sites and sampled populations

District	# of TB patients on DOT	Proportional sample
Techiman	147	68
Wenchi	32	15
Sunyani Municipal	63	29
Berekum	109	51
Dormaa Municipal	74	34
Banda	82	38
Total	**507**	**235**

3.7.2 Sampling method

Six districts in the BAR were selected for the study. The districts with the highest number of TB cases for 2013 were selected. All health facilities offering DOT services in the six districts were included to determine the timeliness of anti TB treatment initiation. Samples were then proportionately allocated to the districts based on their estimated annual data on smear positive PTB patients. All diagnosed patients on DOT treatment were selected as they were diagnosed and consent to the study until the required sample size was met.

3.7.3 Selection of participants

Health records were reviewed using a checklist to obtain the list of all smear positive PTB cases recorded between November 2014 and May 2015. TB registers at all study sites were reviewed and smear positive case patients details were abstracted including their addresses and contact numbers. From the check list every second patient was selected for interview. Selected participants who did not consent or could not be traced were replaced with the next available participant. Patients were invited to DOT centers via phone call and some came during their regular treatment dates. Consenting PTB patients were asked some few questions to obtain information concerning their demographic and socio-economic characteristics, knowledge of TB, duration of symptoms before seeking medical consultation diagnosis and anti TB treatment initiation. Information about knowledge of TB, causes, symptoms, the diagnosis and treatment process. The patient’s health passport, TB treatment card/ sheet and TB registers were evaluated where appropriate to verify the responses.

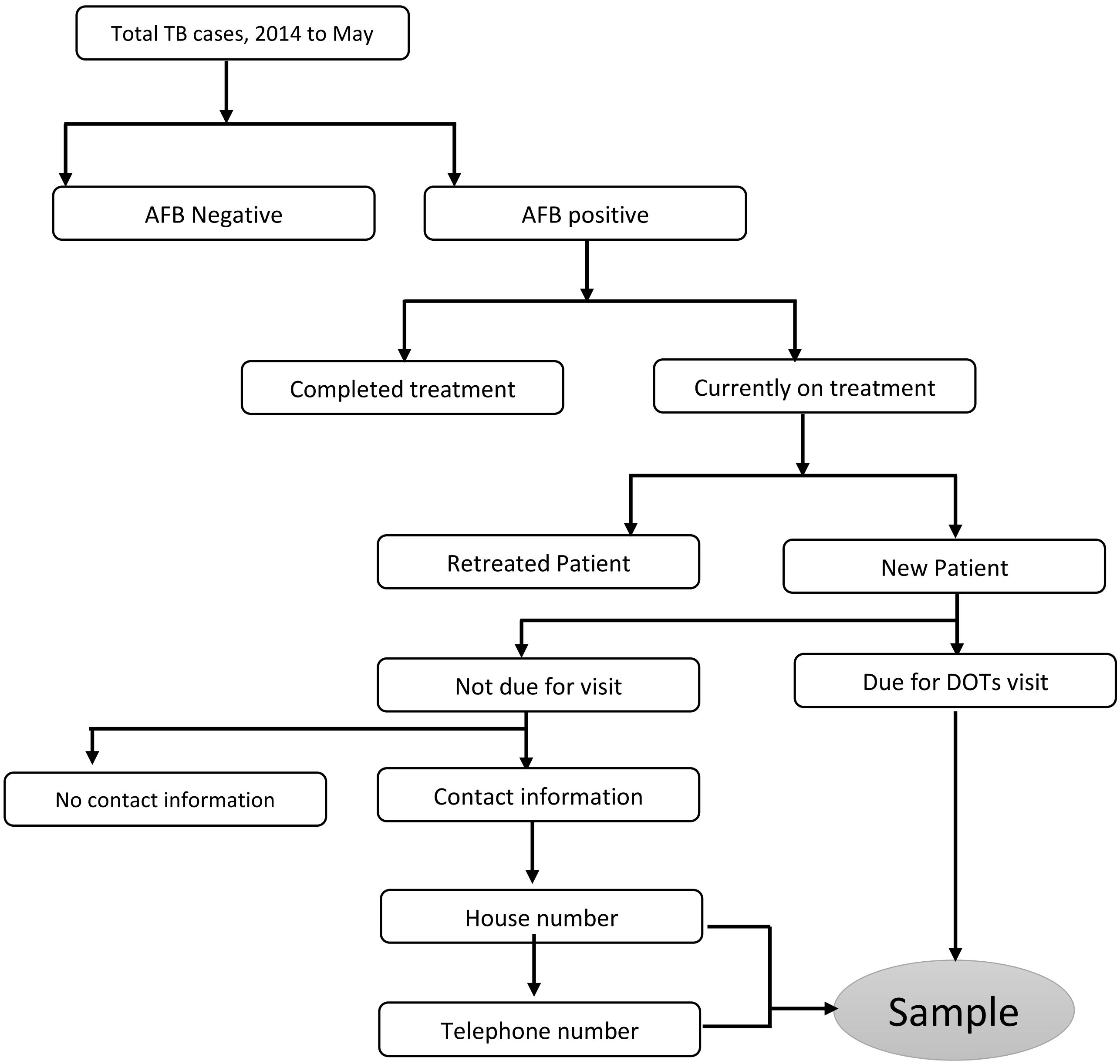

Figure 5: Sampling process

3.8 Data Collection Technique and Tools

3.8.1 Review of Patients' Records

Health facility records of smear positive patients on TB treatment were reviewed from the TB registers in the selected districts using a checklist. The checklist was designed to document the following information: sex, age, and geographic location, diagnosis, date of initial visit, date diagnosed with TB, date treatment started and patient folder number of TB Patient who were diagnosed of TB between November, 2014 and May 2015 (Appendix II).

3.8.2 Interviews

An interviewer assisted structured questionnaire was used to collect the data. Patients were selected from a list of all smear positive PTB patients between November 2014 and May 2015 for whom records were available. The research assistants conducted face to face interviews with smear positive PTB patients during their routine visits at the DOT centers. The tool captured patient socio-demographics including age, sex, educational level, employment status, type of settlement and how long it took patient upon onset of symptoms to seek care at a health facility. The patient's health passport, TB treatment card/ sheet and TB registers were evaluated where appropriate to verify the responses.

3.9 Data Quality Control

This included training of data collection and entry field workers on processes involved in abstracting data from the registers and interview processes. During data collection in the field, twenty four (10%) of the completed questionnaires containing raw data were selected by the supervisors at random and checked to identify errors and/or omissions and corrective actions made. The checks were repeated during data entry. . Data was double entered into Epi Info and merge in order to detect errors. All the data were backed up with external storage device. The questionnaire was pre-tested in a district that is not part of the study sites.

3.10 Data management and analysis

On a daily basis, the principal investigator collected and checked the completed forms and corrected errors that arose during data collection. To ensure quality, collected data were double entered into Epi Info version 3.5.4 and validated. Records that were discordant during the validation process were resolved by consulting the questionnaire. Data was exported to STATA version 13 for analysis. Data was first analysed descriptively by running for frequencies and proportions. Continuous variables such as; age was summarized into mean median and range, time (duration) between onset of symptoms and patient first consultation to a health facility (PT), diagnoses (HFT) and treatment initiation (TIT) were summarized into medians and interquartile ranges. Age was then re categorized into age groups of 10 years interval according to the WHO recommendation (WHO, 2014a). PT, HFT and TIT (all continuous variables) were dichotomized as binary outcomes into delays (Yes/No). Patient delay was defined as more than three week (>21 days) period (Tobgay *et al.*,2006), Health facility delay as > 2 weeks and treatment initiation delay was also dichotomized using the cut off of more than 30 days for smear positives patients. Pearson chi square test was done to determine significance differences between delays and categorical variables and presented as contingency tables with p values and fishers exact done for variables with less than 5 frquencies. Variables with P-value <0.05 at bivariate level were considered statistically significant. Binary logistic regression was done to determine factors associated with delays. The variables which were significant as well as those proven plausible in literature to be risk factors for PTB including sex, age groups and patient residence were controlled for in a multiple logistic regression model to detect factors that were statistically significant to cause delay.

The results were presented in two by two tables which displayed the frequencies, percentages, crude and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) and p-values.

3.11 Ethical considerations

Ethical approval for this study was obtained from the Ghana health service Ethical Review Committee. Permission was also sought from the Brong Ahafo Regional health directorate and the district health management teams. Written informed consent was sought from individual clients (smear positive PTB patients on DOTS treatment) before administering the questionnaire. Permission letters and consent form were available in English and intensive explanations were given in twi (local language) to ensure participants have comprehensive understanding of the study objectives, potential risks and benefits and assurance of confidentiality. Participants were also given the opportunity to refuse to participate and the right to opt out at any point in the course of the interview. Participants' confidentiality and privacy were respected during questionnaire administration and interactions. To ensure proper confidentiality and privacy, names of participants were not used in the write- up since the questionnaire was coded. The findings from the study was reported such that the names of the respondents were not used. All information was treated as confidential. Data collected was only accessed directly by those involved in the research. All data were stored under lock and key and would be destroyed after ten years.

3.12 Pre testing of tools

Pre-test was done in the Sunyani West Municipal to identify errors in the questionnaires. To ensure that the questions were clear, and respondents understood the questions as intended, the pre-test was done outside the study area during training of field workers (National service personnel). Final data collection was done by these trained field workers.

CHAPTER FOUR

RESULTS

4.1 Characteristics of study participants

The questionnaire was successfully completed by 237 eligible smear positive pulmonary tuberculosis (PTB) patients. Participants from six district hospitals (Berekum, Sunyani, Techiman, Banda, Wenchi and Dormaa) who were receiving the intensive phase of TB treatment were enrolled in the study between November 2014 and May 2015. There were 65% (154/237) males. Ages of participants ranged from a minimum of 18 years to 82 years with a mean age of 39.9 years (SD 15.1; males 40.0 and female 39.7 years). Figure 5 shows age groups and sex distribution of smear positive PTB patients studied. Patients' aged between 25-34 years had the highest frequency 27.4% (65/237) of total smear positive cases.

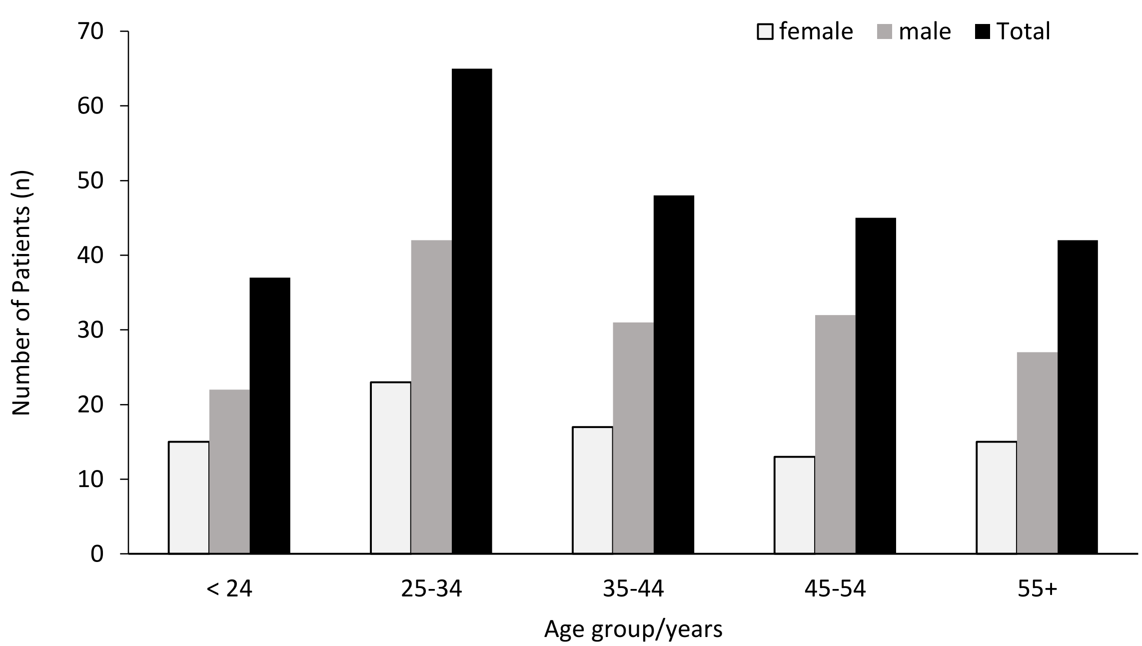

Figure 6: Age group and sex distribution of smear positive pulmonary TB patients, BAR, November 2014 - May 2015

Figure 7 shows the major complaints reported by patients at first visit to the outpatient department (OPD). Cough was the main complaint reported by 57.7% (135/237) followed by night sweat 19.2% (45/237) and fever 13.7% (32/237). Other symptoms are shown in figure 6.

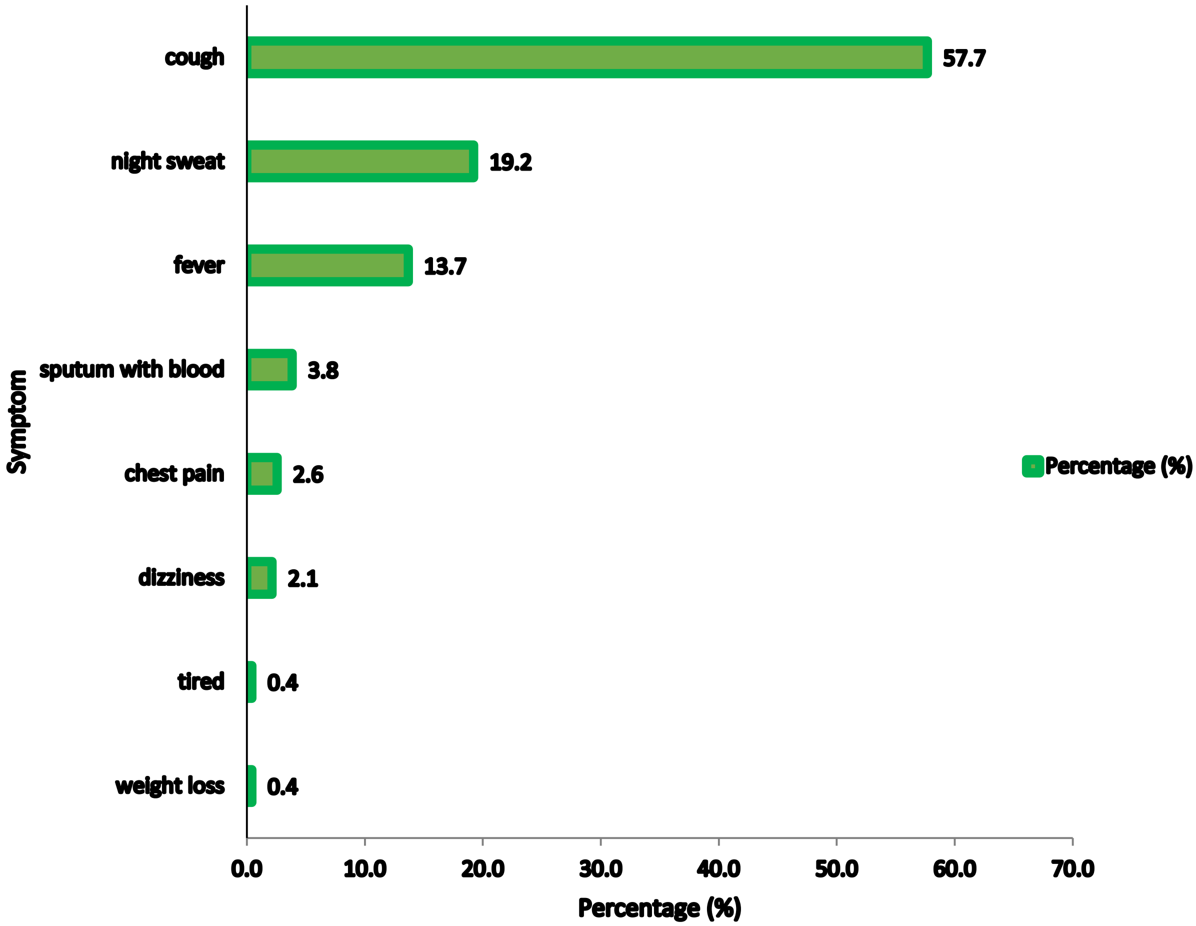

Figure 7: Major symptoms reported by TB patients at first consultation to a health care facility, BAR, November 2014 – May 2015

Table 2. Shows other characteristics the study participants. Among the study participants, 81.0% (174/215) reported to be living within a 10 km radius central to a health service facility. With respect to employment status, a larger proportion 47.3% (112/237) of the participants were unemployed. Almost all 93.2% (220/237) of smear positive PTB patients had heard of TB before their diagnoses. Majority 88.5% (207/234) of these patients had knowledge on the primary symptom of TB as cough for more than three weeks. For patient first point of call, 45. 1% (106/235) of patients were public health facility, 17.5% (41/235) self-treated symptoms, 12.8% (30/235) visited a traditional healer, 12.8% (30/235) visited a private practitioner and 11.9% (28/235) went to a pharmacy shop. With respect to patient symptoms after patient first choice treatment, 45.5% (95/209) did not see any change in their condition, 32.5% (68/209) had their situation worsened only 22.0% (46/209) of study participants seemingly saw an improvement in their symptoms.

Majority, 86.6% (187/216) of smear positive patients were first diagnosed with TB in a government health facility, 5.6% (12/216) in private and 7.8% (17/216) in others (herbalist, prayer camps). Majority 47.1% (93/202) made at least three visits prior to being diagnosed as TB patients, (36.1% (73/202) made two visits and 22.0% (34/202) were diagnosed at their first visit to the health facility. Initial diagnosis made at health facilities include; upper respiratory tract infection (URTI) 52.0% (97/186), malaria, HIV and other diseases; 17.0% (31/186), 25.0% (47/186) and 6.0% (11/186) respectively.

Table 2: Patient and health system timeliness of treatment initiation among smear positive Pulmonary TB patients, BAR, November 2014 – May 2015

		Patient Timeliness (Days)		Health facility Timeliness (Days)		Total Timeliness (Days)	
Variable	**N (%)**	**Median**	**IQR**	**Median**	**IQR**	**Median**	**IQR**
Overall	237 (100)	30	(14 – 60)	8	(4 – 10)	36	(25 – 69)
Sex							
Female	83(35.0)	30	(14 – 60)	5	(4 – 10)	35	(25 – 69)
Male	154(65.0)	30	(14 – 60)	7	(5 – 14)	37	(25 – 73)
Age category (years)							
≤ 34	102(43.0)	38	(7 – 30)	5	(5 – 7)	34	(15 – 47
>34	135(57.0)	36	(21 – 60)	6	(4 – 20)	48	(25 – 73)
Educational level							
Tertiary	31(13.1)	21	(14 – 30)	11	(5 – 12)	37	(26 – 69)
Primary/High school	138(58.2)	30	(14 – 60)	7	(5 – 12)	38	(26 – 76)
No formal education	68(28.7)	30	(21 – 60)	6	(4 – 10)	31	(21 – 52)
Residence							
Urban	61(25.7)	30	(14 – 60)	5	(4 – 11)	34	(22 – 87)
Semi urban	65(27.4)	30	(21 – 60)	8	(5 – 17)	41	(28 – 73)
Rural	107(45.2)	30	(14 – 60)	6	(4 – 10)	37	(23 – 67)
Homeless	4(1.7)	56	(18 – 105)	-	-	85	(35 – 194)
Distance to health facility							
≤ 10 Km	112(52.1)	30	(14 – 60)	7	(4 – 11)	37	(24 – 69)
>10 Km	103(47.9)	30	(14 – 37)	5	(5 – 5)	33	(33 – 53)
Employment status							
Employed	45(19.0)	21	(14 – 30)	12	(11 – 15)	30	(30 – 62)
Self employed	62(26.2)	30	(21 – 60)	7	(5 – 15)	36	(26 – 67
Unemployed	130(54.8)	30	(21 – 60)	6	(4 – 10)	39	(28 – 95)
Heard of TB before diagnosis							
Yes	165(76.0)	30	(14 – 60)	7	(4 – 12)	36	(18 – 64)
No	52(24.0)	30	(14 – 60)	12	(7 – 17)	36	(25 – 73)
Knowledge of coughing > 3 weeks as a TB symptom							
Yes	207(88.5)	21	(7 – 60)	17	(6 – 28)	30	(20 – 60)
No	27(11.5)	30	(21 – 60)	7	(4 – 12)	37	(7 – 60)
Treated initially for							
RTI	97(52.0)	21	(14 – 37)	5	(5 – 8)	32	(22 – 62)
Malaria	31(17.0)	30	(14 – 60)	6	(4 – 15)	36	(20 – 121
HIV	47(25.0)	30	(21 – 60)	7	(3 – 10)	38	(31 – 69)
Other	11(6.0)	50	(30 – 90)	4	(4 – 4)	96	(35 – 150)

Table 2: Patient and health system timeliness of treatment initiation among smear positive Pulmonary TB patients, BAR, November 2014 – May 2015

Variable	Patient Timeliness (Days)			Health facility Timeliness (Days)		Total Timeliness (Days)	
	N (%)	Median	IQR	Median	IQR	Median	IQR
After initial treatment with non TB drugs, symptoms							
Improved	46(22.0)	30	(14 – 80)	8	(4 – 9)	42	(24 – 114)
Worsened	68(32.5)	35	(28 – 60)	7	(5 – 13)	52	(33 – 109)
Same	95(45.5)	30	(24 – 60)	5	(5 – 19)	34	(24 – 64)
Patient first choice of treatment							
Self-treated	41(17.5)	30	(14 – 80)	5	(4 – 6)	34	(30 – 63)
Traditional healer	30(12.8)	40	(28 – 60)	6	(5 – 8)	51	(35 – 69)
Public hosp/clinic	106(45.1)	25	(14 – 60)	8	(5 – 17	35	(22 – 76)
Private practitioner	30(12.8)	30	(14 – 60)	9	(5 – 12)	44	(26 – 97)
Pharmacist/vendor	28(11.9)	25	(14 – 60)	9	(7 – 19)	36	(20 – 64)
Number of visits before diagnosis							
One	34(16.8)	30	(14 – 60)	5	(3 – 13	35	(23 – 92)
Two	73(36.1)	30	(14 – 60)	8	(5 – 11)	35	(25 – 67)
3 or more	95(47.1)	30	(14 – 60)	5	(4 – 7)	36	(23 – 69)
Facility where first diagnosis made							
Government	187(86.6)	30	(14 – 60)	7	(5 – 12)	37	(25 – 76)
Private	12(5.6)	60	(25 – 90)	6	(4 – 11)	80	(36 – 114)
Other	17(7.8)	30	(14 – 30)	5	(5 – 5)	34	(21 – 37)
Is the Health facility **easy to get to**							
Yes	157(70.4)	30	(14 – 60)	7	(5 – 13)	37	(25 – 87)
No	60(29.6)	30	(14 – 60)	8	(5 – 9)	35	(23 – 63)
Do you have to pay for transportation							
Yes	164(70.4)	30	(14 – 60)	6	(4 – 15)	36	(25 – 69)
No	69(29.6)	30	(14 – 60)	8	(6 – 10)	39	(25 – 95)
Do you have to pay to see a health provider							
Yes	4(1.7)	25	(18 – 49)	17	(11 – 22)	60	(26 – 95)
No	232(98.3)	30	(14 – 60)	7	(4 – 12)	36	(25 – 69)
Do you have to pay to have a lab test done							
Yes	11(4.7)	60	(28 – 70)	20	(10 – 30)	87	(35 – 118)
No	223(95.3)	30	(14 – 60)	7	(4 – 11)	36	(24 – 68)

Note: Median days with 25^{th} and 75^{th} inter quartile range

4.2 Patient timeliness for TB treatment

The median number of days measured for patient, health facility and treatment initiation are presented in table 2. The median time in days between onset of symptoms and patient reporting to a health care provider was found to be 30 days, IQR (14 – 60). The median patient timeliness (PT) among persons with tertiary education was 21 days IQR (14 – 30), 30 days IQR (14 – 60) for primary/SHS and 30 days IQR (21 – 60) for no formal education. Median PT among homeless patients was 66 days IQR (18 – 105). Employed patients had median PT of 21 day, IQR (14-30). Among patients who had knowledge that coughing for more than three weeks was a symptom of TB, median PT was 21 days IQR (7 – 60) compared to those who did not know; median PT was 30 days IQR (21 – 60). Patients who were initially treated for median PT was RTI 21 days IQR (14 – 37), patients who were initially treated for other diseases median PT was 50 days IQR (30 – 90) . The median PT for patients who were initially treated with non TB drugs, patients whose symptoms worsened, median PT was 35 days IQR (28 – 60). Patients who first sought treatment from a traditional healer, median PT was 40 days IQR (28 – 60). For patients who had to pay to have a lab test done for TB, median PT was 60 days IQR (28 – 70). The complete median PT with corresponding 25^{th} and 75^{th} interquartile ranges are indicated on table 2. `.

4.3 Health facility timeliness

The median number of days spend in health facility before the commencement of TB treatment for smear positive PTB patients was 8 days IQR (4 – 10). Higher (>8 days) median Health Facility Timeliness (HFT) with corresponding 25^{th} and 75^{th} interquartile ranges (table 2) were reported among patients with tertiary education, patients with employment, having knowledge that cough is a symptom of TB and having to pay to have a laboratory tests for TB. However, urban and rural residents had lower (<8 days) median HFT compared to the average.

4.4 Timeliness for TB treatment initiation

The median TB Treatment Initiation Timeliness (TIT) i.e. from the onset of TB symptoms through TB diagnoses to treatment initiation, for smear positive PTB patients was 36 days IQR (25 – 69). The median days taken to initiate male and female smear positive PTB patients in TB treatment were 37 IQR (25 – 73) and 35 IQR (25 – 69) days respectively. There were high median TIT reported among males (37), persons age >34 years (48), homeless patients (85) visiting a traditional healer (51) and treating initially for other diseases (96) with corresponding 25th and 75th interquartile ranges (table 2). Lower median TIT were however seen among females (35) urban dwellers (34) and patients with employment (30). Table 2 shows a detailed median TIT with their corresponding 25th and 75th interquartile ranges.

Table 3: Proportion of smear positive PTB patients' with delay > 21 days in seeking TB treatment in health facilities in BAR, November 2014 – May 2015

Characteristics	N	Patient delay >21 (Days) No n (%)	Yes n (%)	P value
Sex				0.75
Male	153	62(40.5)	91(59.5)	
Female	82	35(42.7)	47(57.3)	
Age category (years)				0.47
≤ 34	101	39(38.6)	62(61.2)	
> 34	134	58(43.3)	76(56.7)	
Educational level				0.26
No formal education	67	26(38.8)	41(61.2)	
Primary/High school	137	54(39.4)	83(60.6)	
Tertiary	31	17(54.8)	14(45.2)	
Residence				0.67
Urban	61	27(44.3)	34(55.7)	
Semi urban	64	27(43.8)	36(56.2)	
Rural	110	42(38.2)	68(61.8)	
Employment status				0.09
Self employed	61	24(39.3)	37(60.7)	
Employed	45	25(55.6)	20(44.4)	
Unemployed	129	48(37.2)	81(62.8)	
Heard of TB before diagnosis				0.21
Yes	165	70(42.4)	95(57.6)	
No	52	17(32.7)	35(67.3)	
Knowledge of coughing > 3 weeks as a TB symptom				0.11
Yes	207	81(39.5)	121(60.5)	
No	27	15(55.6)	12(44.4)	
After initial treatment with non TB drugs, symptoms				0.01*
Improved	46	18(39.1)	28(60.9)	
Worsened	68	16(23.5)	52(76.5)	
Same	95	44(46.3)	51(53.7)	
Patient first choice of treatment				<0.01*°
Self-treated	41	17(41.5)	24(58.5)	
Traditional healer	30	5(16.7)	25(83.3)	
Public clinic/hospital/H/center	106	53(50.0)	53(50.0)	
Private practitioner	30	8(26.7)	22(73.3)	
Pharmacist/vendor	28	14(50.0)	14(50.0)	
Overall	237	97 (41.3)	138(58.7)	

*p-value refers to statistical comparison of proportions of patients with delay > 21 days with independent variables, °=Fisher's exact test

Table 3: Proportion of smear positive PTB patients with delay > 21 days in seeking TB treatment in health facilities in BAR, November 2014 – May 2015 continue

Variable	Patient delay >21 (Days)			
	N	No n (%)	Yes n (%)	P value
Idea of the cause of TB				0.48º
Infection	172	73(42.4)	99(57.6)	
Punishment	10	2(20.0)	8(80.0)	
Unavoidable	3	2(66.7)	1(33.3)	
Don't know	43	18(41.9)	25(58.1)	
Other	5	1(20.0)	4(80.0)	
Initially treated for				<0.01*º
RTIs	97	54(55.7)	43(44.3)	
Malaria	31	10(32.3)	21(67.3)	
HIV	47	14(29.8)	33(70.2)	
Other	11	1(9.1)	10(90.9)	
Patient suspected TB				0.95
Yes	82	33(40.2)	49(59.8)	
No	145	59(40.7)	86(59.3)	
Fear of losing job				<0.01*
Yes	95	30(31.6)	65(68.4)	
No	120	60(50.0)	60(50.0)	

*p-value refers to statistical comparison of proportions of patients with delay > 21 days with independent variables, º=Fishers exact test, RTIs=Respiratory tract infections

4.5 Proportion of smear positive PTB patients who delayed in seeking health care

Of the total smear positive patients studied, 58.7% (138/235) of patients delay in seeking treatment in a health facility (males 65.9% and 39.1% females). Bivariate analysis showed significant differences between delay and patient first choice of treatment ($p < 0.01$), patient current condition after initial treatment with non TB drug ($p=0.012$), initial diagnosis ($p < 0.01$) and patient fear of losing current job ($p<0.01$) in table 3.

The proportion of delay among patients who after initial treatment with non TB drugs symptoms, improved were 60.9% (28/46), worsened 76.5% (52/78) and 53.7% (51/95) remained same. Over 90% (10/11) of patients who initially treated for other conditions, 70.2% (33/47) among those treating fir HIV, 67.3% (21/31) for malaria and 44.3% (43/97) among those who treated for RTIs delayed in seeking care.

The proportions of delay between patients first choice of treatment were; self-treated 58.5% (24/41), first visited a traditional healer 83.3% (25/30), public health facility 50% (53/106), private practitioner 73.3% (22/30) and a vendor 50.0% (14/28) delayed in seeking health care. Also among patients who first visited a public health facility, 53 (50.0%) delayed in seeking TB care , 22 (73.3%) patients who first went to see a private practitioner delayed in seeking TB care and for patients who visited a pharmacy shop, 14 (50.0%) delayed in seeking TB treatment.

Table 4: Logistic regression analysis of determinants of longer patient delay (≥21 days), BAR, November 2014 - May 2015

Variable	N	Unadjusted OR	Unadjusted 95% CI	Unadjusted p- value	Adjusted OR	Adjusted 95% CI	Adjusted p- value
Initially treated for				<0.001*			<0.01*
RTIs	97	1.0					
Malaria	31	2.6	1.1- 6.2		3.6	1.2- 11.2*	
HIV	47	3.0	1.4 – 6.2		3.0	1.2 - 7.3*	
Other	11	12.6	1.5- 98.8		20.1	2.2-182*	
After initial treatment with non TB drugs, symptoms				0.01*			0.01*
Same	95	1.0					
Improved	68	1.3	0.7 – 2.7		1.6	0.6 – 4.1	
Worsened	46	2.8	1.4 – 5.6*		2.7	1.1 – 6.9*	
Fear of losing job				<0.01*			<0.01*
No	95	1.0					
Yes	120	2.1	1.2 – 3.8*		2.5	1.2 – 5.4*	
Patient first choisce of treatment				<0.01*			0.15
Public health facility	106	1.0					
Self-treated	41	1.4	0.7 – 2.9		1.3	0.5 – 3.5	
Traditional	30	5.0	1.8 – 14.0*		9.6	1.8-50.5*	
Private facility	30	2.8	1.1 – 6.7		1.8	0.6 -5.6	
Pharmacy/vendor	28	1.0	0.4 – 2.3		1.4	0.1 5.0	

Note: RTIs=Respiratory tract infections, *=statistically significant, OR= Odds ratio

Factors associated with longer patient delay in first consultation with a health facility

Table 4 display patient factors significantly associated with longer patient delay in seeking health care. In univariate analysis, type of condition initially treated for (p<0.001), the situation of patient symptoms after initial treatment (p=0.01), patient fear of losing current job (p<0.0) and patient first port of treatment (p<0.01) were significantly associated with patient delay. All the factors in the univariate analysis remained significant (p<0.05) in a multiple regression model except for patient first port of treatment (p=0.15).

Table 5: Summary of logistic regression analysis of factors influencing total patient delay (> 30 days) in treatment initiation, BAR, November 2014 - May 2015

	Unadjusted			P-value	Adjusted		P-value
Variable	N	OR	95% CI		OR	95% CI	
Sex^				0.40			0.33
Female	83	1.0			1.0		
Male	154	1.3	0.7 – 2.2		1.5	0.6 – 3.6	
Age category (years)^				0.45			0.39
≤34	102	1.0			1.0		
>34	135	08	0.4 – 1.4		0.8	0.2 – 4.2	
Residence^				0.07			0.62
Urban	61	1.0			1.0		
Semi urban	65	0.8	0.4 – 1.5		0.1	0.1 – 0.4*	
Rural	111	1.5	0.8 – 3.0		0.3	0.1 – 1.0	
Employment status				0.02			0.01
Employed	45	1.0			1.0		
Self employed	62	1.8	0.8 – 3.9		2.7	0.7 – 10.3	
Unemployed	130	2.6	1.3 – 5.3*		7.4	1.9 – 28.8*	
After initial treatment with non TB drugs, symptoms				0.09			0.13
Same	46	1.0			1.0		
Improved	68	1.5	0.7 – 3.3		1.3	0.4 – 4.3	
Worsened	95	2.2	1.1 – 4.4*		1.5	0.5 – 5.3	
losing current job				0.01			0.01
No fears	120	1.0			1.0		
Fear	95	2.1	1.2 – 3.8*		3.4	1.3 – 8.5*	
Patient first choice of treatment				0.09			0.21
Public health facility	41	1.0			1.0		
Self-treated	30	1.6	0.7 – 3.4		1.4	0.5 – 4.7	
Traditional	106	3.7	1.3 – 10.4*		10.6	1.3 - -66.8*	
Private facility	30	2.0	0.8 – 4.9		1.2	0.3 – 4.1	
Pharmacy/vendor	28	1.3	0.6 – 3.1		3.0	0.6 – 10.9	
Treated initially for				<0.001			<0.01
RTI	97	1.0			1.0		
Malaria	31	2.3	0.9 – 5.5		3.0	0.8 – 11.1	
HIV	47	3.1	1.4 – 6.7*		4.9	1.6 – 14.8*	
Other	11	-	-		-		
Patient cough > 3 weeks				<0.01			0.91
No	99	1.0			1.0		
Yes	135	2.6	1.4 – 4.7*		0.7	0.1 – 3.3	

Note: ^=known confounders, OR=Odds ratio, CI= confidence interval, *statistically significant

4.6 Factors associated with TB treatment initiation delay

Univariate and multivariate analysis of factors associated with TIT delay among smears positive PTB patients are summarized in Table 5. In this study, patient employment status, effect on patient symptoms after initial treatment with non TB drugs, fear of losing current job, patient first choice of treatment, initial diagnosis and patient knowledge of cough as a symptom of TB were found to be significantly associated with TB TIT delay in the univariate analysis with p values all < 0.05. The odds of self-employment among TB patients about 2 times (cOR=1.8, 95% CI 0.8 – 3.9) more likely to delay in treatment initiation in both univariate and multivariate analysis compare to patients with employment status, but was not statistically significant. Unemployed patients were 3 times (cOR=2.6, 95% CI 1.3-5.3) more likely to delay in treatment initiation compared to patients who were employed in univariate analysis. This association remained independently significant (aOR=7.4, 95% CI 1.9 – 28.8) in the multivariate model.

Formal education was not significantly associated with delay. The odds of a patient with no formal education delaying in treatment initiation is increased by 1.6 times (cOR=1.6 95% CI 0.7 – 3.8). similarly the odds of a patient with primary/ secondary education delaying in treatment is increased by 1.6 times compared with those with tertiary education (cOR=1.6 95% CI 0.7 – 3.6). Also the odds of a male patient delaying in treatment initiation was increased by 2 tines compared to females (aOR=1.5 95% CI 0.6 – 3.6). Other factors that were found to increase TIT delay among smear positive patients but were not statistically significant include; patients with knowledge of cough as TB symptom (cOR=1.2 95% CI 0.7 – 2.1), patients with easy access to health care(cOR=1.4 95% CI 0.8 – 2.6), patients who had to pay to be able to see a health provider (cOR=1.6 95% CI 0.2 – 15.7) and patients who paid to have a laboratory test done (cOR=5.6 95% CI 0.7 – 44.5) shown in appendix IV.

Having knowledge of cough as a symptom of TB was significantly associated with delay in treatment initiation. Patients with knowledge of cough as a symptom of TB, were almost 3 times more likely to delay in seeking treatment compared to those who did not know that cough was a symptom of TB (cOR=2.6 95% CI 1.4 –4.7), this was however not significant after adjustment. Patients who visited a health facility at least 2 times or 3 or more times before a diagnosis was made were less likely to delay I treatment initiation compared to those who visited were diagnosed at their first visit (cOR=0.8 95% CI 0.3 – 1.9). The odds of a patient living in a semi urban area delaying in treatment initiation was reduced by about 90% (aOR=0.1 95% CI, 0.1 – 0.4) after adjustment.

The odds of TIT delay among patients whose first choice was to go to a traditional healer upon onset of symptoms was 3.7 (1.3 – 10.4) times the odds of patients who chose to visit a public health facility. The odds of patients who self-treated symptoms first was 1.6 times and 2.0 times in those patients visiting a private practitioner compared to the odds of patients choosing to visit a public health facility in the univariate analysis.

CHAPTER FIVE

DISCUSSION

This study is a description of timeliness of treatment initiation for smear positive PTB patients in Brong Ahafo Region, Ghana. This study reported much longer delay between onsets of symptoms till treatment with anti-tuberculosis drugs compared to the one month recommended by the WHO. This duration ranged, from about three weeks to three months among all participants. More than half (~ 60%) of all smear positive TB patients included in the study delayed in seeking treatment. Patient who first sought treatment from traditional healers before visiting the health facility had the highest proportion (over 80%) of patient delay. Up to six months delay was observed among rural patients during which they could be transmitting the infection in the community.

Unemployed patients delayed more in seeking treatment than employed patients. Also educated patients sought treatment earlier than uneducated ones. There was no significant differences in proportions of delay with regard to residential setting. Across the study participants, there were significant differences in employment status, patient first choice of treatment, illness initially treated for, and patient fear of losing jobs. Some study findings suggest that patient delay is a major contributor to delay in TIT in Somalia, Syria, Iraq and Yemen (WHO, 2006). This present study found patient delay to be longer (over one month) compared to health system delay which was only one week.

The success of TB control program largely depends on early case detection, prompt treatment initiation and high level of adherence to treatment. TB patient behavior has a direct influence on whether a patient will receive timely diagnosis and successful treatment of their illness or not (Paz-Soldan *et al.,* 2014). The significant patient delay observed in this study could be explained by the health seeking behaviour of Ghanaians. Self-medication with over the counter drugs, spiritual beliefs that compel people to go to herbalist or prayer camps and fear of stigmatization if diagnosed with TB are the most likely causes of delay. Delay in the diagnosis and treatment initiation only further increases the burden of the disease to the individual, family, the community and the TB control program (Irani *et al.,* 2008;Sreeramareddy *et al.*, 2009; Tarimo, 2012). It is known that socioeconomic indicators are strong determinants of the health seeking behaviour of the patients, which in turn, are the main factors influencing patient delay among smear positive pulmonary TB patients (Aliyu *et al.*, 2013; Sultan *et al.*, 2013).

TB affects all people regardless of age, sex, race or occupation. In this study, there were more males coming down with smear positive PTB than females. These were mostly the youth between 25 and 34 years. This is similar to global findings by WHO and a cross sectional study among smear positive PTB in Nigeria (Oladayo Biya *et al.*, 2014; WHO, 2014a). Consistent with previous studies by Loren and colleagues (Miller *et al.*, 2000), cough was the most frequent symptom experienced by patients prior to TB diagnosis though some patients had multiple symptoms. Many of these patients had received prior information on TB before going to the hospital besides knowing that, cough for more than three weeks was a symptom of TB. However there are several reasons why most people after several days of cough and unsuccessful self-treatment may not go the hospital. For instance, some patients think it would be shameful to be diagnosed with TB, others are afraid of social rejection or even job losses. In this study, we observed that most patient upon onset of TB symptoms would go round seeking for treatments elsewhere but eventually, they end up being diagnosed in government and other private health facilities. This is probably because other facilities including prayer camps and traditional healers do not have the capacity in respect of laboratory personnel and equipment to carry out basic tests for persons suspected with pulmonary tuberculosis.

The median time of one month, taken by patients from the onset of symptoms until they sought treatment was found to be longer than the acceptable time interval (3 weeks) recommended by the World Health Organization (WHO, 2006). Nonetheless the median patient time (PT) found in this study was consistent with previous studies from southern Ethiopia (Asefa & Teshome, 2014). This delay despite TB treatment in Ghana being free possess a serious challenge to reducing the burden of TB in the region. The principal reasons for treatment-seeking delays could be due to lack of knowledge and confusion of TB symptoms, fear and embarrassment of receiving a TB diagnosis, and a patient tendency to self-medicate prior to seeking formal medical attention (Paz-Soldan *et al.*, 2014). Generally, patients spend shorter period of time, about just a week in health facilities once they report to a public health facility before initiation of treatment in this study. With the establishment of TB DOTS centers and chest clinics in most health facilities in the region, patient follow ups are easier especially when laboratory diagnosis are done within the facility. Median health facility timeliness (HFT) was less than 10 days. This agrees with the findings by Sreeramareddy *et al.*, 2009 from studies in Italy and Taiwan. In a study involving some hundred and sixty six newly diagnosed PTB patients, median health service delay was found to be 9 days (Kansiime *et al.*, 2013) consistent with finings in this study and similar to HFT (7 days) Somalia. On the contrary, median health system delays in Egypt, Iran Islamic republic and Pakistan were higher, 18, 42 and 87 median days respectively. However lower (<4 median days) HFT were reported from Iraq and Yemen. According to reports from WHO (WHO, 2006), Health system delay was the main contributor to the total delay in Pakistan, Islamic Republic of Iran and Egypt.

The total treatment initiation timeliness (TIT) in this study was shorter (36 days) than the median timelines found in other studies in some parts of Africa. In Malawi, the median days for treatment initiation was 80 days (Makwakwa *et al.*, 2014), 60 median days were found in Gambia (Lienhardt *et al.*, 2001) and 84 days in Botswana (Steen & Mazonde, 1998). The findings were similar to an in-depth analysis of the health-seeking behaviour of patients and health system response in seven countries of the Eastern Mediterranean Region by the World Health Organization (WHO, 2006). In that review, 35 and 37.5 median days found in Yemen and Iraq respectively. The reasons for these variations are largely attributable to the methods employed in estimating the duration between times of onset of symptoms to initiation of treatment. It could also be the real difference in TIT. Even though we validated the local calendar and local events and were careful during patient interview, the estimation of TIT is subject to error due to recall bias. Other factors may include individual variations in the way they perceive diseases. Furthermore, the patient's understanding of what "onset of symptoms" mean could indeed prolong the estimated delay since most patients are likely to misinterpret the symptoms of other diseases as TB or vice versa. Another challenge is that, patients with symptoms of TB visiting OPD turn to report of symptoms suggesting viral infections, malaria or HIV for those already positive for HIV infection at the onset of their illness. The timeliness therefore is estimated considering a wide range of events and occurrences as well as the patient's perception of diseases.

Although TB treatment in Ghana is free, a higher proportion close to 60% of smear positive PTB patients delayed in seeking treatment. An earlier study conducted in Tigray, northern Ethiopia in public health institutions (Mesfin *et al.*, 2005), showed that 81.2% of study participants experienced patient delay (>21 days) in first consultation with a public health facility. Similarly among smear positive PTB patients 52% delayed in seeking medical care in Bahir Dar City Administration, Northwest Ethiopia (Gebeyehu *et al.*, 2014) However patient delay is still high in BA indicating limited impact on community interventions put in place to improve patient timeliness of reporting to public health facilities. Other studies however showed a lower proportion of delay among smear positive PTB patients. An Indian study looking at factors responsible for patient and treatment delays, reported 29% patient delays (Tamhane *et al.*, 2012). It is generally believed that considerable proportion of TB patients in low and middle income countries do not have adequate knowledge on TB.

Patient employment status proved to be significant predictors of delay in this study. Unemployed TB patients were about seven times more likely to delay in seeking and initiating TB treatment compare to those in formal employment. Though not significant self-employed patients were also almost three times likely to delay in initiating treatment compared to those in formal employment. This could be due to the fact that employed patients are most likely educated or have the financial ability to immediately seek care. Several studies have underscored the link between unemployment, poverty and delay in seeking treatment, similar to the findings of this study (Tarimo, 2012). Fear and stigmatization were also significant determinant of delay. Patients who were employed and were afraid of losing their jobs if diagnosed with TB had a threefold increased odds of delay in treatment initiation. This same fear could be the reason why patients self-treat symptoms. Participants are probably afraid of job security and societal comments as revealed in a qualitative study in Lima, Peru by Paz-Soldan and colleagues. Fear and/or embarrassment resulting from either being seen by other members of their community at the TB clinic or having an infectious disease and being discriminated against by peers, neighbors or health facility staff are some possible reasons for the delay. TB patients are usually scared of what people will say about them though everyone is at risk (Paz-Soldan *et al.*, 2014). The stigmatizing attitudes and behaviours of the community members towards the disease and its sufferers may lead individuals with very obvious signs and symptoms of TB to attribute it to other non-stigmatizing conditions or hide the diagnosis from others as well as default from treatment (Dodor & Kelly, 2009). Visiting a traditional healer upon first symptoms of disease and been treated initially for other infections were also significant risk factors for delay in TIT among smear positive patients which agrees with finding of another study among newly diagnosed sputum smear-positive pulmonary tuberculosis (TB) patients in Mumbai, India (Tamhane *et al.*, 2012). Residence proved to be a significant risk factor for delay in the study where living in semi urban area was associated with a 90% reduced risk of delay in TIT for TB. Contrary to this observation, findings from Iraq, Somalia, and Pakistan proved that semi urban residence significantly increased the odds of delay by 3, 2.2 and 2.5-folds respectively in the three countries, comparing patients with semi urban residence to patients in urban areas (WHO, 2006).

An overall assessment of the delay in initiating treatment after onset of symptoms, suggest that health system delay is relatively less compared to patient delay. This is probably due to the effective decentralization of TB treatments and implementation of the DOTS policy with effective referral and follow up of patients. However what remains a major challenge to reducing new TB infections is that, patients are staying longer at home with a high tendency to initially treat their symptoms by self-medicating with pharmaceutical drugs or natural homemade remedies. In a study by Paz-Soldan et al (Paz-Soldan *et al.*, 2014), it was reported though among a handful of patients that, patients preferred to consult herbalist or use herbal remedies for diagnosis, prior to seeking formal medical care. In most cases, pharmacists or naturalists provide what they feel to be helpful, effective advice (Paz-Soldan *et al.,* 2014). Participants tended to assume that their symptoms were not serious and could be treated with a basic drug from a pharmacy. Most patients reported that they had heard of TB and many were aware that it affected the lungs, however, they were not familiar with other symptoms. Numerous patients expressed confusion that their non-pulmonary symptoms, such as fevers or fatigue, were indicative of TB.

Limitations of the study

Possible limitations in this study were recall bias and patients perception of symptoms of TB

1. We anticipated recall bias to some extent since patients had to remember the time they actually started showing symptoms of the disease. To minimize this error, we adopted the use of a local calendar listing the main national and religious events other timelines considered were farming seasons and cultural activities over a one year period in a chronological order to estimate the date of onset of symptoms.
2. Individual variations in the way the perceived diseases could also be a factor, patient's understanding of what "onset of symptoms" meant could indeed be related to another disease probably coincidentally with the beginning of TB or could indeed have contributed to it. Data collectors were trained not to ask probing questions.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The median number of days for treatment initiation among smear positive PTB patients in the study area was 36 days with about 60% of patients delaying in seeking treatment. The study revealed that, private sector including traditional healers were the first choice of treatment for more than two-thirds of the patients in the region. The factors that were significantly contributing to the treatment initiation delays were; unemployment, TB patient fear of losing current job, visiting a traditional healer upon first symptoms and also treating initial symptom as HIV.

6.2 Recommendations

Based on findings in this study, the following are recommended

Ministry of Health:

- Should liaise with employers to ensure that employees diagnosed with TB are not at risk of losing their jobs, and that conditions of service for employees include care for TB.
- Should through the national commission for civic education, organize continuous health educational programs on TB with emphasis on the signs and symptoms of TB.

The regional health directorate:

- Should sensitize traditional healers, drug sellers/pharmacist and religious leaders to refer symptomatic individuals to public health facilities for tuberculosis test. This is because, the study found almost 50% of patients visiting these places upon onset of first symptoms. This was found to be significantly influencing delay in reporting to a public health facility and thus leading to delayed treatment initiation.

- Health officials should involve traditional healers in the provision of care for TB patients Should incorporate the key risk factors for delay in educational materials
- Promotion of concerted efforts to increase awareness of the signs and symptoms of TB in the community and encourage self-referral to the health services
- A community based research can be conducted to identify symptomatic individuals who are not attending health facilities.

District health directorates

- Organize sensitization programs on TB for private pharmacy owners and vendors and owners of private hospitals to increase their understanding of TB and ensure that they refer suspected TB cases promptly to DOTS centers where they can be diagnosed and properly treated.

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APPENDIX I: INFORMATION SHEET

Project Title

Timeliness of anti TB treatment initiation among smear positive pulmonary tuberculosis patients in Brong Ahafo Region

Institutional Affiliation:

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University of Ghana, Legon

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Background

The principal investigator is Charles Lwanga Noora, a student of the school of public health, conducting a research on Evaluation of timeliness of TB treatment initiation among smear positive pulmonary tuberculosis patients in Brong Ahafo Region. This study is solely for academic purposes and requirement for the award of master of philosophy in applied epidemiology and disease control degree. The project is under the supervision of Dr. Ernest Kenu of the school of public health, university of Ghana, Legon.

Procedure

Information will be collected on basic socio demographic data, signs and symptoms of TB, health seeking behavior of patients and reasons for early or delay in initiation of anti TB treatment for patient diagnosed as having PTB

Possible risk and discomfort

There are no risks associated with your participation in this study, however it will require about 20 minutes of your time to ask you some questions concerning the disease. Also some patients may be emotional in recounting their experiences

Possible benefits

There will be no direct benefit for participating in this study. However you will significantly contribute to our understanding of the key problem in the disease treatment initiation and how best to improve activities in order to successfully control the disease in the region. This will not affect your treatment schedules.

Confidentiality

Information provided by participants will be kept safe and cannot be trace to you, except the team involved in the research of this study. This will be done using codes or numbers in place of participant's names. We will not reveal you names or identity in any of our reports or papers. All recodes will be kept in a secured place with the principal investigator and accessible only by research team members

Compensation

There is no compensation for participants in this study.

Voluntary Participation and right to leave the research

You have the right not to take part in the study if you do not want to, and be assured that your non participation will not affect you in anyway. If you have enrolled in the study, you may also decide to leave at any point in time without penalty, and you will not be affected in any way.

Before you consent:

Do you have any questions you wish to ask? You are free to ask any question now later or any time you wish to seek clarification on anything concerning the research. Please do not hesitate to contact the principal investigator (Noora Charles Lwanga) on; Telephone number 0208776329 or send an email to wooncla@yahoo.com. You may also contact my academic supervisor on 0244592122. For further information on this study you can contact Ms. Hannah Frimpong, administrator of the Ghana Health Service Ethical Review Committee on telephone number 0242323525

APPENDIX II: PARTICIPANT INFORMED CONSENT

I, ………………………………………………………………………………………. have been adequately informed about the purpose, procedure , potential risks and benefits of this study. I have had the opportunity to ask questions and the questions have been answered to my satisfaction. I know that I can refuse to participate in this study without any loss or benefit to which I would have otherwise been entitled to. Having gone through the consent form thoroughly, I agree to enroll in this study.

Participant Signature/ Right thumbprint ……………………………… Date …………….

Witness Signature ……………………………… Date …………….

Interviewer statement

I have explained the procedure to be followed in this study to the client in the language that he/she understands best and he/she has agreed to participate in the study.

Researcher: ………………………………………………………………………………………..

Signature of interviewer ……………………………… Date ……………

APPENDIX III: STRUCTURED QUESTIONNAIRE

Timeliness of TB treatment initiation Evaluation Tool

Exit interviews (Smear Positive PTB patients)

DD MM YY

Date of Interview: ..../............../..............

Interview Location: ....

Form No: ....

Introduction and Consent

Hello my name is Charles Lwanga Noora, and I am working on Timeliness of TB treatment initiation in the Brong Ahafo Region. We are conducting a study to improve health services for TB patients. We would like to ask you a few questions about the care you have received and the information you have been given. Your opinions are very important to us. Your answers will be kept confidential and your name will not be written on the survey so there will be no possibility to identify you. Your participation in this study is voluntary and you can withdraw from the interview at any moment without any negative consequences for you.

This will take about 30 minutes of you time. Do you have any questions?

Do you agree to take part in this study?

Signature of Interviewer: ....

Name of interviewer: ....

For: Patients currently on active TB treatment

We kindly request that you answer the following questions as truthfully as possible, all the answers that you provide are anonymous

A) DEMOGRAPHY

1. Age……………………….

2. Sex: a) Male b) Female

3. **Educational level**: a) Tertiary b) Primary/High Sch c) No formal Education

4. **Marital status**: a) Single b) Married c) Divorced d) Widowed e) Separated f) Cohabiting

5. Occupation: a) Professional b) Temporal c) House wife d) Unemployed

6. Residence: a) Urban b) semi urban c) Rural d) Homeless e) other

7. Ethnicity: ....

8. Religion: a) Muslim b) Christian c) other

B	**PATIENT KNOWLEDGE**		
No	**Questions and filters**	**Coding Categories**	**Skip to ≠**
1	Do you know what TB is?	Yes…………………………………….1 No……………………………….…….2	
2	Do you think that TB is a serious disease?	Yes…………………………………….1 No……………………………….…….2	
3	What in your opinion cause TB?	1. Infection 2. Punishment 3. Unavoidable 4. Don't know 5. Others	

4	What are the symptoms of someone infected with TB? Multiple response)	1. Cough for more than 3 weeks 2. Sputum with blood 3. Fever 4. Weight loss 5. Don't know	
5	How can a person get infected (Transmission)?	1. through germs present in air droplets expelled in the cough 2. Sharing utensils objects with an infected person 3. Others (food, water, etc) 4. Don't know	
6	Do you know how TB is diagnosed?	1.TB is diagnosed through sputum examination 2. TB is diagnosed through X-ray 3. Other 4. Don't know	
7	Do you know that TB can be cured?	Yes……………………………………1 No……………………………………2	
8	Do you know that some causes of TB will require a longer treatment to be cured (MDR-TB)	Yes……………………………………1 No……………………………………2	
C	**Attitude towards TB**		
9	Do you think TB patients should be helped with?	1. TB medicines for free 2. Food support	

		3. Transportation support to access health care 4. Other	
10	Should people with TB disclose their illness to other people?	Yes……………………………………1 No…………………………….……….2	
11	Who do you think is likely to get TB, men and women?	female………………………………....1 male ………………………………....2	
12	How did you feel when you found out that you had TB?	1. Scared 2. Depressed 3. Didn't believe (denial) 4. Other	
13	Did you inform your friends/family that you had TB?	Yes……………………………………1 No…………………………….……….2	
14	Why or why not?	……………………………	
15	Have you relationships with your friends/family changed since finding out you have TB?	Yes……………………………………1 No…………………………….……….2	
16	How?	……………………………………	
17	Are people with TB being discriminated against in the community?	Yes……………………………………1 No…………………………….……….2	
18	Are males or females TB patients more discriminated against?	Female………………………………1 Male..……..…………………………....2	
19	Have you been afraid you may lose your job if it is known you have TB?	Yes……………………………………1 No…………………………….……….2	

20	(For women) Do you think that TB will affect your ability to become pregnant/have healthy children?	Yes……………………………………1 No…………………………….………2	
D	**Access to TB diagnosis**		
21	How far is your home from this health facility (distance or time?)	.... Hours or .... Km	
22	Is there other health facility closer to your home?	Yes……………………………………1 No…………………………….………2	
23	Is there a herbalist you know who treat TB	Yes……………………………………1 No…………………………….………2	
24	Is the health facility easy to get to (convenience of transport/accessibility)?	Yes……………………………………1 No…………………………….………2	
25	Do you have to pay for transportation to get to the health facility?	Yes……………………………………1 No…………………………….………2	→ 27
26	How much?	………………………………………	
27	Do you have to pay to see a health provider?	Yes……………………………………1 No…………………………….………2	→ 29
28	How much?	………………………………………..	
29	Do you have to pay to have a lab test done?	Yes……………………………………1 No…………………………….………2	→ 31
30	How much?	………………………………………	
31	Does the health facility have convenient hours?	Yes……………………………………1 No…………………………….………2	

E	**Health seeking behavior**		
33	Where did you first seek treatment when you became ill?	1. Self-treated 2. Traditional healer 3. Public clinic/Hospital/Health center 3. Private practitioner 4. Pharmacist/Vendor 5. Other	
34	Why?	1. Was cheaper 2. Was closer 3. More convenient 4. Better care received 5. Better attitude from health workers 6. Trusted more 7. Others	
35	Did you seek for treatment from somewhere else?	Yes……………………………………1 No………………………………………2	→ 37
36	From whom	1. Traditional healer 2. Public clinic/Hospital/Health center 3. Private practitioner 4. Pharmacist/Vendor 5. Other	
37	Did you think you had TB?	Yes……………………………………1 No………………………………………2	

38	Where would you prefer to be treated for TB?	1. Government 2. Private 3. Other	
F	**<u>Estimation of timeliness</u>**		
39	How long were you sick before you first sought treatment?	.... Days .... Weeks .... Months	
40	What were the first symptoms you had?	1. Cough for more than 3 weeks 2. Sputum with blood 3. Fever 4. Weight loss 5. Tired/weak 6. Dizzy 7. Chest pain 8. Night sweat 9. Other	
41	Did you take any treatment before you were diagnosed?	Yes.......................................1 No...2	→ 43
42	Which treatment?	....	
43	After you were giving the treatment, did your symptoms	1. Improved 2. Worsened 3. Same	

44	Why did you choose to come to this facility?	1. Close 2. Been here before 3. Friend/family recommendation 4. Referred 5. Know provider 6. Other	
45	Were you informed about the possibility of having TB?	Yes……………………………………1 No……………………………………2	→ 46
46	When were you informed?	First visit ……………………………..1 Other visits …………………………2	
47	How many visits more before you were informed of the possibility of TB?	…………………… (Number)	
48	With whom did you have repeated visits?	1. With the same facility 2. Different provider in the same facility 3.Different Providers (healer, private, government, etc)	
49	If not what other diagnoses were sought?	1. Respiratory infection 2. Malaria 3. HIV 4. Other	
50	What type of facility made the initial diagnosis?	1. Government 2. Private 3. Other	

5 1	Were you diagnosed with TB in this facility?	Yes………………………………….1 No…………………………………….2	
5 2	How long did it take since you first seek health attention until you were informed you had TB?	.... Days .... Weeks .... Months	
5 3	How long did it take from the time you were informed you had TB to begin treatment?	.... Days .... Weeks .... Months	
5 4	What factors may have made you delay seeking treatment for symptoms that led to the diagnosis of TB?	1.Not aware of the severity of my symptoms 2. Fear of rejection/losing my job 3. Expensive 4. Lack of time 5. Difficult access to health care 6. Not having a previous satisfactory experience with the health system 7. Others	
5 5	Who do you think can better reduce the amount of time spend in the diagnosis and treatment of TB?	1. The patient 2. The family 3. The health system 4. The government 5. Others	
G	**Sources of information**		

56	Did you receive information about TB in the last six months before you were diagnosed?	Yes……………………………………..…1 No…………………………………..………..2	
57	Where did you receive most of your information?	1. Health Provider 2. Pharmacist 3. Friend/Family 4. Media (Type) 5. Other	

APPENDIX IV: ADDITIONAL ANALYSIS, CRUDE AND ADJUSTED ODDS RATIOS

Logistic regression analysis of factors influencing total delay (>30 days) in treatment initiation, BAR, November 2014 - May 2015

Variable	N	Unadjusted			Adjusted		P-value
		OR	95% CI	P-value	OR	95% CI	
Sex^				0.40			0.33
Female	83	1.0			1.0		
Male	154	1.3	0.7 – 2.2		1.5	0.6 – 3.6	
Age category (years)^				0.46			0.39
≤34	102	1.0			1.0		
>34	135	08	0.4 – 1.4		0.8	0.2 – 4.2	
Educational level				0.45			
Tertiary	31	1.0					
Primary/High school	138	1.6	0.7 – 3.6				
No formal education	68	1.6	0.7 – 3.8				
Residence^				0.07			0.62
Urban	61	1.0			1.0		
Semi urban	65	0.8	0.4 – 1.5		0.1	0.1 – 0.4*	
Rural	111	1.5	0.8 – 3.0		0.3	0.1 – 1.0	
Distance to health facility				0.30		-	-
<10 Km	112	1.0				-	-
≥10 Km	103	0.7	0.4 – 1.3			-	-
Employment status				0.02			0.01
Employed	45	1.0			1.0		
Self employed	62	1.8	0.8 – 3.9		2.7	0.7 – 10.3	
Unemployed	130	2.6	1.3 – 5.3*		7.4	1.9 – 28.8*	
Heard of TB before diagnosis				0.27			
No	52	1.0					
Yes	165	0.7	0.3 – 1.4				
Knowledge of coughing > 3 weeks as a TB symptom				0.02			0.08
No	50	1.0			1.0		
Yes	182	1.2	0.7 – 2.1		0.4	0.2 -0.9	
After initial treatment with non TB drugs, symptoms				0.09			0.13
Same	46	1.0			1.0		
Improved	68	1.5	0.7 – 3.3		1.3	0.4 – 4.3	
Worsened	95	2.2	1.1 – 4.4*		1.5	0.5 – 5.3	
losing current job				0.01			0.01
No fears	120	1.0			1.0		
Fear	95	2.1	1.2 – 3.8*		3.4	1.3 – 8.5*	
Patient first choice of treatment				0.09			0.21
Public health facility	41	1.0			1.0		
Self-treated	30	1.6	0.7 – 3.4		1.4	0.5 – 4.7	
Traditional	106	3.7	1.3 – 10.4*		10.6	1.3 - -66.8*	

Private facility	30	2.0	0.8 – 4.9		1.2	0.3 – 4.1	
Pharmacy/vendor	28	1.3	0.6 – 3.1		3.0	0.6 – 10.9	
Number of visits made before diagnosis				0.88			
One	34	1.0					
Two	73	0.8	0.3 – 1.9				
Three or more	95	0.8	0.4 – 1.9				
What type of facility made first diagnosis				0.09			
Government	187	1.0					
Private	12	5.6	0.7 – 4.4				
Other	17	0.6	0.2 – 1.6				
Treated initially for				<0.001			<0.01
RTI	97	1.0			1.0		
Malaria	31	2.3	0.9 – 5.5		3.0	0.8 – 11.1	
HIV	47	3.1	1.4 – 6.7*		4.9	1.6 – 14.8*	
Other	11	-	-		-		
Is the health facility easy to get to				0.22			
No	60	1.0					
Yes	157	1.4	0.8 – 2.6				
Do you have to pay for transportation				0.36			
No	69	1.0					
Yes	164	0.8	04 – 1.4				
Do you have to pay to see a health provider				0.68			
No	4	1.0					
Yes	232	1.6	0.2 – 15.7				
Do you have to pay to have a lab test done				0.07			
No	11	1.0					
Yes	223	5.6	0.7 – 44.5				
Patient cough > 3 weeks				<0.01			0.91
No	99	1.0			1.0		
Yes	135	2.6	1.4 – 4.7*		0.7	0.1 – 3.3	
Smear result				0.29			
(Scanty)	28	1.0					
(+)	45	0.8	0.1 – 9.6				
(++)	41	1.0	-				
(+++)	59	1.9	0.1 - 26				

Note: ^=known confounders, OR=Odds ratio, *statistically significant

APPENDIX V: ADDITIONAL ANALYSIS OF DIFFERENT DELAYS

Different categories of total delay separated by sex of study participants, BAR, 1/11/14 to 31/5/15

Timeliness	Total (both male and female)	Male	Female	P-Value
Patient timeliness (days)				
Mean (±SD)	51 (88)	54 (91)	46 (82)	
Median	30	30	30	
IQR	14 – 60	14 – 60	14 – 60	0.509
Diagnostic timeliness (days)				
Mean (±SD)	14 (32)	15 (36)	12 (24)	
Median	4	4	4	
IQR	3 – 7	2 - 10	3 - 7	0.668
Treatment timeliness (days)				
Mean (±SD)	9 (49)	10 (59)	7 (22)	
Median	2	2	2	
IQR	2 – 4	1 - 4	2 – 4	0.556
Health system timeliness (days)				
Mean (±SD)	23 (62)	25 (69)	20 (44)	
Median	8	7	5	
IQR	5 – 15	5 - 14	4 – 10	0.843
Total timeliness (days)				
Mean (±SD)	74 (130)	78 (146)	65 (94)	
Median	36	37	35	
IQR	25 – 69	25 - 73	25 – 69	0.175

APPENDIX VI: TB case detection, cure and success rates Per 100,000 population

	Case detection rate		Cure rate		Success rate	
Year	**Brong Ahafo**	**National**	**Brong Ahafo**	**National**	**Brong Ahafo**	**National**
1998	NA	NA	59.8	43.8	68	61
1999	34.2	56.6	53.9	49.3	69	62
2000	35.2	58.0	50.9	44.9	66	65
2001	31.5	61.4	55.2	47.9	65	65
2002	39.2	59.1	63.5	56.1	70	68
2003	33.6	58.4	63.7	61.0	69	70
2004	32.7	56.6	61.1	64.0	67	72
2005	28.0	57.0	60.8	67.6	66	73
2006	31.0	57.0	59.0	76.1	70	79
2007	36.0	57.0	64.1	77.5	77	84
2008	30.0	61.0	70.9	78.8	82.3	85.6
2009	38.0	64.0	NA	NA	NA	NA

Note: NA= Not available

Source: GHS facts and figures 2010