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ASSESSMENT OF ENABLERS' SUPPORT PACKAGE IN TUBERCULOSIS TREATMENT IN CENTRAL REGION OF GHANA

BY

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DECLARATION

I, **Martin Sumani Daanko,** hereby declare that with the exception of the references made to other peoples' work which have been duly acknowledged, this dissertation is my original work under the supervision and guidance of my supervisor, and it has neither in whole nor in part been presented to another institution or elsewhere for the award of any degree.

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DATE……..

SIGNATURE…….

DR. ERNEST KENU

(SUPERVISOR)

DATE……..

DEDICATION

I dedicate this work to my lovely and supportive wife, Erica Naangmenebe Tungmene and the children: Benedict Naah Daanko (aka Pope), Benedicta Ziem Daanko, Benita Korzie Daanko and Anastasia Maal-yir Daanko, whose prayers, encouragement and best wishes enabled me to complete the master's programme at the University of Ghana School of Public Health. And to my late father, Mr. Daanko Doodi Dorgbul, who was a pillar in my life and would have been happy to see me reach this level in education. May his soul continue to rest in perfect peace.

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ABSTRACT

Introduction: Tuberculosis (TB) is a disease of public health importance, affecting over 10 million people globally in a year. The TB disease is the single largest cause of mortality relative to communicable disease globally. TB treatment success rates have been below the WHO target of at least 85% while defaulter and failure rates have been higher than the national average since 2015 in Central Region. Ghana introduced a nationwide financial incentive known as the enablers' package for TB patients, treatment supporters and health care providers in 2006 to ensure treatment adherence and better TB treatment outcomes. Enablers' support package is currently benefitting only MDR-TB patients.

Objective: The objective of the study was to assess the contribution of the enablers' package to TB treatment success in the Central Region of Ghana.

Methods: A cross-sectional analytical study was used. Records of TB patients from the district TB register were reviewed from 2012-2017. Pearson's chi square test to test for associations between the dependent variable and independent variables, and multiple logistic regression analysis was used to determine the predictors of TB treatment success. Two-sample test of proportions was used to compare the proportion of TB treatment success rates between TB patient groups while propensity-score matching was used to estimate the contribution of the enablers' package to treatment success between the two groups. Stata was used for the data analysis with level of significance at $p<0.05$

Results: Records of 2,127 TB patients were reviewed in the five districts and 98.1% (2,087/2127) of them met the inclusion criteria. About 64% (1339/2087) of the patients were males and 56% (1166/2087) of them lived in rural areas. Nearly 94% (1957/2087) of the patients were new cases. About 64% of the TB patients adhered to treatment whilst overall treatment success rate was 84%. TB patients who received enablers' package had marginal

better treatment success (84.3%). The enablers' package contributed about 12.7% to TB treatment success in the Central Region.

Conclusion: The financial enablers' package contributed to the TB treatment success rates in the Central Region. Government and stakeholders should find sustainable sources of funding for TB control activities in the region and country.

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LIST OF ABBREVIATIONS

AL	Advanced Level
AIDS	Acquired Immune Deficiency Syndrome
CDC	Centre for Disease Prevention and Control
DDHS	District Director of Health Service
DHD	District Health Directorate
DHIMS2	District Health Information Management Systems 2
DOTS	Directly Observed Therapy Short-course
DR-TB	Drug Resistant Tuberculosis
GHS	Ghana Health Service
HIV	Human Immunodeficiency Virus
IDI	In-depth Interviews
JHS	Junior High School
MDR-TB	Multi-Drug Resistant Tuberculosis
MMDAs	Metropolitan, Municipal, District Assemblies
MPH	Master of Public Health
MSLC	Middle School Leaving Certificate
NHIS	National Health Insurance Scheme
NTD	Neglected Tropical Diseases
O'L	Ordinary Level
PSM	Propensity Score Matching
SDG	Sustainable Development Goals
SHS	Senior High School
SPSS	Statistical Package for Social Sciences
TB	Tuberculosis
WHO	World Health Organization

DEFINITION OF TERMS

Enablers' support package: In this study shall be understood to be any form of financial support given to or received by TB patients.

Treatment adherence: Taking medications according to prescription and schedule, consistently and without missing a day or dose. In this study, treatment adherence was defined as completing TB treatment within the specified duration for each regimen. Non-adherence to treatment was any TB patient who spent less or more days to the declaration of treatment outcomes. The following definitions of the TB treatment outcomes have been adopted from (WHO, 2013b).

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

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

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

Died: A TB patient who dies for any reason before starting or during the course of treatment.

Lost to follow-up: A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more.

Not evaluated: A TB patient for whom no treatment outcome is assigned. This includes cases "transferred out" to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit.

Treatment success: The sum of ***cured*** and ***treatment completed***.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Tuberculosis (TB), an infectious disease caused by *Mycobacterium tuberculosis,* is a disease of global public health importance. It affects millions of people, resulting in high proportion of deaths. There are two types of TB- pulmonary, affecting only the lungs, and spread when an infected person expel the TB bacilli into the air through coughing or sneezing; and extra-pulmonary- affecting any parts of the body (WHO, 2017).

According to the 2018 Global Tuberculosis Report, TB is the 9th leading cause of deaths from a single infectious disease more than HIV where an estimated 10 million new cases of TB, comprising 5.8 million men, 3.2 million women and 1.0 million children (about 133 cases per 100,000 population) were recorded in the world in 2017 in the whole world. The global TB burden is highest in South East Asia (44%), Sub-Saharan Africa (25%) and Western Pacific (18%) regions of WHO. During the same period under review, deaths attributable to TB in HIV-negative people were about 1.3 million. Africa is one of the continents with the highest burden of the TB disease after Asia. It accounts for more than half of the 30 countries with the highest TB burden in the world (WHO, 2017, 2018b).

In Ghana, 14,550 cases of TB of all forms comprising 13,915 adults and 635 children under 15 years were notified in 2017 which is about a five percent reduction from that of the 2016 notified cases of 14,632. This translates into a case notification rate of 48.2 per 100, 000 in 2016 as against 54 per 100, 000 population in 2016 with Northern Region and Volta Region recording lower than the national case notification in 2017 (Ghana Health Service, 2018b).

The low case TB case notification rates have been reported between 2013 and 2015 (Ghana Health Service, 2017).

The Sustainable Development Goals (SDGs) aim to end the three epidemics of AIDS, TB, and malaria before 2030 (WHO, 2017). In the light of this, all efforts and strategies must be put in place by countries to achieve the target.

The Ghana Health Service (GHS) reports of declining TB case notification of all forms in Ghana where14,632 cases were detected in 2016 putting the national notification case rate at 54/100,000 (Ghana Health Service, 2017) with treatment coverage reported to be 32% (WHO, 2018a) below the End TB Strategy target of ≥90 (WHO, 2018b). Furthermore, treatment outcomes have not seen much improvement relative to the national targets: TB cure rate hovers around 74-75% between 2010 and 2015, with death rate from smear positive cases and defaulter rate being 7% and 2.6% as at end of 2015 (Ghana Health Service, 2017).

Tuberculosis cure rate in the Central Region has been lower than the recommended national and international target of more than 85%. A five-year TB treatment outcome analysis trend shows a lower cure rate in the region. Similarly, death and defaulter rates, the undesirable outcomes of TB treatment have been above the national average of 5% (Ghana Health Service, 2018a). Successful treatment outcome among TB patients is the ultimate goal of the tuberculosis control programme. In 2017, the TB cure rate in the Central Region was 44.7% with a defaulter rate of 6% (Ghana Health Service, 2018a). The high prevalence (286/100,000) of TB coupled with rising cases of MDR-TB in Ghana (Ghana Health Service, 2018b) calls for intensified efforts to eliminate TB in the country by 2035 as proposed/targeted by the End TB Strategy (Uplekar et al., 2015; WHO, 2015). The WHO has set successful treatment targets for the TB control programme with recommended cure rate of ≥85% (WHO, 2015, 2017, 2018b).

To have improvement in treatment adherence and successful treatment outcomes, the Ministry of Health/Ghana Health Service through the National Tuberculosis Control Programme started the implementation of an enabler's support package in 2006 after a pilot in 2003. The purpose of the enabler's package as an incentive, was to provide the needed financial support to reduce the costs due to the treatment, for TB patients to achieve cure and also to reduce the cost of TB diagnosis by health facilities and to motivate health staff (Auer et al., 2009; Bonsu et al., 2007). The enablers' package was a link between three systems: the TB patient, health worker and health facilities (Auer et al., 2009).

The provision of comprehensive TB prevention and care which will not bring impoverishment to those who need it most is being hampered by the absence of universal health coverage and social intervention and protection systems in most countries (Uplekar et al., 2015). The TB Enablers' support package was introduced to help increase TB case detection, improve treatment adherence and success treatment by reducing the cost associated with the TB treatment to the patient and health workers. Despite a progress in the rate of TB treatment success possibly as a result of the implementation of the enablers support package in the country, it has been acknowledged that TB treatment success rate has been below targets and low case detection is remains a big challenge (Bonsu et al., 2014). The TB cure rate and treatment success rate in the Central Region for 2017 were 43% and 81.1%, respectively (Ghana Health Service, 2018a) which are below the target of ≥85%. Higher defaulter rate (5.8%) than national average is also recorded in the Central Region.

The non-implementation of the enablers' support package for routine TB cases but for only MDR-TB cases is likely to reverse the gains in the TB control programme which has been somehow attributed to the enablers' support package. Therefore, the focus of attention on giving enablers' package to only MDR-TB cases to the neglect of the other pulmonary TB

cases could lead to reversal in the TB treatment success because of likely non-compliance to treatment especially the financially challenged patients.

The study seeks to assess the effect of the enablers' support on adherence to TB treatment and successful treatment completion in the Central Region.

1.2 Problem statement

Enablers' support package is currently benefitting only MDR-TB patients instead of all types of TB patients on treatment. TB treatment success rates have been below the WHO target of at least 85% while defaulter and failure rates have been higher than the national average since 2015 in Central Region. The enablers' package has been introduced as a form of support to improve treatment adherence in TB patients for improved treatment outcomes. It is to among other objectives address the issue of defaulting among TB patients and addressing their financial challenges. Tuberculosis as a disease of poverty and worsens the economic burden of patients and their affected families. Poverty affects patients' ability to adhere to treatment for successful treatment outcomes. Poor adherence to TB treatment is a challenge to many countries especially the developing ones (Thiam et al., 2007) and can result in negative consequences such as multi-drug resistant TB (MDR-TB), treatment failure and deaths (Gugssa Boru, Shimels, & Bilal, 2017; Kliner et al., 2015; Tesfahuneygn, Medhin, & Legesse, 2015). According to Klein et al., (2019), identifying interventions to improve compliance and reduce defaulting in treatment may represent a great contribution to reduce MDR-TB.

A five-year TB treatment outcome analysis trend shows a lower cure rate of less than 85% in the region while death and defaulter rates, have been above the national average of 5% (Ghana Health Service, 2018a). Similarly, the Ghana National TB Control Programme reports of rising cases of MDR-TB, incidentally from the time of no enablers' package: 50,

72, 107 and 209 confirmed MDR-TB cases were reported in 2014, 2015, 2016 and 2017 respectively (Ghana Health Service, 2018b). There have not been many evaluation studies on the impact of the enablers' support package on TB treatment adherence and outcomes in Ghana except in the Western, Ashanti and Upper West Regions (Auer et al., 2009) who recommended similar evaluations in other parts of the country.

Therefore, allowing all types of TB patients to benefit from the enablers' package will ensure adherence to treatment, prevent or reduce defaulter and ultimately prevent MDR-TB. This study assessed the contribution of the enablers' package to TB treatment outcomes in the Central Region.

1.3 Justification of the study

There has not been an evaluation of the enablers' package in the Central Region. The study will help to know the contribution of the enablers' support package on TB treatment success in the Central Region by comparing two periods: 2012-2014 when the enablers' package was in place and 2015-2017 when it was limited to only MDR-TB cases. The study will help to identify programmatic challenges, if any, in the implementation of the policy. Findings from the study will also contribute knowledge to the limited literature on the impact of financial support interventions in TB control in Ghana.

1.4 Research questions

1. What is the proportion of treatment adherence and treatment success among TB patients who received enablers' support package and who those who did not?
2. What is the contribution of the enablers' support package to positive treatment success among TB patients in the Central Region?
3. What factors determine treatment success among TB patients in the Central Region?

1.5 General objective

To assess the contribution of the enablers' support package in TB treatment in the Central Region of Ghana

1.5.1 Specific objectives

1. To determine the proportion of treatment adherence and successful TB treatment among TB patients in the Central Region.
2. To assess the contribution of the enablers' support package to TB treatment success in the Central Region.
3. To explore factors which determine treatment success among TB patients in the Central Region.

1.6 Conceptual frameworks

Treatment outcomes (otherwise referred to as cohort analysis) are measured by the cure rate, completion rate, defaulter/loss to follow-up rate, failure rate and death rate. These treatment outcomes can be grouped into two arms: positive treatment outcomes which include the cure and completion rates and negative treatment outcomes which include loss to follow-up/defaulter, failure and death rates. The negative TB treatment outcomes are indicators which every national TB control programme including that of Ghana work to minimize.

Treatment success which is a measure of TB cure and completion rates is affected by factors such as socio-demographic and TB disease characteristics. Sunday et al., (2014) in their study in Ogbomoso of South-western Nigeria found that people aged 20-49 years were mostly affected by TB. They however, observed that treatment category and place of residence (for taking TB medicines) but not age group, gender and were factors associated with successful treatment outcomes which are similar findings to a study in Kwahu West Municipality of

Ghana (Ansah, 2017). The type of TB patient in terms of new, relapse, defaulter and disease type in pulmonary can affect successful treatment outcomes.

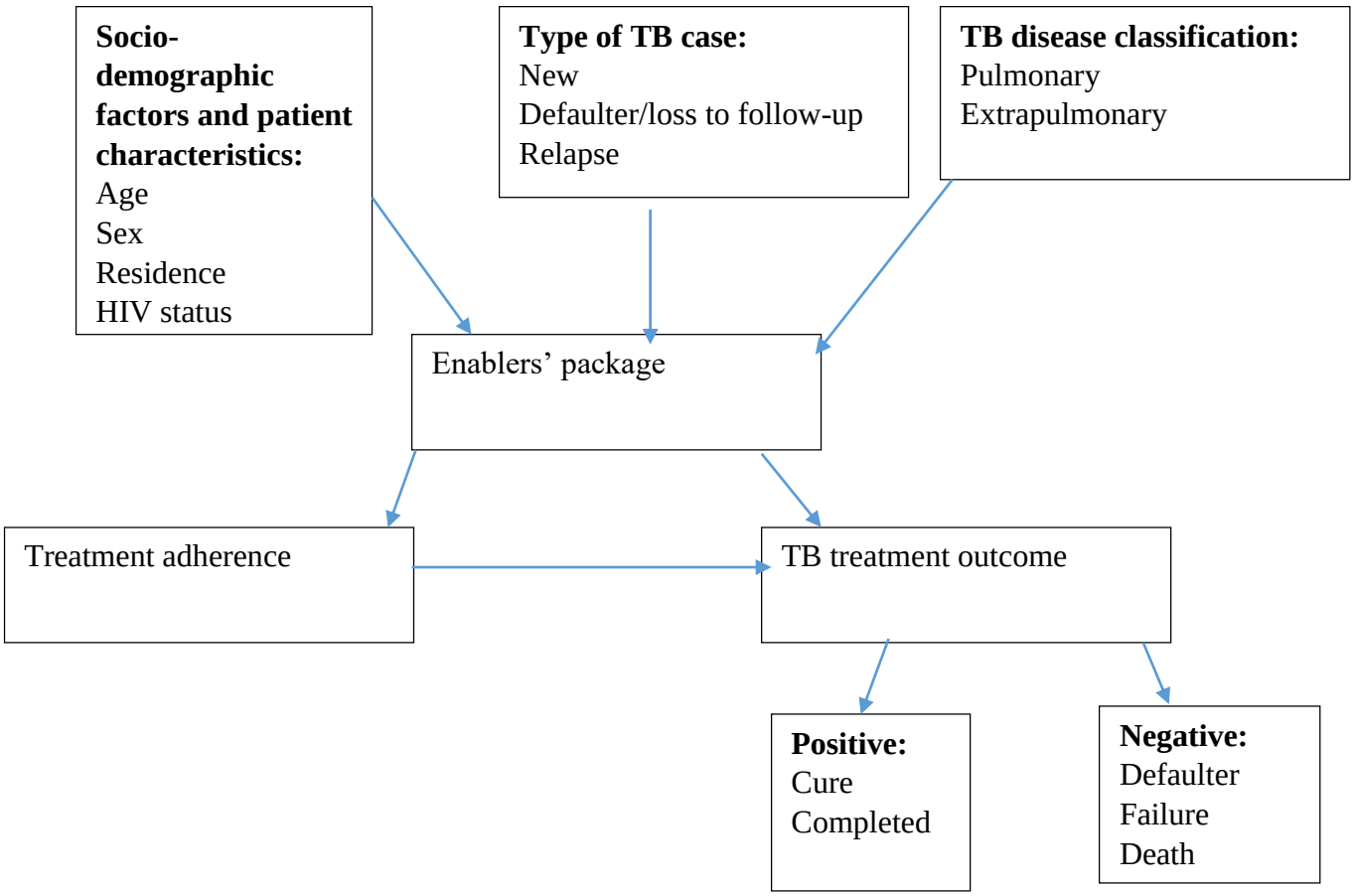

Figure 1: Conceptual framework of TB patient characteristics and enablers' package

It is hypothesized that TB patients who receive enablers should have good treatment outcomes. The enablers' package which serves a motivation to patients is supposed to ensure adherence to TB treatment and reduce defaulting among TB patients. Adherence to treatment is expected to result in good treatment outcomes such as cure and completed. Therefore patients who received the enablers' package between 2012 and 2014 are expected to have good treatment outcomes than those who did not receive same between 2015 and 2017.

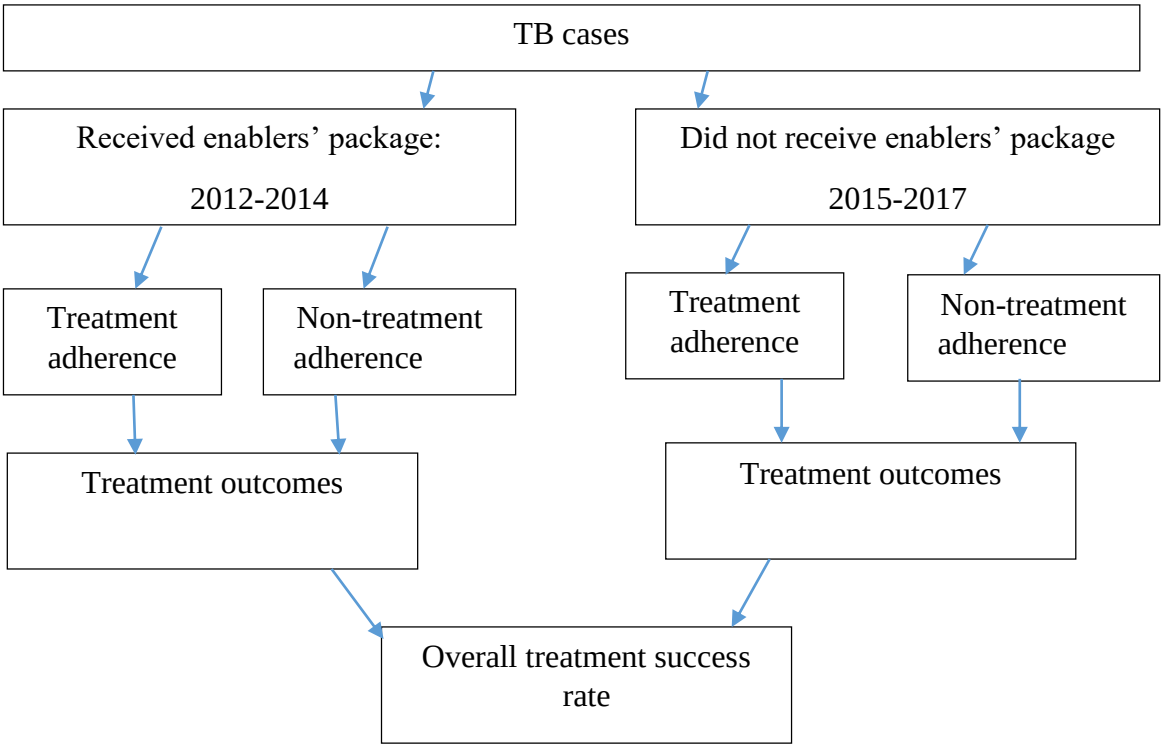

Figure 2: Conceptual framework of enablers' package and TB treatment adherence and outcomes

CHAPTER TWO

LITERATURE REVIEW

2.0 Economic burden of TB

Tuberculosis is a disease associated with poverty which imposes huge financial burden on TB patients and their families and the larger community. The End TB strategy has, among its milestone indicators to end the TB disease by 2035 proposed that no families affected by tuberculosis should face catastrophic costs from direct medical and direct non-medical costs and loss of income while under care. It wants TB patients and TB-affected families to have access to appropriate social protection programmes that can help to reduce the effect of direct non-medical costs and income losses (WHO, 2014).

Diagnosis and treatment of TB has been free over the years (WHO, 2015). However, TB patients incur a lot of costs, some of which are direct and indirect, during the cost of TB treatment for which reason there is the need to provide them social protection support in terms of cash transfers, food, insurance, transport cover (Tanimura, Jaramillo, Weil, Raviglione, & Lönnroth, 2014; WHO, 2015). In a three country study in Ghana, Viet Nam and Dominican Republic on direct and indirect cost of treatment among TB patients and households, (Mauch et al., 2013) observed that hospitalization and food items accounted for the bulk of direct expenses by TB patients and their families. They therefore suggested that TB patients should benefit from social protection interventions to help them have equitable access to TB care.

Blankson (2012) in a study on the economic burden of TB patients in the Western Region of Ghana found that TB had a catastrophic economic cost on TB patients and their households as well as the health system and proposed that a social protection safety nets be established to cushion them against high cost so as to ensure treatment completion among patients.

As part of efforts to end the TB epidemic, the WHO and partners launched the End TB Strategy in 2014 as was adopted by the World Health Assembly. Among the targets of the strategy are to reduce TB deaths by 95%, a 90% reduced TB incidence rate of less than 10 TB cases per 100, 000 population and 100% end to catastrophic costs attributable to TB on affected households, all by the year 2035 with 2015 as the reference year (WHO, 2014, 2015).

It is recognized that catastrophic costs can result in barriers to access and adherence to TB treatment and bring about negative health outcomes thereby increasing the danger of spreading the disease among the populace (Tanimura et al., 2014). In Ekurhuleni North Sub-District of South Africa, it was observed that 53% of TB patients encountered catastrophic direct cost due to the TB illness necessitating about 8% of them to adapt different coping strategies such as taking loans, selling of assets in order to survive (Mudzengi et al., 2017). Similar coping strategies as observed in a study in South Africa in addition to reducing budgets in education and housing were used by TB patients in Benin where nearly 72% of TB patients and their households faced huge costs in the TB treatment (Laokri, Dramaix-Wilmet, Kassa, Anagonou, & Dujardin, 2014).

Tuberculosis with other Neglected Tropical Diseases (NTD) have been described as poverty related diseases (WHO, 2013a). Poverty affects individuals and families' ability to access health care services in time for prompt treatment. The delays, probably occasioned by poverty leads to worsened health conditions at the time they might even visit the hospital. Financial challenges can affect adherence to and completion of TB treatment which may result in high default, treatment failures and resistant to first line TB drugs.

Treatment for TB as a chronic disease lasts for about six to 12 months and the drugs come with side effects. TB is a stigmatized disease for which reason people always do not want to be diagnosed for treatment to start. The stigma and side effects of drugs can affect treatment adherence and completion, therefore it has been argued that incentives and enablers can help individuals to avoid these challenges to adhere to and complete treatment (Bidonde & Fønhus, 2015).

Some studies have been done in South Africa on the effect of financial interventions to treatment adherence among TB patients in South Africa (Lutge, Lewin, & Volmink, 2014) and Brazil (Boccia et al., 2011) but about only two have been done in Ghana to evaluate the impact of economic support to TB treatment outcomes (Auer et al., 2009; Bonsu et al., 2007).

To help overcome the barriers including financial barriers associated with TB treatment, the MOH/GHS with support from the Global Fund for HIV, Malaria and TB introduced the enablers' package. In the context of TB Control programmes, enablers are things that make it easier for TB patients to receive and adhere to TB treatment by overcoming barriers such as transportation cost (Auer et al., 2009; Bonsu et al., 2007; CDC, 2014). The purpose of the TB enablers' package was ensure to improved access to TB care services by reducing treatment cost to TB patients and health workers/facilities so as to achieve treatment success in the country (Auer et al., 2009).

2.1 Proportion of treatment adherence and success among TB patients

A major barrier to the improvement of successful TB treatment outcomes related to socioeconomic factors that could affect a patient's ability to adhere to care or the effectiveness of treatment (Oliosi et al., 2019). Incentives are interventions that have been used to increase patient adherence to treatment of diseases or health conditions (Sutherland, Leatherman, & Christianson, 2008). Adherence to the treatment or management of a disease

or any health event is a form of an individual's behaviour which is influenced by the presence or absence of facilitators or barriers (Forson et al., 2018).

In order to ensure treatment adherence among TB patients, the WHO introduced a policy known as the Directly Observed Therapy Short course (DOTS) after declaring TB as a public health emergency by the World Health Assembly in 1993 (WHO, 2012; WHO Global Tuberculosis Programme, 1994). This policy has been implemented in the world by National TB Control Programmes which saw huge improvement in TB treatment outcomes.

A Brazilian national conditional cash programme in which newly diagnosed TB patients receiving cash transfers during treatment were compared with those receiving it after the end of treatment observed an 82% cure rate in the exposed group compared to about 77% in the unexposed group (Carter et al., 2017; Torrens et al., 2016). This findings are similar to those by Klein et al., (2019) in their prospective cohort study to evaluate a social protection policy on tuberculosis treatment outcomes in Argentina. They found that treatment success was 83% among the group which received conditional cash transfer compared to 69% among those who did not receive it and expectedly higher defaulter rate of 20% in the non-beneficiaries and 11% in the beneficiary patients.

A study comparing the impact of incentives on TB treatment outcomes in Moldova found that patients who received incentives got a better treatment success rate of 88% as against 79% for patients who did not receive incentives had treatment and contributed to reduction of unsuccessful treatment outcomes such as defaulter, death and failures (Ciobanu et al., 2014). It was therefore concluded that incentives were highly associated with improved anti-tuberculosis treatment outcomes with a recommendation for the incentive programme to be continued in the country (Ciobanu et al., 2014). It was further argued that the incentives

would potentially improve patient adherence and treatment retention, and ultimately reduce DR-TB in Moldova.

Also, a study in Brazil comparing TB treatment outcomes (cure and defaulter rates) between recipients of a social intervention programme (Bolsa Familia Programme) in which 196 patients were beneficiaries and 1043 non-beneficiaries found no significant difference (p=0·774) in cure rates between the two groups. A cure rate of 87% among the non-beneficiaries and 88% of the beneficiary patients was reported (Oliosi et al., 2019).

In a randomized controlled study assessing the impact of socioeconomic support on TB prevention and treatment in Peru, Wingfield et al., (2017) found that 64% of TB patients who received the standard TB treatment with socio-economic support as the intervention group had successful TB treatment as compared to 53% of the patients in the control group who received only the standard treatment care. These findings are lower than findings in Moldova where patients who received incentives in 2011 having treatment success rates of about 95% and 58% for those who did not receive (Ciobanu et al., 2014).

In a study among pulmonary TB patients in Shandong, China, it was reported that 16% of them did not adhere to anti-TB treatment likely due to factors as lack of treatment supervisor, no health education prior to commencement of treatment, marital status, financial indebtedness, working more than 8 hours per day and five days per week. The study also revealed that the Chinese government's policy of free TB drugs and X-ray tests for all TB patients did not influence treatment adherence, and the authors attributed that to the extra cost TB patients incurred in terms of check-ups during follow-up visits and transportation costs (Zhou et al., 2012).

According to an intervention study on the contribution of transportation and living allowances on treatment success rates among migrant TB patients in Shanghai, Lu et al.,

(2013) report of an increase in the proportion of treatment success rate from 60% at the beginning of the programme to 88% at the end of the intervention which was statistically significant ($p<0.001$). In Thailand, the treatment success rate among TB patients who received financial support from the Thai TB fund was found to be significantly higher than those who did not receive the support (69.3% vrs 51.6%; RR:1.35; 95% CI: 1.20–1.53; $P < 0.001$) (Ngamvithayapong-Yanai et al., 2013). In Kosovo, a study on TB treatment adherence between adherent and non-adherent groups of patients found that place of residence was associated with non-adherence to TB treatment as high level of non-adherence was in urban than rural areas (Krasniqi et al., 2017).

According to Tola et al., (2019), a five year retrospective review of TB data in two public hospitals in Eastern Ethiopia found a high proportion of treatment success of about 93% among TB patients which was possible from factors such as being a female, HIV negative status, a pre-treatment weight of 20-29kg and a new TB patient. In Mogadishu of Somalia, successful TB treatment of 82% was reported among TB patients though lower than the international standard of 85% (Ali, Karanja, & Karama, 2017).

In a non-randomised intervention study assessing the impact of economic support intervention on tuberculosis treatment outcomes in rural Nigeria, Ukwaja et al., (2017) report that 86% of patients who received the standard TB care with financial incentives had successful treatment compared to 71% of patients who received on the standard treatment care. A study in Southern Ethiopia found an overall prevalence of non-adherence to anti-TB treatment among TB patients in public health facilities to be about 25% (Woimo, Yimer, Bati, & Gesesew, 2017). Gebremariam, Bjune, & Frich (2010) in their study on barriers and facilitators of adherence to TB treatment in Addis-Ababa observed that provision of food and financial support could lead to treatment adherence among TB patients while acknowledging

barriers to treatment adherence to include side effects, burden of TB pills, stigma, no disclosure and communication with health workers. While the study made significant observations, it must be noted that it was a qualitative study where in-depth interviews were done among fifteen TB/HIV clients and nine health workers.

In a study on non-adherence to anti-tuberculosis treatment, reasons and associated factors among TB patients attending at Gondar town health centres in Northwest Ethiopia, it was found that the overall rate of non-adherence was 21.2% with return-after-defaulting treatment highest at 47% whilst new patients recorded the lowest rate of 19.1% (Mekonnen & Azagew, 2018). The reasons attributed to the high non-adherence rate were forgetfulness, busy at work and traveling out of town. The TB treatment non-adherence rate of 19.1% among new patients in this study is almost similar to that of a study in Bala and Malabo provinces of Equitorial Guinea which recorded a 17.8% (Fagundez et al., 2016).

In a study on factors influencing adherence to tuberculosis treatment in Asmara in Eritrea, it was found that lack of financial or social support in about fifty percent of TB patients affected adherence to TB treatment (Gebreweld et al., 2018). When patients themselves perceive that they will face serious health consequences and social isolation as a result of the TB disease, they are likely to adhere to treatment instructions to be fully cured (Salifu, Eliason, & Mensah, 2017).

2.2 Contribution of incentives (enablers) to successful TB treatment outcomes

.In a study to estimate the impact of transportation subsidies and living allowances on TB treatment outcomes in Shanghai, China, it was found that there was an 18.9% increase in treatment success rate between before intervention and after intervention groups. The authors therefore concluded that transportation subsidies and living allowances contributed to the improvement of TB treatment success among internal migrants TB cases in Shanghai (Lu et

al., 2013). While this study found a positive impact of enablers support on TB treatment outcomes, a similar study on the effect of incentives on TB treatment in Shanxi of China found the contrary. It was observed that 70% of patients who received financial incentives had improvement in treatment outcomes as compared to 99% of the patients who did not receive the incentives. The conclusion of the study was that provision of incentives was not effective in TB control possibly due to lack of operational tools or that influential health systems went unaddressed (Yao et al., 2008).

Financial support has been found to improve treatment adherence and outcomes among MDR-TB patients in Zhejiang in Eastern China where 78% of patients who received financial support had successful treatment outcomes (Yin, Wang, Zhou, & Wei, 2018). Similarly, in Shanghai of China, a community intervention study on the impact of transportation and living allowances on treatment outcomes among internal migrant TB patients reported almost 19% increase in TB treatment success rate between the project and non-project districts attributable to the intervention (Lu et al., 2013). The authors concluded that giving transportation and living allowances to TB patients contributed greatly to treatment outcomes and recommended getting sustainable means and collaboration with other stakeholders to reduce the burden of TB patients.

In Brazil, national conditional cash programme in which TB patients who benefited from the cash transfer were found to be 7% better likely to have TB cure than those who did not receive the cash benefit. The authors therefore suggested that the cash transfer programme could lead to better TB cure rates in Brazil (Carter et al., 2017; Torrens et al., 2016). Also, Oliosi et al., (2019) argue that a 7·6% higher cure rate was recorded among beneficiary TB patients of the Bolsa Familia Programme group than the comparison group which was likely linked to a 7% lower drop-out rate in the BFP group. The conclusion by the authors was that

of a marginal direct effect on treatment outcomes due to the programme and recommended its expansion to cover families with low socio-economic status in addition to targeted TB patients. A similar study in Argentina found that TB patients who registered for a conditional cash transfer had higher odds of treatment success compared to those not on the programme (OR 2.9, 95%CI 2-4.3, p<0.001:) (Klein et al., 2019). It was concluded that the cash transfer programme increased treatment success by 15% (95%CI: 9%-21%) while defaulter rate was reduced by about 13% (95%CI:-8%, 18%).

An interventional study in Swaziland on the effect of incentivised treatment supporters on TB treatment outcomes found that financial incentives for treatment supporters significantly improved treatment outcomes among TB patients where treatment success rate of 60% in those who did not receive financial incentives was lower than the 73% in those who received them (Kliner et al., 2015). Similarly, a study in Ebonyi State of South-East Nigeria revealed that 71% of TB patients who did not receive financial incentives except the standard care (control group) had successful tuberculosis treatment as compared to 86% of patients who received the standard TB care and financial incentives (the intervention group) (Ukwaja et al., 2017). The two studies concluded that financial incentives appeared to have an impact on TB treatment outcomes. However, there exist differences between the two studies in terms of study participants: whereas the study in Swaziland collected data on the treatment supporters, the Nigerian study collected data on the TB patient themselves to assess treatment outcomes. This makes it unlikely that the impact of the characteristics of the treatment supporters on TB patients' uptake of ant-TB drugs were factored. The Nigerian study observed that financial incentives increased TB treatment success by 21% justifying the effectiveness of such programmes and recommended the expansion of the programme as policy to low economic settings (Ukwaja et al., 2017).

2.3 Factors associated with TB treatment adherence and treatment success.

2.3.1 Socio-economic factors

Socio-demographic and clinical characteristics of TB patients in many studies have been established to be associated with TB treatment outcomes. In Moldova, a study comparing financial incentive recipients and non-recipients observed that place of residence and age greatly influenced successful TB treatment (Ciobanu et al., 2014). In Armenia, it was found that satisfaction with the provision of social support such as cash, food packages, transportation cost subsidies resulted in good treatment outcomes among TB patients (Davtyan et al., 2015).

Social support ($p<0.001$) and financial support ($p<0.001$) are factors to have association with treatment success in a study assessing the relationship between social support, treatment interruption and treatment outcome in patients with multidrug-resistant tuberculosis in China (Yin et al., 2018). According to Ukwaja et al., (2017), TB patients receiving financial incentives had higher odds of improved TB treatment outcomes than those who did not receive the incentives in rural Nigeria. They further observed that financial incentives in particular contributed to a three-quarters reduction in defaulting among TB patients.

In Ghana, it has been found that good family support in the form of financial and material assistance to TB patients greatly improved adherence to treatment and possible successful outcomes in the Sekyere South District of Ashanti Region (Salifu, Eliason, & Mensah, 2016).

2.3.2 Patient-related factors

Adherence to TB medication ($p<0.001$) was found to be highly associated with TB treatment success rates in the Chinese. In assessing factors affecting successful treatment outcomes in pulmonary tuberculosis in Turkey, (Sengul et al., 2015) report of young age being significantly associated with successful treatment comes compared to patients older than 55

years who had about 2.5 folds higher odds of unsuccessful treatment. This agrees with (Tola et al., 2019) in Northwest Ethiopia. Successful treatment outcomes have reported to have been influenced by educational level and marital status in Mogadishu where the authors reported that illiterates had lesser odds of successful treatment (OR: 4.1, 95% CI 1-15.9) whilst married couples had 3 fold higher odds of successful treatment (OR:3, 95%CI:0.1-0.6) (Ali et al., 2017). According to Ukwaja et al., (2017), being female (aOR: 1.9, 95%CI: 1.1-3.4, p=0.04) and HIV negative (aOR: 2.5 95%CI:1.2–5.3, p=0.02) increase the odds of a TB patient greatly improving treatment in rural Nigeria.

2.3.3 Clinical characteristics of TB patients

The clinical state of a TB patient has a great impact on whether he or she will successfully complete treatment. Smear positive sputum and HIV results at the start of TB treatment significantly influenced treatment success among TB patients who received financial support in Moldova (Ciobanu et al., 2014). Clinical features of TB are known to predict successful treatment. TB patients with history of previous anti-TB treatment had lower odds of successful treatment as reported in Turkey (Sengul et al., 2015). Patients with pulmonary TB (positive and negative) in the Gambella Regional State, Ethiopia were more likely to have successful treatment compared with extrapulmonary TB patients (Ejeta, Beyene, Balay, Bonsa, & Abebe, 2018).

A retrospective study among tuberculosis patients at Gondar University Teaching Hospital in Northwest Ethiopia found females, young aged 15-24 years old, smear positive pulmonary TB patient and the urban residence status of a TB patient to be associated with higher treatment success rate (Tessema et al., 2009). While these studies found females and youthful age of TB patients to be associated with improved TB treatment success, a study in the two cities of Equatorial Guinea found the contrary where no difference between sex and age groups existed in treatment success rates (Fagundez et al., 2016). About 46% of relapse

patients were not adherent to TB treatment in the Equatorial Guinean study (Fagundez et al., 2016).

Similar finding of females and TB/HIV non-infected being highly associated with successful treatment has been reported in Gambella Regional State of Ethiopia (Ejeta et al., 2018); Mogadishu (Ali et al., 2017). These studies contradict others in Northwest Ethiopia (Sinshaw, Alemu, Fekadu, & Gizachew, 2017) who reported HIV/TB co-infected patients having 65% lower odds of successful treatment similar to that of (Adane, Alene, Koye, & Zeleke, 2013) that HIV status of a TB patient (TB/HIV co-infection) highly increases the chances of non-adherence to anti-TB treatment in the North Gondar zone of northwest Ethiopia.

CHAPTER THREE

METHODS

3.1 Study Design

A retrospective analytical cross-sectional non-interventional study involving quantitative data collection procedures with structured questionnaire was used for the study in the Central Region. The study collected data on treatment outcomes to find out if there was a difference in treatment outcomes during and after the introduction of the enablers' package in the Central Region.

This involved the retrospective records review of all registered TB cases during 2012-2017. Five districts- Assin North, Mfantseman, Awutu Senya, Gomoa West and Upper Denkyira West were randomly selected for the study. According to CDC, retrospective cohort review can be done annually, biannually or quarterly and it helps to monitor the progress of treatment outcomes in the cohort group and also to identify programme challenges (CDC, 2014).

3.2 Study Area

The study was conducted in five districts of the Central Region of Ghana. The Region occupies a land area of 9,826 square kilometres constituting about 4.1 percent of the total land area of Ghana, and the third smallest in area after Greater Accra and Upper East (Ghana Statistical Service, 2013). The capital of the Central Region is Cape Coast which was formerly the administrative capital of the Gold Coast, now Ghana. The region has a population of 2,518,616 (projection from the 2010 Population and Housing Census). There are twenty-two (22) Metropolitan (Cape Coast), Municipal and District Assemblies (MMDAs) in the region of which two new ones were created in 2018. The Central Region shares boundaries with the Western Region to the west, Greater Accra Region to the east, Ashanti and Eastern Regions to the north and the Gulf of Guinea to the south.

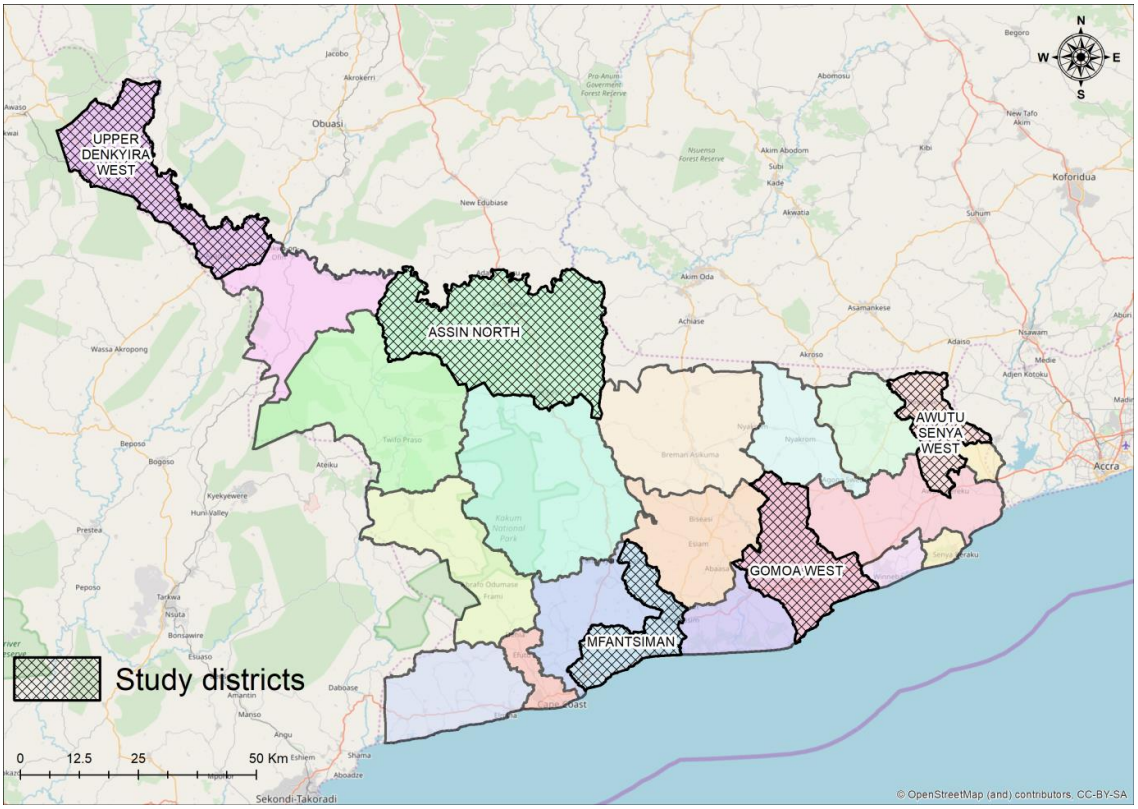

Figure 3: Map of Central Region showing study districts; Credit: Winfred Dotse, 2019.

3.3 Variables of the Study

The dependent variable for the study was TB treatment success. The successful treatment outcomes were classified into two: positive outcomes which comprised cure and treatment completion, and negative outcome which comprises defaulter, treatment failure, transfer out and death.

The independent variables of the study treatment adherence, socio-demographic characteristics of the patients such as age, sex, place of residence (rural or urban), and HIV status (positive, negative, not done), treatment supporter, receiving the enablers' package and any other support. Also the type of TB disease (pulmonary positive and pulmonary negative) and type of TB patient (new, relapse, treatment after failure, treatment after default, transfer in and other previously treated) and the treatment category (category I, II and paediatric) were all independent variables.

Table 1: Explanation of variables

Variable	Operational definition	Scale measurement	Source of data
Age	Age as at last birthday	Continuous (years)	TB register
Gender	Male or female	Nominal	TB register
Residence	Respondent's place of residence obtained from the address of the patient and categorized as rural or urban	Nominal	TB register/ Questionnaire
Type of TB	Whether it is pulmonary positive, pulmonary negative or extra-pulmonary	Nominal	TB register
Type of patient	Whether a new patient or retreatment	Nominal	TB register
Treatment category	Whether it is Cat I, Cat II or Paediatric	Nominal	TB register
Treatment supporter	Someone who assists a TB patient to take his medication and provides other assistance	Nominal	TB register
Treatment adherence	Patient completing treatment according to schedule including timely lab results	Nominal	TB register
Treatment success	**successful** (cured or completed) or **poor** (default, failure, death)	Nominal	TB register
HIV status	Positive, negative and not done	Nominal	TB register

3.4 Sampling

The study was carried out in five districts that were in existence before 2012. Out of the 22 districts in the Central Region, 16 met the criteria of being in existence before 2012. The names of all the 16 districts were written on pieces of paper in no order of importance and put into a bowl. The papers were thoroughly shaken to ensure uniform mix of the papers. A research assistant picked without replacement from the bowl the first district. The process was repeated until the other four districts were selected. At the selected districts, total

sampling (census) was used where records review of all registered TB patients in the District TB Register was done. Review covered two periods: 2012-2014 (enablers) and 2015-2017 (no enablers).

3.4.1 Study Population

The study population for the study was TB patients registered for treatment in five districts in the Central Region which were in existence before 2012.

3.4.2 Sample size

All TB patients on treatment and registered in the District TB registers except MDR-TB cases.

3.5 Inclusion and exclusion Criteria

3.5.1 Inclusion criteria

All TB patients who were registered in the District TB Register from 2012-2017 and had treatment outcomes evaluated.

3.5.2 Exclusion Criteria

All MDR-TB cases were excluded because they were the only category of TB patients still benefitting from the financial enablers' package. All extra-pulmonary TB (EPTB) cases were also excluded.

3.6 Data collection Procedure

Data was extracted from records of registered TB patients. A data collecting tool was used to collect data on TB patient characteristics as captured in the District TB registers. The principal investigator and four research assistants extracted information on patients' demographic characteristics, treatment adherence patterns, treatment outcomes, HIV status, type of TB patient at start of treatment, classification of the TB disease, category of TB treatment.

3.7 Data collection instrument

A structured data extraction tool (Appendix I) was designed with Microsoft Office Excel for the data collection. The data extracted from the TB register were entered directly into a laptop by the researcher and his assistants.

3.8 Data processing

The data were then thoroughly cross-checked according to the districts before merging them into a regional data and exported into Stata Version 15 (StataCorp, College Station, Texas, USA) for further statistical analysis.

3.9 Data analysis

Data was analysed using Stata Version 15 (StataCorp, College Station, Texas, USA). The demographic characteristics of patients and each objective were analysed using different statistical approaches as below:

Descriptive statistics were summarized as frequencies and proportions for categorical variables and mean (SD) for continuous variables.

Two-sample test of proportions was used to compare the proportion of successful TB treatment between patients who received enablers' package and those who did not. The estimated proportion of TB patients having successful TB treatment was presented with the confidence intervals of the point estimates.

Treatment to adherence was assessed by taking the difference in days between initiation of anti-TB treatment and date of treatment completion. While (Kayigamba et al., 2013; Xu et al., 2009) used number of doses taken by patients where good adherence was defined as patients taking more 90% of their medications and measured treatment adherence as the expected number of doses to mean "the number of days between the start of treatment and the date of treatment completion", this study also used the duration between treatment initiation

and completion to measure adherence. Any patient taking longer than expected duration to have a treatment outcome was considered non-adherent.

The study reviewed non-randomized data on TB patients who received enablers' package and those who did not receive. Propensity score matching (PSM) was used to the estimate the treatment effects controlling for the existence of confounding factors based on the idea that the bias was reduced by comparing the outcomes of treatment success between the enablers' TB patients (treated) and the non-enablers' TB patients (comparison subjects). The propensity score is the probability of assigning treatment conditional on observed baseline characteristics and allows one to design and analyze an observational (non-randomized) study so that it mimics some of the particular characteristics of a randomized controlled trial (Austin, 2011).

Graphs such as Cumulative PS curve, PS Whisker plot, Kernel density curve, PS histogram were used to assess the level of imbalance or mismatch in covariates between enablers (intervention) and comparison (non-enablers) groups to evaluate the quality of matching. Cumulative PS curve, PS Whisker plot, Kernel density curve, PS histogram and covariates imbalance graphs assessed the matching to be of good quality before and after matching. The contribution of the enablers' package was estimated by using PSM 1:1 and 1:2 (one to one and one to two covariates) on the outcome (treatment success). The average treatment effect (ATE), was used to estimate the effect of the enablers' package on both the enablers' and non-enablers' TB patients whilst the average treatment on the treated (ATET) was used for only the enablers' TB patients.

The Pearson's Chi Square test was used for bivariate analysis to determine the factors associated with treatment success. Multiple Logistic regressions analysis were used to determine factors that were independently associated with TB treatment success. Factors with

a p-value<0.20 at bivariate analysis were considered for multiple logistic regression analysis Variables with p-value>0.20 but found to be significant from literature review were also added for the logistic regression analysis. In the final model factors with p-value ≤0.05 were considered to be significant predictors of TB treatment success.

3.10 Ethical Consideration

The study obtained ethical clearance from Ghana Health Service Ethics Review Committee with Reference: GHS-ERC 070/02/19 (Appendix II) through the School of Public Health, University of Ghana. Permission was obtained from the Central Regional Directorate of the Ghana Health Service (Appendix III) to conduct the study in the five districts of the region. Data would not to be shared with unauthorized third parties. Research Assistants were trained and given ID cards for the data collection. Names of patients in the registers were not captured. The data is solely for academic purposes and will not be used for another study without seeking ethical approval from the GHS Ethics Review Committee. The data will be stored for at least five years in line with GHS data storage policy after which it can be discarded.

3.10.1 Informed consent

Informed consent was sought from the District Directors of Health Service (DDHS) and District TB control officers to have access to the District Registers.

3.10.2 Duration of data collection

The study interview lasted between two to three days depending on the number of registered patients in each district.

3.10.3 Potential Risks

The study took a lot of time of the research assistants who were officers at the district health directorates (DHD). This was likely to disrupt their activity schedule for the period.

3.10.4 Benefits

There was no direct benefit to study for participants.

3.10.5 Costs to participants

No cost was directly incurred by registered TB patients as only their data was extracted from the district TB registers.

3.10.6 Compensation

No compensation was paid for the use of data. Messages of appreciation were extended to DDHS for their permission and to the research assistants who were officers at the DHD for helping out in the data collection.

3.10.7 Confidentiality

All information gathered from the study were treated with utmost confidentiality. Data was extracted using Microsoft Excel. The names of TB patients, treatment supporters, programme officers were not extracted. Data is for academic purpose only and will not be used for any other study elsewhere without seeking ethical approval from the Ghana Health Service Ethics Review Committee.

3.10.8 Sharing of participants Information/Data

Data generated from the study, was kept by the investigator through his email and will be destroyed after three years if no further need for it. It will not be shared with unauthorized institution(s) or individuals. Copy of the findings from the study be shared with the Central Regional Health Directorate or presented during its annual performance review meetings in early 2020.

3.10.9 Provision of Information and Consent for participants

District Directors of Health Service provided consent to the study as they were informed by the Regional Director of Health Services about the study through a letter dated 10th December, 2018 (Appendix VI).

3.10.10 Declaration of conflict of interest

The principal investigator does not have any interest to declare in the study.

CHAPTER FOUR

RESULTS

A total of 2,127 TB patient data were attracted and 2,087 were used for analysis.

4.1: Socio-demographic and clinical characteristics of TB Patients

The highest number of cases (491) was registered in 2012 with Mfantseman District recording the highest number of TB patients (630) during the period under review. As shown in Table 2, majority [21%, (442/2087)] of the TB patients were in the age group of 35-44 years with a median age of 40 years, 64.2% (1339/2087) were males. Also, 55.9% (1166/2087) of the TB patients were from rural areas.

***Table 2**: Socio-demographic characteristics of TB patients*

Variable	**N=2087; n (%)**			**X^2**	**p-value**
	2012-2014	**2015-2017**	**total**		
Districts					
Assin North	297 (59.0)	206 (41.0)	503		
Awutu Senya	195 (52.3)	178 (42.7)	373		
Gomoa West	174 (53.5)	151(46.5)	325		
Mfantseman	359 (57.0)	271(43.0)	630		
UDW	154 (60.2)	102 (39.8)	256		
Registration year				9.7497	0.083
2012	-	-	491 (23.5)		
2013	-	-	347 (16.6)		
2014	-	-	341 (16.3)		
2015	-	-	314 (15.1)		
2016	-	-	297 (14.2)		
2017	-	-	297 (14.2)		
Age group (years)					
Mean (SD): 42.1 (17.4)					
Median: 40				16.2796	0.001*
<15	34 (61.8)	21(38.2)	55		
15-24	161(54.8)	133 (55.2)	303		
25-34	231(56.9)	175 (43.1)	412		
35-44	265 (60.9)	170 (39.1)	442		
45-54	226 (55.7)	180 (44.3)	411		
55-64	112 (47.9)	122 (52.1)	236		
65+	150 (58.4)	107 (41.6)	260		
Sex				4.1539	0.042*
Female	424 (56.7)	324 (43.3)	748		
Male	755 (56.4)	584 (43.6)	1339		
Residence				19.8892	<0.001*
Rural	641 (55.0)	525 (45.0)	1166		
Urban	538 (58.4)	383 (41.6)	921		

*UDW=Upper Denkyira West, %=row percentages; SD= standard deviation; *significant at p<0.05*

Table 3 provides clinical information of the TB patients. About 94% (1,957/2087) of the TB patients were new cases on enrolment, 66% (1367/2087) were pulmonary positive cases. Only 11% (235/2087) of them were HIV positive and 64% (1326/2087) were non-adherent to TB treatment whilst 76% (1586/2087) reportedly had treatment supporters to assist them in the management of the disease.

***Table 3**: Clinical characteristics of TB patients in Central Region, 2012-2017*

Variable	Enablers (2012-2014) (n=1,179)	No enablers (2015-2017) (n=908)	N=2087	χ^2	p-value
Type of TB patient on enrolment				5.2424	0.022*
New	1,112 (94.3)	845 (93.1)	1957		
Retreatment	67 (5.7)	63 (6.9)	130		
TB disease classification				16.3107	<0.001*
Pulmonary negative	425 (36.0)	295 (32.5)	720		
Pulmonary positive	754 (64.0)	613 (67.5)	1367		
Category of treatment				5.5939	0.061
Category 1	1102 (93.5)	836 (92.1)	1938		
Category 2	67 (5.7)	63 (6.9)	130		
Category 3	10 (0.8)	9 (1.0)	19		
HIV status				49.3075	<0.001*
Negative	923 (78.3)	663 (73.0)	1586		
Positive	102 (8.7)	133 (14.7)	235		
Not done	154 (13.0)	112 (12.3)	266		
TB Treatment supporter				0.5387	0.463
No	323 (27.4)	73 (8.0)	396		
Yes	856 (72.6)	835 (92.0)	1691		
Received enablers' package				0.1415	0.707
Yes	1179 (100)	0 (0.00)	1179		
No	0 (0.00)	908 (100)	908		
Received other additional support				3.2124	0.073
No	1082 (91.8)	393 (43.3) 515	612		
Yes	97 (8.2)	(56.7)	1475		
Treatment adherence				560.1435	<0.001*
Non-adherent	454 (38.5)	307 (33.8)	1326		
Adherent	725 (61.5)	601 (66.2)	761		

Column percentages

4.2 Proportion of tuberculosis treatment success in the Central Region

From Table 4, TB treatment success was lowest in Upper Denkyira West District among TB patients with successful TB treatment. The highest TB success rate was in 2012 (22.8%). In

Table 4, more males (63%) than females (37%) had successful TB treatment whiles rural areas have better treatment success than urban areas (58% versus 42%). Also, TB patients with treatment supporters had slightly better successful treatment than those without (84.3% versus 82.8%).

***Table 4**: Patient characteristics and treatment success in Central Region, 2012-2017*

	Treatment success		
	Successful, N=1754 n (%)	**Poor, N=333 n (%)**	**Total=2087**
Districts			
Assin North	423 (24.1)	80 (24.0)	**503**
Awutu Senya	310 (17.7)	63 (18.9)	**373**
Gomoa West	288 (16.4)	37 (11.1)	**325**
Mfantseman	497 (28.3)	133 (39.9)	**630**
Upper Denkyira West	236 (13.5)	20 (6.0)	**256**
Year of registration			
2012	399 (22.8)	92 (27.6)	**491**
2013	296 (16.9)	51 (15.3)	**347**
2014	299 (17.0)	42 (12.6)	**341**
2015	272 (15.5)	42 (12.6)	**314**
2016	244 (13.9)	53 (15.9)	**297**
2017	244 (13.9)	53 (15.9)	**297**
Age group (years)			
<15	44 (2.5)	11 (3.3)	**55**
15-24	265 (15.1)	29 (8.7)	**294**
25-34	354 (20.2)	52 (15.6)	**406**
35-44	356 (20.3)	79 (23.7)	**435**
45-54	336 (19.2)	70 (21.0)	**406**
55-64	198 (11.3)	36 (10.8)	**234**
65+	201 (11.5)	56 (16.8)	**257**
Sex			
Female	645 (36.8)	103 (30.9)	748
Male	1,109 (63.2)	230 (69.1)	1,339
Residence			
Rural	1,017 (58.0)	149 (44.7)	**1,166**
Urban	737 (42.0)	184 (55.3)	**921**
Type of TB patient on enrolment			
New	1,654 (94.3)	303 (91.0)	**1,957**
Retreatment	100 (5.7)	30 (9.0)	**130**
TB disease classification			
Pulmonary negative	573 (32.7)	147 (44.1)	**720**
Pulmonary positive	1,181 (67.3)	186 (55.9)	**1,367**
Category of treatment			
Category 1	1,637 (93.3)	301 (90.4)	**1,938**
Category 2	100 (5.7)	30 (9.0)	**130**
Category 3	17 (1.0)	2 (0.6)	**19**
HIV status			
Negative	1,378 (78.6)	208 (62.5)	**1,586**
Positive	189 (10.8)	46 (13.8)	**235**
Not done	187 (10.7)	79 (23.7)	**266**
TB Treatment supporter			
Yes	1,426 (81.3)	265 (79.6)	**1,691**
No	328 (8.7)	68 (20.4)	**396**

From Table 5, TB patients in Upper Denkyira West District who received the enablers' package had highest treatment success, same as among TB patients who did not receive the enablers compared to the other four districts. Mfantseman reported the lowest treatment among patients in the enablers' group and the non-enablers group (77.7% vrs 19.6%). Females in the non-enablers' group had better treatment success than those in the enablers' group (87.7% versus 85.1%). TB patients in rural areas who received the enablers package recorded slightly better treatment success (87.7%) compared to patients in the rural areas who did not receive the enablers (86.7%). Also, in Table 5, treatment success was better in new TB patients who did not receive the enablers' package compared to the new patients who received the enablers' package (85% versus 84.2%).

***Table 5**: Level of treatment success by patient characteristics and enablers' versus no enablers' package*

	Enablers			No enablers		
Variable	**Successful Treatment, n(%)**	**Unsuccessful Treatment, n(%)**	**Total**	**Successful Treatment, n(%)**	**Unsuccessful Treatment, n(%)**	**Total**
Districts						
Assin North	252(84.9)	45(15.2)	297	171(83.0)	35(17.0)	206
Awutu Senya	156(80.0)	39(20.0)	195	154(86.5)	24(13.5)	178
Gomoa West	161(92.5)	13(7.5)	174	127(84.1)	24(15.9)	151
Mfantseman	279(77.7)	80(22.3)	359	218(80.4)	53(19.6)	271
UDW	146(94.8)	8(5.2)	154	90(88.2)	12(11.8)	102
Year of registration	399(81.3)	92(18.7)	491	0(0.0)	0(0.00)	491
2012	296(85.3)	51(14.7)	347	0(0.0)	0(0.00)	347
2013	299(87.7)	72(12.3)	341	0(0.0)	0(0.00)	341
2014	0(0.0)	0(0.0)	0(0.0)	272(86.6)	42(13.4)	314
2015	0(0.0)	0(0.0)	0(0.0)	244(82.2)	53(17.9)	297
2016	0(0.0)	0(0.0)	0(0.0)	244(82.2)	53(17.9)	297
2017						
Age group (years)						
<15	28(82.4)	6(17.6)	34	16(76.2)	5(23.8)	21
15-24	138(85.7)	23(14.3)	161	127(95.5)	6(4.5)	133
25-34	198(85.7)	33(14.3)	231	156(89.1)	19(10.9)	175
35-44	215(81.1)	50(18.9)	265	141(82.9)	29(17.1)	170
45-54	197(87.2)	29(12.8)	226	139(77.2)	41(22.8)	180
55-64	98(87.5)	14(12.5)	112	100(82.0)	22(18.0)	122
65+	120(80.0)	30(20.0)	150	81(75.7)	26(24.3)	107
Sex						
Female	361 (85.1)	63 (14.9)	424	284(87.7)	40 (12.3)	324
Male	633 (83.8)	122 (16.2)	755	476 (81.5)	108 (18.5)	584

Table 5 continued						
Residence						
Rural	562(87.7)	79(12.3)	641	455(86.7)	70(13.3)	525
Urban	432(80.3)	106(19.7)	538	305(79.6)	78(20.4)	383
Type of TB patient on enrolment						
New	936(84.2)	176(15.8)	1,112	718(85.0)	127(15.0)	845
Retreatment	58(86.6)	9(13.4)	67	42(66.7)	21(33.3)	63
TB disease classification						
Pulmonary negative	345(81.2)	80(18.8)	425	228(77.3)	67(22.7)	295
Pulmonary positive	649(86.1)	105(13.9)	754	532(86.8)	81(13.2)	613
Category of treatment						
Category 1	927(84.1)	175(15.9)	1,102	710(84.9)	126(15.1)	836
Category 2	58(86.6)	9(13.4)	67	42(66.7)	21(33.3)	63
Category 3	9(90.0)	1(10.0)	10	8(88.9)	1(11.1)	9
HIV status						
Negative	804(87.1)	119(12.9)	923	574(86.6)	89(13.4)	663
Positive	80(78.4)	22(21.6)	102	109(82.0)	24(18.0)	133
Not done	110(71.4)	44(28.6)	154	77(68.8)	35(31.2)	112
TB Treatment supporter						
Yes	725(84.7)	131(15.3)	856	701(84)	134(16.0)	835
No	269(83.3)	54(16.7)	323	59(80.8)	14(19.2)	73
Additional support						
Yes	86(88.7)	11(11.3)	97	442(85.8)	73(14.2)	515
No	908(83.9)	174(16.1)	1,082	318(80.9)	75(19.1)	393
Treatment adherence						
Adherent	711(98.1)	14(1.9)	725	594(98.8)	7(1.2)	601
Non-adherent	283(62.3)	171(37.7)	454	166(54.1)	141(45.9)	307

%=row percentages; UDW= Upper Denkyira West

As shown in Table 6, 84.3% of TB patients who received the enablers' package had successful TB treatment (95%CI: 82.1-86.3). Proportion of TB treatment success among TB patients who did not receive enablers' package was 83.7% (95%CI 81.2-86.0). The difference in treatment success rates between the enablers' group and the non-enablers group is not statistically significant (p-value=0.707).

Table 6: Proportion of treatment success among TB patients with enablers versus those without enablers' package in Central Region, 2012-2017

Treatment success (N=1,754)	**Proportion**	**p-value**	**95% Confidence interval**
Enablers	84.3 (994/1,179)		82.1-86.3
No enablers	83.7 (760/908)		81.2-86.0
		0.707	

The results as in Table 7 show that TB cure rate was about 50% (589/1,179) in the enablers period with treatment success rate at 84.3% (994/1,179) whilst the rate and treatment success rate in the non-enablers period were 53.1% and 83.7% respectively. The death rate of 11% (107/908) and defaulter rate of 3.6% (33/908) were reported in the non-enablers group compared to the death rate of 10.4% (13/1,179) and defaulter rate of 3.1% (37/1,179) respectively.

Table 7: *Tuberculosis treatment outcomes in the Central Region, 2012-2017*

Variable	**Enablers' n=1,179**	**No enablers n=908**	**Total=2,087 n (%)**
Treatment outcome			
Cured	589 (50.0)	482 (53.1)	1071 (51.3)
Completed treatment	408 (34.6)	280 (30.8)	688 (33.0)
Death	123 (10.4)	107 (11.8)	230 (11.0)
Defaulter	37 (3.1)	33 (3.6)	70 (3.4)
Transfer out	16 (1.4)	2 (0.22)	18 (0.9)
Failure	4 (0.51)	6 (0.41)	10 (0.71)
TB treatment success			
Successful	994 (84.3)	760 (83.7)	1754 (84.0)
Poor	185 (15.7)	148 (16.3)	333 (16.0)

%=Column percentages

Figure 4 shows that adherence to TB treatment increased from 54% in 2012 to 74% in 2015 and reduced drastically to 60% in 2016.

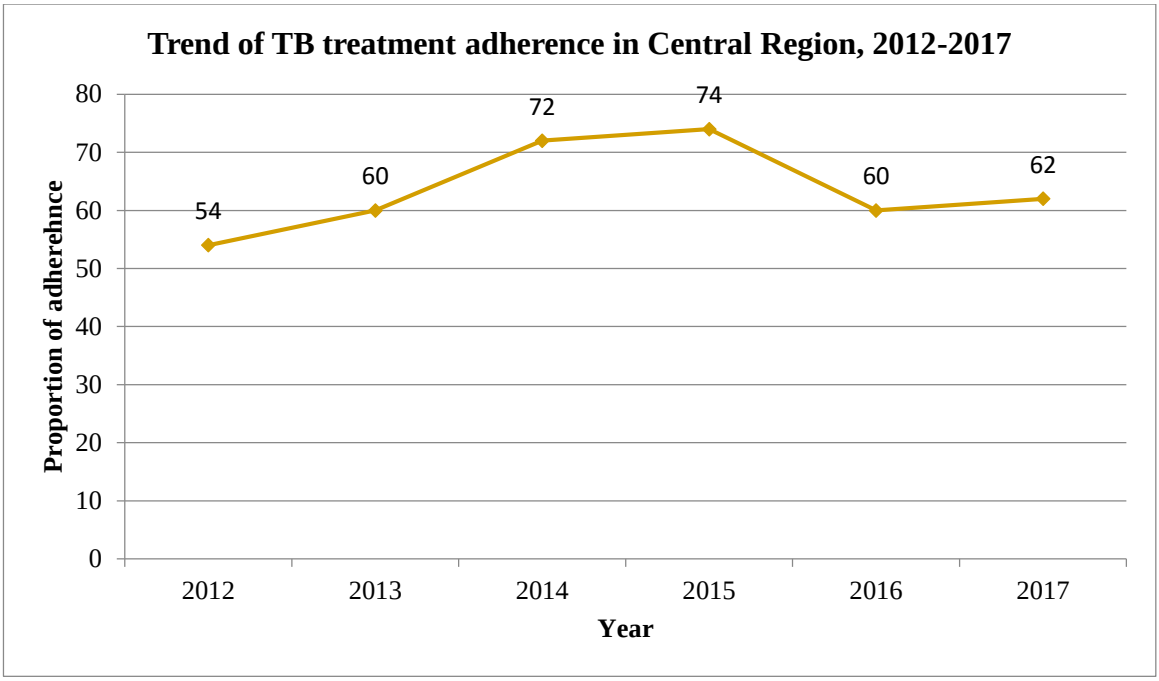

***Figure 4**: Trend of TB treatment adherence in Central Region, 2012-2017*

As shown in Figure 5, Gomoa West district had the highest TB cure rate of 63.4% compared to the lowest of about 44% in Assin North and Awutu Senya districts.

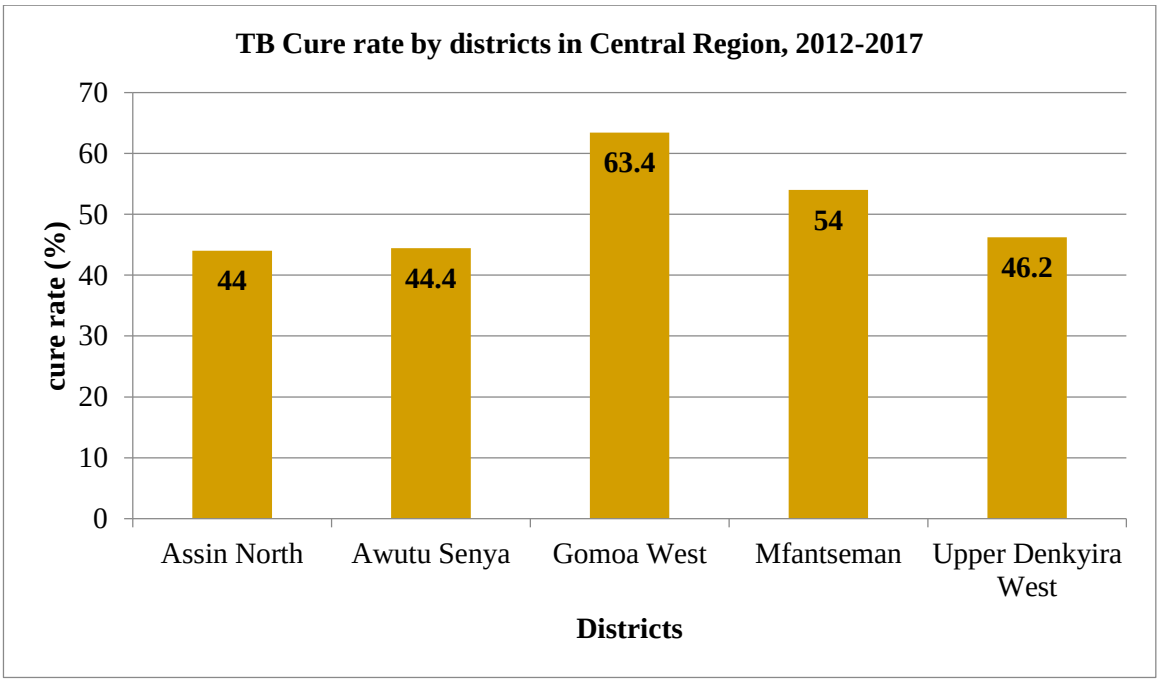

***Figure 5**: TB cure rate by districts in Central Region, 2012-2017*

Figure 6 shows that TB treatment success rate increased from 81% in 2012 to 88% in 2014 and declined to 87% in 2015 before remaining steady at 82% in 2016 and 2017.

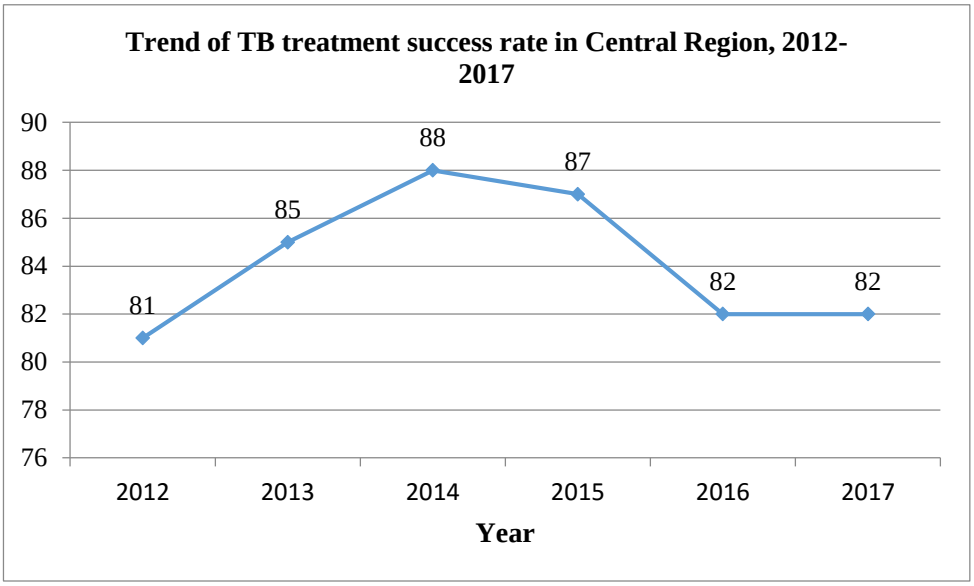

***Figure 6**: Trend of TB treatment success rate in Central Region, 2012-2017*

Tuberculosis treatment success rate was highest (92.2%) in Uppe Denkyira West District whilst the lowest was in Mfantseman (Figure 7).

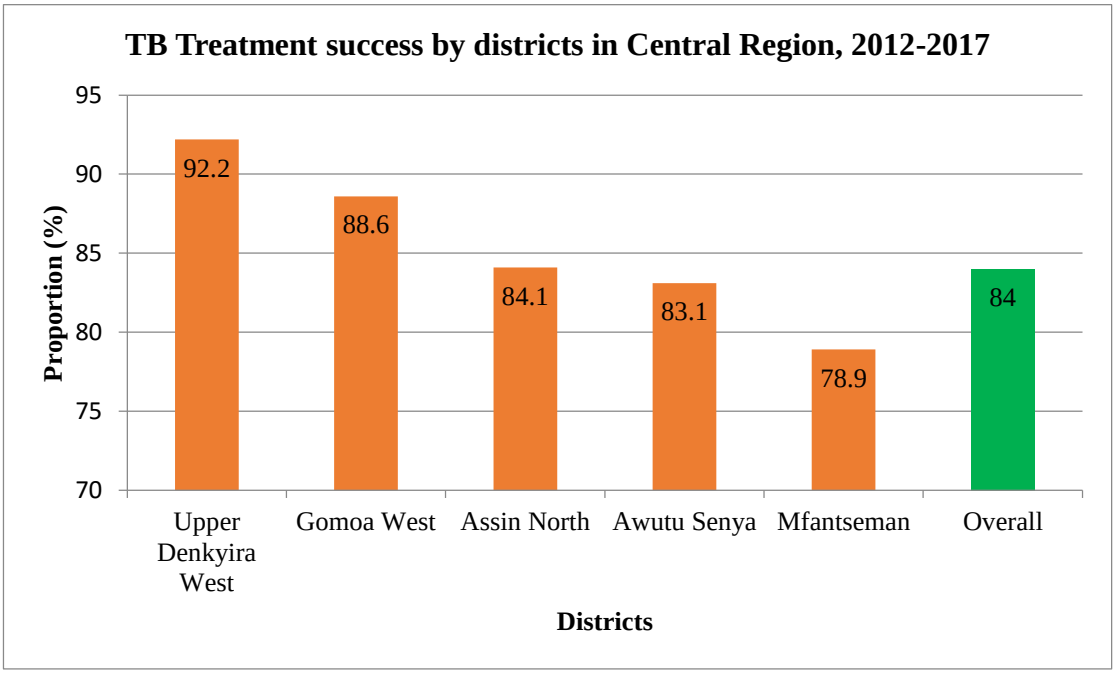

***Figure 7**: TB Treatment success by districts in Central Region, 2012-2017*

Table 8 provides information on all the TB treatment outcomes in the Central Region using selected patients and clinical characteristics within the period under review.

Table 8: Selected patient characteristics by Treatment outcomes in Central Region, 2012-2017

Characteristic	Treatment outcomes						
	Cured	**Completed**	**Defaulter**	**Failure**	**Died**	**Transfer out**	**Total**
Age group (years)							
<15	17 (30.9)	27 (49.1)	1(1.82)	0 (0.00)	6 (10.9)	4 (7.3)	**55**
15-24	195 (66.3)	72 (24.5)	12 (4.1)	2 (0.7)	8 (2.7)	5 (1.7)	**294**
25-34	230 (56.7)	125 (30.8)	17 (4.2)	1 (0.25)	32 (7.8)	1 (0.3)	**406**
35-44	206 (47.4)	151 (34.7)	18 (4.1)	2 (0.5)	55 (12.6)	3 (0.7)	**435**
45-54	208 (51.3)	128 (31.5)	10 (2.4)	3 (0.7)	54 (13.3)	3 (0.7)	**406**
55-64	120 (51.3)	78 (33.3)	6 (2.5)	1 (0.4)	29 (12.4)	0 (0.0)	**234**
65+	95 (36.3)	107 (41.4)	6 (2.7)	1 (0.4)	46 (17.9)	2 (0.8)	**257**
Sex							
Female	407 (54.4)	239 (31.0)	12 (1.6)	4 (0.5)	80 (10.7)	6 (0.8)	**748**
Male	664 (49.6)	449 (33.5)	58 (4.3)	6 (0.5)	150 (11.2)	12 (0.9)	**1,339**
Residence							
Rural	607 (52.0)	413 (35.4)	24 (2.1)	5 (0.4)	108 (9.3)	9 (0.8)	**1,166**
Urban	464 (50.4)	275 (29.9)	46 (5.0)	5 (0.5)	122 (13.3)	9 (1.0)	**921**
Type of TB							
New	1026 (52.3)	633 (32.4)	64 (3.3)	8 (0.4)	208 (10.7)	18 (0.9)	**1,957**
retreatment	45 (34.6)	55 (42.3)	6 (4.6)	2 (1.5)	22 (16.7)	0 (0.00)	**130**
TB classification							
Pulmonary	-	578(80.3)	17(2.4)	-	120 (16.7)	5(0.7)	**720**
negative	1071(78.4)	110 (8.1)	53 (3.9)	10 (0.7)	110 (8.1)	13(1.0)	**1,367**
Pulmonary positive							
Treatment category							
Category 1	1022 (52.7)	620 (31.9)	63 (3.3)	8 (0.4)	208 (10.8)	17 (0.9)	**1,938**
Category 2	45 (34.6)	55(42.3)	6 (4.6)	2 (1.5)	22 (16.9)	0 (0.00)	**130**
Category 3	4 (17.4)	13 (68.4)	1 (5.3)	0 (0.00)	0 (0.00)	1 (45.3)	**19**
HIV status							
Negative	858 (54.1)	523 (33.0)	51 (3.2)	10(0.62)	131 (8.3)	13 (0.8)	**1,586**
Positive	127 (54.0)	63 (26.8)	10 (4.3)	0(0.00)	31 (13.2)	4(1.7)	**235**
Not done	86 (32.3)	102 (38.4)	9 (3.4)	0(0.00)	68 (25.6)	1(0.4)	**266**

%=row percentages

4.3 Contribution of the enablers' support package to TB treatment success in the Central Region

4.3.1 Results of Propensity Score Matching

The propensity score histogram (Figure 8) shows a good match between the enablers' (treated) and the non-enablers (untreated) groups. This means that there was a good control (non-enablers') match for each TB patient who received the enablers' package (treated) covariates between the two groups and the bias was reduced to almost 1. However, there were a few cases in the enablers' (treated) group who did not get a good match, described as lack of common support.

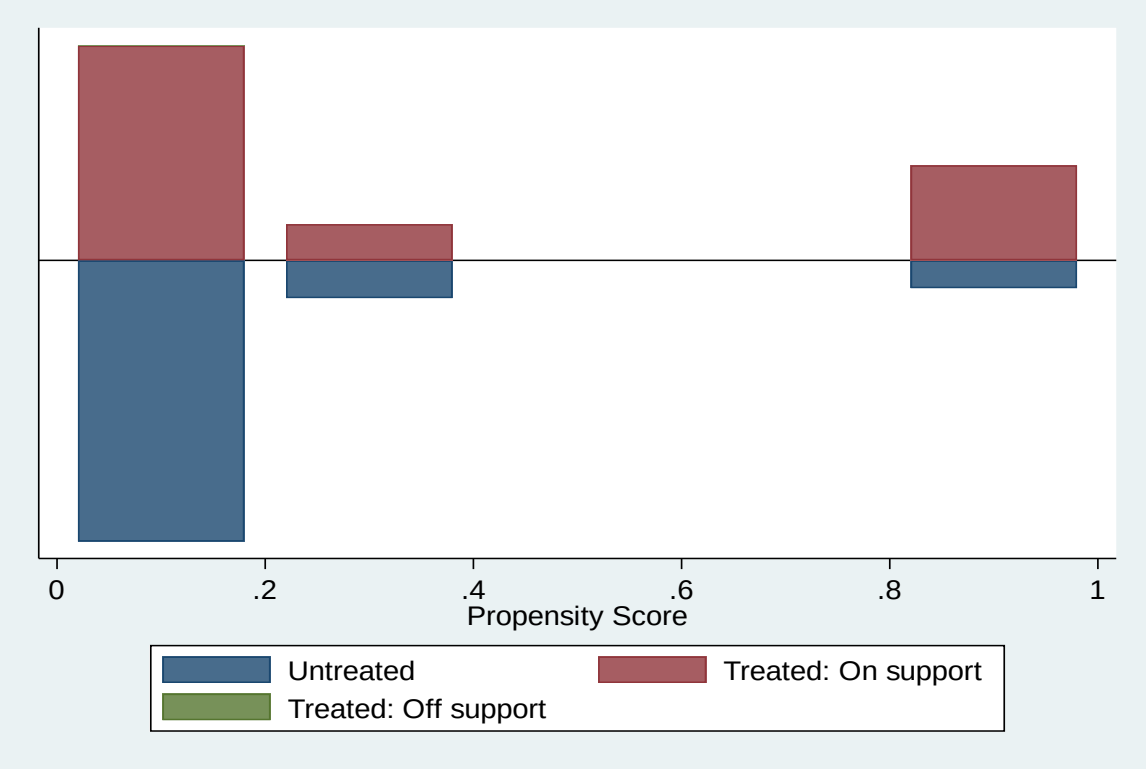

Figure 8: Assessing common support for propensity scores by status of enablers' package

Key: Untreated= TB patients who did not receive the enablers' package; Treated= TB patients who received the enablers' package; Treated off support: TB patients who did not find a good match.

4.3.2 Covariate balance between enablers' TB patients and non-enablers TB patients

The diagnostic graph assessment of the covariate balance between TB patients with enablers package and non-enablers' TB patients revealed a drastic reduction in the standardized percentage bias among covariates between the two groups after matching (Figure 9).

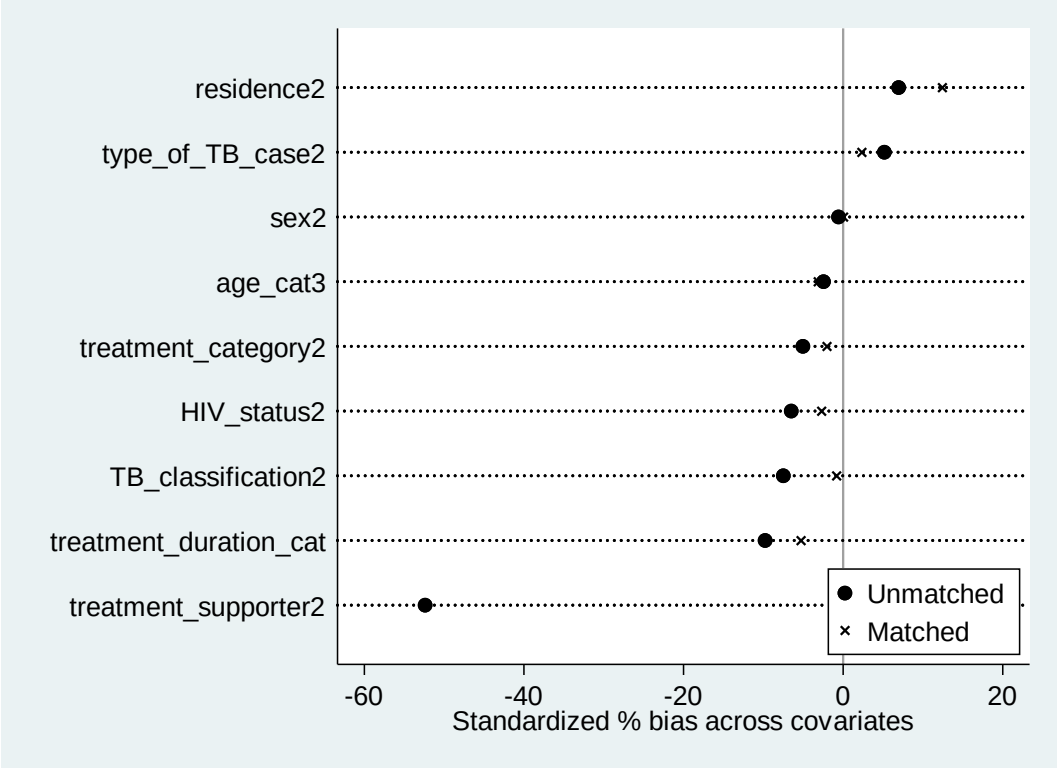

Figure 9: Covariate balance between enablers' TB patients and non-enablers' TB patients.

4.3.3 Estimating the effect of enablers' package on treatment success using propensity score matching

Three matching procedures were used to estimate the effect of the enablers' package on TB treatment success among the enablers TB patients only (treated) and both populations (enablers and non-enablers TB patients). After adjusting for covariates, PSM with 1:3 matching (one case to 3 comparison cases) shows effect of the enablers package on the

treatment success increased by 9.8% on both groups and by 12.7% on the treated (enablers TB patients) and was statistically significant (95%CI: 0.004-0.192, p=0.041 versus 95%CI:-0.005, 0.216; p=0.031) as shown in Table 9.

As can be seen in Table 9, the contribution of the enablers' support package to TB treatment success with PSM 1:3 matching in the study was estimated to be 12.7% and statistical significant (p=0.041; 95% CI: 0.011, 0.242) while that with 1:1 matching was 8.8% and not statistically significant (p=0.175; 95%CI:0.039-0.214).

Table 9: Estimated contribution of enablers' package on TB treatment success in Central Region, 2012-2017

	Both groups (enablers and no enablers)			**Only enablers**		
Matching procedures	**ATE**	**p-value**	**95% CI**	**ATT**	**p-value**	**95% CI**
PSM 1:1	0.058	0.307	-0.053, 0.168	0.088	0.175	0.039,0.214
PSM 1:3	0.098	0.041	0.004, 0.192	0.127	0.031	0.011, 0.242

Key: *PSM: Propensity Score Matching; ATET: Average Treatment Effect; ATT: Average Treatment effect on the treated (TB patients with enablers)*

4.4 Factors associated with treatment success in Central Region

Logistic regression analysis was done to identify factors associated with TB treatment success in Central Region.

In the bivariate analysis, the Pearson's chi-square test of association in Table 3 showed that age (p<0.001), sex (p=0.042), residential location of TB patient (p<0.001), type of TB patient on enrolment of treatment (p<0.001), HIV status of TB patient (p<0.001) and adherence to anti-TB treatment (p<0.001) were strongly associated with TB treatment success were included in the multivariate analysis. However, having a treatment supporter (p=0.463) and financial support (enablers' package) [p=0.707] which were not significantly associated with

treatment success at p=0.20 in this study but were found to be significant from literature review were also added to the multiple logistic analysis model.

In the multiple logistic regression analysis, only residential location, type of patient on start of TB treatment, classification of TB disease, HIV positive status and treatment adherence remained significant predictors of TB treatment success. It is indicated in Table 10 that patients in rural areas have reduced odds of treatment success than their urban counterparts (aOR: 0.41, 95%CI: 0.30-0.56) and was statistically significant (p<0.001). Also new TB patients (aOR: 1.78, 95%CI: 1.01-3.15, p=0.047) and those who adhered to treatment (aOR: 58.26; 95%CI=36.02-94.24; p<0.001) were at higher odds of having successful TB treatment than their respective counterparts. Although, patients who received the enablers' package had 1.27 higher odds of successful treatment as compared to those without enablers' package, it was not statistically significant (aOR: 1.29; 95%CI=0.91-1.85, p=0.155).

Table 10: Multiple logistic regressions analysis of factors associated with TB treatment success in Central Region, 2012-2017

Variable	Unadjusted Odds Ratio	95%Confidence Interval	p-value (unadjusted)	Adjusted Odds Ratio	95%Confidence Interval	p-value (adjusted)
Age						
<15	Ref	Ref	Ref	Ref	Ref	Ref
15-24	2.28	1.06-4.90	0.034*	1.24	0.45-3.44	0.675
25-34	1.70	0.83-3.50	0.149	1.13	0.43-2.96	0.808
35-44	1.13	0.56-2.28	0.740	0.94	0.36-2.41	0.891
45-54	1.20	0.59-2.44	0.614	0.81	0.31-2.10	0.665
55-64	1.38	0.65-2.91	0.405	0.95	0.35-2.59	0.922
65+	0.90	0.44-1.85	0.769	0.57	0.22-1.51	0.260
Sex					Ref	Ref
Female	Ref	Ref	Ref	Ref	0.57-1.09	0.151
Male	0.77	0.60-0.99	<0.001*	0.79		
Residence						
Rural	Ref	Ref	Ref	Ref	Ref	Ref
Urban	0.59	0.46-0.74	<0.001*	0.41	0.30-0.56	<0.001*
Type of TB patient						
Retreatment	Ref	Ref	Ref	Ref	Ref	Ref
New	1.64	1.07-2.51	0.023*	1.78	1.01-3.15	0.047*
TB classification						
Pulmonary negative	Ref	Ref	Ref	Ref	Ref	Ref
Pulmonary positive	1.63	1.28-2.07	<0.001*	0.49	0.35-0.66	<0.001*
Treatment category						
Category 1	Ref	Ref	Ref	Ref	Ref	Ref
Category 2	0.61	0.40-0.94	0.024*	1.00	Omitted	Omitted
Category 3	1.56	0.36-6.80	0.552	3.81	0.62-34	0.148
HIV status						
Negative	Ref	Ref	Ref	Ref	Ref	Ref
Positive	0.62	0.44-0.88	0.008*	0.57	0.36-0.91	0.018*
Not done	0.36	0.26-0.48	<0.001*	0.34	0.22-0.51	<0.001*
TB treatment supporter						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.11	0.83-1.49	0.463	0.78	0.54-1.16	0.224

Table 10 continued

Enablers' package						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.05	0.83-1.32	0.707	1.29	0.91-1.85	0.155
Other support						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.28	0.98-1.67	0.074	1.18	0.80-1.73	0.412
TB treatment adherence						
Adherent	Ref	Ref	Ref	Ref	Ref	Ref
Non-adherent	43.18	27.41-68.04	<0.001*	58.26	36.02-94.24	<0.001*

**Significant at p<0.05*

CHAPTER FIVE

DISCUSSIONS

The study found a low level of adherence to TB treatment in both groups. This level of non-adherence is higher than reported in other studies in Southern Ethiopia (25%)(Woimo et al., 2017); Northwest Ethiopia (21%) (Mekonnen & Azagew, 2018) and Equatorial Guinea (17.8%) (Fagundez et al., 2016). While these levels of non-adherence varying significantly in the studies could be attributed to the different approaches being employed by the various authors in the absence of an internationally accepted measurement of non-adherence in TB, the author in this study finds a disconnect between the high proportion of TB patients with treatment supporters and the high level of non-adherence to treatment among the TB patients. Treatment supporters are close relatives or friends of TB patients who supposed to supervise or monitor the intake of medications and other treatment instructions with the ultimate aim of ensuring compliance. This suggests that the level of supervising TB patients at home by treatment supporters who were also beneficiaries of the enablers' package as a motivation because of their roles could be weak and probably places the burden of treatment compliance on the self-instincts of the patient, reinforcing the opinion by Salifu, Eliason, & Mensah (2017) that patients would likely adhere to treatment for complete cure if they perceive that the disease could bring about serious consequences and societal isolation and stigma.

The overall treatment success rate was lower than national and international targets of at least 90% success rate but consistent with the Central Region's performance of less than 85% (Ghana Health Service, 2018a). The success rate is similar to other studies which reported increase in treatment success among TB patients receiving cash and other forms of financial support: 82% in Brazil (Carter et al., 2017; Torrens et al., 2016), 83% in Argentina (Klein et al., 2019), 88% in Moldova, 82% in Mogadishu of Somalia (Ali et al., 2017).

Intriguing was the finding of no marked differences in the treatment success rates between patients who received the enablers' package and those who did not (84.3% vrs 83.7%; p-value=0.707). Among other purposes, the enablers' package was introduced to reduce defaulter rates (improve adherence to treatment) among TB patients (Auer et al., 2009; Bonsu et al., 2007). Therefore, it would have been anticipated that a substantial proportion of the patients who received the enablers would have greater rate of treatment success. The observed that the treatment success rates began to decline from 2015, the period without the enablers' package which could be a contributory factor.

The study found that there was a marginal effect of enablers' package on treatment success after adjusting for confounders in the study. The almost 13% improvement in TB treatment success rate among the patients who received the enabler's support package was lower than the 18.9% reported in Shanghai (Lu et al., 2013), 15% in Argentina (Klein et al., 2019) but higher than the 7-8% improvement in treatment success rates among TB patients receiving cash transfers in Brazil (Carter et al., 2017; Oliosi et al., 2019; Torrens et al., 2016).

The decrease in level of treatment adherence and corresponding treatment success rates in the period without the enablers' package compared to the period of the enablers' package could still lead to an acknowledgement of the importance and contribution of the programme regardless of the quantum of increase in treatment success rate as found in this study.

The marginal effect of less than 15% of the enablers' package in TB treatment success in addition to the no significant difference in treatment success between patients receiving financial incentives and those not receiving them could mean that some other factors played a part in the treatment success rates of TB patients. This assertion agrees with the proposition that low certainty of evidence abounds regarding the effect of incentives on treatment outcomes as (Bidonde & Fønhus, 2015; van Hoorn et al., 2016) and Bidonde & Fønhus

(2015) ague that material incentives and enablers, such as cash, vouchers or hot meals, may have little or no effect treatment success. However, it is the considered opinion of the author that addressing any systemic challenges with the administration of the enablers' package especially ensuring its intended and targeted purpose would produce better results in the TB control activities.

The finding in this study of residence and classification of TB being independent predictors of treatment success agrees with similar studies in Moldova (Ciobanu et al., 2014) as well as in (Tessema et al., 2009), in rural Nigeria (Ukwaja et al., 2017), in Ethiopia (Ejeta et al., 2018) and in Kampala District of Uganda (Annet, Wongwichit, & Anuwatnonthakate, 2017). It is possible that persons in rural areas are always likely to believe in and take the words of health workers as almost "gospel truth" and would likely comply with treatment instructions while people in urban areas will likely be "difficult and stubborn" in complying with treatment partly due to their level of educational exposure and availability of several health care options.

Whilst this study finds having a treatment supporter not to be a predictor of TB treatment success, (Annet et al., 2017) in Kampala District of Uganda reports of the contrary. Also social support which might include a treatment supporter was significant predictor of TB treatment success in Armenia (Davtyan et al., 2015). It can be argued that having a close relative or a trusted person as a supporter in TB treatment should contribute to treatment adherence and successful completion as they are expected to monitor the intake of the patient's medication according to schedule. If the finding of no significant impact of the enablers' package (financial support) and treatment supporter in TB treatment success is anything to go by, then can be said it behooves on the individual inflicted by a disease such as TB to strictly adhere to treatment instructions for complete cure of his/her illness. It will

therefore be difficult to disagree with Salifu, Eliason, & Mensah (2017) who argued forcefully in similar manner. The lack of association between enablers' package and treatment success from the logistic regression analysis is consistent with the results of this study where there was no much difference in the treatment success rate between those who received the enablers' package and those who did not (84.3% versus 83.7%). This agrees with the finding in Moldovo that cash incentives somehow worked better than non-cash incentive which was not statistically significant. The marginal difference was attributed to the small number of patients who received non-cash incentives (Ciobanu et al., 2014). However, Okwaja and colleagues (2017) found financial incentives to be a significant predictor of treatment success in rural Nigeria.

Strength and limitations of the study

The study was done in five randomly selected districts in the Central Region and findings could be generalized to other areas in the country. The sample of 2,087 is also large so results of the study could be generalizable.

However, the retrospective nature of the study makes it difficult to have gathered some patient characteristics such as occupation, marital status, educational level, income levels, cultural and religious practices that could also influence treatment success. Nonetheless, the propensity matching score employed in the data analysis makes the results still valid.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 conclusions

A higher proportion (56%) of TB patients received the enablers' package. There was no much difference in treatment success rate between the TB patients who received the enablers and those who did not (84.3% versus 83.7%). The overall treatment success rate among the TB patients from 2012-2017 in the Central Region was 84% which is below the WHO target of at least 85%.

The study concludes that treatment success rate improved by 12.7% on the TB patients who received the enablers' package 95%CI:-0.005, 0.216; p=0.031). Factors which were found to be associated with treatment success were age and residence of the TB patient, type of patient at the start of treatment, the classification of the TB patient (new and retreatment), HIV status and treatment adherence.

6.2 Recommendations

1. The National TB Control Programme (NTP) should extend the enablers' package to all type of TB patients on treatment in the country instead of only the MDR-TB patients.
2. The government should employ sustainable means of financing TB control activities such as allowing the District Assemblies to allocate a percentage of the District Assemblies' Common Fund for TB activities at each district level.
3. Further studies could be explored by the National TB Control Programme on the effectiveness of treatment supporters to treatment adherence and treatment success.
4. District TB Control officers should adhere to the duration for the declaration of TB treatment outcomes

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APPENDICES

Appendix I: Questionnaire:

Assessment of the Enablers Support Package in Tuberculosis Treatment in the Central Region of Ghana

Introduction

I am Martin Sumani Daanko, a Master of Public Health (MPH) student of the School of Public Health, University of Ghana. I am conducting a study on the topic **"Assessment of the Enablers Support Package in Tuberculosis Treatment in the Central Region of Ghana".**

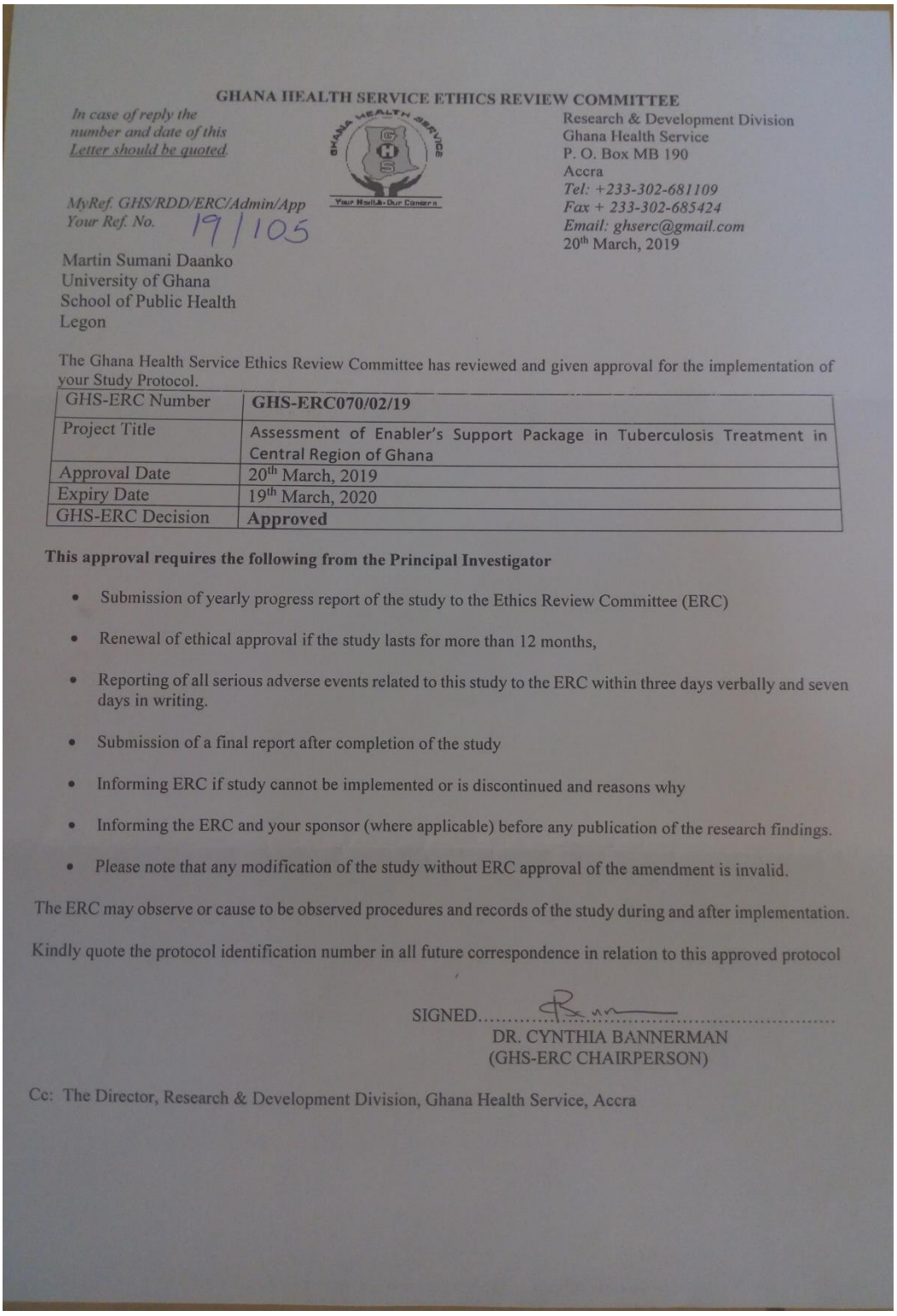
The purpose of the study is assess the contribution of the financial enablers' package to treatment outcomes in TB.

The study is part of the requirements for the award of the MPH degree

Name of District/Municipality: ……. District/Municipal TB Code: ……Interview date:…/…/2019 Time:……..				
QN	**Questions**	**Coding categories**	**Skip**	**CODES**
Section A: Patient characteristics				
1	Year of registration of TB patient	2012 [ ] 2013 [ ] 2014 [ ] 2015 [ ] 2016 [ ] 2017 [ ]		Registration year
2	Patient District TB number	…….		TB number
3	Age of TB patient	Years ……...		Age
4	Sex of TB patient	Male……0 [ ] Female……1 [ ]		Sex
5	Residential location of TB patient	Rural……...0 [ ] Urban……..1 [ ]		Residence
6	Does TB patient have Treatment supporter?	No……...0 [ ] Yes……..1 [ ]		
7	TB disease classification	Pulmonary +ve ……..0 [ ] Pulmonary –ve ……..1 [ ] Extrapulmonary .....2[ ]		TB type
8	Categorization of patient (Patient type)	Cat I……0 [ ] Cat II…….. 1 [ ] Cat III (Paediatric)……..2 [ ]		Patient type
9	HIV status of patient	Negative ……...0 [ ] Positive ……1 [ ] Not done ……...2 [ ]	Go to Q10	HIV status

10	HIV treatment	No……..……...0 [ ] Yes…….....1 [ ]		HIV treatment
11	Treatment category	Cat 1……..0 [ ] Cat 2 …….....1 [ ] Cat 3 ……..2 [ ]		Treatment cat
Section B: Treatment adherence among TB patients				
12	Date of diagnosis	Laboratory date: …./…../..... NA…….……[ ]		Diagnosis date
13	Treatment initiation	Date: …../…./……		Treatment start
14	Sputum results at month 0	Negative …… 0 [ ] Positive……...1 [ ] Not done/available……..2 [ ] Date of lab results:…/…../….		Month 0
15	Sputum results at month 2	Negative …… 0 [ ] Positive……1 [ ] Not done/available…...2 [ ] Date of lab results:…/…../….		Month 2
16	Sputum results at month 3	Negative …… 0 [ ] Positive……1 [ ] Not done/available…...2 [ ] Date of lab results:…/…../….		Month 3
17	Sputum results at month 5	Negative …… 0 [ ] Positive……1 [ ] Not done/available…...2 [ ] Date of lab results:…/…../….		Month 5
18	Sputum results at month 6	Negative …… 0 [ ] Positive……1 [ ] Not done/available…...2 [ ] Date of lab results:…/…../….		Month 6
19	TB patient received other form of enablers' support apart from the financial support?	No……0 [ ] → Q25 Yes……1 [ ]		Other enablers
20	What form of enablers' support was received by TB patients	…… ……		Enablers_Type
Section C: Treatment outcomes among TB patients?				
21	Treatment outcome of patient	Cured……0 [ ] Completed……1 [ ] Defaulter……...2 [ ] Failure……...3 [ ] Death…….....4 [ ]	If PN case	Treatment Outcome
22	Date of end of treatment	……..		
22	Categorized treatment outcomes	Positive outcome …1 [ ] Negative outcome ...2 [ ]		Final Treatment outcome

Appendix II: Ghana Health Service Ethics Review Committee approval letter



GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

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

MyRef. GHS/RDD/ERC/Admin/App
Your Ref. No. 19/105

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com
20th March, 2019

Martin Sumani Daanko
University of Ghana
School of Public Health
Legon

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

GHS-ERC Number	**GHS-ERC070/02/19**
Project Title	Assessment of Enabler's Support Package in Tuberculosis Treatment in Central Region of Ghana
Approval Date	20th March, 2019
Expiry Date	19th March, 2020
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

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

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

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

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

Appendix III: Central Regional Health Directorate permission letter

In case of the reply, the number and the date of this letter should be quoted.

GHS Core values
PEOPLE CENTRED
PROFESSIONALISM
TEAMWORK
INNOVATION/EXCELLENCE
DISCIPLINE
INTEGRITY

GHANA HEALTH SERVICE
Your Health · Our Concern

GHANA HEALTH SERVICE
REGIONAL HEALTH
DIRECTORATE
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GHANA
Tel: 042 32281/2
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My Ref. No.CR/G- 263/633
Your Ref. No...

10th December, 2018

MR. MARTIN SUMANI DAANKO (PRINCIPAL INVESTIGATOR)
SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA
P. O. BOX LG13
LEGON, ACCRA

RE: PERMISSION TO CONDUCT RESEARCH ON "ASSESSMENT OF THE ENABLERS' PACKAGE IN TUBERCULOSIS TREATMENT IN THE CENTRAL REGION OF GHANA"

Reference your application letter dated 5th November 2018, seeking permission to conduct the above-mentioned research in the Central Region, I write to grant you permission on the following conditions:

1. A copy of the proposal of the study in full should be lodged with the Research and Development Unit of the Central Regional Health Directorate;
2. Ethical clearance from the **Ghana Health Service Ethics Review Committee (GHS-ERC)** should be obtained for the study;
3. Data collection should commence **only upon receipt of clearance from the GHS-ERC** and a copy of the clearance certificate lodged with the Research and Development Unit of the Central Regional Health Directorate; and
4. A copy of the final report of the study in full should be lodged with the Research and Development Unit of the Central Regional Health Directorate.

By copy of this letter, Metropolitan/Municipal/District Directors of Health Services and Medical Superintendents are directed to provide the necessary support to make the study a success.

Thank you.

DR. ALEXIS NANG BEIFUBAH
REGIONAL DIRECTOR OF HEALTH SERVICES
CENTRAL REGION

CC:- All DDHS
- All MED. SUPTs.