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Evaluation of the Tuberculosis Management Program in Ghana

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Abstract

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MHA, Framingham State University, 2014

BSc, University of Ghana, 2011

Dissertation Submitted in Partial Fulfillment of the

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Abstract

Tuberculosis (TB) is a major health issue estimated to be affecting about 1/3 of the world's population. TB is a major health problem in Ghana primarily because of weak health infrastructure and poor TB case detection and management practices. Measuring and evaluating the performance of health programs is an important aspect of health care services in any country. The purpose of this quantitative study was to evaluate the TB management program in Ghana. A cross-sectional research design was used to answer the research questions. Secondary data were obtained from the Ghana District Health Information Management System database. The theoretical foundation used for this study was the performance measurement model that links accountability and performance measurement. The research questions sought to determine if there is an association between socioeconomic status, education, employment status, health facility location, number of trained health workers, ethnicity/tribe, and TB treatment completion in Ghana. The results of logistic regression and a chi-square test show that number of trained healthcare workers and health facility location significantly predicts the odds of treatment completion among TB patients. The findings from this study may provide crucial information for improving service delivery for TB patients and may contribute to long-term global TB elimination. Results can also serve as a basis for developing guidelines.

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Dedication

This study is dedicated to my wonderful family, especially my wife Racheal and my two daughters Petra and Phoebe, and also to my dad Paul K. Akese.

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I would like to thank the Almighty God for his protection. My appreciation goes to my chair Dr. Gudeta Fufaa for his tremendous support and guidance throughout this journey. Also many thanks to my committee members Dr. T. Osoba and Dr. Scott Mcdoniel. Also I would like to thank the Ghana Health Service TB program coordinators for their support. Finally, I would like to thank my siblings Gloria Akese and Oduro Akese for their help and support in making this journey come true.

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Chapter 1: Introduction to the Study

Background

Tuberculosis (TB) has long been among the six killer diseases listed by the Ghana ministry of health (Amo-Adjei, 2013). Despite increased efforts in prevention and the widespread availability of effective short-course antituberculosis chemotherapy, the incidence of TB is on the increase both in developed and developing countries. TB is a major health problem affecting about one-third of the world's population despite a number of preventive and control measures taken in the past few decades (Ahorlu & Bonsu, 2013).In Ghana, TB is a major health problem that poses a serious obstruction to development, primarily because of weak health infrastructure and poor TB case detection and management practices.

Ghana Health Service (2014) provided information on how inadequate screening and missed opportunities for diagnosing TB has led to a low number of presumed cases. Kasu (2015) compared treatment outcomes of cohorts registered in 2003–2005 with centralized short-course directly observed treatments (DOTs) at the health facility level and cohorts registered in 2007–2009 with decentralized DOTs at the community level. Kasu (2015) concluded that the system operation availability and representation could be improved by opening additional TB diagnostic centers and training more laboratory staff in sputum microscopy. The challenges facing the health system's availability of health care facilities could be improved by bringing health services as close as possible to those who need them. Amo-Adjei (2013) identified barriers that hinder TB control in Ghana, such as tension between public health and clinical staff, funds, the quality of

infrastructure, accessible healthcare facilities, and slack attitudes toward TB programs. Prinz and Salisu (2009) revealed that TB patients face a number of barriers in seeking diagnosis and treatment, including financial costs related to charges for health services, transportation, accommodations, nutrition, and lost income, productivity, and time. These barriers cause delays in seeking health care, resulting in more advanced disease and continued transmission of TB. Ahorlu and Bonsu (2013) concluded that lack of effective communication between the peripheral facilities and the laboratory at the district hospital resulted in late TB case detection.

The health status of Ghanaians has improved recently, but the rate has been slow. Ghana is ranked 19th in Africa and 38th among 145 countries in the world for the highest estimated number of new TB cases per year (Ahorlu & Bonsu, 2013). Previously, TB patients had to pay out-of-pocket for health services, but few could afford it. This led to a large decline in health services use and constituted a financial barrier to health care for poor people. In an effort to resolve this issue current treatment of TB at health care centers in Ghana is free and the estimated TB mortality has declined from 32 deaths per 100,000 per year in 1990 to nine per 100,000 in 2013 (Amo-Adjei, 2013). Regardless of the number of reported TB cases in a jurisdiction, key treatment outcomes are expected to improve in line with World Health Organization (WHO) treatment outcome benchmarks. Currently, international benchmarks for assessing countries performance in cure rates is 85%. TB treatment success rate is reported with a 1-year lag. In 2013, about 87% of all diagnosed TB patients completed their treatment successfully, while the remaining 13% either dropped out of treatment or died before treatment was complete. The National TB

Program (NTP) finalized a national TB prevalence survey in 2014. Preliminary findings indicated a correction of the national TB prevalence from 71 to 264 persons with TB per 100,000 Ghanaians (Ghana Health Service, 2014).

The NTP is concerned about inadequate screening and missed opportunities for diagnosing TB patients at facilities leading to a too low number of presumed cases. Confirmation of TB diagnoses among presumed cases is further complicated by suboptimal diagnostic tests. The National Tuberculosis Health Sector Strategic Plan for Ghana, 2009–2013, clearly identified the low TB case detection rate as one of the main challenges facing TB control there (Ghana Health Service, 2014). Total health expenditures, including private expenditures, have risen from $680.55 million to $964.68 million. The public health system now faces a variety of obstacles, including shortages of personnel and funding (Ghana Health Service, 2014), which have direct implications for the effectiveness of TB management programs.

Problem Statement

TB is a major health problem affecting about one-third of the world's population despite a number of preventive and control measures available (Ahorlu & Bonsu, 2013). The performance of a country's health system ultimately shapes its population's health outcomes. Ghana has increased tremendously in the number of professional health workers, yet the health care delivery system continues to remain inadequate and inaccessible to many citizens. In Ghana, TB is a major health problem that poses a serious obstruction to development, primarily because of weak health infrastructure and poor TB case detection and management practices. Ghana is ranked 19th in Africa and

38th among 145 countries in the world for the highest estimated number of new TB cases per year (Ahorlu & Bonsu, 2013).

Although the Ghanaian public health system faces a variety of obstacles, including personnel and funding shortages (Ghana Health Service, 2014), the responsibility of the health care system is to combat diseases associated with lack of education and poverty (Amporfu et al., 2013). In an effort to resolve the adverse effects of TB several strategies and interventions have been applied at the individual, national, and international levels (Frimpong, 2013). The health status of Ghanaians has improved recently, but the rate has been slow. Currently TB mortality in Ghana declined from 32 deaths per 100,000 per year in 1990 to nine per 100,000 in 2013 (Amo-Adjei, 2013). Nonetheless, WHO estimates that Ghana is detecting only 26% of all TB cases—well below the African regional average of 47% and WHO's target of 85% (Osei et al., 2015). Research examining TB management programs in the Ghanaian context is lacking. Such research, assessing the efficiency and effectiveness of the TB management program in Ghana, would be important and necessary to remedy the existing knowledge gap.

Purpose of Study

The purpose of the study was to evaluate the performance of TB management program in Ghana. The study will highlight factors that contribute to or hinder the TB management program in Ghana. Assessing health system performance is crucial to optimal policy making, resource allocation, and interventions to improve health. Quantitative research can quantify the externalities of the barriers to TB control

highlighted in the various studies. Such studies will enhance the understanding of specific barriers that need attention by policy makers.

Research Questions and Hypotheses

RQ1: Is there an association between socioeconomic status (employment status, occupational status, and income), education, tribe/ethnicity, and TB treatment completion in Ghana?

$H_0$1: There is no association between socioeconomic status (employment status, occupational status, and income), education, tribe/ethnicity, and TB treatment completion in Ghana

H_a1: There is an association between socioeconomic status (employment status, occupational status, and income), education, tribe/ethnicity, and TB treatment completion in Ghana.

RQ2: Is there an association between the health facility location, number of trained health workers, and TB treatment completion in Ghana?

$H_0$2: There is no association between health facility location, number of trained health workers, and TB treatment completion in Ghana

H_a2: There is an association between health facility location, number of trained health workers, and TB treatment completion in Ghana

Theoretical Framework

The theoretical foundation for this study was the performance measurement model, which suggests a link exists between accountability and performance measurement (Harrison, Rouse, & De Villiers, 2012). Performance measurement

endorses a process perspective in which the focus is on the internal process of quantifying the effectiveness and the efficiency of action with a set of metrics (Jean-Francois, 2014). Measuring and evaluating performance is one of the most important concerns for a health care system in any country (Smith et al., 2008). Performance measurement involves efforts to evaluate and establish the relationship between the goals, resources, outputs, and achievements of the desired goals of an organization (Smith et al., 2008). Performance measurement contributes to strategy formulation and implementation by revealing the links between goals, strategy, lag and lead indicators (Jahammehr et al., 2015; Smith et al., 2008). Most program evaluation models used in performance assessments and measurement in health help to improve management and delivery of health services.

For example, the Canada Department of Health and Social Services used the notion of measuring and evaluating performance for developing the Canadian Institute for Health Information (CIHI) framework, which is primarily used for assessing the effectiveness of health care services delivery in Canada. In this study, I adopted a similar framework to CIHI's framework that considers the prevailing socioeconomic, political, and cultural factors in Ghana, as they offer an analytical and interpretative scheme to evaluate and improve health programs (Canada Department of Health and Social Services, 2014).

This framework is composed of four interrelated quadrants: (a) health system outcomes, (b) social determinants of health, (c) health system outputs, and (d) health system inputs and characteristics. I sought to answer two basic questions: How healthy

are citizens? And how is health care in any specific country performing? The purpose of this performance measurement framework was to provide a consistent approach for systematically collecting, analyzing, using, and reporting on the performance of the public health sector.

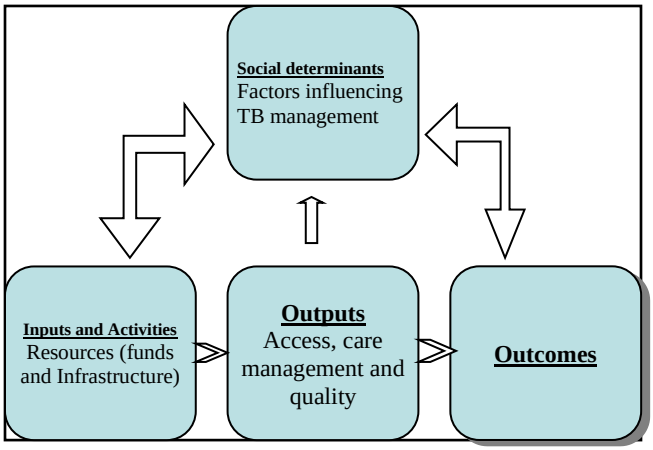

Figure 1. Framework for evaluating tuberculosis management program.

Nature of the Study

This study was a quantitative study with cross-sectional research design used to answer the research questions. The study involved collecting data or searching records for a specified population and ascertaining the relationships among the variables of interest (Campbell & Stanley, 1963). Logistic regression and chi analyses were used to analyze the data. The goal of the study was to explain or explore in-depth and determine if there is an association between selected variables. This design is appropriate for any study seeking relationships between variables in nonexperimental research.

Definitions of Terms

Case detection rate: The proportion of notified cases of TB, including new and relapse, among the WHO estimated incident cases in a country, reported as an annual

figure (Stop TB Partnership, 2011).It is most often expressed as number of newly notified cases per 100,000.

Culture: Socially transmitted knowledge and behavior shared by a group of people or knowledge, attitudes, and habitual behavior patterns shared and transmitted by members of a particular society (Birukou et al., 2007).

Health care accessibility: The ability of a population or a segment of the population to obtain health services or the ability to reach, afford, and obtain entrance to services (MacKinney, 2014).

Ethnicity/tribe: The extent to which people identify themselves with a particular ethnic or tribal group with shared knowledge, attitudes, and habitual behavior patterns (Birukou et al., 2007).

Socioeconomic status: Finely graded hierarchy that can be used to describe overall social position or standing. It can be indicated by a number of concepts, such as employment status, occupational status, educational attainment, income, and wealth (Marks et al., 2000).

Treatment completion rate: The number of patients with no signs of continued active disease whose treatment was successfully completed and bacteriological success demonstrated (WHO, 2013).

Treatment success: The proportion of new smear-positive TB cases registered in a given year that successfully completed treatment, whether with bacteriologic evidence of success cured (WHO, 2013).

Tuberculosis: A communicable disease caused by a type of bacteria known as *Mycobacterium tuberculosis,* commonly referred to as *TB bacilli* (WHO, 2013).

Tuberculosis management program: A planned series of events for coordinating the planning, implementing, managing, and financing of TB control activities in respective regions.

Limitations

A major limitation of this study was the availability of information in terms of completeness and accuracy of the information. The study involved the use of secondary data collected from the Ghana District Health Information Management System (DHIMS) database, and there was the possibility of information being incorrectly entered into the database by health professionals.

External validity is seriously threatened if biases or other limitations exist in the accessible population (Kihn & Ihantola, 2011). In this study, because sample selection was based on specific selection criteria, this was likely to influence the outcome of the study. When it comes to quantitative research, threats to external and internal validity are important because they determine whether the findings can be considered valid for the specific subject in the research and the general population. Most often, population, time, and environment may threaten the external validity of a quantitative study (Kihn & Ihantola, 2011). If the sample size is inadequate and/or the participants are not randomly selected, the estimates may be meaningless because the sample may not faithfully reflect the entire population. The environment might pose a threat to this study because it would

have been difficult to reach participants that represent various ethnic, cultural, and tribal groups living in various communities.

Significance

The findings of the study may help policy makers adjust existing health policy and improve the public health system. As an implication to positive social change, the study may help policy makers develop programs and policies to resolve disparities in the health care system in Ghana. Carefully measuring, evaluating, and identifying factors that affect health care system performance provides crucial information for improving service delivery and health outcomes. The results of my study may provide information helpful to health care decision makers, clinicians, policy makers, and health educators to make well-informed decisions that improve the quality of health and life. The results can be used as the basis for developing guidelines for public health departments at the national level.

Summary

Despite increased efforts in prevention and the widespread availability of effective short-course anti tuberculosis chemotherapy, the incidence of TB is on the increase both in developed and developing countries. TB is a major health problem in Ghana and has long been among the six killer diseases listed by the Ghana ministry of health (Amo-Adjei, 2013) due to weak health infrastructure and poor TB case detection and management practices. The health status of Ghanaians has improved over the last few decades, but the rate has been slow. Ghana is ranked 19th in Africa and 38th among 145 countries in the world for the highest estimated number of new TB cases per year (Ahorlu

& Bonsu, 2013). The WHO estimates that Ghana is detecting only 26% of all TB cases, well below the African regional average of 47% and the WHO target of 85% (Osei et al., 2015). In order to better understand the problem, I sought to evaluate the performance of the TB management program in Ghana. The study will highlight the factors that contribute to or hinder TB management program in Ghana.

In Chapter 1, I outlined and presented brief description of the study, research problem and questions, the nature of the study and study limitation. In the next chapter, I discuss the findings from the literature in terms of variables being considered and the methodology being used in the study.

Chapter 2: Literature Review

Introduction

TB is a disease that spreads through airborne transmission and is caused by Mycobacterium tuberculosis. TB can affect other parts of the body, such as the brain, spine, or kidneys, but usually affects the lungs (WHO, 2010). TB is still considered a major health problem across the globe. According to WHO (2015), TB ranks alongside human immunodeficiency virus (HIV) as a leading cause of death worldwide, causes ill-health among millions of people each year, and remains a major source of morbidity and mortality. In Asia and Africa, TB is considered among the top 10 causes of death (WHO, 2015). Globally, TB threatens public health and affects people in their productive lives (U.S. Agency for International Development, 2011). In Ghana, the impact of TB on people often affects not only physical health, but also their economic, social, and psychological well-being. A significant cause of adult morbidity and mortality in Ghana is TB (Feuser, 2014). TB leads to loss of workdays and decline in household welfare due to the impact of coping strategies and its burden on rural households where incomes are generally low. The illness causes irregular school attendance among children, poor academic performance, loss of self-confidence, embarrassment, and fear (Feuser, 2014).

According to WHO (2015), effective treatment is a major element in reducing the transmission of TB and achieving TB elimination. The proportion of cases with successful treatment outcome is key indicators to assess the performance and effectiveness of any TB control program. Evaluation of a TB management program and treatment outcomes is central to the assessment of effectiveness (Owusu-Amoako, 2013).

Research into the factors that influence the outcome of treatment and monitoring TB treatment outcome is an important part of a TB control program because it guides policy makers to make effective measures in a direction that can reduce the disease burden (Owusu-Amoako, 2013).

This chapter includes a detailed review of literature on TB treatment and TB management programs in Ghana and other countries. This chapter contains a detailed description of literature search strategy used in the review and an overview of the CIHI framework adopted for this study and the justification for using this framework. This gives the reader a better understanding of the process current research or studies have presented related to TB management. This chapter also contains a detailed discussion of the issues related to the TB management program in Ghana, including mortality rate, prevalence of TB, incidence of TB, treatment success, poor TB case detection and management practices. Also in this chapter is a discussion of the different frameworks used in similar studies using related research variables and gaps in previous studies pointing to the need for further study. This chapter will then transition into Chapter 3 where I present the methodology for this study.

Literature Search Strategy

The selection criteria for articles reviewed were based on published, peer-reviewed journal articles and government-affiliated documents. These documents were accessed electronically through the Walden University Library, Framingham State University Library, and Google search engine, alongside government and other institutional websites, such as the CINAHL Plus, ProQuest, PubMed, Medline, Google

Scholar, WHO, Centers for Disease Control and Prevention, and Ghana Ministry of Health. The search conducted considered articles published from the year 2010 to the present. To obtain the most relevant search results related to my study for this literature review, I used select keywords in my search that allowed for the retrieval of specific articles and reduced the necessity to review articles that would not contribute to this study. These keywords were *tuberculosis, tuberculosis management, tuberculosis management program, tuberculosis in Ghana, prevalence of tuberculosis, incidence of tuberculosis, treatment outcome and success*, and *tuberculosis case detection*. The words were searched individually and in combination with one another. To allow for a more comprehensive assessment of the available literature, duplicate publications were omitted from the search. In addition, further weekly searches were conducted to identify literature published since the initial search.

Theoretical Framework

In this study, I adopted a theoretical framework that argues for a link between accountability and performance measurement (Harrison et al., 2012). Recently, most program evaluation models only focus on measuring outcomes, but then Frye and Hemmer (2012) argued that because any program is considered a social system composed of component parts that interact with the program's environment, program evaluation models should be able to identify the sources of variation in program outcomes from both within and outside the program. Patton (2012) indicated that many program evaluation studies seeking to measure performance were influenced by theories that attempt to isolate individual program components to determine associations with outcomes, and thus

the assumption of linearity is evident in some popular program evaluation models such as the context/input/process/product (CIPP) model, the logic model, and the before, during, and after model. With the assumption of linearity, it is assumed that program success or lack of success in achieving outcomes can be explained once the factors contributing to an outcome are known. In other words, a change in program contributing factors or elements is said to have a predictable impact on the outcome, meaning a large change in factors would be expected to have a large impact and a small change would be expected to have a small impact. In general, program evaluation models have components that can be categorized into four parts: (a) inputs, (b) activities, (c) outputs, and (d) outcomes (Çokluk, 2010).

Most program evaluation models used in performance assessments and measurements are used in health to help improve management and delivery of health services. The demand and need for evaluation and performance measure in the health sector is growing due to concerns about persistent inequalities, effectiveness and equity consequences, increasing health care costs, ageing populations, efficiencies of health systems in making best use of available resources, and their ability to meet the challenges of ever-changing medical advances. For example, CIHI and Statistics Canada realized that rising expectations required creative policy approaches. In 1999, CIHI and Statistics Canada started a joint effort to develop a set of performance indicators using a series of consultations with health system stakeholders (CIHI, 2013). They successfully developed the framework for their joint health indicators initiative, which was well-accepted nationally, recognized internationally, and published in 2000. It was endorsed as an

international technical standard by the International Standardization Organization in 2010 (CIHI, 2013).

This framework was designed to answer two basic questions: How healthy are citizens? And how are the health care system and programs in any specific country performing? The main aim of the CIHI framework was to provide managers, decision makers, and policymakers with a tool channeled toward the improvement of health system performance. The framework adopted WHO's definition for health system and programs, which consists of all people, organizations, and actions whose primary aim and goal is to restore, promote, and maintain health (Arah et al., 2013), including efforts to influence determinants of health and health-improving activities.

The framework captures major factors that encompass the health system, as well as factors that influence the attainment of key health system and program goals. The advantage of this framework is that it consists of factors that affect health but are external to the health system, and it suggests causal links between the different dimensions (Arah et al., 2013). The CIHI framework is composed of four macro dimensions, or four interrelated quadrants: (a) health system outcomes, (b) social determinants of health, (c) health system outputs, and (d) health system inputs and characteristics. Each of the four quadrants is composed of performance and evaluation indicators in demographic, environmental, political, and economic contexts linked through expected relationships that enable each quadrant to interact with each other (Arah et al., 2013).

Health System Outcomes Quadrant

The health system outcomes quadrant represents the high-level outcomes that are the ultimate goals of the health system or program corresponding to the expectations of any health system stakeholders, which are to improve the health status of the population by providing services to improve health in a way that meets the needs and expectations of the people being served (CIHI, 2013). In the context of the Ghana health system, improvement in health status of TB patients, mortality and improvement in TB management program (treatment completion) were considered under this quadrant.

Health System Outputs Quadrant

The health system outputs quadrant consists of factors that measure the outputs of the health system or program, including public health services delivered (CIHI, 2013). This quadrant is subdivided into two parts. The first part represents the capacity of the system or program to deliver services, including disease prevention and health promotion, in an equitable way. The second part represents the properties of health services delivered: safety, appropriateness, effectiveness, integration of health care services, and patients' experiences with health services (CIHI, 2013). In the context of the Ghana health system, factors such as hospital use will be considered.

Social Determinants of Health Quadrant

The social determinants of health quadrant represent social, cultural, and environmental factors influencing the health of a population, such as poverty, socioeconomic status, working conditions, transport policy, social support, unemployment, social position, and physical environment. Although the health care

system or program can cure people of diseases and prolong survival, the improvement of population health also depends largely on public health policies and on governmental actions (Wilkinson & Marmot, 2008). This quadrant emphasizes the importance of public health policies to improve the health status of any given population. In the context of the Ghana health system, factors such as environmental, demographic, socioeconomic, and behavioral factors will be considered in this quadrant.

Health System Inputs and Characteristics Quadrant

The health system inputs and characteristics quadrant is composed of dimensions that frame the health system or program, such as (a) infrastructure, (b) leadership and governance, (c) inputs or resources available to the health system activities and initiatives, (d) health system innovation and learning capacity, and (e) the capacity to adjust and adapt to better meet changing population health needs (Arah et al., 2013).In the context of the Ghana health system, factors such as number of trained health workers will be considered.

When evaluating health systems or programs, it is important to consider all inputs that correspond to the health system and ensure that the valued outcomes being assessed also represent the contribution of the inputs (Arah et al.,2013). Evaluation most often uses performance indicators that are measures of the factors of processes, production, outputs, and outcomes related to programs, projects, or strategies (Arah et al., 2013).

Management of Tuberculosis in Ghana.

TB has caused more death and suffering than any other infectious disease and continues to be a major public health problem worldwide (Mauch et al., 2013). In 1993,

TB was declared a global emergency in recognition of its growing importance as a public health problem (WHO, 2015). About one-third of the world's population is infected with the TB bacilli, over 1.5 million cases occur annually in sub-Saharan Africa, and about 25% of all avoidable deaths in developing countries are caused by TB (WHO, 2016). Ghana has seen tremendous improvement in the treatment of TB from 2004 to date with the help from the Danish government. In 2004, the number of TB incidents was recorded as 206 per 100,000 populations, where 92 per 100,000 populations were new smear positive cases. The National Tuberculosis Control Program (NTP) has been tasked with reducing the TB mortality rate, preventing the development of drug resistance, and also reducing the transmission of TB to a level where it poses no threat to public health (Danso et al., 2015).

DOTS is recognized internationally and has been the treatment approach adopted by NTP. The DOTS approach is basically giving the most effective TB medication to patients, ensuring that the medications are taken regularly as prescribed, and then monitoring their progress. The Ghana Health Service responded to the TB epidemic by implementing the expanded framework of the DOTS strategy together with the Stop TB strategy in all health facilities nationwide, which addressed communication strategies about the disease (Yeboah-Manu et al., 2012).

The WHO DOTS strategy's main components are (a) case detection among self-reporting patients with symptoms using sputum smear microscopy, (b) political commitment, and (c) short-course chemotherapy under proper management. Its main goal is to detect at least 70% of new smear-positive cases and successfully treat 85% of them.

DOTS' strategy highlights and emphasizes the ways to properly detect, treat, and monitor the disease to reduce TB morbidity rates, but it does not provide ways to educate people to raise awareness of the treatments available for TB in Ghana.

Tuberculosis Treatment in Ghana.

The entire TB program in Ghana is managed by NTP, which has partnered with several civic society organizations and nongovernmental organizations under the umbrella of the Stop TB partnership in Ghana to perform treatment activities and case finding across the country. The duties of the NTP involve resource mobilization and ensuring political commitment to the program. The NTP provides leadership support throughout the development and implementation of TB program guidelines and policies and ensures the regular supply of TB drugs. As TB continues to remain a national priority, TB management financing has been improved through the global fund and currently no fees are charged by health care providers when they provide services to TB patients.

The TB program has been integrated into the Ghana health services structure at all levels of care across the country. TB management takes place at various levels across the country, and at the regional level, various health care workers are trained and posted to the districts to help treat TB patients. At the district level, each district has TB teams headed by a district director of public health who sees to the coordination and implementation of TB control policies and activities. Access to health facilities continues to be a challenge and studies have shown that people living in most parts of the country have little access to a health facility within a 10- to 15 kilometer radius. In Ghana, TB

diagnosis is mostly done through outpatient clinics, but due to limited health facilities, community health workers and volunteers or community-based agents perform outreach to treat people in villages and serve as treatment supporters in the enablers' package program by assisting in defaulter tracing and prevention.

Risk Factors for Tuberculosis in Ghana

In general the risk factors for TB is considered to be Drug or alcohol abuse, aging, malnutrition, Infection with the human immune deficiency virus (HIV) and medical conditions such as diabetes (Narasimhan et al., 2013). However in Ghana, in addition to the risk factors for TB include behavioral and socioeconomic risk factors such as poverty, smoking, and indoor air pollution. Studies conducted by Narasimhan et al (2013) and Tornee et al., (2004) shows that crowded conditions, poor housing with poor ventilation systems, low income, lack of knowledge of TB prevention and lack of inaccessible health care services are associated with TB infection. Likewise WHO (2010) indicated that though TB is not a disease of the poor yet the widespread of TB is associated with poverty.

According to Narasimhan et al., (2013), records show poor countries have the highest risk of TB and people with low socioeconomic status are mostly exposed to several risk factors of TB. There is the possibility for people with low socioeconomic status being exposed to crowded environmental conditions with limited safety. Inmates in prisons also face the higher risk of getting TB due to the crowded living conditions. The Ministry of Health (2015) stated in their annual report that among prisoners in Ghana TB case notification is higher as compared to the general population. Smoking rate is high

among people with low socioeconomic status, studies have shown clearly the risk of TB disease is high among smokers as compared to nonsmokers indicating smoking is still a risk factor for TB infection and increases the risk of death in active TB patients (Narasimhan et al., 2013; Tornee et al., 2004).

Factors Affecting Tuberculosis Treatment

Drug Resistance

TB treatment compliance has been seen to improve and number of people being cured has increased using the DOTS approach that allows TB patients to take their daily drugs under observation (Yeboah-Manu et al., 2012). However, patients infected by strains of the Mycobacterium tuberculosis complex the causative agent of TB which is resistant to the first line drugs especially Isoniazid and Rifampicin (RIF) are unable to be cured by the DOTS treatment strategy making case management more complicated, expensive, and posing a major challenge to this strategy in TB control (Addo et al, 2013). Despite all efforts and strategies put in place to eradicate TB, the mortality in Ghana is relatively still high. A report from Korle-Bu Teaching Hospital Ghana indicates that TB is the cause of death in 1 out of 7 autopsies (Danso et al, 2015). A research conducted by the WHO indicates over 46,000 new TB cases occurs every year in Ghana (Owusu-Amoako, 2013). According to the NTP in reality health facilities in the country officially only report one third of the estimated number of cases each year (Owusu-Amoako, 2013).

Stigma

Addo et al (2013) believed that due to the stigma attached to the disease many people infected with TB does not report to health facilities. Mostly due to misconceptions

about TB, people are socially isolated after having TB so people choose to ignore the symptoms of the disease and others use another condition to explain their symptoms in order to avoid being stigmatized and isolated by society (WHO, 2015). Feuser (2014) have found not enough evidence that consider the quality of health services to influence the delay in care-seeking. Instead, Feuser (2014) have identified low awareness about the risk of TB symptoms, external constraints, stigma, gender differences, cultural and social influences as the factors associated with delay in care-seeking. Feuser (2014) believed that most TB patients would prefer to keep their diagnosis very secret and as result TB stigma leads to low detection rates. Nevertheless Feuser (2014) thought TB stigma differs among people based on TB education programs and quality of TB care programs available to them. Patients with a higher health literacy and know more about the severity of the TB are less likely to delay diagnosis and care-seeking than patients with low health literacy. TB control programs that aim to address behavioral challenges should incorporate incentive programs such as food subsidies and free transportation for patients in order to minimize costs of treatment (USAID, 2016). Yahaya, Aquah, and Sagoe (2014) conducted a study (n = 5,720) to assess if there has been improvement in TB detection. The study found that there has been improvement in case detection due to strengthening of the health systems and improvement in diagnosis processes. Though there has been improvement in case detection, stigma is still a challenge that hinders TB management.

Furthermore due to inaccurate sputum smear examinations by laboratory personnel, most infected patients are misdiagnosed. WHO (2016), estimated that globally

millions of people become infected with TB each year, and a large proportion of these are missed by NTP and the failure for health systems to screen people before they develop active TB is as a results of delays and setbacks in the health system. The U.S. Agency for International Development (USAID) stated there are number of factors that account for why health systems miss patients infected with TB diseases and therefore as global TB targets are being set ever higher, the wide and persistent gap in TB case detection is a cause for concern worldwide even though few countries have had great success in narrowing the gap between the estimated incident and notified patients, yet most countries including Ghana have not (USAID, 2011).

Mismanagement

Mitchell et al (2013) agree to the fact that reducing TB incidence, prevalence and mortality by preventing ongoing transmission and alleviating TB suffering should be the main goal of TB management program. Giovanni and Giovanni (2015) found incorrect TB program design and mismanagement of TB programs as the main reasons why TB has become difficult to eliminate and recommend appropriate strategies for the management of TB that includes: new or updated training module for health care providers, a new effective vaccine for primary prevention, improved diagnosis, and treatment for both active and latent infection to be in place. Mitchell et al (2013) suggested that TB management programs should develop active case finding by adapting strategies that stimulate earlier diagnosis. TB can be very severe and a threat to the general public if there is limited accessibility and poor quality of health services together with limited awareness of TB signs and symptoms. Prilutski (2010) and Ahorlu and

Bonsu (2013) believe throughout the country incorrect information regarding TB is still prevalent therefore there is the need for health communication strategies to be in place alongside with DOTS.

Medication Noncompliance

Mauch et al (2013) stated TB patients' noncompliance with medication is the reason TB persists in the country despite effort to eradicate the disease. Generally, attention is given to the medical aspects of the disease rather than looking at it from a social viewpoint as patients' noncompliance with TB medication is gradually becoming a health burden in the country. This is a behavioral issue which requires research to generate knowledge that would help decision and policy makers to design effective approaches to solving the problem (Owusu-Amoako, 2013).

Health Care Infrastructure

Researches has identified other social factors such as poverty, inadequate health care infrastructure, non-compliance to treatment schedule, overcrowding, lack of education and lack of commitment on the part of national control program as factors leading to global increase in TB cases (Khan, 2016; Jahanmehr et al, 2015). In a study conducted by Ahorlu and Bonsu (2013) in the Sissala East district in the Upper West Region of Ghana to determine factors affecting low TB case detection found lack of effective communication and inadequate health facility are the major problem affecting TB management in the locality and also TB medication delivery is solely from the district hospital when a TB case is confirmed. In addition, the laboratory at the district hospitals delay or refuse to send results of specimen sent for testing to the community health

centers which complicates treatment because nothing could be done without the test results. Due to lack of appropriate laboratory infrastructure the extent of TB drug-resistant is not entirely known because the Drug Susceptibility Testing is not routinely performed in Ghana, and hence TB burden in Ghana is likely to be substantially higher than the what WHO estimated (Danso et al, 2015) and thus for many people access to high-quality health care is still unavailable and there is the possibility of more people dying from this curable TB disease (WHO, 2016).Addo et al. (2010) identified under-utilization of health care services, bad implementation, lack of diagnostic tools in health clinics, and oversight by health care providers due to insufficient knowledge about TB as major factors affecting TB case detection. Yeboah-Manu et al (2012) claims late reporting of patients for medical care, and the presence of HIV co-infection as the contributing factors of high rise of TB. Owusu-Amoako (2013) believed poor quality of services explains why a large number of patients are not diagnosed and as a matter of facts the quality of services ranges from infrastructural deficits to poor interpersonal communication of health care providers.

Addressing Tuberculosis Factors

In most advance countries TB test results can be retrieved on the same day when molecular detection of mutations that are associated with resistance to certain drugs are performed using DNA extracts prepared directly from sputum specimens. However, this cannot be possible in countries such as Ghana with limited resources and where TB diagnosis relies mainly on sputum smear microscopy which has the ability to detect less than 50% of all TB cases (Owusu-Amoako, 2013).

In a study conducted by Mitchell et al (2013) which analyzed the roots of variability in mortality among TB patient in five different African Countries (Ethiopia, Ghana, Kenya, Mozambique, and Zambia) found the wide range in mortality rates among TB patients is as a result of the time of diagnosis, co-morbidities, quality of drug regimen, and variation in quality of care. Mitchell et al (2013) found TB mortality is disproportionately high among sub-populations (rural dwellers) that are not actually targeted by TB programs. Availability of accurate data is limited in the sense that data recorded are incomplete and the existing data is also hard to interpret because key variables are missing. Analysis of TB surveillance data is yet to become routine in most countries (Mitchell et al, 2013). Mitchell et al (2013) advice that it is therefore essential and highly important to improve recording and reporting of TB registry data and as a matter of fact evaluating TB management program is a key to start.

The recently launched End Tuberculosis Strategy by WHO main goals include: eliminating TB with emphasis on the role of quality TB management (WHO, 2015). WHO (2015) in their report highlighted that to reduce the incidence of TB to fewer than one case per million population by 2035, adequate diagnosis, prevention, and treatment of patients should be part of the TB management strategy. For all new TB cases initial treatment duration in Ghana is six months with intensive phase of two months and continuation phase of four months. Treatment supporter who supervises the in-take of medication are usually assigned to patients to prevent cases of default (Owusu-Amoako, 2013).

To effectively manage TB it involves a joint effort and commitment from both the community and the government. In other words, to control TB successfully timely and proper diagnosis as well as efficacy anti-TB drugs are needed but factors such as perception and knowledge about the disease play a role in prevention and control of TB.

TB management program is directly impacted by socio-economic factors and the challenges of health service provision. However, fighting these challenges is a communal responsibility of all regional health departments, health professionals, and senior government officials. Giovanni and Giovanni (2015) suggested that new TB management policies that target hard-to-reach groups such as the homeless should be in place together with ways and means of reaching out to those at risk despite the practical challenges. Most of the literature reviewed emphasized that TB is highly considered to be a stigmatized disease and its patients suffer from discrimination and social inclusion. In most cases women confront the severe consequences. Many of the studies recommended in order to manage TB effectively there is the need for TB management programs to prioritize stigma, gender, and sociocultural issues because they are the cause of the persistent difficulties TB control programs faces. It is clear from the literature review that to manage TB successfully requires specific behavior from health care providers and patients. In other words understanding behavior from stakeholders of TB management is the fundamental to design good and reliable TB intervention control programs (Ansa et al, 2015) and also conducive environment and good communication intervention might help to identify problem and target population.

Khan (2016) believe identifying the approaches for success and also identifying approaches that did not work or did work is an essential program management tool in public health. Nuti et al. (2012) believe developing and improving quality of services, health care system, and programs is an important factor to achieve better health and quality of life standards. Addo et al. (2010) recommended that rapid detection of drug resistance, prompt and effective therapy is a crucial strategy for reducing the spread of TB. The goal of the national TB program (NTP) is to prevent and control TB disease to reduce incidence rate, mortality and prevalence rate. In order to treat infected people at the earliest possible time to reduce transmission of TB within the community, DOTS or TB centers have set up in various health facilities and in addition to that more training have been given to health workers to help support TB control or management program. Also TB management activities have been linked to HIV activities and mechanism has been established to detect, prevent and trace TB treatment defaulters. In an effort to educate people and resolve the issue of stigma, WHO (2015) recommend all different types of media channels such as print materials, seminars, and community activities to be used in educating people on TB and create behavioral-change messages on the need to start TB treatment as soon as possible. This type of communication strategy might help deliver messages that will change the mindset and behavior of people.

Critique and Gaps in Previous Tuberculosis Studies

Most of the reviewed literature identified factors that make TB management difficult and gave less attention to factors such as socioeconomic status, education, culture, health facility location, number of trained health workers, and ethnicity/tribe. The

studies failed to highlight whether the TB management program in the country is meeting its objectives and goals. Factors considered in most of the studies were mainly in terms of demographic contexts and physical inputs that correspond to the health system or program. Khan (2016) agree it is equally important to not just consider the physical inputs that correspond to the health system but consider contextual factors, such as the economic, political, and other activities such as public health and health promotions. In other words social, political, demographic, geographic and economic factors which contribute to the broader service delivery process of the health system or program needs to be considered. Various statistical methods have been used ranging from descriptive statistics (Danso et al.,2015) to inferential statistics such multivariate, bivariate, and poisson regression (Amo-Adjei, 2013; Ansa et al., 2015; Agyemang et al.,2012).Sample selection and Sample size calculations are important for validity purposes most of the studies did not provide discussion on how the effect size and sample size were determined but among the studies there were variations with respect to sample size used which ranged from 73 (Osei et al.,2015) to 5128 (Agyemang et al, 2012).

Ansa, Walley, Siddiqi, and Wei (2015) conducted a cross-sectional quantitative study in three district hospitals in the Eastern region of Ghana to evaluate TB control interventions program and to determine if TB treatment outcomes changed significantly after integration of services. A before-and-after study involving all TB patients registered (n = 1275) for a two-year period was done at each of the sites. Osei et al. (2015) assessed the factors associated with delays diagnosing new TB patients (n = 73) in Hohoe Municipality of Ghana and found that the median delay days was 104 days and concluded

that perceived stigma (AOR = 5.30; P <0.018), lack of medical insurance (AOR = 6.12; P < 0.025) and frequent visit to the hospital are the factors that hinder the delay in TB case detection. Danso et al. (2015) conducted a cross-sectional study in two locations in the Suhum Kraboa Coaltar District in Ghana examining patients' compliance with TB medication. The study found that 63% (which is less 85% national target) of the patients complied with medication pointing out financial problems, depression, and duration of treatment as the factors affecting TB management. Danso et al. (2015) found no association between patients' sex, marital status, educational level, occupation age, and medication compliance. These studies (Ansa et al., 2015; Danso et al., 2015; Osei et al., 2015) considered factors such as stigma, sex, age, lack of medical insurance, educational level, marital status medication compliance and treatment success. These studies found no associations between selected variables. The weakness of these studies is that they were undertaken in only one or two district and as a result it is hard to generalize the findings to the general population of Ghana.

However, Amo-Adjei (2013) combined qualitative and quantitative methods to investigate and examined TB treatment outcomes based on specific factors, TB treatment success and completion rate increased from 43.6% to 87.7% between 1997 and 2010. Indicating improvements in community TB care, TB diagnosis, no stigmatization among community and health workers towards TB patients contribute to better treatment outcomes. Likewise, as an intervention to improve treatment outcomes in Eastern Region of Ghana Agyemang et al., (2012) evaluated the decentralization and community supervision of TB treatment program. Treatment outcomes of cohorts registered in 2003-

2005 (n = 5128) were compared and there was a significant difference between treatment success rates 82.7%in the decentralized period as compared to the 69.6%, in centralized period (P<0.0001). Cured rate improved during the decentralized period 75.8% as against the centralized period 63.2% (P<0.0001).

Kasu (2015) observed a percentage increase in TB case detection and notification from 41.2% in 2010 to 44.4% in 2011in a study conducted in Akatsi, Ghana which evaluated the TB surveillance system. The study concluded that improvement in system operations and availability of TB services at all health care facilities will help reduce the incident of TB and increase cure rate. Dodor (2012) explored the feelings and experiences of TB patients, and highlighted how TB stigma may affect case finding and compliance with treatment. Most TB patients attribute their TB symptoms to malaria and ordinary cough due to the stigma attached to the disease in society and report to the hospital only after a long period of self-medication with traditional herbs. The stigma makes it a challenge for patients to comply with the long duration of TB treatment.

Das et al, (2015) assessed the associations between various components of TB case management and provider qualifications. Ivany and Boulton (2014) identified provider behavior as the best approach to improve the quality of TB care management. Ivany and Boulton (2014) found a variation of quality of care and poor adherence to standard of care among providers. Among all TB cases only 21% were correctly managed by providers. It is believed that providers behavior contribute to poor TB diagnosis and treatment outcomes and these studies (Das et al, 2015; Ivany & Boulton, 2014) raise concerns relevant to policy reform that deal with providers behavior. These studies

(Amo-Adjei, 2013; Agyemang et al, 2012; Kasu, 2015; Dodor, 2012; Das et al, 2015; and Ivany & Boulton, 2014) used descriptive statistics to investigate TB treatment outcomes within districts. The variables considered were TB diagnosis, stigma, TB patient experience, case detection and treatment completion. These studies (Amo-Adjei, 2013; Agyemang et al, 2012; Kasu, 2015;Dodor, 2012; Das et al, 2015; and Ivany & Boulton, 2014) used descriptive statistics and regression to analyze their data and also failed to address how the samples were drawn and only focused on the program success giving less attention to factors such as socioeconomic status, education, culture, health facility location, number of trained health workers, and ethnicity/tribe. Therefore, my study will attempt to evaluate TB management program considering TB factors such as socioeconomic status, education, health facility location, number of trained health workers, and ethnicity/tribe which were not considered or addressed in reviewed literature.

Summary

In chapter 2 the review of literature as related to TB management and the factors that affect or hinder TB management in general and within the context of Ghana in particular were conducted. In this Chapter, search strategy used in identifying reviewed literature and the justification for using the theoretical framework which argues that a link between accountability and performance measurement was provided.

TB is still considered to be a burden in the world and it is estimated about 2 million deaths from TB occur each year globally (USAID, 2016). According to Ghana Health Service (GHS) the persistent of TB making it difficult to control is influenced by

poor public health systems, poverty, and increasing prevalence of HIV/AIDS (GHS, 2014). In Ghana, the effort to control TB disease can be traced as far back in the early 1900s (GHS, 2014). A report from the Ghana Ministry of Health (MOH) outlined the objectives of the national TB program (NTP) as providing leadership and helping develop policies and guidelines to be followed by regions and district to improve their capacity to control TB (MOH, 2013) in other to achieve 70% case detection and 85% treatment success but the issue of non-completion of treatment and diagnosis delay remains a challenge.

Ismail and Josephat (2014) believe prompt initiation of treatment and early diagnosis should be the key elements in any TB control program. Other researchers believe effective communication, and knowledge about the disease is keen to improving treatment (Prilutski, 2010; Osei et al, 2015). Likewise, other researchers also think certain behaviors from health care providers and patients are required to achieve TB detection and treatment success (Kahissay, 2015; Khan, 2016). Ahorlu & Bonsu (2013) emphasized that knowing the dangers of TB is important information needed to be communicated to improve health seeking behavior for TB patients.

In addition, health care providers should be able to successfully perform a number of actions including performing laboratory testing adequately, and monitoring medicine intake by patients. Ansa (2012) stated patients' refusal to or delay seeking medical attention even though they are expected to do is because of the stigma attached to the disease. It is presumed by many community members that almost every TB patient to be suffering from HIV/AIDS which is even more stigmatized than TB. The directly

observed treatment short course (DOTS) which is globally accepted is the main TB treatment strategy adopted by the National TB program in Ghana, this approach is recommended to improve treatment and enhance TB treatment compliance (GHS, 2015). But this approach depends on diagnosis from the laboratory to confirm clinical cases before treatment can start. This has been the problem since there are few laboratories available in community health facilities and also results from samples sent to periphery facilities for testing are not communicated at all or early enough to begin treatment (Osei et al, 2015).

Most of the studies conducted by several researchers related to delays and factors associated with the detection of TB suggested that in order to identify how to improve the quality of TB care and control, it is important to analyze factors associated with health care services and patient delay (Osei et al, 2015; Ahorlu & Bonsu, 2013; Amo-Adjei, 2013; Ismail & Josephat, 2014; Danso et al., 2015).According to Arah and Westert (2005) health is a function of multiple determinants or factors that work in complex ways. Moreover, studies which only considered socioeconomic factors and health care inputs failed to identify any associations between variables since health has stronger relationship with non-medical determinants than with health care indicators (Arah & Westert, 2005).

Similar health programs which have been successfully implemented in some setting also fail in other setting due to socioeconomic, political, and demographic factors (CDC, 2011). CDC suggest that evaluating programs is the means to know how well program implemented stick to its protocols and in addition determine if activities are

carried out as planned. Evaluation help identify the strengths and weakness and areas which needs immediate attention and improvement. In Chapter 3, I will provide detailed explanation of the research methodology and design. In addition, discussion on hypothesis, research question, overview of the study data source, and sampling procedures will be provided. The study variables are to be defined clearly as well as threats to study validity and ethical considerations will also be described.

Chapter 3: Research Method

The main purpose of this quantitative study was to evaluate the performance of the TB management program in Ghana. Assessing TB management program is important for optimal resources allocation and policy making. Several factors can affect the efficiency and effectiveness of the TB management program in Ghana, such as quality of health care services, health infrastructure, and poor TB case detection and management practices (Addo et al, 2010). Arah and Westert (2005) found that health is a function of multiple factors that work in complex ways, so this study considered multiple factors ranging from economic and social to demographic.

This chapter is subdivided into three sections: (a) research design, (b) methodology, and (c) threats to validity. The research design section includes details about the study design, the rationale, and the study variables. In the methodology section I discuss the methodological aspects, such as the study population, the data collection method, and the statistical procedures used to test the hypotheses. Then threats to validity together with ethical considerations are discussed.

Research Method and Rationale

A researcher can use any of the three methods—quantitative, qualitative, or mixed (Creswell, 2009) to answer the research questions of interest. These research methods differ from each other in character and form. Each method has a set of principles and assumptions that determine its appropriateness for answering the research question.

Quantitative and qualitative research methods are identified on the basis of logical inquiry, data collection and analysis, and approach to explanation. Mixed method

combines qualitative and quantitative methods to reduce or eliminate the weaknesses in both methods (Creswell, 2009). According to Wang, Huang, and Dismyukes (2004), the nature of the research question determines the methodological approach used.

In this study, I used a quantitative research approach because I sought to test hypotheses regarding the effectiveness and efficacy of a TB management program. A cross-sectional study design was used to answer the research questions. According to Sedgwick (2014), cross-sectional studies are generally quick and easy to perform. In a cross-sectional study, all the measurements for a sample are obtained at a given point in time. The use of a cross-sectional study design was justified because the data gathered on the relevant variables for looking at their associations represent occurrences at a certain point in time. The advantages of using a cross-sectional design are that it can be used to capture a specific point in time, it contains multiple variables at the time of the data snapshot, and the data collected can be used for answering various types of research. The research questions for this research were:

RQ1: Is there an association between socioeconomic status (employment status, occupational status, and income), education, tribe/ethnicity, and TB treatment completion in Ghana?

$H_0$1: There is no association between socioeconomic status (employment status, occupational status, and income), education, tribe/ethnicity, and TB treatment completion in Ghana.

H_a1: There is an association between socioeconomic status (employment status, occupational status, and income), education, tribe/ethnicity, and TB treatment completion in Ghana.

RQ2: Is there an association between the health facility location, number of trained health workers. and TB treatment completion in Ghana?

H_02: There is no association between health facility location, number of trained health workers, and TB treatment completion in Ghana

H_a2: There is an association between health facility location, number of trained health workers, and TB treatment completion in Ghana.

My research design selection was guided by the research questions and the characteristics of the data. The study research questions were answered using statistical analyses to evaluate associations and relationships among variables. This design is appropriate for nonexperimental research studies looking for associations between variables. Quantitative research including cross-sectional studies, mostly use statistical tools to examine associations between variables from large sampled data that has been collected through a precise process to generate statistically representative data, which allows generalization of the findings (Creswell, 2009).

Statistical Analyses Methods

Logistic regression and chi-square tests were used in analyzing the data in this study. A chi-square testis a statistical test used to examine the association between categorical variables (Beaumont, 2012). Logistic regression analysis is a statistical tool that can be used to investigate relationships between a dichotomous response variable and

independent variables (Campbell &Campbell, 2008).To determine the linear relationship between variables, regression is normally used; regression is appropriate for studying functional dependencies between variables (Creswell, 2009). Arah and Westert (2005) found that health is a function of multiple factors that work in complex ways, and in this case, regression was well suited to analyze the data. Considering the objectives of the study, choosing a quantitative method was relevant because finding relationships and associations between variables was achievable; qualitative methods would not be appropriate because they deal with lived experiences (Campbell & Campbell, 2008).I selected a quantitative cross-sectional design because the data were numerical and the data could only be analyzed using statistical tools. Because the study was set to examine and analyze factors that hinder the TB management program in Ghana, this approach had the ability to generate relationships and associations between variables, making quantitative the most appropriate method for the study.

Methodology

This section provides an overview of the methodology, including a description of the target population, sampling and sampling procedures, type of data and data collection, and variables and how they were operationalized.

Target Population

The study was conducted in Ghana, West Africa. According to Ghana Statistical Service (2013), the population of Ghana was 24,658,823 in the 2010 census, with a projection of 28 million in 2018. The aim of the study was to assess and evaluate the TB management program in Ghana. Due to logistical and time constraints, data were

collected on TB patients in four regions: Greater Accra Region, Ashanti Region, Eastern Region, and Western Region. As Table 1 shows, the Ashanti Region has a projected population of 5,406,200, Greater Accra Region has a population of 4,613,600, Eastern Region has a population of 3,028,600, and Western Region has a population of 2,887,100 (Ghana Statistical Service, 2013). These regions are the most densely populated and they constitute about 60% of the total population of Ghana. In addition, these regions also have the highest incidence and prevalence of TB cases (see Figure 2).

Table 1

Ghana Population by Region, 2010 Census and 2017 Projections

Region	Area(km²)	2010 census	2017 projection
Ashanti	24,389	4,780,380	5,406,200
BrongAhafo	39,557	2,310,983	2,660,600
Central	9,826	2,201,863	2,437,800
Eastern	19,323	2,633,154	3,028,600
Greater Accra	3,245	4,010,054	4,613,600
Northern	70,384	2,479,461	2,858,800
Upper East	8,842	1,046,545	1,188,800
Upper West	18,476	702,110	792,500
Volta	20,570	2,118,252	2,434,200
Western	23,921	2,376,021	2,887,100
Ghana	238,533	24,658,823	28,308,300

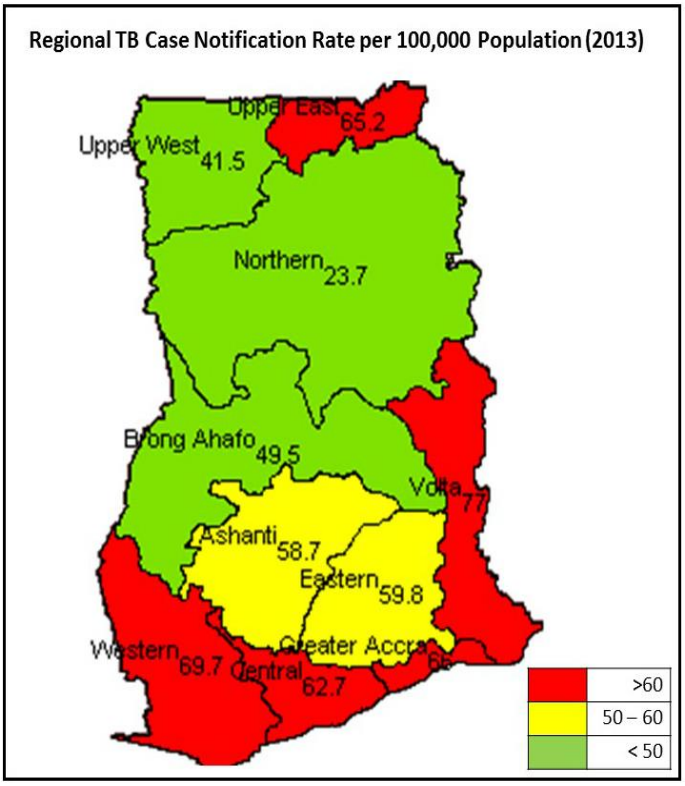

Figure 2. Map of Ghana showing all regions. ,Retrieved from https://www.google.com/search?q=map+of+ghana&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjHjsb5oIPYAhWRUN8KHS0PCnwQ_AUICygC&biw=1366&bih=662#imgrc=22o9y9J99ybC-M:

Sampling and Sampling Procedure

This study required the use of secondary data containing information on both TB patients who had completed their treatment and those currently receiving treatment in the selected four regions. The sample included all TB cases reported between 2015 and 2017. The data were obtained from the DHIMS database that contains nationwide data on TB patients' demographics, treatment outcomes, mortality rate, and treatment administered.

Sample Frame

According to WHO(2017) standards, cases of TB should be below 92 per every 100,000, but the prevalence of TB in Ghana was estimated to be about 45,000 or 160 per

100,000.In 2015, 14,632 new TB cases were reported (Ghana Ministry of Health, 2015). The selected regions understudy constituted about 60% of new TB cases. Ashanti Region recorded 3,041, the highest cases of TB; Greater Accra Region recorded 2,901, Western Region recorded 1,758, and Eastern Region recorded 1,677 cases.

The data collected from the selected regions were a strong representation of the study population. Also the selected sample from the data was based on eligibility and inclusion criteria. Study participants were selected only from the four study regions reported between 2015 and 2017. Data from other regions and not within this timeframe were not considered.

Data Collection

In this study, secondary data on TB patients' recorded between the year 2015 and 2017were collected. In order to have access to this data, I sought permission from the Ghana health services and the Ministry of Health after my proposal was approved by the Institutional Review Board (IRB) and successful completion of my oral defense.

The District Health Information Management System (DHIMS) database contained national health information but unlike other countries, in Ghana the statistical reporting was considered to contain inconsistent, inaccurate, and incomplete data. Ministry of Health, Ghana (2010), admits that because most of the professional health workers lack basic computer skills or knowledge the system completeness and reliability continues to be a challenge because of incomplete and late entry of information. In search of data, I relied on personal contact and consultation with the regional TB coordinators,

the national headquarters officials, and alongside perform computerized database search on the national health database.

Operationalization of Variables

Dependent Variable

The dependent variable was Treatment completion. The treatment completion was measured in number of completed treatment days (WHO, 2016). For the DOT strategy used in Ghana, the treatment duration in days were 6 months (168 days) and a person was considered to have completed treatment if he/she had taken 168 doses of medication. For this study, the outcome variable was divided into two parts as ≥ 168 days of treatments/doses of medication taken as treatment completion and < 168 days of treatment/doses taken as treatment uncompleted. The code considered for the variable was0 = No (treatment not completed) and 1 = Yes (treatment completed).

Independent Variables

Ethnicity/tribe: The extent to which one identifies him/herself with a particular ethnic or tribal group with shared knowledge, attitudes, and habitual behavior patterns. This variable was categorized based on the language an individual speaks.

Health Care facility Location: The place when the health facility can be located. This variable was categorized into two categories Urban - 0 and Rural = 1.

Number of trained health workers: The total number of trained health care workers in each selected region.

Level of education: The level of attained education at the time of registering for treatment. This variable was recorded as a categorical variable into four categories: No education = 0, Elementary education = 1, High school = 2 and College Education = 3.

Socioeconomic Status: It is the finely graded hierarchy of social positions which can be used to describe a person's overall social position or standing. It was indicated by a number of concepts such as employment status, occupational status, education, and income.

Table 2

Variable Characteristics

Type	Variable name	Level of measurement
Dependent	Treatment completion	Nominal
Independent	Level of education	Nominal
	Health facility location	Nominal
	Number of trained health workers	Discrete Quantitative
	Ethnicity/Tribe	Nominal
	Socioeconomic status (employment status, occupational status, and income)	Nominal

Sample Size Estimation

For the statistical test, the alpha level alpha level (p-value) which is the chance of error that researchers are willing to accept (Walden University, 2014) is less than 0.05 (< 0.05) and it was used as the statistical significance cutoff with a confidence interval of 95%.Confidence interval of 95% on the other hand indicates 95 out of 100 times the samples true value of the population mean which fall within its limits (Field, 2013). The

likelihood of finding a statistical difference when one exists is referred to as power which was set at 80% (Field, 2013).G*Power software was used to compute sample size based on inputs of the significant difference level, statistical test, and effect size. The study used two distinct statistical tests to test hypotheses related to RQ1 and RQ2. The sample size calculation for the logistic regression assuming 80% power, odds ratio of1.3, Pr (Y = 1 | X = 1) H0 = 0.3, alpha of 0.05, yielded a sample size of 438.

Dataset Preparation and Data Analysis Plan

Data analysis in any study helps readers to understand and interpret the research hypothesis or question and also the results of the study (Garbarino & Holland, 2009).In addition, the appropriateness of statistical tools in any study depends on the research question and the type of variables being considered (Field, 2009). For this study the data analysis plan followed a systematic process that ensured the accuracy and completeness of data and the selected statistical method aligned with research question and the study variables. As stated earlier, the secondary data was obtained from the District Health Information Management System (DHIMS) supplemented with the regional TB patients registers. I then cross check to verify that there were no missing or incomplete information, but rather correct entry has been done. For the purpose of this study, I used the Statistical Package for Social Scientists (SPSS 23) to organize and analyzed my data.

I provided a summary of the data using descriptive statistics and I created a frequency table for the variables to examine the distribution of data. I then conduct a measure of central tendency which included the standard deviation, the mean and lastly examined the dispersion of data. Based on the nature of the dependent variable in RQ1

and RQ2, logistic regression analysis was well suited to answer RQ1 and RQ2 because linear regression could not deal with dependent variable's that are dichotomous and categorical (Çokluk, 2010). Logistic regression is mostly used in studies in which the dependent variable has only two values such as Yes and No or a value of 1 and 0. In addition, logistic regression analyses the association between a categorical dependent variable and a set of independent variables (Çokluk, 2010). Logistic regression was more over easier to use with SPSS and, and required fewer assumptions, and was more statistically robust. In logistic regression analysis, it was important to categorize the dependent variable into codes such as 0 and 1 in the analysis. Considering the dependent variable in my study, I coded treatment not completed as 0 = No and treatment completed as 1 = Yes. For this study, the Wald chi-square statistic was used to test statistical significance of individual regression coefficients (Exp β) which measured each independent variable's partial contribution to variations or changes in the dependent variable and then interpreted in terms of the change in odds. Using SPSS the overall significance was tested using Chi square, which was derived from the likelihood of observing the actual data under the assumption:

1. Logistic regression does not assume a linear relationship between the dependent and independent variables ((Chao-Ying et al., 2002)
2. Independent variable should not be too highly correlated (Field, 2014)

Threats to Validity

In quantitative research, threats to validity are important because they determine if the findings of the study can be considered to be valid and generalized to the population.

In any study, the validity of the research is most often affected by the study design, data analysis and data collection procedure. For a quantitative research study to be accepted, the study design must minimize threats to validity and reliability (Lameck, 2013). Cooper and Schindler (2010) divided validity into two forms internal and external validity. Internal validity is the extent in which the data instrument measures what is intended to measure. In other words, internal validity becomes significant when the measuring instrument fails to answer the study hypothesis and question. External validity deals with the practicality of the data with respect to the settings, time, and participants (Cooper and Schindler, 2010). According to Cooper and Schindler (2010) a study is likely to result in negative outcome if the researcher fails to assess the validity of the study.

The purpose of this study was to evaluate the performance of TB management program in Ghana. Since threat to validity included information and selection bias, data were collected from four regions. The selection of these regions was critical though it might raise the concern of threat to validity of the study. Because the general TB population could not be used in the study, the selection of sample within the TB population in the country did raise the issue of selection bias and this was addressed in different ways.

The estimated TB population in the four selected regions was considered to be about 60% of the entire TB population in Ghana which showed that these regions fairly represent the TB patients in the country. According to Creswell (2009) to be able to address the issue of information bias the ability to obtain genuine secondary data was very important. However, this study made use of secondary data that might contain in

correct figures or information from the original report. To depend solely on the District Health Information Management System (DHIMS) database there was a possibility of incomplete medical records or existence of missing data. I had to verify as a researcher to ensure the accuracy of the data.

Ethical Procedures

In any study that involves subjects and secret information or materials, confidentiality is paramount (Cooper and Schindler, 2010). Part of the data was publicly available on the government official Web sites where informed consent was not a necessary condition. But it was necessary to get permission from the Ghana Health Services or Ministry of Health in order to get access to certain government documents and files.

However, data collected deserved the protection and respect following the rules and regulation of Ministry of Health in Ghana. In addition, IRB formal approval by Walden University was required. The purpose of the IRB was to ensure that this study meets all ethical standard criteria that demonstrate greater benefit than risk.

Summary

In this chapter the purpose of the proposed study is discussed and a detailed description of the research design, data collection population size, sample and sampling procedure, statistical methods to be used for testing the stated hypotheses, ethical procedures and threats to validity are provided. The research questions to be addressed by the proposed research are (1) Is there an association between socioeconomic status (employment status, occupational status, and income), education, Tribe/ethnicity and TB

treatment completion in Ghana? and (2) Is there an association between the health facility location, number of trained health workers and TB treatment completion in Ghana?

In this study, a cross-sectional design was used to answer the stated research questions. The selected research method contained necessary steps that minimized selection and information bias. The data analysis included a logistic regression analysis, descriptive statistics and correlation analysis using SPSS (Version 23.0). Ethical procedures were followed so as to ensure privacy and confidentiality of the research participants also was discussed. In Chapter 4 descriptions and presentations of the results of the data analyses are provided.

Chapter 4: Results

The purpose of the study was to evaluate the TB management program and its outcome for TB patients in Ghana. The study sample was selected from the four regions in Ghana with the highest TB incidents: Greater Accra Region, Ashanti Region, Eastern Region, and Western Region. The specific objective of the study was to determine the effectiveness of the TB management program, considering factors such as the number of trained health care worker available, education level, employment status, and ethnicity. Findings from the literature review indicated that less attention has been given to the factors being considered in this study. The study initially considered two research questions, each with a corresponding hypothesis to examine: (a) whether there is an association between socioeconomic status (employment status, occupational status, and income), education, tribe/ethnicity, and TB treatment completion in Ghana; and (b) whether there is an association between the health facility location, number of trained health workers, and TB treatment completion in Ghana. However, due to unavailable data for occupational status and income variables, modification was made to the research questions to best analyze the data received. According to Becker et al. (2015), adding control variable helps to produce a more conservative test of hypotheses and reveals the true relationships or association among variables. To better understand the effects of an independent variable, additional variables, such as age, gender, and marital status were added to the study variables.

In this chapter, I present and describe results of the analyses of data obtained from the National TB program from the Ghana Health Services. The general overview of the

descriptive statistics for the sample or study participants and the findings from the binary logistic regression analysis are presented. In the final section, a summary of answers to the research questions based on the statistical findings is presented.

Data Collection and Management

Data for this study were obtained from the DHIMS database with the help of TB program coordinators in Ghana after gaining Walden IRB approval to conduct the study. Only authorized personnel from Ghana Health Services have access to the DHIMS database with a secure password. The initial dataset extracted by the TB program coordinators in Ghana contained aggregate information for the entire country and later the appropriate dataset was obtained. Evaluation of the data indicated a small portion of missing entries. The data sample only included cases recorded in the four selected regions between 2015 and 2017. Based on the sample size calculation indicated in Chapter 3, the study required a minimum of 438 participants. The initial data size requested from the Ghana Health Service was between 600 and 800 participants, but then a total of 1,122 cases were randomly selected from the database with the help of Ghana Health Services representatives. The age range for the participants included minors and Ghana Health Services representatives confirmed they have obtained consent on my behalf. The final sample size that was included in the analysis was 1,122 cases, which was higher than the minimum sample size determined in my power analysis.

Results of Descriptive Statistics

I conducted a descriptive statistics analysis with SPSS (Version 24.0) to examine the characteristics of the participants. Table 3 displays a summary of descriptive statistics

of the characteristics of the participants that were sampled in the study. The statistical results show that, among the 1,122 TB cases, 41.8% were female patients and 58.2% were male patients. In addition, 3.8% fell within the age group 5–14 years, 9.7% within 15–24 years, 23.8% within 25–34 years, 28.7% within 35–44 years, 20.5% within 45–54 years, 4.3% within 55–64 years, and 9.2% were 65 and above. The study mean age was 39.8+/–15.6 years and the age range was from 5 to 87 years. Figure 3 shows the age distribution.

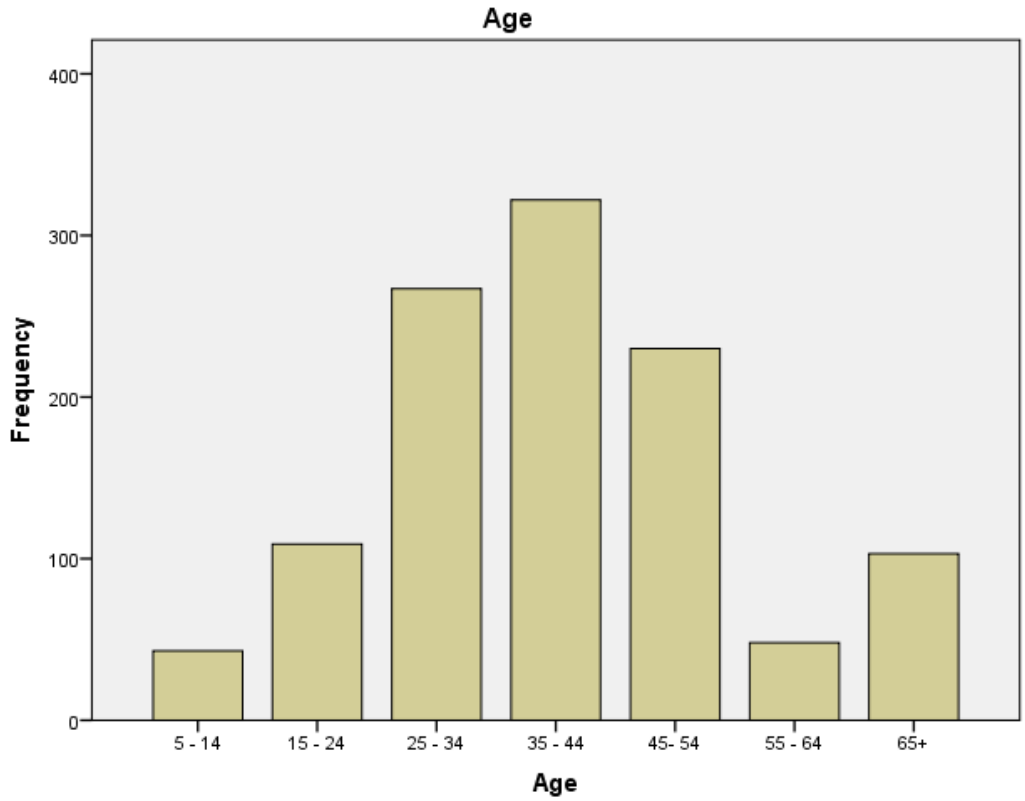

Figure 3. Bar chart of age distribution.

Table 3

Descriptive Statistics of Participant Characteristics

Participant characteristics		Frequency	Percentages (%)
Gender	Female	469	41.8
	Male	653	58.2
Age	5–14years	43	3.8
	15–24years	109	9.7
	25–34years	267	23.8
	35–44years	322	28.7
	45–54years	230	20.5
	55–64years	48	4.3
	65+years	103	9.2
Marital status	Single	486	43.3
	Married	608	54.2
	Missing	28	2.5
Ethnicity/tribe	Akan	786	70.1
	Ewe	39	3.5
	Ga	211	18.8
	Mole-Dagbon	78	7.0
	Missing	8	0.7
Employment status	Unemployed	189	16.8
	Employed	932	83.1
	Missing	1	0.1
Health facility location	Urban	706	62.9
	Rural	416	37.1
Education level	No education	319	28.4
	Elementary	379	33.8
	Secondary	287	25.6
	Tertiary	131	11.7
	Missing	6	0.5
Treatment Completion	Yes	757	32.5
	No	365	67.5
Region	Ashanti	294	26.2
	Greater Accra	324	28.9
	Eastern	275	24.5
	Western	229	20.4

In addition 53% were married and 44.5% were single; those who were single included those who had lost a spouse or divorced. In regard to employment, 83.1% were employed and 16.8% were unemployed. The four regions under study were dominated by

the Akan ethnic group, which constituted 70.1%; others were 3.5% Ewe, 18.8% Ga, and 7% Mole-Dagbon (Northerners). Among the study participants, 28.4% had no education, 33.8% had elementary education, 25.6% had secondary education, and 11.7% had either college or tertiary education. The proportion of the sample drawn across the four regions was evenly distributed with 26.2%from Ashanti Region, 28.9% from Greater Accra Region, 24.5% from Eastern Region, and 20.4% from Western Region.

Results of Bivariate Analyses

I conducted a chi-square test analysis to examine the effect of each study variable on treatment completion. The bivariate analyses relied on two statistical assumptions: (a) the data are randomly drawn from a population, and (b) the application of the chi-square test to a small sample could lead to an unacceptable rate of Type II errors (Bolboacă et al., 2011). The sample size was sufficiently large, so I concluded that study data met statistical assumptions related to bivariate analyses. The corresponding results are presented in Table 4. The results of the chi-square test measured the significance of each variable in the study. The results indicated that marital status of study participants ($\chi 2 = 0.170$, $p > 0.680$) did not demonstrate a significant association between treatment completion among the study participants; employment status ($\chi 2 = 1.239$, $p > 0.266$), education level ($\chi 2 = 5.003$, $p > 0.172$), and ethnicity/tribe ($\chi 2 = 4.996$, $p > 0.172$) did not demonstrate a significant association between treatment completion among the study participants as indicated by their respective *p* values. However, as shown in Table 4, patient location ($\chi 2 = 13.327$, $p < 0.000$) demonstrated a significant association with treatment completion. Likewise, age ($\chi 2 = 16.946$, $p < 0.009$) and number of trained

health care workers ($\chi 2 = 100.723$, $p < 0.000$) demonstrated a significant association between treatment completion among study participants as indicated by the p values.

Table 4

Chi-square test Analysis of variables for Treatment Completed (Yes or No)

Variables	Treatment completed (yes)	%	Treatment completed (no)	%	Total	Chi-square
Gender						
Female	322	42.5	147	40.3	469	$\chi 2$(0. .518)
Male	435	57.5	218	59.7	653	P(0.472)
Number of trained health care workers						
1–150	92	12.2	137	37.5	229	$\chi 2$(17.733)
151–300	197	26.0	69	18.9	266	P(0.001)
301 – 450	228	30.1	84	23.0	312	
451 – 600	166	21.9	44	12.1	210	
601+	74	9.8	31	8.5	105	
Age						
5–14	31	4.1	12	3.3	43	$\chi 2$(16.946)
15–24	87	11.5	22	6.0	109	P(0.009)
25–34	163	21.5	104	28.5	267	
35–44	226	29.9	96	26.3	322	
45–54	153	20.2	77	21.1	230	
55–64	27	3.6	21	5.8	48	
65+	70	9.2	33	9.0	103	
Marital status						
Single	322	44.0	164	45.3	486	$\chi 2$(0.170)
Married	410	56.0	198	54.7	608	P(0.680)
Health facility location						
Urban	504	66.6	202	55.3	706	$\chi 2$(13.327)
Rural	253	33.4	163	44.7	416	P(0.000)
Ethnicity/tribe						
Akan	545	72.7	241	66.2	786	$\chi 2$(4.996)
Ewe	24	3.2	15	4.1	39	P(0.172)
Ga	133	17.7	78	21.4	211	
Mole-Dagbon	48	6.4	30	8.2	78	
Employment status						
Unemployed	134	17.7	55	15.1	189	$\chi 2$(1.239)
Employed	622	82.3	310	84.9	932	P(0.266)

Table Continue…….

Variables	Treatment completed (yes)	%	Treatment completed (no)	%	Total	Chi-square
Education						
No education	191	25.3	128	35.4	319	$\chi 2(5.003)$
Elementary	259	34.4	120	33.1	379	P(0.172)
Secondary	199	26.4	88	24.3	287	
Tertiary	105	13.9	26	7.2	131	
Region						
Ashanti	191	25.2	103	28.2	294	$\chi 2(2.168)$
Greater Accra	222	29.3	102	27.9	324	P (0.538)
Eastern	193	25.5	82	22.5	275	
Western	151	19.9	78	21.4	229	

Assumption Testing

Logistic regression results can only be reliable only when some assumptions are not violated. To ensure how reliable the results from the logistic regression are, the assumption of multicollinearity and the linearity of the logistic analysis were tested.

Table 5

Multicollinearity Diagnosis

Predictors	Collinearity statistics	
	Tolerance	VIF
Patient location	0.636	1.572
Regions	0.959	1.043
Number of trained health care workers	0.629	1.590
Education level	0.991	1.010
Ethnicity/tribe	0.981	1.020
Employment status	0.966	1.035
Marital status	0.969	1.032

According to Field (2014) the assumption of multicollinearity assumes that independent variable (predictors) should not be too highly correlated. According to Field (2014) because SPSS does not actually have an option to test for multicollinearity

diagnostics in logistic regression, the best alternative is to get the statistics results on collinearity diagnostics tolerance and VIF by simply running a linear regression analysis using the same variable and thus tolerance value less than 0.1 and VIF value greater than 10 indicates there is an issue of multicollinearity between the predictors. The results for the test are shown in Table 6 below. As indicated the assumption of multicollinearity was not violated because none of the values of tolerance for various variable is 0.1 and likewise none of the values for VIF for variables were greater than 10.

Linearity of the logit: Logistic regression does not assume a linear relationship between the dependent and independent variables (Chao-Ying, Lee, &Ingersoll, 2002) but it does assume that the independent variables are related linearly to the log odds. The test will underestimate the strength of the relationship and the alternative hypothesis will be rejected as the relationship is not significant if this assumption is violated. As indicated in Table 6, the H-Lgoodness of fit test shows that the data perfectly fits well into both models, model 1X2 = 5.739, df= 8, p > 0.676; model 2 X2 =15.321, df= 8, p > 0.053 and thus the assumption of linearity was not violated.

The General Logistic Regression Model Predictive Ability

I evaluated two binary logistic regression models for each research question to examine the ability of the model to predict the outcome variable. I compared a 2 X 2 classification table of each model with all the predictors with the null model without predictors to examine the ability of the model to predict the outcome of the variables correctly. Table 6 shows the results for the test.

For Model 1 the results indicated that the outcome variable (treatment completion) was correctly classified by the logistic regression model for 66.9% of the cases compared to 66.8% in the null model. According to Field (2014), how better the model predicts the outcome variable can be assessed using the model chi-square statistic, which measures the difference between the model as it currently stands and the model when only the constant is included. Omnibus test of model coefficient was examined to check if the addition of predictors to the regression did improve the baseline model. Chi-square test was used to verify the significance of the improvement of the model over the baseline model and the results of shows that model 1 did explain more of the variance in the outcome as indicated in Table 6.The value of Nagelkerke pseudo R2 also suggested that the model predicted 3.5% of the variation in the outcome variable (treatment completion). Also, the value for the H-L goodness of fit indicated that Model 1 was a good fit for the data with $p = 0.676 > 0.05$. Therefore the above evaluation results presented indicated that the data fits the regression and Model 1 correctly classified the outcome for majority of the cases.

For Model 2, the results indicated that the outcome variable (treatment completion) correctly classified by the logistic regression model for 66.9% of the cases compared to 70.4% in the null model. Also Omnibus test of model coefficient was examined to check if the addition of predictors to the regression did improve the baseline model. Chi-square test was used to verify the significance of the improvement of the model over the baseline model and the results of shows that Model 2 did explain more of the variance in the outcome as shown in Table 6.The value of Nagelkerke pseudo R2also

suggests that the model predicts 10.4% of the variation in the outcome variable (treatment completion). Also the value for the H-L goodness of fit indicate that Model 2 is a good fit for the data with p = 0.053> 0.05 Therefore the above evaluation results presented indicate that the data fits the regression and Model 2 can correctly classify the outcome for majority of the cases.

Table 6

Results Table of the Model Test

Test	Results	
	Model 1	Model 2
Overall 2 x 2 Classification	66.8%[66.9%]	66.9%[70.4%]
Chi-square	X2 = 27.373, df= 15, p < 0.026	X2 = 84.950, df= 13, p < 0.000
NagelkerkeR2	0.035	0.104
Hosmer & Lemeshow (H-L)	X2 = 5.739, df= 8, p > 0.676	X2 = 15.321, df= 8, p > 0.053

Answering Research Questions and Hypothesis

In order to answer the research questions, binary logistic regression analysis was performed. All variables were entered into the model simultaneously. The results of the binary logistic regression are shown in Tables below and discussed in subsequent sections. As stated earlier, due to missing data the initial research questions were modified to include controlling variables age, marital status, and gender.

RQ1: Is there an association between employment status, educational level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender?

$H_0$1: There is no association between employment status, educational level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender.

H_a1: There is an association between employment status, educational level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender.

Table 7

Binary Logistic Regression Analysis of Predictors and Treatment Completion with OR, 95% CI, Wald and P values (N= 1122)

Variables	B (SE)	OR	wald	P	95% CI	
					Lower	Upper
Employment status						
Unemployed		1.00				
Employed	-0.086 (0.222)	0.918	0.148	0.700	0.594	1.419
Health facility location						
Urban		1.00				
Rural	-1.299 (0.197)	0.273	43.688	0.000	0.186	0.401
Ethnicity/tribe						
Akan		1.00	1.208	0.258		
Ewe	0.276 (0.251)	1.318	0.002	0.272	0.805	2.157
Ga	0.017 (0.413)	1.018	.005	0.966	0.453	2.286
Mole-Dagbon	-0.020 (0.281)	0.980	1.208	0.944	0.565	1.700
Education level						
No education		1.00	4.722	0.193		
Elementary	-0.414 (0.233)	0.661	3.145	0.076	0.419	1.044
Secondary	-0.142 (0.237)	0.868	0.358	0.550	0.545	1.382
Tertiary	-0.131 (0.244)	0.878	0.287	0.592	0.544	1.415
Number of trained health care workers						
1–150		1.00	42.929	0.000		
151–300	1.193 (0.304)	3.297	15.375	0.000	1.816	5.986
301–450	1.702 (0.303)	5.487	31.622	0.000	3.031	9.931
451–600	0.395(0.245)	1.484	2.586	0.108	0.917	2.400
601+	0.218 (0.256)	1.244	0.725	0.395	0.753	2.055

A binary logistic regression was performed to examine the association between employment status, educational level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender. The results in Table 7 indicated that for the ethnicity; Ewe [OR = 1.318, p = 0.272], Ga [OR= 1.018, p = 0.966], and Mole-Dagbon [OR = 0.980, p = 0.944] were not statistically significant. From Table 7 the results show that employment status did not significantly predict the odds of treatment completion (OR = 0.918, p = 0.700). As indicated in Table 7, the results from the logistic regression shows that for the educational level; Elementary [OR = 0.661, p = 0.076], Secondary [OR = 0.868, p = 0.550], and Tertiary [OR = 0.878, p = 0.592] were not statistically significant therefore, I fail to reject the null hypothesis and conclude that there is no association between employment status, educational level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender.

RQ2: Is there an association between the health facility location, number of trained health workers, and TB treatment completion in Ghana controlling for age, marital status, and gender?

$H_0$2: There is no association between the health facility location, number of trained health workers, and TB treatment completion in Ghana controlling for age, marital status, and gender.

H_a2: There is an association between the health facility location, number of trained health workers, and TB treatment completion in Ghana controlling for age, marital status, and gender.

I conducted a Logistic regression analysis to examine the association between health facility location, number of trained health workers, and TB treatment completion in Ghana controlling for age, marital status, and gender. The results from the logistic regression analysis as indicated in Table 7 shows that health facility location [OR = 0.273, p = 0.000] significantly predicted the odds of treatment completion among TB patients and health facility in rural location has a negative relationship with treatment completion as the B (SE) value shows-1.299 (0.197). This mean that patients who access health facility located in the rural are 72.7% likely not to complete their treatment and 27.3% likely to complete their treatment as compared to their counterpart who access health facility located in the urban.

In addition, the odds ratio of treatment completion with respect to number of trained health workers was statistically significant and also significantly higher among 151 – 300 workers [OR = 3.297, p = 0.000], and 301 – 450 workers [OR = 5.487, p = 0.000]. However the odds ratio for number of trained health workers451 – 600 workers [OR = 1.484, p = 0.108], and 601+ worker [OR = 1.244, p = 0.395] were not statistically significant.

Summary

In this chapter I presented the analysis and results of the secondary data on TB patients between the years 2015 and 2017 from the Ghana Health Services District Health Information Management System (DHIMS) database to answer the study research questions. Initial effort concentrated on dataset preparation with a participant of 1122 patients. Two research question and their attendant hypothesis were examined. For

research question 1 (RQ1), I examined three independent variables (employment status, educational level, and ethnicity), one categorical variable (treatment completion) and three covariates (marital status, age, and gender). For research question 2 (RQ2), I also examined two independent variables (health facility location, and number of trained health workers), one categorical variable (treatment completion) and three covariates (marital status, age, and gender). A bivariate analysis was conducted to examine the effect of each study variable on treatment completion followed a binary logistic regression analysis to test hypotheses associated with each research question.

The results from the Chi-square test shows that marital status, employments status, education level and Ethnicity of study participants did not demonstrate a significant association between treatment completion among the study participants. However patient location likewise number of trained health care workers demonstrated a significant association between the treatment completions.

The aim of RQ1 was to examine the association between employment status, educational level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender. However, the results from the binary logistic regression indicated that for RQ1, there is no association between employment status, educational level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender.

In RQ2 the aim was to examine the association between the health facility location, number of trained health workers, and TB treatment completion in Ghana controlling for age, marital status, and gender. The results from the logistic regression

analysis indicated that health facility location significantly predicts the odds of treatment completion among TB patients and also the health facility in rural location has a negative relationship with treatment In addition the odds ratio of treatment completion with respect to number of trained health workers was statistically significant and also significantly higher among various number of trained health worker.

In Chapter 5, discussion and interpretation of the study results in relation to findings in literature are provided, the implications of the findings of this investigation for effecting for positive social change as related to Ghanaian TB management program, discussion of the limitations of the study, recommendation for future study or research, and conclusions as pertain to the findings of the study are provided.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to assess and evaluate TB management and determine possible factors that hinder TB management in Ghana. Previous research (Khan, 2016; Jahanmehr et al., 2015) identified factors such as poverty, inadequate health care infrastructure, noncompliance to treatment schedule, overcrowding, lack of education, and lack of commitment on the part of national control program—as factors leading to an increase in TB cases and treatment noncompletion. I conducted a quantitative cross-sectional study to analyze secondary data obtained from the DHIMS database for four regions: Greater Accra, Ashanti Region, Eastern Region, and Western Region. I used statistical analyses to examine relationships between the variables and to test hypotheses associated with each research question.

In this chapter, I provide the interpretation of the study findings. Then I provide a discussion of the limitations of the study, recommendations for future study or research, and conclusions.

Summary of Findings

The summary of findings in this subsection represents the analysis of secondary data obtained from DHIMS for TB patients between 2015 and 2017. The study required a minimum of 438 participants, and a total of 1,122 participant records were obtained. The results of my analyses indicate that the majority of participants (58.2%) were male, 28.7% fell within the age 35–44 years, 33.8% had elementary education, 54.25% were married, 83.1% were employed, and the Akan ethnic group constituted 70.1%. However,

the logistic regression analysis of the data failed to establish any significant predictive ability for employment status, education level, and ethnicity on TB treatment completion. Logistic regression analysis of the data did confirm that number of trained health workers and health facility location are significant predictors of TB treatment completion, and health facilities in rural locations have a negative relationship with treatment completion. The odds ratio of treatment completion with respect to number of trained health workers was significantly higher among 151–300 workers and 301–450 workers.

Interpretation of the Findings

The study was designed and executed to examine if there is an association between the number of trained health care workers available, health facility location, education level, employment status, ethnicity, and TB treatment completion. I hypothesized that there was no association between employment status, education level, ethnicity, and TB treatment completion in Ghana controlling for age, marital status, and gender. The results indicated that the null hypothesis could not be rejected and thus treatment completion had no significant association with employment status, education level, and ethnicity. I also hypothesized that there was no association between the health facility location, number of trained health workers, and TB treatment completion in Ghana, controlling for age, marital status, and gender. The results of the study indicate that health facility location[OR = 0.273, p = 0.000]significantly predicts the odds of treatment completion among TB patients and [B (SE) =1.299 (0.197)].The likelihood of TB treatment completion declined among health facility locations in rural areas compared to health facilities located in urban. Also the odds ratio for treatment completion with

respect to number of trained health workers was statistically significant and also significantly higher among number of trained health care professionals 151–300 [OR = 3.297, p = 0.000] and 301–450 [OR = 5.487, p = 0.000], with the exception of 451–600 [OR = 1.484, p = 0.108] and 601+ [OR = 1.244, p = 0.395],which were not statistically significant.

Interpretation of the Findings with Relation to the Literature

The first research question examined the association between employment status, education level, ethnicity, and TB treatment completion in Ghana, controlling for age, marital status, and gender. The odds ratio from the logistic regression analysis was not significant. The results from the logistic regression indicated that treatment completion had no significant association with employment status, education level, and ethnicity. This finding agrees with results found in several previous studies.

Previous research conducted by Danso et al. (2015) with 40 participants found no association between patients' sex, marital status, education level, occupation, and age. However, the result of this study is difficult to generalize because the sample size was limited and the study participants were from one district out of 21 districts in Eastern Region. Ansa et al. (2015) conducted a similar study with 40 participants and found no association between sex, age, lack of medical insurance, education level, marital status, medication compliance, and treatment completion. Another study conducted by Osei et al. (2015) in the Hohoe District with a sample of 73 participants also found no association between education level [OR = 5.06, p = 0.199], employment [OR = 2.87, p = 0.420], and treatment completion. The only limitation to these studies is that they were undertaken in

only one or two districts with one or two health facilities, which is limited in generalizing to the general population of Ghana. Gyimah and Darko-Gyeke (2019) found an association between marital status, employment, and treatment completion, indicating that patients who had no means of income are likely not to complete their treatment due to the cost of TB treatment. Mauch et al.(2013) evaluated the direct and indirect cost of TB treatment across 135 participants; they did not report the p-value but found an association between employment and treatment completion and stated that 70% of TB patients who had no work borrowed or sold property in order to cover treatment expenses. Findings from this study with regards to employment and treatment outcome contradict findings from Gyimah and Darko-Gyeke (2019) and Mauch et al. (2013). The differences in the outcome between Gyimah and Darko-Gyeke (2019) and Mauch et al. (2013) and this study can be partially attributed to sample size.

The second research question examined the association between the health facility location, number of trained health workers, and TB treatment completion in Ghana, controlling for age, marital status, and gender. The results from the logistic regression analysis indicated that health facility location significantly predicted the odds of treatment completion among TB patients. The results of this study agree with results in previous research by Ahorlu and Bonsu (2013) conducted in the East Sissala District in Ghana. Ahorlu and Bonsu (2013) found health facility location to be a predictor of treatment completion and concluded that patients in rural areas are less likely to complete their treatment and that access to high-quality health care is still unavailable, resulting in the possibility of more people dying from this curable disease. Danso et al. (2015) found

that the location of a health facility influences treatment completion. According to Danso et al. (2015) study conducted in Suhum Kraboa Coaltar District in the Eastern Region of Ghana, due to lack of appropriate laboratory infrastructure and health facility in rural locations, approximately 71% of TB patients are unable to complete their treatment. Kasu (2015) conducted a study in the Akatsi District and confirmed that number of trained health care staff does influence TB treatment completion. Kasu (2015) found that rural settings had fewer trained health care staff and TB treatment completion was low compared to locations with more trained health care staff. Kasu (2015) indicated that training more staff is important to help improve the treatment of TB and recommended opening additional TB diagnostic centers in all rural districts. These findings were further supported by Salifu et al. (2017), who found an association between health facility location, trained health care workers, and treatment completion, indicating that treatment completion increased in proportion to an increase in trained health care workers. Thus, locations with more trained health care workers allowed patients to adhere to the duration of treatment. Salifu et al. (2017) concluded that to better prevent and control TB alongside adherence to full treatment course by patients in the rural setting, availability of more trained health care workers providing continuous education and counseling is important and will help sustain the TB program. Gyimah and Darko-Gyeke (2019) also agreed that health facility location is a factor that influences TB treatment completion and suggested that to improve treatment in rural areas, strategic measures should be adopted to channel resources (financial and personnel) to these areas. Gyimah and Darko-Gyeke

(2019) indicated challenges facing the TB program are related to patients and the health system.

It is no surprise that the results of this study found an association between the health facility location, number of trained health workers, and TB treatment completion. It has been widely reported (USAID, 2016) that residents in the rural settings lack basic amenities such as quality health care facilities as compared to their counterparts in the urban setting. The shortfall in TB treatment completion in the rural setting can be attributed to lack of access to source of information such as television and radio. The study results also indicated that the number of health care workers 451 – 600, and 601+ workers were not statistically significant,

Ansa et al (2015) reported this disparity and attributed it to inadequate health care facilities and funds. Also the even distribution of health care workers across the country leads to some parts of the country highly dense with health care workers and shortage of health care workers in other areas.

Limitations of the Study

As stated previously, the study used secondary data obtained from four regions in Ghana between the periods 2015 to 2017.The study did not include data from all regions in Ghana which makes the research to be only limited to these four regions. It is likely that TB patients in other regions might have different treatment completion rates. Therefore the results of this study might not represent the entire TB patient population in the country. Moreover the selected regions in the study are dominated by the Akan ethnic group. The data under represent the entire ethnic groups in Ghana because data were not

obtained for all regions, it led to some ethnic groups not being considered in the study. Data was given by TB coordinators therefore the accuracy of the data is beyond the control of the researcher because only authorized personnel from Ghana Health services had access to the DHIMS database. There was unavailability of data on some variables considered in the initial study which resulted in modification of the research questions. According to WHO it is important to identify comorbidities in people diagnosed with TB in order to improve diagnosis and management. Comorbid conditions such as HIV, diabetes, smoking, malnutrition, and chronic lung disease are highly prevalent in the general TB population (Narasimhan et al, 2013). These comorbidities are said to influence TB treatment outcome. This study did not consider these comorbidities among TB patients. Inclusion of these comorbidities might have influenced the study findings.

Recommendations for Further Study

Although the findings from the study broadens knowledge of association between employment status, educational level, ethnicity, and treatment completion, study limitations are likely to influence the study results. To be able to better examine the TB management program in Ghana, it will be important to give attention to data collection. There seems to be no data on several variables that can be used in research. Several basic information such as income and occupation were not available or recorded. The Ghana Health Services should direct resources to train health care staff on data collection and storage. This might help future researchers have variable options to consider. The data used in this study only included four selected regions in Ghana, therefore it is recommended that future studies to be undertaken consider data from all regions of the

country. Moreover, comorbidities among the study participant were not considered and thought conditions as such are prevalent among TB patients it will be very important if future studies include comorbidities to reveal important findings and better understanding of TB programs. In addition, the Ghana health Service should pay critical attention to patients or health facilities in the rural areas and provide more education in order to improve TB treatment completion rate. Because all Health care workers are assigned to their job site by the Ghana Health Service, then it will be very important for the Ghana Health Service to evenly assign health care staff to various Facilities in the country. This may help resolve the disparity in the 451 – 600, and 601+health care staff having no influence on treatment completion.

Implications for Positive Social Change

This study is considered to be among few studies that had been conducted to assess and evaluate the TB management program in Ghana involving two or more regions. In that regards, this study provide valuable literature that can be useful to health care decision makers, clinicians, policy makers and health educators. It was evident in the study that Patients in rural communities are more likely not to complete their treatment as compared to patients in the urban areas. This could be inadequate information and education provided to patients in rural areas. Unfortunately in the rural areas, illiteracy rate is far greater that the urban areas. Therefore the results of the study can serve as the basis for development of guidelines because most of the residents in the rural areas do not have access to communication channels such as the internet, phone applications, cable television, and radio. The government can develop an approach to disseminate

information and also make resources available and create incentive health program in those rural areas to improve upon treatment completion. Also the government should consider reassigning health care workers to disadvantage rural locations.

Conclusion

This study contributes to the already existing body of knowledge with regard to factors that affect TB treatment completion. The results of the study showed that most of the TB patients were males and between the ages 35 – 44 years. Also the Akan ethnic group was dominant in the population. The results of the study did not find any association between employment status, educational level, ethnicity, and TB treatment completion. However on the other hand the study did confirm that there exist an association between health facility location, number of trained health workers, and TB treatment completion. The results indicated that TB patients in the rural areas are less likely to complete their treatment and if this trend is not addressed it might lead to a bigger problem such as more people being infected with TB and increase in TB mortality rate. Moreover, the results for the number of health workers revealed that 451 – 600, and 601+ health had no influence on TB treatment completion. This disparity in the number of health care workers influence on Treatment completion can be attributed to misallocation of human resources (Health care workers) in the country.

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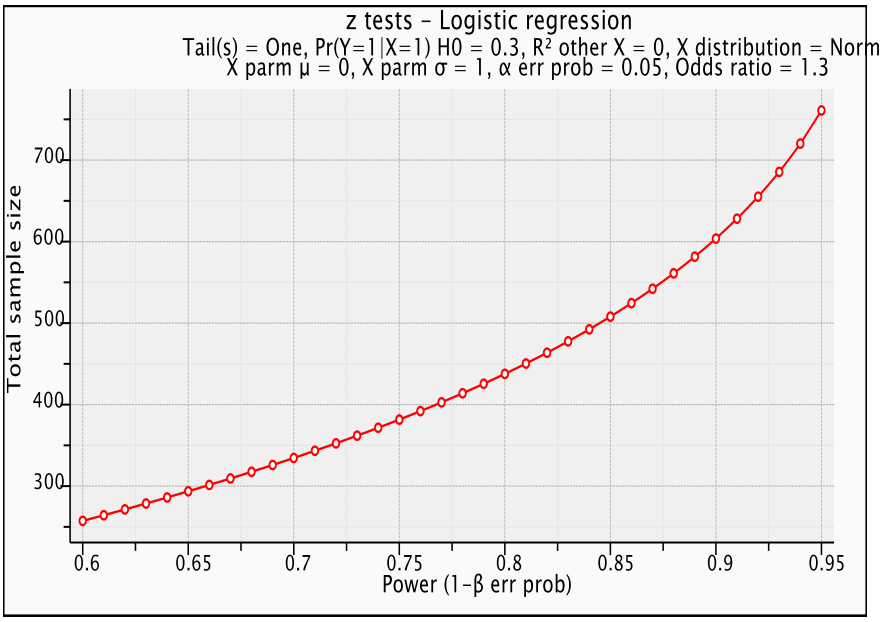
Appendix


z tests - Logistic regression
Tail(s) = One, Pr(Y=1|X=1) H0 = 0.3, R² other X = 0, X distribution = Normal,
X parm μ = 0, X parm σ = 1, α err prob = 0.05, Odds ratio = 1.3
Total sample size
700
600
500
400
300
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
Power (1-β err prob)