SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA

TUBERCULOSIS INVESTIGATION AMONG HOUSEHOLD CONTACTS OF INDEX TB CASE IN GA WEST MUNICIPAL OF GREATER ACCRA REGION

BY

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DECLARATION

I, Patrick Larbi-Debrah, declare that except for other people investigations which have been duly acknowledged, this work is the result of my own original research, and that this dissertation, either in whole or in part has not been presented elsewhere for another degree.

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DEDICATIONS

I dedicate this work to my wife – Grace Yaa Kwaa Owusua and our kids Nana Yaa and Papa Kwasi who have endured all my absence during this period.

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LIST OF ACRONYMS

ANC	- Antenatal clinic
ART	- Antiretroviral therapy
BCG	- Bacillus Calmette-Guérin
CBSV	- Community-based surveillance volunteers
DANIDA	- Danish International Development Agency
DOTS	- Directly Observed Treatment Short
ERC	- Ethical Review Committee
GHS	- Ghana Health Service
GSS	- Ghana Statistical Service
GWM	- Ga West Municipal
HHC	- Household contacts
HIV	- Human immunodeficiency virus
MDGs	- Millennium Development Goals
NTPs	- National Tuberculosis Programmes
OPD	- Out Patients Department
PTB	- Pulmonary tuberculosis
SDGs	- Sustainable Development Goals
TB	- Tuberculosis
UHC	- Universal Health Coverage
WHO	- World Health Organization

DEFINITION OF TERMS

Index TB case – The initially identified case of new or recurrent TB in a person of any age in a specific household or other comparable setting in which others may have been exposed.

Household contact – A person who shared the same enclosed living space for one or more nights or for frequent or extended period during the day with the index case during the 3 months before commencement of the current treatment episode.

Close contact – A person who is not in the household but shared an enclosed space, such as a social gathering venue, workplace or facility, for extended periods during the day with the index case during the 3 months before commencement of the current treatment episode.

Contact tracing or contact investigation – A systematic process intended to identify previously undiagnosed cases of TB among the contacts of index case. In some settings, the goal also include testing for latent tuberculosis infection to identify possible candidates for preventive treatment.

Sputum smear microscopy –A method of diagnosing TB in which bacteria are observed in sputum samples examined under the microscope.

Facilities in the Municipals – All health facilities providing TB contact investigation in the three-sub municipality.

Facility record– Records of all index cases and household contacts.

ABSTRACT

Background: Tuberculosis continues to be a major global health problem and a cause of mortality and morbidity across all age groups throughout the world, especially in developing countries. It is estimated that, a single individual living with pulmonary TB infection in the community can infect an average of 8-10 people in a year and, each household contact contributing to about 4.5% to 7.8% of active disease.

Objective: To determine the prevalence of Tuberculosis investigation among household contacts of index TB case in Ga West Municipal of Greater Accra.

Methods: This was a descriptive cross-sectional study using purposive sampling to select 107 contacts of index TB cases. Structured questionnaires were administered to collect data for the study. The data collected was analyzed using STATA version 14.

Results: The study found high awareness of TB among contacts. Knowledge of mode of transmission of TB was also high among contacts. However, knowledge of signs and symptoms of Tb was low with low level of screening among contacts. Prevalence of TB among contacts was 20%.

Conclusion: Healthcare facilities should take advantage of high awareness and knowledge of TB to educate contacts on the need to screen for TB.

Keywords: Index cases, contacts, knowledge, Tuberculosis.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

World Health Organization (WHO) estimates that 3 million people living with tuberculosis are "missed" each year by health systems, leading to the persistence of infectious cases and the airborne disease transmission within families and communities (World Health Organization, 2016). WHO estimates approximately 35% incident cases were missed in 2012 (Blok *et al.*, 2015). Although millions of individuals who are infected yearly with tuberculosis are treated, global tuberculosis decline rate of 1.5% per year has been stagnant for more than a decade now (Yuen *et al.*, 2015). This is partly due to the fact that, people who fall sick with the tuberculosis infection are missed and never diagnosed and treated, though tuberculosis is preventable and curable. Household contacts of TB index cases are high among people living in crowded residents, with an incidence of 76.4% (Singh *et al.*, 2013). This is because the risk of infection is increased with proximity and duration of exposure to the source of tuberculosis infection (Augustynowicz-Kope *et al.*, 2012)

Tuberculosis (TB) is a respiratory infectious disease transmitted mainly via aerosol and it is caused by *Mycobacterium tuberculosis*. It continues to be a major global health problem and a cause of mortality and morbidity across all age groups throughout the world, especially in developing countries (Singh *et al.*, 2013). It is estimated that, a single individual living with pulmonary TB infection in the community can infect an average of 8-10 people in a year and, each household contact contributing to about 4.5% to 7.8% of active disease (Otero *et al.*, 2016). Effective early case detection helps early initiation of treatment and thus interrupts the

transmission cycle of tuberculosis infection. A reliable case detection strategy recommended during the Millennium Development Goals (MDGs) years was the use of sputum smear microscopy to identify people with active TB.

Globally, 6.4 million people with TB were detected and notified to all national TB programmes (NTPs) in 2015, with over 6.1 million having an incident episode (new or relapse). Though there has been an identified gap between detection and treatment, best estimate was 4.3 million (WHO, 2016). It is also estimated annually that, 8 million new cases of TB occur and 2 million die from TB globally (Ma *et al.*, 2014).

In 2015, 10.4 million incident cases of TB were estimated worldwide, representing 142 cases per 100,000 population with 90% of the cases being adults, occurring in Asia (61%) and WHO African Region (26%) and the remaining small proportion in the other WHO Regions (WHO, 2016).

Each household contact contributes about 4.5% to 7.8% of active disease and a single individual living with pulmonary TB infection in the community can infect an average of 8-10 people in a year (Otero *et al*., 2016).

In sub-Sahara Africa, TB case detection rate of 52% has still not reached the 70% target set for 2005 (WHO, 2014). It's also known in sub-Saharan Africa, that the period between an individual exhibiting first symptom of the disease, being diagnosed and initiation of early treatment of tuberculosis is relatively long (Yeboah-Manu *et al.*, 2013).

Since the launch of National Tuberculosis Programme (NTP) in 1994, NTP's objective has been to reduce transmission of the disease until it no longer becomes a public health problem (Kik et

al., 2008). Specifically, it sought to increase the level of case finding from 36% (1994) to 70% of all total estimated incidence of smear-positive cases by the end of 2006 (Asomani-Wiafe, 2003)

Household contact (HHC) tracing has been inadequate leading to the low case detection in the Ga West Municipality. In 2015, most facilities recorded low or no case detection in the Municipality. This study therefore sought to investigate how effective household contact investigation are implemented through TB index cases and inform the Municipal on the state of household contact case investigation in fighting against tuberculosis disease.

1.2 Problem Statement

Ghana's case detection rate of 46% still sits below the 70% global target. Ghana's TB prevalence rate was 264 per every 100,000 people in 2014 and the same in 2015 (GHS Annual report, 2015). The goals for tuberculosis control in Ghana are "To reduce by 20% the 2013 TB prevalence baseline level of 290/100,000 population by 2020 in line with the post-2015 Global TB Control Strategy", "to reduce to 35% by 2012 TB mortality rate baseline of 4 deaths per 100,000 population by 2020" and "to end the TB epidemic in Ghana by 2035 without catastrophic cost due to TB affected families" (Lönnroth & Raviglione, 2016).

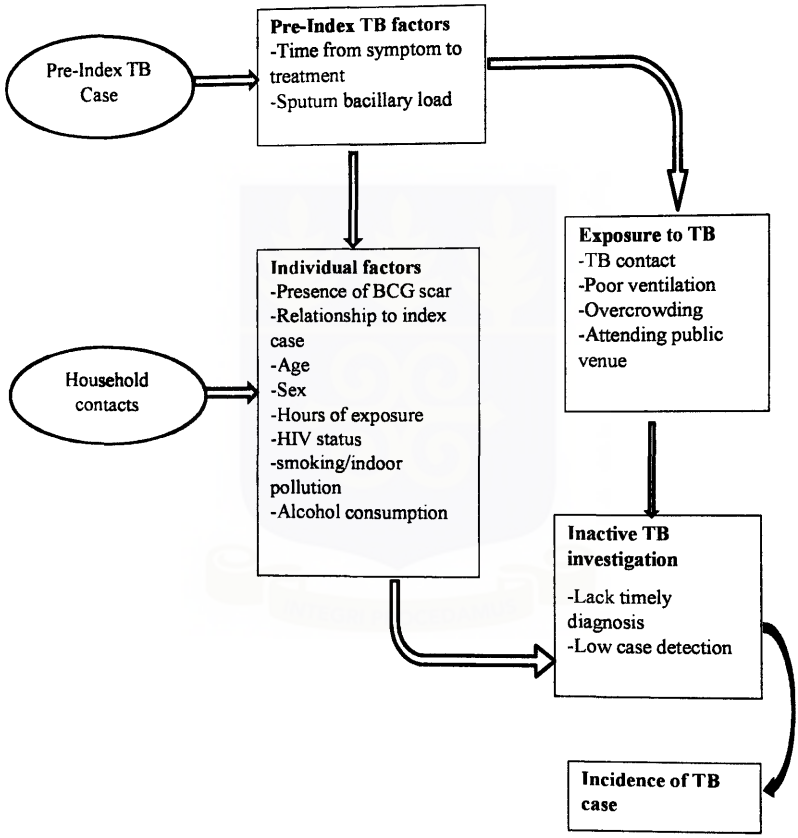
Greater Accra Region recorded 2,073 TB cases in 2014, representing 46 per 100,000 population. In 2013 however, the case notification rate was higher – 51 cases per 100,000 population.

Records available indicate that, the Municipalities have a low case detection rate of 57% in 2015 (GWM Annual Report, 2016). The municipality fell below the Region and National target of 70% the same year. Their TB case detection rate improved from 52.9% in 2014 to 57.0% in 2015, but this still fell below the Municipal target of 60%. Inadequate TB case detection leads to

increased transmission and high TB prevalence rate as a single individual living with pulmonary TB infection in the community can infect an average of 8-10 people in a year (Otero *et al.*, 2016) Left undetected, TB can develop into complications leading to premature death.

Furthermore, the goal to end TB epidemics as adapted by Ghana is to end the global epidemic. One indicator is dedicated to TB-infected households. This is to attain a zero TB-infected families facing catastrophic cost due to TB by 2035. This can be realized through active case finding of tuberculosis contact investigation. Actively finding tuberculosis case and diagnosing, will help initiate treatment promptly which is the sure way of decreasing tuberculosis incidence. Early TB diagnosis and subsequent treatment of HHC will significantly improve case detection and tuberculosis cured rate. Contact investigation is a core tuberculosis control strategy widely employed in countries with low to intermediate tuberculosis incidence like Ghana, some other sub-Sahara African and south Asia countries (Anger *et al.*, 2012). This study was therefore undertaken to determine the prevalence of tuberculosis among individuals who were household contacts of index TB case in the municipality.

Figure 1:1 Conceptual Framework



Conceptual framework Narrative

Factors like the time taken for an infected person to commence treatment also facilitates exposure to TB infection, as household members who are susceptible will easily contract the disease An index cases sputum bacillary load level and irregular treatment, is contributing to a household member's chance of infection as an individual get in close contact with the index TB patient (Singh *et al.*, 2013).

An index TB infected person is more infectious when economic opportunities are limited. The infrastructure available to the index case in terms of housing, overcrowding and access to public venues contributes to the spread of the infection. This also includes access to treatment centers, travel time and the cost of patients and their family accompanying.

At the individual level, age, sex and genetic factors determine their susceptibility to TB. Also, immunization status of the individual with an indication of either a presence or absence of BCG scar will determine the likelihood of being infected. Relationship to the index case also determines the frequency of contact and this may contribute to developing the disease. A household member's Human immunodeficiency virus (HIV) status, behavioral risk factor like alcohol consumption and unhealthy eating habits affects the individual exposure to contracting TB from an index TB case.

So, when conditions like poor ventilation and overcrowding, attending public venue present itself, it predisposes an individual in close contact with index TB case, to a high risk of acquiring TB.

With lack of active case detection and timely diagnosis of newly infected TB patients, there will be late detection and treatment of TB cases.

1.3 Justification of the problem

Active case finding aims at decreasing tuberculosis incidence which is an essential component of the control of tuberculosis, but since 2009, in spite of effort to increase TB case finding, reported cases on TB case detection has been low. Case detection performance shows a downward trend, despite all efforts in tuberculosis case finding implementation. Newly infected individuals who undetected, contribute to a stable stage on the fight against tuberculosis. Active case finding serves as an opportunity to prevent the transmission of tuberculosis and those that are identified with the infections, are identified early and prompt treatment initiated. This study sought to investigate the prevalence of household contacts infected by TB index cases. It also determined whether all household contacts were screened for TB and those found infected initiated on treatment.

1.4 Research question

- What is the proportion of household contacts of TB index case infections?
- How many household contacts of TB index case are screened and treated?
- What are the factors associated with household contacts diagnosed as pulmonary TB?

1.5 Objectives

1.5.1 General Objective

To determine the prevalence of Tuberculosis investigation among household contacts of index TB case in Ga West Municipal of Greater Accra.

1.5.2 Specific Objective

- To determine the proportion of household contacts screened for TB in the Municipality.
- To determine the proportion of household contacts diagnosed of TB in the Municipality.
- To determine the proportion of household contacts treated for TB in the Municipality.
- To determine factors associated with the non-screening of household contacts of TB in the Municipality.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.0 Introduction

The general purpose of this study was to investigate how effective household contact investigation are implemented through TB index cases. This chapter reviews and summarizes relevant literature by scholars and post studies in the area of study i.e. active case detection, that helps in understanding tuberculosis, case detection, household contacts infections, their knowledge about tuberculosis and its effects.

2.1 Definition of tuberculosis and its infection

Tuberculosis (TB) is an infectious disease caused by *mycobacterium tuberculosis* and occasionally by *mycobacterium bovine* and *mycobacterium africanum (*Getahun *et al., 2015)*. The latter causes up to half of human tuberculosis in West Africa. It has two strains *M. africanum* West African 1 and *M. africanum* West African 2 (WHO, 2016). TB is transmitted mainly via aerosol disease from person to person by droplet infection through sneezing, coughing, and spitting. TB caused by the mycobacterium bovine is transmitted mostly through drinking of unpasteurized milk from infected cow. The disease can affect almost every organ of the body but over 85% of the cases are present in the lungs (Lönnroth & Raviglione, 2016). The clinical manifestation depends on the organ affected and some general symptoms.

TB is an airborne transmitted disease which in human beings is caused by *mycobacterium tuberculosis bacteria* (Mtb). These Mtb droplets are released during coughing and/or sneezing of infectious individual into the atmosphere. Tubercle bacilli carried by such droplet lives in air for a short period of time (about 2 hours) (Song *et al.*, 2002), and therefore it is believed that

occasional contact with an infectious case rarely leads to an infection. Tuberculosis is also described as a slow disease because of its long and variable latency period distribution and its short and relatively narrow infectious period distribution. Active TB cases may be pulmonary or extra pulmonary, but only pulmonary cases are infectious. These pulmonary cases form the majority of most cases of active TB. An infected individual with active TB presents symptoms such as tiredness, high fever, and a cough. But a positive sputum culture is required of active TB. Extra pulmonary TB accounts for between 5 and 30% of the total cases and may affect any part of the body. Pulmonary cases affect the lungs. Recently, infected individuals have a high chance of developing active TB within 5 years and these are classified as primary TB cases, and those who progress to active TB many years after infection as a result of endogenous reactivation and/or exogenous re-infection are classified as secondary active TB cases (Bhunu *et al.*, 2009).

2.2 Epidemiology of TB

The progress of tuberculosis in a community, in contrast to that of other infectious diseases of public health importance like smallpox, cholera or haemorrhagic fevers e.g. Ebola, etc. is complex. It can be likened to low-intensity warfare, where there is a dormant initial stage which progresses into an active latent stage. Although most people never develop active tuberculosis, one third of the world's population is infected, and the potential for disease is always there.

The classical epidemiology for tuberculosis is composed of exposure, infection, disease, and death. The determinants or risk factors for progression from one stage to the next in the pathogenesis of tuberculosis is gradual. Understanding of these factors is essential to

comprehend the dynamics of tuberculosis and to appreciate the forces that drives its progress in a community, and to hypotheses on the impact of intervention.

The main factors that determine the risk of being exposed to tubercle bacilli include the number of infectious cases in the community, the duration of infectiousness and social mixing pattern (Rieder, 1999). Although exposure is a prerequisite for tuberculosis infection, infection does not always follow exposure. The main risk factors for infection are density and duration of exposure. While an important aim of tuberculosis programs is to reduce exposure in the community. All the classical stages of the epidemiology of tuberculosis (exposure, infection, disease and death) involves socioeconomic and environmental factors and thus the need for holistic public health intervention. There are other risk factors not mentioned above, that can increase the risk of disease in person infected with *M. tuberculosis*. However, it's impossible to determine why a particular individual does or does not develop tuberculosis after infection (Rieder, 1999). The exception is in settings with a high prevalence of co-infection with HIV, which is an obvious culprit.

According to the WHO, an estimated 10.4 million tuberculosis cases occurred in 2016, approximately 2.9 million of whom were in women and about 1.8 million died (World Health Organization, 2016). Most cases are estimated to be in Asia and Africa (61% and 26% respectively), with the highest incidence recorded in India, Indonesia, Pakistan and South Africa, accounting for 60% of the total number of cases (World Health Organization, 2016). A wide variation among high-income countries of under 10 per 100,000 population and high TB burden countries of 150-500 per 100,000 population are observed (WHO, 2016).

There is a much greater focus on reducing the TB burden to less than 100,000 cases per year by 2050, focusing on areas of high TB burden with sub-Saharan Africa being worst hit (Maher, 2006). Notably among this focus is targeted active case-finding activities that requires staff from the health services to actively find cases of all contacts of TB index case and provide prompt diagnostic support to initiate early treatment, which will in turn impact greatly on tuberculosis programme A lot of this new infections are not detected early through active case finding, leading to the persistence of infectious cases. Air borne diseases transmission within families and communities, as estimated, 3 million people with tuberculosis are missed by the health system each year (WHO, 2013).

2.3 TB Control Strategies: Past and Future Steps

Strategies recommended by WHO include Directly Observed Treatment Short Course Chemotherapy (DOTS) which has among its characteristics, reliable case detection using sputum smear microscopy to identify people with active TB. The policy of DOTs outlined the use of rifampicin and pyrazinamide in the first 2 months as well as isoniazid and streptomycin or ethambutol by prescriber. Post WHO Expert Committee on Tuberculosis in their ninth report in 1974, reviewed the aggravated tuberculosis situation globally and stressed the need for national tuberculosis programme in member countries to implement some essential principles tools to control and eliminate tuberculosis as a public health problem (WHO, 2016).

In reflecting global attention to elimination of tuberculosis, post 2015 (2016-2030) ushered the Sustainable Development Goals (SDGs) and the End TB strategy which is once again looking at case detection as important strategy to end the global TB epidemic in their global targets and

milestones. Targets set in the End TB Strategy include a 90% reduction in TB deaths and an 80% reduction in TB incidence by 2030, compared with 2015 (WHO, 2016). To achieve the targets and their accompanying milestones, the End TB Strategy has four underlying principles and three pillars. The principles are: government stewardship and accountability, with monitoring and evaluation; a strong coalition with civil society organizations and communities; protection and promotion of human rights, ethics and equity; and adaptation of the strategy and targets at country level, with global collaboration. The three pillars are: integrated, patient-centered TB care and prevention; bold policies and supportive systems; and intensified research and innovation (WHO, 2016).

The End TB Strategy has three high-level, overarching indicators and related targets; these are the number of TB death per year, the TB incidence rate per year and the percentage of TB-affected households that experience catastrophic cost as a result of TB disease. The third indicator (the percentage of TB-affected households that experience catastrophic costs as a result of TB disease), the milestone for 2020 is zero, to be sustained thereafter. This indicator is a good tracer for progress towards universal health coverage (UHC) (Lönnroth & Raviglione, 2016). If UHC is in place, then people with TB should be able to access high-quality diagnosis and treatment with financial protection; that is, they should not face catastrophic costs.

In 1991, due to poor TB situation, the Government of Ghana recognized tuberculosis as a disease of public health importance and developed important measures to combat it. In 1992, National TB Control programme was designed and the Danish International Development Agency (DANIDA) was approached for financial support. In November 1993, DANIDA and the Government of Ghana signed an agreement based on a Project Document and the programme implementation started in 1994.

When Ministers of Health and Finance from countries that have 80% of the world's TB cases met in Amsterdam, Netherlands in March 2000, they declared that "actions against TB should be accelerated through expansion of coverage of population with the WHO recommended strategy to combat TB by achieving a case detection rate of at least 70% by the year 2005 through DOTS" (Amo-Adjei & Awusabo-Asare, 2013). Currently, Ghana National TB case detection rate is targeted at 81%.

Whilst TB cure rates have made progress even above the 85%, case detection still sits below 70% (Corbett et al., 2009). This calls for much effort on an improvement of early case detection of all people who come into close contact with a TB patient. The household where active TB infected person dwells forms a unique environment for transmission to others. There is a transmission through air from an infected pulmonary TB patient especially at close proximity (Singh *et al.*, 2013).

An infectious tuberculosis individual can discharge large volumes of tubercle bacilli in the community and household. Left untreated, or not completing recommended treatment, an infectious individual is a threat to the community. It's estimated that, a single pulmonary TB individual can infect an average of 8-10 people in a year (Otero *et al.*, 2016).

2.4 Tuberculosis case detection

Tuberculosis contact investigation is one of the interventions adopted in countries with low to intermediate tuberculosis incidence, to identify individual who are infected with the disease, thereby helping in case finding and preventing the spread of tuberculosis (Anger *et al.*, 2012). The main goal of contact investigations is to identify all secondary cases of active TB

and latent TB infection among contacts so that they can begin therapy. This TB control strategy aims at halting the transmission to prevent new infections and new cases. When individuals are identified early through contact investigation, initiation of prompt treatment will reduce the infection and spread (Yuen *et al.*, 2015). Contact investigation consists of two components; identification and prioritization, and clinical evaluation.

2.5 Case detection identification and prioritization

First, cases are to be identified through case finding by clinicians and reported to the health institution. Patients suspected or confirmed TB are identified for onward reporting for treatment to commence. Index cases are then interviewed by health staff to obtain information about persons they may have had contact with when potentially infectious (WHO, 2013).

In prioritizing, investigation is based on the amount of exposure to the index case, so those considered as most contacts are evaluated first before those considered as less contacts. Sputum smear laboratory examination is conducted to confirm for the presence of the infection. Other test can also be used for investigation, and these include tuberculin skin test, chest radiograph examinations, etc (WHO, 2016).

TB case-finding can be either passive or active. Passive case-finding requires that affected individuals are aware of their symptoms, have access to health facilities, and are evaluated by health workers or volunteers who recognize the symptoms of TB and who have access to a reliable laboratory (WHO, 2016). Patients with symptoms compatible with TB are usually identified in health facilities, and all health workers and volunteers should be aware of the symptoms of TB, and how to proceed if TB is suspected. Health workers should also be aware of

the circumstances in which a patient must be assessed for potentially drug-resistant TB. Active case-finding requires systematic screening and clinical evaluation of persons who are at high risk of developing TB, such as people who are contacts of someone who was diagnosed with TB or people living with HIV (WHO, 2016). The use of active case-finding assumes that (i) groups at high risk for TB are clearly defined, (ii) procedures to screen and assess individuals belonging to these groups are well established, and (iii) health professionals and community workers who should be involved in implementing these procedures have been clearly identified (WHO, 2016).

Quite recently, Ghana has instituted TB symptom-based screening tool (appendix iii) for case finding. Two eligibility criteria are used across the country in all health facilities. These are; 1) any client/Patient responding "Yes" to cough or contact with a known TB case in addition to two or more other symptoms and signs and 2) any client responding to cough for more than two weeks is mandatory for laboratory screening irrespective of presence or absence of the symptoms A symptom-based screening tool is used in finding TB cases for all clients visiting the health facility. Task shift officer are assigned to the different units of health facilities. These units include; general OPD, ART clinic, Reproduction health antenatal clinic (ANC), Diabetic clinic. etc Screening register are used to capture all individuals presenting some eligibility criteria for all (Report, A. 2015).

The passive form of case detection, has also been a recommended WHO strategy based on the expectation of 1). It been far more cost-effective than the active case detection and 2). Compliance among asymptomatic individual (Becerra *et al.*, 2005). This has nevertheless a been a contributing factor to failure in detecting major new infectious cases. Ghana has been implementing both passive case detection and active case detection until now. Current passive detection implemented in Ghana, include identifying an index TB case and their care giver or

treatment supporter. Together they identify TB infection suspects in people who come in close contact with the index case. These close contacts are then invited to come for screening and possible treatment when tested positive.

2.6 Importance of case detection

Tuberculosis case detection is of great importance in areas of detecting the disease burden of the population which is initiated by health care workers to identify asymptomatic patients for medical evaluation and facilitate early entry into TB care (Golub *et al.*, 2005). It also has a long term effect on the success of the tuberculosis control program and active case finding among household contacts yields more TB cases (Becerra *et al.*, 2005). Case detection helps estimate the efficacy of Bacillus Calmette-Guérin (BCG) vaccination and chemoprophylaxis of tuberculosis infection.

2.7 Household contacts

Household contacts of tuberculosis patients are at high risk for TB infection and disease (Otero *et al.*, 2016). The house provides a conducive environment for the transmission of tuberculosis disease Tuberculosis infection follows a natural two-stage process; first there must be acquisition of the infection and secondly, the development of the disease after the infection (Stein *et al*, 2013). Among other factors that facilitates infection are sputum smear positive status of the index case, proximity of index case to a contact, living in poorly ventilated conditions, and bacillary load among others predisposes a susceptible household contact to the infection (Chheng *et al.*, 2015).

Tuberculosis case detection as captured under End TB strategy was previously contained in Directly Observed Treatment Short (DOTs), a recommended WHO strategy to combat TB by achieving a case detection rate of at least 70% by the year 2015 (Maher, 2006). This time round an indicator dedicated solely to household affected with TB (the percentage of TB-affected households that experience catastrophic costs as a result of TB disease) in the End TB strategy is monitored (Maher, 2006).

Household contacts (HHC) of TB under case investigation are defined as "a person who shared the same enclosed living space for one or more nights or for frequent or extended period during the day with the index case during the 3 months before commencement of the current treatment episode". Continuous close contact between people in the household promotes the transmission of the tuberculosis infection (Javaid *et al.*, 2016). Household contacts of tuberculosis patients are at high risk for TB infection and disease (Otero *et al.*, 2016).

An index case can be defined as initially identified case of new or recurrent TB in a person of any age in a specific household or other comparable setting in which others may have been exposed. For TB transmission to occur, factors related to ventilation and crowding within the home, poverty, clinical characteristics of the index case that make him/her more infectious, and proximity to the index case increases degree of contact being infected (Stein *et al.*, 2013).

2.8 Tuberculosis treatment

Since Robert Koch discovered the tubercle bacillus, the causative agent for tuberculosis in 1882, several studies have advanced the understanding of tuberculosis and it transmission (Guwatudde *et al.*, 2003). Ehrlich, in 1885 developed the acid-fast staining method for identifying the bacilli

in specimen and Roentgen discovered the X-rays in 1895 and until 1940s, treatment of tuberculosis were mainly bed rest, nutrition and exposure to sun or sea air (Scano & Nunn, 2004) Scientists discovered the first drugs - streptomycin bacteriological effect on the bacillus, which are now used for TB treatment. This lead to the development of modern chemotherapy and most recently the combination therapy aimed at avoiding emergence of resistance, which has proven efficient in the control of tuberculosis (Scano & Nunn, 2004).

CHAPTER THREE

3.0 METHODS

3.0 Introduction

This chapter specifies the methodological strategy and procedures chosen for this study. It focuses on the research design used in the study, population of study, sample and sampling procedure, data gathering instruments, approach to data analysis.

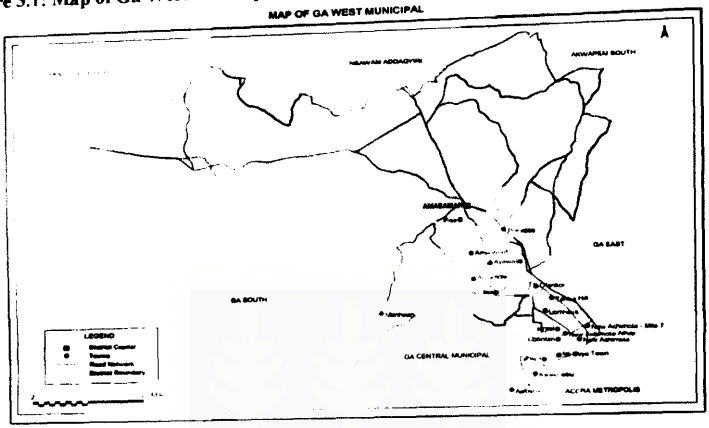
3.1 Study Design

The study was a descriptive cross-sectional study that applied quantitative methods to answer the research questions.

3.2 Study Area

Ga West Municipality is one of the 16 administrative Municipals in the Greater Accra Region created in 2008and was the study area. The district occupies a land area of approximately 305.4 sq km^2 with a 2016 census projected population of 245,224 (GSS). The Municipality is located in the northern part of the Region and it shares common boundaries with Ga East District and La-Nkwantanang-Madina Municipality to the East, Akuapim South and Akuapim North, to the North, Ga South and Ga Central to the South and Ga South, Upper West Akim and Awutu Senya to the West. The Municipal has an annual growth rate of 4% and is rapidly being urbanized. The urban population constitute 67.8% with the remaining 32.2% residing in rural portion of the municipality.

Figure 3.1: Map of Ga West Municipality.



The Municipal, sub Municipal and community has the 3-tier health service delivery system. The Municipality has 193 communities which are grouped under seven sub Municipals. Below are the 2016 projected population distributions by sub municipality.

Table 3:1 Distribution of 2016 projected population by sub municipality in Ga West Municipal.

Sub Municipal	Population (2016)
Amasaman	49,045
Ofankor	41,688
Oduman	36,784
Pokuase	36,784
Trobu	31,879
Kotoku	24,522
Mayera	24,522
District	245,224

The municipal has 81 public and private health facilities, with 14 of these health facilities providing TB services. The municipal hospital serves as a diagnostic center. Additional, 12 other public health and a private health facilities serve as treatment centers.

These 14 health facilities providing TB services are fairly distributed in the municipality. Table 2. below shows the distribution of TB cases detected within three years (2013-2015) by health facilities and sub municipalities.

Table 3:2 The distribution of TB cases detected for the past three years (2013-2015) by health facilities and sub municipalities.

Sub Municipal	Health Facilities	2015	2014	2013
Amasaman	Ga West Municipal Clinic	55	44	45
Ofankor	Ofankor CHPS	0	2	0
	Amamorley Community Clinic	8	0	0
Oduman	Oduman Health Centre	14	10	14
	Nsakina CHPS	0	5	1
	Akramaman Health Centre	0	1	0
Pokuase	Pokuase Health Centre	15	5	8
Troubu	Rahma Maternity Home	0	2	0
Kotoku	Kotoku Health Centre	9	3	0
	Kojo Ashong CHPS	1	0	1
	Dom Sampaman CHPS	0	0	3
Mayera	Mayera Community Clinic	4	3	3
	Samsam Community Clinic	3	2	3
	Otsrikomfo Health Centre	0	0	0
District		109	77	78

3.3 Study variables

The study outcome variable was the outcome diagnosis of pulmonary positive tuberculosis among household contacts. The exposure variables for the study included age, sex, residence, educational level, relationship to index case, eligibility (presence of cough), presence of BCG scar, sputum examination results, and diagnosis among other variables. Also, HHCs knowledge

of TB infections, HHC screened and treated for sputum smear positive and if screened as positive for sputum smear laboratory results, treatment initiated. See Table 3 below for details.

Table 3.3: Variables definitions and their measures for the study.

Variable type	Variable	Definitions	How it will be measured
Dependent	HHC diagnosed as PTB	HHC diagnosed as PTB	Frequency (n-%)
Independent	Age	Age of index case as captured in the records. Age of household contacts as at their last birthday	Frequency (Mean) –t-test
	Sex	Sex of both index case and household contacts	Frequency (n-%)
	Residence	The locality within which the index case resides	Frequency (n-%)
	Educational level completed	Levels of education attained by household contacts in completed academic year.	Frequency (n-%) chi square
	Relationship	The relationship between index case and household contact	Frequency (n-%)
	Sputum result of index case	Sputum-smear examination result of the index case and household contact.	Frequency (n-%)
	Diagnosis	The conclusion of sputum examination results.	Frequency (n-%)
	Knowledge of TB infection	Knowledge on aetiology of the disease, its transmission route and ways to prevent it.	Proportion
	Household screening and treatment	Household screening and treatment initiation.	Proportion

3.4 Sample size determination

Using Cochran's 1963 formulae in calculating for sample sizes (n). This sample size was estimated as the following;

$$n = \frac{(z_{\frac{\alpha}{2}})^2 p(1-p)}{d^2}$$ (Cochran, 1963).....(1)

Where n: sample size,

P: prevalence of household contacts – 7.6%. (Vidal, 1997)

d: margin of error, 5%

z=1-α/2=1.96 since α=5% at 95% Confidence Level (CL)

Inputting the above values into equation (1)

$$n = \frac{(1.96)^2 0.076(1-0.076)}{(0.05)^2} \qquad n = \frac{0.2698}{0.0025} = 107.92$$

Using expected loss ratio of 10%, the final minimum sample size is

n=107.92+(107.92x 0.1) =118.712 ≈ **118**

However, 107 out of the 118 respondents were used as the number of household contacts that were contacted in their homes and interviewed. This is because, most of the index cases had completed treatment and have relocated. Other contacts could not be reached through their documented phone numbers and were therefore not captured in this study. At least two of Index case household contacts were interviewed hoping to attain the pre-determined sample.

In each household, contacts to all index cases were enrolled into the study. In an event that the index case and their household contacts has relocated, the index case details were noted and therefore none of the household contacts enrolled. TB patients who were diagnosed as having

extra pulmonary tuberculosis and those seeking treatment in health facilities within the municipal but resides outside the municipality were excluded from the study.

3.5 Sampling method

Participants were enrolled based on the number of household contacts per index case and so there was no sampling during data collection. The study was conducted in the catchment areas of all the fourteen (14) facilities in the Municipal offering TB contact investigation. Facility records from all Sub-Municipalities on TB index cases and their HHC were studied.

One hundred and nine (109) TB index cases were recorded in the year 2015. These were index cases from all Sub-Municipality in Ga West Municipality. Their household contacts were identified, traced and interviewed in their homes, as recorded in the TB contact investigation register. Other household contacts not captured during contact tracing were also noted. Individuals who had lived with the index case for at least three months before they were diagnosed for tuberculosis were noted. Once a household contacts was identified, written informed consent was obtained and contacts were enrolled into the study.

3.6 Data collection methods

Data were collected from records of TB index case as recorded in the tuberculosis contact investigation register. Index cases were identified from these health facilities providing TB services in their catchment area. Their household contacts were enrolled by first identifying those stated as their contacts in this register and followed into the communities. Their consents were sought before the commencement of the study.

3.7 Data collection technique

Hospital records on TB index cases and their corresponding household contacts were extracted. A structured questionnaire was also designed for HHC in the study.

3.8 Data collection instrument

The main instruments that were employed were data extraction tool and structured questionnaire. Data extraction was used to determine the number of TB index cases and their treatment supports. Index cases addresses were used to trace their household contacts and their contacts interviewed. Variables that were extracted included names of TB index cases, their age as at the day of reporting to the health facility, sex, type of TB diagnosed and household contact identified. On the household contact, their names and contact details were noted for tracing, ages, sex, duration of cough, and diagnosis if positive for sputum smear. Structured questionnaire was administered to these household contacts to seek their knowledge on TB, ascertain whether they have been screened, and if confirmed positive for tuberculosis, find out if they are being treated.

Pre-testing of questionnaire was conducted in another district (Ga South Municipality). Ga South Municipality was chosen due to their demographic similarities. The questionnaire was reviewed after the pretest and amended based on issues that were effected.

3.9 Data processing

Data reviewed from the tuberculosis contact investigation register on index case records were captured in Microsoft Excel, and their laboratory findings validated from the tuberculosis

laboratory microscopy register. Data derived from responses on the questionnaire from household contacts were double entered and validated in Microsoft Excel.

3.10 Data Analysis

All records on index cases and their household contacts available from TB contact investigation register and TB microscopy laboratory register were entered in Microsoft Excel and imported into STATA 14 (Stata Corp, Collage Station) for analysis. Frequency distribution and description on outcome and exposure variable were calculated. Comparison were made using Pearson Chi square test for categorical variables (proportions) and Student's t-test for continuous variables (mean and median) at a significant level of 0.05 (5%).

All pulmonary positive tuberculosis index cases were investigated, but index case diagnosed as pulmonary negative tuberculosis, extra pulmonary and children below 5 years were excluded.

3.11 Quality control

Two research assistants were trained on reviewing records from the tuberculosis contact investigation register and TB microscopy laboratory register. Two research assistants, community health nurses and community-based surveillance volunteers (CBSV) were trained on administration of questionnaire for the household contacts.

3.12 Ethical consideration

Ethical review and approval was obtained from the Ghana Health Service Ethical Review Committee, with number GHS-ERC: 95/02/17. Approval was also sought from the Regional Director of health service, Municipal Director of Health Service in the Ga West Municipal Hospital and all facility heads. All patients' data that were reviewed were kept confidential during data collection and beyond. Participation in this study was completely anonymous. Their names or any identifiable information were not asked during the study. Information gathered were kept confidential and only handled by study personnel. Questionnaires were stored under lock and key and accessible for data entry and verification by principal investigator.

Written informed consent was obtained from household contacts before they were enrolled into the study.

The risks associated with participating in this study were minimal and limited only to disclosure of personal or sensitive information about themselves and their family. However, the information gathered from this study will be used to assist researchers and policymakers in improving TB case detection strategies among household contacts and reducing the prevalence of tuberculosis in the Ga West Municipality. Patients and their household contacts were not compensated for participating in the study. Participation in the study was entirely voluntary.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the findings of the study after a thorough analysis of the data collected from respondents. The results of the data collection procedures are described in this chapter and in line with the thematic areas outlined in the objectives of the study. The results are presented using a combination of charts and tables.

4.1 Hospital Review of Records of Index Cases

A total of 109 index cases were reviewed from January – December 2015 from hospital records. Their socio-demographic profile is shown in Table 4.1. The index cases were mostly males (71.7%) with a median age 39 and a range of 6-84 years. Median was used because there were outliers which could have effect on the mean and also, the age distributions was not normally distributed. Index cases were predominantly pulmonary positive (69.7%). Index cases (76) were those who were visited and their contacts interviewed. Sputum smear result of '+' constituted 25.7%, 17.4% had a result of '++' and about 21.1% sputum smear results of '+++'. About 20.2% were negative for sputum smear. Though there were a 10% missing data on tuberculosis classification from the health facility tuberculosis register (appendix III).

Table 4:1 Characteristics of index cases of TB in Ga West Municipality, Ghana

Variable (n=109)	n (%)
Age median and range*	39 (6-84) years
Sex	
Male	78 (71.7)
Female	31 (28.4)
TB classification	
Pulmonary Positive	76 (69.7)
Pulmonary Negative	20 (18.4)
Extra Pulmonary TB	13 (11.9)
Sputum smear result before treatment	
Negative	22 (20.2)
Scanty	6 (5.5)
+	28 (25.7)
++	19 (17.4)
+++	23 (21.1)

*=median and range, n (%)=actual value (frequency) and percentage

4.2 Socio-demographic characteristics of household contacts

A total of 107 household contacts of indexed TB cases participated in the study giving a response rate of 100%. Thus, the analysis of the study was based on the 107 participants who correctly completed the administered questionnaire (Figure 4:2).

The ages of household contacts recruited for the study ranged from 16-64 years with a mean age of 35.7 (SD± 11.8). Of the 107 participants, majority were male (63 (58.9%)) and most household contacts of indexed TB cases in this study (84 (78.5%)) were urban dwellers.

In terms of educational level attained by contacts, 34 of them had completed Junior High School (JHS) level of formal education representing 31.8% and (14 (13.1%)) of them had no formal education. The presence of BCG scar signifies ones' vaccination against TB during childhood. This study found that (79 (73.8%)) of the household contacts had the presence of a BCG scar.

With regards to characteristics relative to the living environment of study participants, the number of individuals who lived in the households of participants were assessed. It emerged that (68 (63.6%)) of contacts lived with 8 or more individuals in a household.

Table 4.2: Socio-demographic and living environmental characteristics of participants

Variable (n=107)	Frequency	Percentage (%)
Age		
≤ 20 years	7	6.5
21-30 years	33	30.8
31-40 years	27	25.2
41-50 years	25	23.4
51-60 years	13	12.1
> 60 years	2	1.9
Sex		
Male	63	58.9
Female	44	41.1
Residence		
Urban	84	78.5
Rural	23	21.5
Educational level		
None	14	13.1
Primary	10	9.3
JHS	34	31.8
SHS	29	27.1
Tertiary	20	18.7
Presence of BCG scar		
Yes	79	73.8
No	28	26.2
Household members		
2-4 members	17	15.9
5-7 members	22	20.6
≥ 8 members	68	63.5
Number of bed rooms		
1-2 rooms	15	14.0
3-4 rooms	46	43.0
> 4 rooms	46	43.0
Windows in room		
< 2 windows	16	15.0
2-4 windows	90	84.1
> 4 windows	1	0.9

4.3 Household contact's knowledge of Tuberculosis

To determine the knowledge of study participants regarding TB, the household contacts who participated in this study responded to questions on various aspect of TB ranging from awareness of TB, signs and symptoms, mode of transmission to treatment and prevention (Table 4.3). Three respondents declined to answer questions in this section and thus were excluded from the analysis in respect of knowledge of study participants on TB.

The study found that most 97 (90.7%) were aware of TB, and 83 (77.6%) believed that TB is curable.

Table 4.3: Household contact's knowledge of TB

Variable	Frequency	Percentage (%)
Ever heard of TB		
Yes	97	90.7
No	10	9.3
Signs and Symptoms		
Mentioned 5 correct signs and symptoms	7	6.7
Mentioned 4 correct signs and symptoms	9	8.6
Mentioned 3 correct signs and symptoms	4	3.8
Mentioned 2 correct signs and symptoms	9	8.6
Mentioned 1 correct signs and symptoms	51	48.6
Mentioned no correct signs and symptoms	25	23.8
Know TB is curable		
Yes	83	77.6
No	24	22.4
Transmittable		
Yes	84	78.5
No	20	18.7
Don't know	3	2.8

In terms of knowledge of the signs and symptoms of TB, participants who were able to mention 4-5 signs and symptoms of TB were classified as having high knowledge, those who mentioned 2-3 signs and symptoms had moderate knowledge while those who mentioned only one was categorized as having low knowledge. Study participants who could not mention any sign and

symptom of TB were classified as having no knowledge of TB. As shown in Table 4.3, the study found low knowledge on the signs and symptoms of TB among household contacts as (51 (48.6%)) could only mention one correct sign and symptom of TB.

With respect to mode of transmission of TB, 84 (78.5%) agreed that TB can be transmitted from one person to another and majority (77 (72.0%)) identified correctly that TB could be transmitted through air while 102 (95.3%) correctly identified that TB is not transmitted through blood. Majority (99 (92.5%)) also identified that TB is not transmitted through sex as shown in figure 4.1

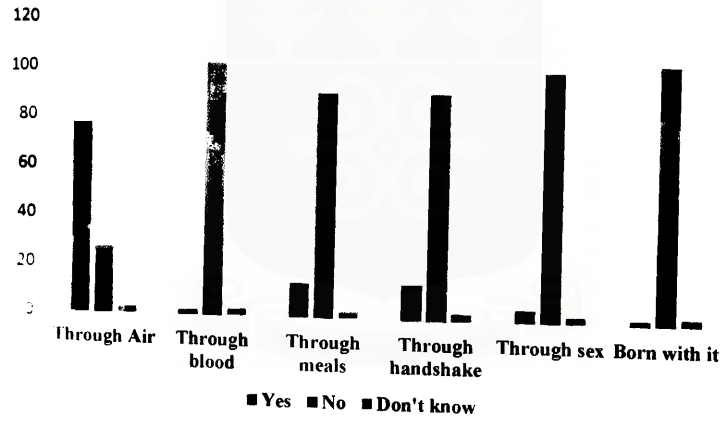


Figure 4.1 Household contact's knowledge of mode of transmission of TB

4.4 Background characteristics of household contacts and awareness of TB

The study sought to determine any association between background characteristics of study participants and hearing about TB. The results showed that educational level ($P < 0.05$) of participants was significantly associated with awareness of TB as illustrated in Table 4.4 below.

Table 4.4: Background characteristics of participants and awareness of TB

Variable	Heard of TB n (%)		χ2	P-value
	Yes	No		
Age			47.985	0.107
≤ 20 years	6 (85.7)	1 (14.3)		
21-30 years	31 (93.9)	2 (6.1)		
31-40 years	26 (96.3)	1 (3.7)		
41-50 years	20 (80.0)	5 (20.0)		
51-60 years	12 (92.3)	1 (7.7)		
> 60 years	2 (100.0)	0 (0.0)		
Sex			0.006	0.940
Male	57 (90.5)	6 (9.5)		
Female	40 (90.9)	4 (9.1)		
Residence			0.473	0.492
Urban	77 (91.7)	7 (8.3)		
Rural	20 (87.0)	3 (17.0)		
Educational level			17.237	**0.002**†
None	11 (78.6)	3 (21.4)		
Primary	6 (60.0)	4 (40.0)		
JHS	32 (94.1)	2 (5.9)		
SHS	28 (96.6)	1 (3.4)		
Tertiary	20 (100.0)	0 (0.0)		
Presence of BCG scar			1.092	0.296
Yes	73 (92.4)	6 (7.6)		
No	24 (85.7)	4 (14.3)		

†=p-value<0.05; n (%)=actual value (frequency) and percentage

4.5 Household contact's screening for TB

The study determined the number of household contacts with index TB cases who have screened for TB. The findings revealed that more than half (62 (57.9%)) have not screened for TB while 45 (42.1%) have screened for TB. Figure 4.2 demonstrates the outcome of screening among household contacts of index TB cases in the Ga West Municipality.

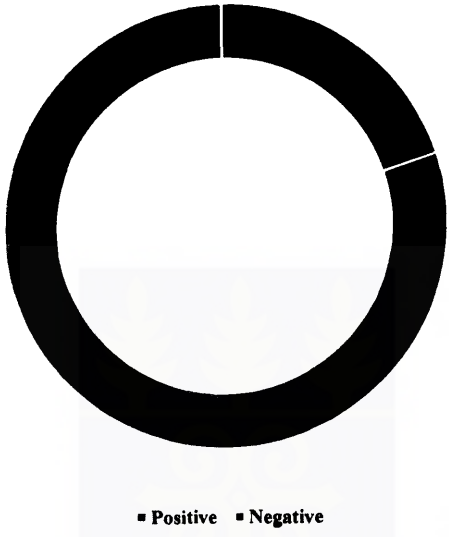


Figure 4.2: TB screening outcome among household contacts.

A bivariate analysis was done to identify any association between the background characteristics of study participants and screening for TB. The results as shown in table 4.5 revealed that place of residence of participants as well as distance to health facility were significantly associated with screening for TB.

Table 4.5: Bivariate analysis between screening for TB and background characteristics of participants.

Variable	Screened for TB n (%)		χ^2	P-value
	Yes	No		
Age			42.163	0.257
≤ 20 years	2 (28.6)	5 (71.4)		
21-30 years	13 (39.4)	20 (60.6)		
31-40 years	11 (40.7)	16 (59.3)		
41-50 years	9 (36.0)	16 (64.0)		
51-60 years	8 (61.5)	5 (38.5)		
> 60 years	2 (100.0)	0 (0.0)		
Sex			0.994	0.319
Male	29 (46.1)	34 (53.9)		
Female	16 (36.4)	28 (63.6)		
Residence			4.255	**0.039**†
Urban	31 (36.9)	53 (63.1)		
Rural	14 (60.9)	9 (39.1)		
Educational level			6.653	0.155
None	5 (35.7)	9 (64.3)		
Primary	3 (30.0)	7 (70.0)		
JHS	15 (44.1)	19 (55.9)		
SHS	9 (31.0)	20 (69.0)		
Tertiary	13 (65.0)	7 (35.0)		
Presence of BCG scar			2.064	0.151
Yes	30 (38.0)	49 (62.0)		
No	15 (53.6)	13 (46.4)		
Months lived with index TB case			2.359	0.307
< 3 months	7 (63.6)	4 (36.4)		
≥ 3 months	35 (39.8)	53 (60.2)		
Distance to Health Facility			10.408	**0.001**†
< 5 km	27 (33.3)	54 (66.7)		
> 5 km	18 (69.2)	8 (30.8)		

†=p-value<0.05; n (%)=actual value (frequency) and percentage

Additionally, the study sought to identify socio-demographic characteristics and other independent variables associated with screening outcomes for TB. The results found no statistically significant associations between socio-demographic characteristics of study participants and screening outcomes for TB. Similarly, no significant association was found

between screening outcome and other selected independent variables as demonstrated in Table 4.6.

However, with respect to age of respondents and screening outcome of TB, majority (5 (55.6%)) of the positive cases were in the age range of 21- 30 years while there was no positive case among participants who were 20 years and less and those above 60 years. Most (6 (66.7%)) of the positive outcome for TB screening were male and majority (5 (55.6%)) resided in urban settlements.

Study participants who completed Junior High School (JHS) education had more than half (5 (55.6%)) of the positive TB cases while there were no reported positive TB cases among participants with primary and SHS level education. Participants who reported presence of a BCG scar on them recorded the highest number of positive TB cases representing (7 (77.8)). Participants who reported living with the indexed TB cases for more than three months had positive TB screening outcome.

4.5 Household contact's treatment for TB.

Among the positive TB outcomes identified through the screening, the study determined proportion of them that were treated for TB. The findings established that, of the 9 positive TB outcomes, 8 of them have been treated representing 88.9%.

Table 4.6: **Bivariate analysis of socio-demographic characteristics of study participants and TB screening outcome**

Variable	Screening Outcome n (%)		χ^2	P-value
	Positive	Negative		
Age			40.974	0.754
≤ 20 years	0 (0.0)	2 (100.0)		
21-30 years	5 (41.7)	7 (58.3)		
31-40 years	2 (25.0)	6 (75.0)		
41-50 years	1 (12.5)	7 (87.5)		
51-60 years	1 (11.1)	8 (88.9)		
> 60 years	0 (0.0)	2 (100.0)		
Sex			1.716	0.424
Male	6 (23.1)	20 (76.9)		
Female	3 (20.0)	12 (60.0)		
Residence			2.891	0.236
Urban	5 (17.9)	23 (82.1)		
Rural	4 (30.8)	9 (69.2)		
Educational level			9.804	0.279
None	2 (40.0)	3 (60.0)		
Primary	0 (0.0)	3 (100.0)		
JHS	5 (33.3)	10 (66.7)		
SHS	0 (0.0)	6 (100.0)		
Tertiary	2 (16.7)	10 (83.3)		
Presence of BCG scar			1.250	0.535
Yes	7 (25.9)	20 (74.1)		
No	2 (14.3)	12 (85.7)		
Household members			2.082	0.721
2-4 members	3 (23.1)	10 (76.9)		
5-7 members	2 (20.0)	8 (80.0)		
≥ 8 members	4 (22.2)	14 (77.8)		
Windows in bedroom			0.500	0.779
< 2 windows	1 (14.3)	6 (85.7)		
2-4 windows	8 (23.5)	26 (76.5)		
Months lived with indexed TB case			0.723	0.948
< 3 months	2 (28.6)	5 (71.4)		
> 3 months	7 (21.2)	26 (78.8)		

n (%)=actual value (frequency) and percentage

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter interpreted the results of the study, the summary of all the findings and compares the findings with other studies that have explored the subject matter under investigation in order to identify differences and similarities in findings. It also includes discussions of these findings and the implications of the results.

5.1 TB Index Cases and Household Contacts Characteristics

The study used hospital records of index TB cases and found that most of the index cases were male and predominantly pulmonary positive. This contradicts results of a previous study which found more than half of the index cases to be female with majority being smear-negative cases (Nakaoka *et al.*, 2006). The difference in findings could be attributed to the differences in number of index cases enrolled in the study. For instance, whereas Nakaoka *et al* (2006) employed a total of sixty index adults' case-patients living in households, this study used one hundred and nine index cases. Another study in a rural district of Malawi reported more female index cases of 55% compared to male of 45% which disagreed with the almost 72% composition of male index cases found in this study (Zachariah *et al.*, 2003).

However, the age characteristics of index cases as found in this study ranged from 6-84 years with a median age of 39 years similar to findings by Zachariah *et al*, (2003) who reported an age range of 15-72 years among index cases in their study with a median age of 31 years. These findings revealed children are equally affected by TB. This is supported by a study which found

that age was not a risk factor for TB and all children like adults, stand a chance of contracting TB independent of age (Nakaoka *et al.*, 2006). This suggests that much should be done to protect children against TB since they may be incapable of taking protective measures by themselves.

In terms of sputum smear grading, sputum smear results of 1+ emerged the majority among cases reviewed and this corroborates with another study in India which reported high numbers of sputum smear of 1+ among cases recruited into the study (Rekha, Jagarajamma, Wares, Chandrasekaran, & Swaminathan, 2009). This probably implies that screening and detection was done early.

On the household contacts, the study revealed that, majority were male with a mean age of contacts being 35 years, standard deviation (SD) of ± 11.8 and ranging from 16-64. This is similar to the index cases of TB and this could suggest uniformity with respect to age and sex characteristics of the study area. These findings in terms of background characteristics of contacts in this study affirms findings in another study which found age range of study participants to be 15-65 years with a predominant male composition of 75% (Rekha *et al.*, 2009). Similarly, an evaluation of investigations conducted to detect and prevent TB transmission reveals a high composition of males in both cases and contacts with a general age range of 6-65 years (Thompson, Mangura, Ford, Valway, & Onorato, 2002).

Most contacts in this study had obtained primary education and above contrary to findings in a study in Nepal that as many as 32.89% of the respondents in the study did not finish primary formal education. However, with respect to residence of study participants', similarity in findings exist as most of the participants in both studies were urban dwellers (Laohasiriwong, Mahato, Koju, & Vaeteewootacharn, 2016). The revelation that most contacts of index TB cases were urban dwellers may suggest prevalence of TB in urban areas than rural areas. This is

supported by a study which reported urban centers have traditionally had higher rates of tuberculosis than rural areas and this could be due to overcrowding in urban areas (Lienhardt *et al.*, 2005).

5.2 Knowledge and Awareness of Tuberculosis among contacts

The study found widespread awareness of tuberculosis among study participants as more than ninety percent of contacts reported that they have ever heard of TB. This suggest high level of consciousness about the disease among contacts and could have been due to their contact with the index TB cases in their households. However, awareness of TB among contacts alone is not enough to ensure prevention. Knowledge of TB is required to enable contacts take preventive steps in order not to contract the disease. Knowledge of contacts in this study regarding TB could be described as generally high as most participants responded correctly to questions meant to assess their knowledge on TB. For instance, 72% of participants had knowledge of the mode of transmission of TB by indicating correctly that the disease is transmitted through air. This affirms findings in another study by Rekha *et al.*, (2009) that overall awareness on the mode of transmission of TB is by the airborne route and that the mouth should be covered while coughing was respectively 73% and 92% among participants recruited into their study.

Additionally, knowledge of the fact that TB is transmittable from one person to another was high among contacts, a result that could suggest that contacts would take preventive measures to prevent contracting the disease from index family members. It is instructive to note, however, that majority of the contacts who had knowledge of the transmission of TB were urban dwellers similar to findings in a study in India that, knowledge about the fact that TB is transmissible to

other family members was significantly lower among rural than urban study participants (Rekha *et al.*, 2009).

The study also revealed that most participants were of the knowledge that TB is curable. This is important particularly for contacts who may be playing treatment supporter role in getting TB positive family members to be treated. It is also crucial for contacts who might be detected to have TB, as this knowledge of TB being curable will influence them to seek for immediate treatment.

Notwithstanding the fact that most participants had knowledge of TB being transmissible, the mode of transmission and curability of TB, their knowledge on sign and symptom of the disease was low. Only few respondents were able to mention five correct signs and symptoms of TB with the majority of them being able to mention only one signs and symptoms. This finding is discouraging considering the fact that, the contact's ability to identify correctly the signs and symptoms of TB will influence their decision in seeking for care by going for screening from the health institutions leading to early detection and prompt treatment. This finding is supported by reports in a study that recognition of sign and symptom of TB was imperative in seeking for checkup and treatment (Lienhardt *et al.*, 2005).

Educational level of contacts was significantly associated with awareness of TB. Many study participants who had SHS and tertiary education were aware of TB compared to those with lower level education. The fact that advancement in education exposes one to the likelihood of getting to learn about common diseases such as TB could be a plausible explanation that could be given for this finding. A study in Brazil found similar association between educational level and awareness of TB (Sanchez *et al.*, 2009).

5.3 Screening for TB and treatment among contacts

More than half of contacts in this study had not screened for TB at the time of the study and this has implications for early detection and subsequent treatment of the diseases since screening offers the crucial opportunity for diagnosing TB at its early stages. The importance of screening for TB is underscored by the World Health Organization (WHO) recommendation that regular screening for tuberculosis in groups at high risk of infection such as groups living in congregate settings, and in contacts of people with tuberculosis is highly imperative and necessary (Kranzer *et al.*, 2010). The low screening found in this study is at variance with results of another study which revealed that more than half (55%) contacts in the study had screened for TB (Thompson *et al.*, 2002). Household contacts are largely missed through the passive case finding strategy, which is also implemented as a strategy under the National Tuberculosis Control Program of Ghana.

The residence of contacts and distance to health facility were found to be significantly associated with screening for TB. Majority of contacts who screened for TB were urban dwellers and this could be attributed to the fact that healthcare facilities may be readily available in urban centers compared to rural areas thus offering urban dwellers the opportunity to screen for TB than their rural counterparts. Similarly, contacts who lived less than 5 km from health facilities screened for TB more than those who live more than 5 km from health facilities and this could probably be due to the proximity of the health facility. These findings are supported by a study which found that the time period between onset of tuberculosis symptoms and diagnosis of tuberculosis is highly variable and depends on numerous factors, including access to health services (Lienhardt *et al.*, 2001). Other studies found that in Ghana and in the Gambia, the time period

between onset of symptoms and initiation of therapy was shorter for patients living in urban areas than for those living in rural areas, showing the impact of differential access to health services (Acheampong, Afful & Lawn, 1998; Lienhardt *et al.*, 2001).

With regards to screening outcome, 20% of contacts who screened for TB were positive. This is less than the 33% screening outcome recorded in a previous study (Thompson *et al*, 2002). However, in terms of the number of contacts screened, the 45 contacts who screened for TB in this study is comparatively less than the 2,103 contacts screened in their study and this could be accountable for the differences in outcomes.

Surprisingly, contacts indicating presence of BCG scar had recorded more positive outcomes of TB screening than those without the presence of BCG scar but this was not significant in statistical analysis. This is at variance with findings in another study that the presence of a BCG scar appeared protective against TB (Lienhardt *et al.*, 2005). It's being established that, BCG given routinely as vaccinations protects contacts aged younger than 10 years (Zelner *et al.*, 2014.)

The results of this current study showed the impact of environmental characteristics of contacts on outcome of TB screening. Contacts who lived with household members above eight recorded more positive cases of TB compared to those who lived with less household members. Also, contacts who lived more than three months with index family members recorded more positive TB outcomes than those who lived with index cases for less than three months. However, these were not significant in statistical analysis. These findings, however, concurred with findings in a study that higher attack rates of tuberculosis exist among persons in familial contact with pulmonary tuberculosis cases and that the number of new tuberculosis cases was highly correlated with overcrowding (defined as the proportion of houses with more than two persons

per room) (Lienhardt *et al.*, 2005). Moreover, contrary to findings by Lienhardt *et al.*, (2005) suggesting that in crowded houses, limited air movement in closed spaces increases risk of TB infection, this study found that contacts who had more windows of 2-4 in a room had more positive TB outcomes after screening compared to those with less than 2 windows in a room.

Prompt treatment of TB patients decreases the potential of transmission to family member and other members of the community. This study found high treatment among contacts screened as TB positive as over 88% of them have been treated for TB after being screened as TB positive. This is similar to a high treatment rate reported in another study among contacts in India (Rekha *et al.*, 2009). This finding is encouraging giving the fact that the potential of transmission will be reduced as long as contacts who are screened as TB positive are treated or remain under treatment In a previous study Corbett *et al.*, (2009) revealed that, TB cure rates have made progress even above the 85%, but case detection still sit below 70%.

5.4 Limitations

- The retrospective nature of some of the variables that required respondents to provide information in the past was prone to recall bias.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Introduction

6.2 Conclusion

This study found that, household contacts screening was inadequate, with less than half of the study participants not having been screened. This is defeating the strategy on the fight against the control and prevention of tuberculosis in the Municipality.

It also revealed that, proportion of household contacts diagnosed were very small. Some were identified as TB positive and all were put on treatment for tuberculosis infections. The Municipalities ability to enroll all into care is very encouraging.

This study also found that awareness of TB among contacts of index TB cases in the Ga West Municipality was high and is crucial for sensitization of the community members about the disease. The knowledge of contacts about TB with regards to its mode of transmission is high among contacts. Contacts are equally knowledgeable of the fact that TB can be treated.

With regards to the factors association with non-screening of contacts, this study found participants place of residence and proximity to health facility as associated with non-screening of household contacts. Public health intervention should be prioritized these factors, attributed to non-screening of household contacts.

The low knowledge of contacts relative to the signs and symptoms of TB could, however, be a potential for delay in seeking healthcare for diagnosis and treatment. Also, the fact that less than half of the contacts screened for TB indicates reluctance on the part of contacts to screen for TB.

6.3 Recommendations

In light of the findings of the study, the following recommendations were made:

1. There is the need for sensitization of contacts of index TB cases in the Ga West Municipality on the need for screening of their household members starting from their treatment supports. Screening must be seen as an important step in interrupting the transmitting route of infection and helps in diagnosing TB early and prompt initiation of treatment
2. Healthcare facilities should improve upon their home visit of contacts for screening while also encouraging facility based screening.
3. The high household contact's knowledge of TB should be taken advantage of in order to educate contacts on preventive measures to prevent transmission of the disease.

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APPENDICES

APPENDIX I CONSENT FORM

Study Title: Tuberculosis investigation among household contacts of index TB case in Ga West Municipality of Greater Accra Region.

INTRODUCTION

I would like to thank you for agreeing to participate in this study. My name is Patrick Larbi-Debrah and I'm a student at School of Public Health, University of Ghana. I am conducting research with the Municipality for academic purposes on tuberculosis case detection with particular focus on household contacts. I would like to talk to you about your knowledge on tuberculosis disease. This discussion should take approximately ten to twenty minutes. The decision to participate is completely voluntary. If you wish to participate in this study, please sign and date this consent form at the bottom.

BACKGROUND AND PURPOSE

This study is being conducted in order to determine the prevalence of tuberculosis investigation among household contacts of index TB case in the Ga West municipality of Greater Accra Region. We hope that the answers collected from you will allow us to gain a better understanding of some limitation of tuberculosis case detection and assist us in making recommendations for policy in the future.

RISKS

The risks associated with participating in this study are minimal. Disclosure of personal or sensitive information about yourself and family You may feel uncomfortable answering certain questions about your knowledge on tuberculosis control, but you may choose not to answer any question for any reason. You have the right to withdraw from the study at any time. You also

have the right to withdraw your data from the study, without penalty for a week from the end of the study. To do this, simply contact your interviewer and inform them that you wish to withdraw your data.

BENEFITS

If you agree to participate in this study, there will be no direct benefits to you. However, the information gathered from this study will be used to assist researchers and policymakers in improving TB case detection strategies among household contacts and reducing the prevalence of tuberculosis in the Ga West Municipality. The results of this study will be available for you in July 2017 at the School of Public Health, University of Ghana.

CONFIDENTIALITY

Participation in this study is completely anonymous. Your name or any identifiable information will not be asked during the study and therefore, will not be included in the research publication and final analysis. Information gathered will be confidential and only handled by study personnel.

DATA STORAGE AND USAGE

Data files will be password protected, hard copy will be stored in lock files cabinets and access will be limited to principal investigator and the academic supervisor of the study Data entered will be stored and secured under encryption key.

PAYMENT

You will receive **no** payment or compensation for your participation in this study.

YOUR RIGHTS AS A RESEARCH PARTICIPANT

Participation in this study is completely voluntary. You have the right to choose not to participate at all or to leave the focus group discussion at any time. If you decide not to participate or leave the study after answering a few questions, there will be no penalty, risk or negative consequences and your benefits will remain the same. If you decide to participate in the study and then choose to leave, the answers obtained from you will not be included in the data analysis or final report of the study.

QUESTIONS OR CONCERNS

If you have any questions regarding the study or this consent form, please contact the principal research investigator Patrick Larbi-Debrah on 0244990130, Academic supervisor: Dr. Benedict Calys-Tagoe (0244602619) and administrator of GHS ERC, Miss Hannah Frimpong (0243235225 or 0507041223)

PARTICIPANT STATEMENT AND SIGNATURE

I certify that I voluntarily agree to answer the survey questions, that the survey has been explained to me. All my questions have been answered satisfactorily. I understand I am free to discontinue participation at any time if I so choose.

Signature or thumbprint of Participant

Date. . .

INVESTIGATOR STATEMENT AND SIGNATURE

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Signature of person who sought consent

Date: . . . . . .

APPENDIX II QUESTIONNAIRE

Tuberculosis investigation among household contacts of index TB case in Ga West Municipal of Greater Accra Region.

Introduction

My name is ....., a field worker working for a student from the school of Public health, University of Ghana conducting research on the topic titled; Tuberculosis investigation among household contacts of index TB case in this municipality. I would like you to spare me a little of your time, to respond to some few questions that would allow to gain a better understanding of some limitation of tuberculosis case detection and assist in making recommendations for policy in future. And also, how TB is being managed in the district and your input to help improve it further. The risk associated with participating in this study are minimal. Disclosure of personal or sensitive information about yourself and family. You may feel uncomfortable answering certain questions about your knowledge on tuberculosis control, but you may choose not to answer and question for any reason. If you agree to participate in this study, there will be no direct benefits to you. However, the information gathered from this study will be used to assist researchers and policy makers in improving TB case detection strategies. Data files will be password protected, hard copy will be store in lock files cabinets and access will be limited to principal investigator and the academic supervisor of the study. Data entered will be stored and secured under encryption key. You will receive no payment or compensation for your participation in the study. All information collected will be treated as confidential? Would you like to participate? Yes or No, if yes, do you have any question to ask before we proceed? (If the participant says no, stop the interview)

Contact person for the information on study include: the principal investigator: Patrick Larbi-Debrah (0244990130), Academic supervisor: Dr. Benedict Calys-Tagoe (0244602619) and administrator of GHS ERC, Miss Hannah Frimpong (0243235225 or 0507041223)

Household contacts questionnaire

1. Date of interview (dd/mm/yyyy)……
2. Name of community……
3. Number of people in the household ……
4. Name of interviewer ……
5. Name of field officer ……

Characteristics of household participants

No	Question	Response	Code	Skip
1	Age (as at last birthday)			
2	Sex	Male	0	
		Female	1	
3	Residence	Rural	0	
		Urban	1	
4	Educational level completed?	No formal education	0	
		Primary	1	
		JHS	2	
		Secondary/Technical	3	
		Tertiary	4	
		Others specify? _____	5	
5	Presence of BCG scar	Yes	0	
		No	1	

Living environment

No	Question	Response	Code	Skip
6	How many are living in the household?	2-4 members 5-7 members >=8 members	0 1 2	
7	Number of rooms in a household	1-2 rooms 3-4 rooms >4 rooms	0 1 2	
8	How many windows are in the bedroom?	< 2 2-4 <4	0 1 2	
9	Within the last three months, had there been a social gathering in this household and the community (e.g. wedding, funeral, etc.	Yes No	0 1	

Knowledge of TB among household members

No	Question	Response	Code	Skips
10	Have you ever heard of the disease called tuberculosis TB?	Yes No	0 1	If No, go to No.14
11	What signs and symptoms can	Coughing > 2 weeks	0	

	show that the person has TB?	Chest pains	1	
		Breathlessness	2	
		Sweating at night	3	
		Weight loss	4	
		Don't know	5	
12	Can TB be passed on from one person to another?	Yes	0	If yes to 13
		No	1	
		I don't know	2	
13	If yes to 10, how is TB transmitted?	Through the air when cough	0	
			1	
		Through blood	2	
		Sharing of meals	3	
		Through handshake	4	
		Sexually transmitted	5	
		Born with it	6	
		Don't know		
14	Have you or anyone in this household ever had any of these symptoms?	Yes	0	If No, go to No.
		No	1	17
15	If yes, did they see a doctor, report at the health facility?	Yes	0	If yes, go to No.
		No	1	17
16	What was your reason for not seeing a doctor?	Felt better	0	
		No need	1	

		Stigma	2	
17	If yes to 14, what is your relationship to the TB patient?	Spouse Parents Son/Daughter Nephew/Niece Siblings Neighbour, friend, etc.	0 1 2 3 4 5	
18	How long have you been living with the index case before the being diagnosed as TB?	>3 months <3 months	0 1	
19	Do you know TB is curable?	Yes No	0 1	
20	Do you know that TB treatment is free?	Yes No	0 1	

Screened and treated for TB

No	Question	Response	Code	Skips
21	Have you been screened for TB	Yes No	0 1	If No, go to No. 25
22	Did the health staff visited the house conduct the screening	Yes No	0 1	
23	If yes to screening, what was the	Positive for TB	0	

	outcome?	Negative for TB Don't Know	1 2	
24	If tested positive for TB, are you on treatment?	Yes No	0 1	
25	What's the distance to health facility for treatment?	< 5km > 5km	0 1	End

APPENDIX III Health facility tuberculosis register