Economic Burden of Tuberculosis (TB) in Ghana

(Case of Western Region)

By

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DECLARATION

I hereby declare that this submission is my own work towards the Master of Arts and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgment has been made in the text.

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DEDICATION

This work is dedicated to the Almighty God for his grace, blessings and the opportunity offered me to pursue this Masters programme.

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ABSTRACT

The study looked at the estimation of the economic burden (direct cost, indirect cost and intangible cost) and household welfare impact of tuberculosis (TB) in the western region of Ghana. Studies into the economic burden of TB in Ghana have been limited. WHO's (2002a) guidelines on cost and cost effectiveness of TB management were followed in the estimation of cost of TB from the patient/household and health provider perspectives. Human capital method was applied in the cost estimation. Wells-Riley model and multiple regression technique were employed in the estimation of the probability of transmission within households and the household welfare impact of TB. Results established that tuberculosis causes a significant deterioration in household income and welfare. The study also found that TB imposes various catastrophic economic costs on affected households and utilise considerable resources within the public health system. It is recommended that safety nets or income insurance be establish for households affected by TB to help cope with high economic burden and help patients fully complete treatment.

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CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Ghana as a transitional economy (GSS 2010) is faced with many developmental challenges. Chief among these is the impact of diseases which affect the quality and quantity of human capital available for development. Diseases such as malaria, HIV/AIDS, tuberculosis (TB) and many “neglected tropical illness” that plague less developed economies are still prevalent.

Malaria, HIV/AIDS and tuberculosis (TB) have being identified as a hindrance to development (Global Fund Africa 2010) and thus resources have been committed into their management in the quest to reduce their impact on human development (Global Fund 2011). Ghana has received over US$296 since 2002 (Global Fund 2011) but some public health policy interest groups have criticised the international community for the massive flow of resources into the management of these three diseases (CSIS 2009). The need for some empirical justification for these resources has necessitated studies into these ill-health and their economic impacts on households and the economy in general.

The country is not among the World Health Organization’s (WHO) 22 high-burden tuberculosis (TB) countries, yet the disease is a major public health problem (USAID 2009).

Tuberculosis (TB) is an infection, primarily in the lungs (a pneumonia), caused by bacteria called *Mycobacterium tuberculosis*. It is spread usually from person to person by breathing infected air during close contact. TB can remain in an inactive state for years without causing symptoms or spreading to other people. When the immune system of a patient with dormant TB is weakened, the TB can become active and cause infection in the lungs or other parts of the body. The risk factors for acquiring TB include close-contact situations, alcohol and IV drug abuse, and certain diseases (for example, diabetes, cancer, and HIV) and occupations (for example, health-care workers). The most common symptoms of TB are fatigue, fever, weight loss, coughing, and night sweats. The diagnosis of TB involves skin tests, chest X-rays, sputum analysis (smear and culture), and PCR tests to detect the genetic material of the causative bacteria. Inactive tuberculosis may be treated with an antibiotic, isoniazid (INH), to prevent the TB infection from becoming active. Active TB is treated, usually successfully, with INH in combination with one or more of several drugs, including rifampin, ethambutol, pyrazinamide, and streptomycin. Drug-resistant TB is a serious, as yet unsolved, public-health problem, especially in Southeast Asia, the countries of the former Soviet Union, Africa, and in prison populations. Poor patient compliance, lack of detection of resistant strains, and unavailable therapy are key reasons for the development of drug-resistant TB. The occurrence of HIV has been responsible for an increased frequency of tuberculosis. Control of HIV in the future, however, should substantially decrease the frequency of TB (http://www.medicinenet.com/tuberculosis/page6.htm).

According to Global Plan to Stop TB Phase 1, Tuberculosis encompasses perhaps the greatest health paradox of our times. Despite the proven effectiveness of a low-cost strategy: just one-quarter of all TB patients worldwide receive care in accordance with the international guidelines for diagnosis, treatment, and monitoring; many TB patients receive inadequate treatment in poorly organized and insufficiently monitored programmes in the public and private sectors, posing a grave danger by encouraging the development of drug-resistant strains, one of the greatest threats to TB control; whiles some TB patients in fact receive no treatment at all.

Worldwide, one person out of three is infected with *Mycobacterium tuberculosis* – two billion people in total. TB accounts for 2.5 % of the global burden of disease and is the commonest cause of death in young women, killing more women than all causes of maternal mortality combined (WHO, 2007). TB currently holds the seventh place in the global ranking of causes of death. Effective drugs to treat and cure the disease have been available for more than 50 years, yet every 15 seconds, someone in the world dies from TB. Even more alarming: a person is newly infected with *M. tuberculosis* every second of every day. Left untreated, a person with active TB will infect an average of 10 to 15 other people every year (WHO, 2007).

Global Plan to Stop TB Phase 1 indicates that TB's persistence, particularly among the poor, constitutes a global humanitarian crisis and an affront to the notion of scientific progress. The disease causes millions of deaths, infects one-third of the world's population, profoundly damages households and national economies, and yet can be cured with drugs that cost as little as $10 per patient.

The link between TB and HIV/AIDS is well documented (Aaron 2004, World Health Organization 2006). HIV and TB form a lethal combination, each speeding the other's progress. In persons infected with *M. tuberculosis* only, the lifetime risk of developing TB ranges between 10 and 20 % whiles those co-infected with HIV, have an annual risk that can exceed 10 %. TB is one of the most common causes of morbidity and the most common cause of death in HIV-positive adults living in less-developed countries, yet it is a preventable and treatable disease.

The relationship between poverty and burden of disease has been established by many studies including Gallup and Sachs (2001) and Commission on Macroeconomics and Health (2001).

These studies reveal that many serious diseases predominantly found in poor countries clearly are a direct consequence of poverty, caused by inadequate sewage treatment, unsafe drinking water, poor hygiene, or substandard housing. It has been identified that the usual complex and interlocking problems of poverty are all operative: the poor may lack the knowledge to protect themselves adequately or seek needed services; they may lack the power to protect their rights; or they may lack income to access services.

According to Stop TB (2000), poverty and the tubercle bacillus create a second vicious circle. Poor people, plagued by hunger and crowded into close, non-hygienic quarters, are easy victims in an environment where TB flourishes. Treatment is often inconsistent or incomplete, to non-existent. The poor are less likely to seek and receive proper care when ill, exacerbating the impact of the disease and there is the greater tendency for them to self-medicate which encourages the emergence of drug-resistant TB strains, further increasing the impact of TB on the poor and the risks to others in society.

Studies have found that TB is gender sensitive; the burden of the disease is greater on women due to stigma and societal settings than on men even though more men suffer TB worldwide than women (Somma et al 2008, Meulemans et al 2002, Hoa et al 2004, Equi-TB 2005, Needham 2001, Karim et al 2007, Muniyandi 2005, Bennstam et al 2004).

An estimated 12,000 of the country's population are infected with tuberculosis annually. With an estimated 47,632 new TB cases in 2007, Ghana ranks 19th in Africa for the highest estimated number of new cases per year, according to WHO's Global TB Report 2009. Nine percent of the

7,786 TB patients registered in 2007 died before completing TB treatment which usually takes eight month duration for the full short term course.

WHO statistics indicates that progress in TB detection, treatment, and management in the country lags behind the world average irrespective of the attainment of full coverage of TB treatment (DOTS) in major health facilities ten years ago (2000) and effective collaboration between donor agencies (WHO, USAID, Global Fund for TB and others), Government of Ghana (Ghana Health Service, National TB Control Program (NTCP), and other NGO's. However, the quality of DOTS in public health facilities is still below expectations (USAID, 2009).

It is more worrying considering the fact that the disease has a high potential for developing common resistance (drug resistant-TB), multiple drug resistant (MDR-TB) and extreme drug resistant (XDR-TB) to known treatments due to patient non-compliance, improper monitoring of treatment procedure by health workers, delays in seeking care, diagnosis and general antibiotics abuse among the populace (GNA 2011).

The nature of the disease, its management and treatment presents substantial economic burden to affected households as well as to the nation. Low income households face catastrophic expenditure (in the form of non-medical cost since TB treatment is "free"), loss of household income due to illness, utility loss to household and high possibility of death with its associated mortality cost and loss of lifetime income to the nation.

In Ghana TB contributes to a significant cause of adult morbidity and mortality (GHS 2007), loss of workdays and fall in household welfare due to impact of coping strategies. Among children, the illness causes irregular school attendance, poor academic performance, utility loss and stigma, loss of self confidence, embarrassment and fear. The disease burden is more devastating on rural households where incomes are generally low.

The number of TB affecting children and adults increased in 2009 (GNA, 2010). World Health Organization (2005) indicate that the "direct costs" of diagnosis and treatment are significant for poor families, the greatest economic loss occurs as a result of "indirect" costs, such as loss of employment, travel to health facilities, sale of assets to pay for treatment related costs, and in particular, lost productivity from illness and premature death.

1.2 Problem Statement

The true burden of TB including economic burden (direct cost, indirect cost and intangible cost) in Ghana since 1957 is not known and the country is yet to collaborate with WHO to undertake such a project (GNA 2010, 2011). However WHO Global Task Force on TB Impact Measurement subgroup on TB Disease Prevalence Survey 2010 report indicate the project could not take off as proposed.

Most institutions quantify the economic burden of the TB pandemic in terms of direct cost (cost of TB programme inputs) of the disease alone (WHO 2010, USAID 2009). The use of direct cost of the disease alone is misleading since indirect and intangible costs are not included and this results in an underestimation of the burden of the disease impacting on the country's policy on TB management.

Studies have revealed the overall primary drug resistance rate of 23.5% in Ghanaian TB patients, which rank the country among those African countries with a high prevalence of drug-resistant TB (Lawn et al 1998) while MDR-TB in Ghana to be 2.6% of all estimated cases (Dye et al.

2002). Drug resistant TB (MDR-TB and XDR-TB) requires relatively enormous resources, drugs with greater toxicity and results in high mortality rates (Madariaga et al 2008).

The emergence of drug resistant TB has considerable cost implications for affected households since the treatment period is significantly prolonged (from 6month up to 2years), thus imposing economic burden on households and the public health system since very expensive drugs and equipments are needed for their management thereby using up more resources with its associated opportunity cost.

1.3 Objective

The main objective of the study is to estimate the economic burden (direct cost, indirect cost and intangible cost) and welfare impact of tuberculosis (TB) in the western region of Ghana.

The specific objectives are as follows;

- To find out the characteristics and treatment seeking behaviour of tuberculosis (TB) patients in the western region.
- To estimate the economic burden of TB, identify how the illness affects household incomes and the coping strategies those households adopts.
- To analyse the trends in reported TB cases in the two districts and assess the institutional cost of the disease.
- To estimate the infection risk or probability of infection (P_I) of tuberculosis within households (confined space).

- To analyse the impact of TB and its outcomes (household burden of TB, workdays lost due to illness, debt accumulation and stigma) on household welfare.

1.4 Hypothesis

H_0: Tuberculosis (TB) and its outcomes do not impact negatively on household welfare.

H_1: Tuberculosis (TB) and its outcomes impact negatively on household welfare.

1.5 Justification of the Study

The study attempts to estimate the true burden of TB, which is essential for guiding effective allocation of resources within tightly constrained health and development budgets. Knowledge of the true burden of TB is vital to inform policy formulation and direction to develop effective, comprehensive and country-tailored remedies to tackle this pandemic. The study will be useful to policy formulation in the following ways;

- Though TB treatment (medical) is free, patient non-compliance and treatment default is significant which results in the development of drug resistant TB, MDR-TB and high transmission rate among the susceptible population (Madariaga et al 2008). Knowledge of indirect patients' cost, additional medical charges and other factors that hinders successful treatment can inform the development of appropriate policies to increase the treatment completion rate which is crucial in lowering the incidence rate.

- 'We cannot win the battle against AIDS if we do not also fight TB. TB is too often a death sentence for people with AIDS' (Nelson Mandela, International AIDS Conference

2004). Effective TB treatment is critical to ensure positive returns to investments in the management of HIV/AIDS patients since 40-50% die from TB and not AIDS (GHS 2007). Though policies of co-management of TB-HIV/AIDS exist, the knowledge of the economic burden of TB will be insightful for policy debate and formulation.

- Knowing which societal group the TB economic burden is heaviest on will aid policy formulators to develop spot-on measures to reduce the negative effects instead of the general policy which may not have the desired effective.

The study will be relevant for research as could be use for literature review and as well as contributing to the stock of TB studies in general.

1.6 Data and Sampling

The data required has two components: at the micro level, the household was the unit of analysis and data involving cost of illness to households were obtained through field survey (questionnaires and interviews). The household was considered an important socioeconomic unit and a TB illness on a member was likely to be a drain on the resources of the household.

At the macro level, data involving cost pertaining to disease detection, treatment and management were obtained from secondary sources such as Ghana Health Service (GHS) and other donor agencies (Global Fund).

Having taking into consideration the disease prevalence, accessibility, financial and time constraints, the districts were selected with the help of the Regional TB coordinator. Sekondi-Takoradi Metropolitan and Ahanta West districts were chosen. A total of 106 respondents were obtained from both districts for the study due to the relatively smaller number of cases reported as compared to malaria which account for 40-60% of all outpatient visits nationwide (Asante et al 2005). This resulted in difficulties in having access to a superior number of households (patients and their treatment supporters (relatives)) with confirmed TB cases.

Sekondi-Takoradi Metropolitan area occupies the south-eastern part of Western Region and has the highest concentration of health delivery facilities and services in the region. Apart from the Effia-Nkwanta Hospital which is a regional hospital, the metropolis has the Takoradi Hospital, Essikado Hospital and Kwesimintsim Polyclinic. There are also 31 private hospitals, 5 government health centres, 5 community clinics/maternities and 8 CHIP zones.

Ahanta West is located in the western region and rural because 80% of its inhabitants are in rural settlements (UNDP 2007). Nana Hima Dakyi District Hospital is the only hospital in the district aside 3 health centres and 2 CHIP zones. The districts were chosen based on socioeconomic conditions (health indicators/facilities) to give a fair representation of the burden of illness in the country and to aid bring out clearly the disease burden peculiar to different settings based on income, geographical location, education, primary occupation and availability of health facilities.

Patients and their treatment supporters were interviewed at the health facilities as they report for monthly medical review and drug ration. This was done to ensure that only households with confirmed cases of TB were captured with the research tools.

1.7 Methodology

Human Capital method has been used extensively (e.g. Kamolratanakul et al. 1999, Russell 2004, Muniyandi et al 2005, Rajeswari et al 1999, Geetharamani 2001, Kemp et al 2007, Needham 1998) to estimate TB cost to households and society and was therefore employed in this study to determine the economic burden (direct cost, indirect cost and intangible cost) of TB in the Sekondi/Takoradi Metropolitan and Ahanta West districts. Input based approach or the ingredient approach was applied in the estimation of institutional cost of TB (WHO 2002a). Multiple regression analysis was used to establish the impact of TB and its outcomes on household welfare.

In determining the probability of infection/infection risk of TB in the two districts, the Wells–Riley model which has been extensively (e.g. Noakes et al 2008, Furuya et al 2007, Furuya 2008, Escombe et al 2007, Liao et al 2005, Fennelly et al 2004) used for quantitative infection risk assessment of respiratory infectious diseases in indoor premises were employed.

1.8 Organization of study

The study is divided into five chapters. Chapter one deals with the introduction, the statement of the problems, objectives, justification of the study, methodology, the purpose of research, hypothesis and organization of the study. Chapter two provides an overview of existing literature on theoretical foundation and empirical studies on TB.

Chapter three gives the profile of the districts, the theoretical framework and the empirical model that underpin the analysis of the data. Chapter four deals with the presentation, analysis and discussion of the data collected from the field.

Chapter five look at the summary of findings, recommendation and policy implications of the research.

CHAPTER TWO

2.0 Literature Review

This chapter reviews theoretical foundations of ill-health and its economic impact on households and governments, some cost definitions applied in healthcare studies as well as empirical review of tuberculosis (TB) studies. To appreciate the possible ways in which disease may lead to economic costs and losses, it is necessary to start by considering what it is that people or societies value in terms of welfare (WHO 2009).

2.1Theoretical Foundation (WHO 2009)

According to welfare economic theory, and subject to various constraints including income, technology, taste and time, individuals or populations seek to maximize utility. They do this by combining to best effect their consumption of a range of goods and services - some of which can be bought and sold (including health care), and some of which cannot but nevertheless have discernible value (e.g. home-grown produce that is directly consumed rather than sold). In addition to the consumption of goods and services, individuals or populations also generate utility via other means, such as taking care of others (without financial compensation), and spending time with family and friends or in other forms of leisure.

Health contributes to individual utility or social welfare in three ways. First, people prefer to be more healthy than less healthy (i.e. health directly affects utility). Second, the enjoyment of consumption of other goods and services is partly influenced by the level of health (i.e. marginal utility derived from consumption is partly a function of health status). Third, without good health other economic objectives, such as producing income that allows people to consume market goods, stand to be compromised; in other words, it is instrumental to an individual's or community's capability to undertake desired activities or functions. While the consumption of most types of goods and services yields welfare directly, the consumption of health goods and services does not. People would prefer not to incur these expenses in terms of money and time, but do so because they believe it will protect or promote their health.

- *Ill-health and its impact on households*

The impact of ill-health on a household can be measured in terms of its impact on the consumption of non-health goods and services (market and non market), leisure, health status - which represent the essential components of welfare or in terms of the overall change in welfare. The mechanisms through which ill-health influence current and future consumption are diverse. For example, and particularly in lower-income countries with a high proportion of direct out-of-pocket health spending, ill-health will drive up household consumption of health-related services and goods at the expense of non-health goods and services. By increasing the time spent seeking care or in states of health that prevent work, it can also reduce production of both market and non-market goods, and through this, consumption.

The impact is not just limited to the current time period; health services and goods may be paid for out of current income, but could also be financed from cash savings if available, or if not, via a loan or the sale of household assets (e.g. dis-savings). Reduced household income, savings and assets resulting from the consumption of health services and goods may in turn lead to depleted investment in (physical, financial and human) capital. These factors influence consumption possibilities in the future (WHO 2009).

- *Ill-health and impact on the government*

Governments essentially produce public goods and redistribute income. Illness in its employees can reduce the output of public goods or increase the cost of producing the public goods. However, governments are often more concerned with the impact of ill-health in the population on its financial expenditures and receipts. These relate to the increased costs of providing or financing health services, increased social security payments including disability or unemployment benefits, and reduced tax receipts (WHO 2009).

2.2 Opportunity and Financial Costs

Cost in economics is opportunity cost. The concept of opportunity cost is fundamental to the economist's view of costs. Scarcity of resources requires choices, which necessitate trade-offs and trade-off result in opportunity cost. Opportunity cost is a measure of the benefits that would have been gained from using resources in their next best alternative use. Economic or opportunity costs recognize the cost of using resources is that it makes such resources unavailable for productive use elsewhere. It is often measured as the monetary cost of the good or service provided, but can also be expressed in terms of the goods or services that, with the same resources, could have been produced instead. For example, the opportunity cost of increased investment in tuberculosis services might be the number of people who could have been treated for malaria with the equivalent expenditure and time. Opportunity cost is useful when evaluating costs and benefits of choices.

On the other hand, any input which must be paid for with money (such as nursing staff, drugs, equipment, vehicles or fuel) represents a financial or accounting cost. Financial costs represent only actual expenditure on goods and services purchased. Inputs made to the production of a good or service at no financial cost (such as TB medical treatment, volunteer's time), but which nevertheless represent a cost in the sense that those inputs could have been applied to another productive use. Therefore economic costs do not always involve monetary expenditure, whereas financial costs do. Within tuberculosis services, inputs provided by donor agencies (e.g. Global Fund, USAID) to Ministry of Health do not constitute a financial cost from the perspective of the Ministry, but they do constitute an economic or opportunity cost.

2.2.1 Application of cost concepts in healthcare evaluation

- **Cost analysis**

A cost analysis focuses on assessing the costs of providing or consuming a service or intervention. It is useful for assessing the affordability of a programme and for guiding budgetary planning. Analysis of costs is also useful for assessing what the costs of expanding or contracting a particular service or intervention might be. Cost analysis does not consider the effectiveness of an intervention or service (WHO 2002).

- **Cost-minimization analysis**

Cost-minimization analysis is used when an evaluation is comparing two or more strategies which have the same effectiveness but which are assumed to have different costs. The question that the analysis is designed to answer is: which strategy has the lowest costs? Cost-minimization analysis would identify which of the strategies have the lowest cost (WHO 2002).

- **Cost-effectiveness analysis**

A cost-effectiveness analysis is appropriate when the aim of an evaluation is to compare alternative strategies that are associated with different costs and different effectiveness. The aim is to identify the strategy with the lowest cost per unit of output, or alternatively the strategy that delivers the highest output for a given fixed budget. In cost-effectiveness analyses in the health sector, the effectiveness indicator is the same for each strategy being compared, and consists of a health outcome measure (WHO 2002).

- **Cost-utility analysis**

Cost-utility analysis is relevant when the aim is to compare alternative health services/interventions that are associated with different costs and different outcomes. The main distinguishing feature of cost-utility analysis from cost-effectiveness analysis is that it involves measurement of the "utilities" associated with different interventions. This estimation technique is based on "expected utility theory", also referred to as von Neumann-Morgenstern utility theory, which is a theory of rational decision-making under uncertainty. The existence of uncertainty in the analysis captures the extent to which individuals are risk averse, risk-seeking or risk-neutral (WHO 2002).

- **Cost-benefit analysis**

Cost-benefit analysis involves assessing both the costs and outcomes associated with a health intervention or service in monetary terms. This is unlike cost analysis, cost-effectiveness and cost-minimisation of evaluation which assign a monetary value to costs only. It requires that a money value be assigned to improvements in health status (WHO 2002).

The study adopts the cost analysis approach since this work seeks to establish the economic burden of tuberculosis on affected households and health system but does not compare different interventions of managing tuberculosis in Ghana.

2.2.2 Cost of illness

Economic costs of illness broadly include direct cost and indirect cost (IQWiG 2009, USAID 2008, WHO 2002a, Rice 1966) and intangible cost (IQWiG 2009, Rice 1966). Most studies however do not include the estimation of intangible cost.

Direct and indirect costs

Costs in health economic evaluations are commonly classified into the following cost categories

- direct medical costs (or direct health care costs)
- direct non-medical costs (or direct non-health care costs), and
- indirect costs (or productivity losses)

Direct costs refer to the resource consumption in the provision of health care interventions. They encompass the entire current resource use and, depending on the timeframe under consideration, also future resource use attributable to the programme. Future costs can span a lifetime in some therapeutic areas.

Direct costs are further split into direct medical and direct non-medical costs. Direct medical costs refer to the resource consumption in the health care sector associated with the provision of health care interventions. Resource consumption includes the costs of hospital stays, outpatient visits, drugs, medicinal substances and devices. Direct non-medical costs refer to resources supporting the medical services delivered in the health care sector. Depending on the perspective (household or health provider), direct non-medical cost can be travel costs to medical interventions or the valuated time spent by patients and their family caregivers in relation to their illness (IQWiG 2009).

Indirect costs denote the production losses due to

- incapacity for work (in the case of illness);
- occupational disability (in the case of long-term illness or disability);
- premature death

Indirect (opportunity) costs differ from financial cost as they include the cost of foregone income due to the inability to work because of the illness and loss of time due to visits to health facilities, time spent on the road to and at health facilities, lost productivity and loss of job in high stigma societies.

Besides direct and indirect costs, a third category of costs are those incurred through coping strategies (coping costs) of a household to meet daily requirements despite extra expenditures or loss of income. Coping strategies can be defined as a set of actions that aim to manage the costs of an event (shock) or process that threatens the welfare of some or all of the household members. Ultimately coping strategies are seeking to sustain the economic viability and sustainability of the household (Sauerborn et al. 1996). These include the sale of assets, taking up debt, saving on food or other items, taking a child out of school to care for the patient or taking up another job.

Russell (2001) noted that coping strategies are vitally important for poor households faced with illness cost shocks, since the costs associated with serious illness can absorb a large proportion of the household budget and therefore require the mobilisation of substantial additional resources. Even minor illness costs can exceed the low and insecure daily or weekly budgets of the poor, who often survive on a daily wage that is barely enough to meet minimum food requirements.

Intangible costs

Intangible costs are a category of costs that is nowadays seldom used. These costs refer to items difficult to measure and value in cost terms, e.g. pain and suffering associated with a treatment, stigma and fear of death. However, parts of intangible costs are actually not costs (i.e. no resources are denied an alternative use), and overall they are often not strictly intangible, as they can actually be valued through quality-of-life measures or willingness-to-pay approach.

2.3 Empirical Review

2.3.1 Cost of Tuberculosis (TB) -Patient/Household Perspective

The review takes into consideration the stage of the disease in which various costs occur:

- Before Diagnosis
- During Diagnosis / Pre-Treatment
- During Treatment

Direct cost (transportation, special foods, visits to pharmacies/chemical shops, private health providers and traditional healers/spiritualist), and indirect cost (lost of income of patients and caregivers, days of work lost, decreased earning ability, change in or lost of work and cost associated with coping strategies such as assets selling and depletion, borrowing among others).

At each stage of the illness, the review will focus on direct cost and indirect cost and in the case of treatment stage a major component of cost incurred is hospitalization.

2.3.2 Pre-diagnosis Costs (Cost Incurred Before Diagnosis)

Patients repeatedly cite lack of money and transportation cost in particular as the principal reasons for the delay in seeking treatment (Squire et al 2005, Needham et al 2004, 1998, Gibson et al 1998, Croft 1998, Muniyandi 2005). The amount of transportation varies with urban or rural location of the patient (Needham et al 1998). Kamolratanakul (1999) found the direct average pre-diagnosis cost to households as between $55-225, similar to Haiti (Jacquet et al 2006). Russell (2004) determines direct costs to amount to 5-21% of annual household income.

Pre-diagnostic costs have also been attributed to visits to private health providers (where user charges apply), pharmacies, chemical shops and traditional healers (Kemp et al 2007, Muniyandi 2005, Lonnroth et al 2001, Needham et al 2004). In Malawi TB patients pay 10% of their monthly income to traditional healers for consultation (Needham 2004) whiles multiple visits to different providers; about 65% of TB patients have been observe in Vietnam (Lonnroth et al 2001). Most patient prefer private health providers due to shorter waiting time, fear of stigmatization and perceived high process quality (Lonnroth et al 2001).

Majority of studies which estimated the pre-diagnosis indirect cost of TB on households centred on lost income, days of work lost, decreased earning ability, change in work and costs associated with coping strategies (Kemp et al 2007, Muniyandi 2005, Croft 1998, Needham 1998, 2004). Studies in Malawi, Bangladesh, India and Zambia estimated indirect pre-diagnosis cost of TB to be averaging $16 (Kemp et al 2007, Needham 1998) which is different from a high of $68 (Jacquet et al 2006). Work days lost ranges from 18days (Needham et al 1998) to 48days

(Needham et al 2004) for patients and 9 to 13days (Kemp et al 2007) for caregivers. Muniyandi (2005) reports 71% of patients borrow money to cope with costs. Croft (1998) reports similar findings with half of her study population coping by selling land and livestock or taking out a loan.

Total costs (direct and indirect) for patients prior to diagnosis, measured as a percentage of mean monthly income varies between 127% (Needham et al 1998) and 135% (Kemp et al 2007). In monetary terms, this amounts to $59 and $29 respectively. Lonnroth et al (2001) found total costs in range of $15 and $77. Needham (1998) found caregiver costs to amount to 31% of mean monthly income. Whereas the poor have pre-diagnosis total cost amounting to 244% of their monthly income, the non-poor's burden amounts to 129%. Needham (1998) reports economic loss to be especially grave for self-employed persons.

2.3.3 Diagnosis Cost (Pre-treatment Cost)

Costs specifically measured for diagnosis are difficult to discern and rarely addressed by themselves. Most studies combine the estimation of diagnostic costs with pre-diagnosis cost or treatment cost though others tried to assess them separately.

Household direct cost associated with TB diagnosis range widely from $2 in Tanzania (Wyss et al 2001), $6 in India (Rajeswari 1999), $57 in Thailand (Kamolratanakul 1999) to $130 in Bangladesh (Croft & Croft 1998). Russell (2004) found diagnosis direct costs to amount to 8-13% of annual household income.

Factors such as over-prescriptions, charges for drugs and informal payments (Gibson et al 1998, Equi-TB 2005, Muniyandi 2005, Boillot & Gibson 1995, Falkingham 2003) were found to contribute significantly to direct cost though these occurrences seems to depend strongly on the setting. Kemp et al (2007) however found informal payments to be rare in Malawi.

Indirect diagnosis cost has been found to exhibit a range between $16 in Malawi (Kemp et al 2007) and $115 in Bangladesh (Croft & Croft 1998) whiles workdays lost due to TB diagnosis vary from 20days (Kemp et al 2007) to 48days (Rajeswari 1999).

Croft (1998) reports the highest diagnosis total cost as $245 in Bangladesh though the average is around $10 - $30. Total cost expressed as a percentage of income are 135% of mean monthly household income in Malawi (Kemp et al 2007) and 31% of annual income per capita in Bangladesh (Croft & Croft 1998), 58% for the poor in Myanmar (Lonnroth et al 2007). Expectedly, Kemp et al (2007) found that the poor spent 244% of monthly income on diagnosis which is 110% more than the average. This emphasizes the fact, that averages do not adequately represent the economic burden of the poor.

2.3.4 Treatment Cost

Treatment direct cost of TB has been found to be affected by disparities in local conditions such as type of facilities administering treatment (hospital/clinic/community/self), health care financing scheme etc. Studies have reported varying cost as low as $5 in Tanzania (Wandwalo 2005) up to $150 in Haiti (Jacquet et al 2006) with $20 and $50 as the average range. Transportation cost and expenditure on food and drugs (if not provided for free or covered by insurance) make up the bulk of this cost (Kamolratanakul 1999, Wyss et al 2001, Sinanovic 2003). Expenditures on health facility visits, travels and drugs were found to be higher among urbanites than among patients living in rural areas and also direct cost was found to be gender sensitive, been higher for women than for men in India (Rajeswari et al 1999). In South Africa, Sinanovic (2003) identified DOT (hospital) visits to be the item accumulating most of the costs.

Out-of-pocket direct expenditures of the very poor for diagnosis and treatment amounted to 15% of their annual per capita income in Thailand, (Kamolratanakul 1999), and 49% in Haiti (Jacquet el al 2006). Medical expenses amounted to 40% of annual income of Chinese households, for low-income households, they were equivalent to 112% of annual income (Zhang et al 2007). Russell (2004) determined direct post-diagnosis costs to amount to 18.4% of annual household income. Moalosi (2003) found home-based care cost 23% less for care givers than hospitalization in Botswana. Sinanovic (2003) established that workplace supervision was much less costly ($11) than clinic supervision ($111) in South Africa.

Admission to hospital constituted 76% of patient cost, with a day in hospital costing the patient $4. Treatment with DOT at health clinic or community level is cost effective than hospital based DOT whiles an outpatient hospital visit cost the patient 5 hours (Floyd et al 1997). Moalosi et al (2003) found home-based care in Botswana to be 42% cheaper for patients than hospital-based care; while the average hospital stay with home-based care was 21 days, it was 93 days with hospital-based care.

Indirect costs in monetary terms amount to $7 (Wandwalo 2005) and $50 (Jacquet et al 2006). Productivity in household or occupation drops by 30% while $150-200 or 15%-20% of annual household income is lost; patients cannot work for 2-4 months and 20-75% of patients incur some form of debt attributable to TB illness and care seeking (USAID 2008). Children discontinuing school due to TB is 11% in India (Geetharamani 2001; Muniyandi et al 2006) whiles 8% (Geetharamani 2001) and 20% (Muniyandi et al 2006) took up employment to cater for sick relatives. Total treatment cost of TB treatment is found to be between 20% and 30% of annual household income (Ramachandran et al 1997, Croft & Croft 1998).

2.3.5 Total Cost of TB (Pre-diagnosis, Diagnosis and Treatment Costs)

Direct costs of TB amount to 3.7 – 15% of annual income, the cost burden been higher for the poor (Kamolratanakul 1999, Rajeswari 1999, Russell 2004). Jackson (2006) however found the household direct costs to be much higher, that is 55% of annual household income in China. These costs are aggravated by extensive use of private providers, particularly in urban settings. The distribution of direct cost is uneven and skewed towards the minority and the poor (Russell 2004).

Russell found TB indirect costs to amount to 5-8% of annual household income, Rajeswari (1999) to 26%. In terms of workdays lost, Needham (1996) reports 2 weeks in Zambia whereas others report an average loss of 8 -12 weeks (Rajeswari 1999, Kamolratanakul 1999, Ahlburg 2000). Ahlburg (2000) indicates that treated patients lose 2 months of work compared to untreated ones losing 12 months. In respect to coping costs, Jackson (2006) reports 66% of patients borrowing money from relatives or friends, 45% sold assets and 8% borrowed money from banks. Rajeswari (1999) reports 14% of annual household income forgone for debt redemption.

The economic burden of TB is clearly depicted when expressed as a percentage of income. The poor spend a far greater proportion on meeting basic needs (e.g. food) whereas the non-poor have more disposable income. The burden of each $ spent is significantly higher for the poor.

Russell (2004) deems a cost burden of more than 10% of annual household income to be already catastrophic for a household's financial situation. Taking this into account, study results point to the enormous burden of households and individuals of 20-30% of monthly income (Needham et al 1996, Muniyandi et al 2005) and 10-90% of annual income (Russell 2004, Rajeswari 1999, Jacquet et al 2006, Ahlburg 2000), noting that the burden is heaviest for the poor and the majority being approximately between 10-40% (Russell et al 2004, Kamolratanakul 1999, Ahlburg 2000, Rajeswari 1999). Ahlburg (2000) determined the cost of morbidity of treated TB to be 15% of GDP per capita.

2.4 Cost of Tuberculosis – Healthcare/Provider Perspective

Effective TB control is a public good: because TB is a contagious disease, curative care for the individual makes the population healthier. TB treatment and control is, therefore, a responsibility of government and public policy. Maintaining a healthy workforce, the health of an adult, who is often the primary wage earners, is another societal benefit. The externality associated with TB control has made the detection, treatment and management of the pandemic free of cost to sufferers. TB management however uses up enormous public resources with its associated opportunity costs.

The cost to the health provider includes the economic value of all inputs involved in the detection and management of tuberculosis. Literature indicates that the healthcare cost attributed to TB are broadly categorised into diagnostic cost, treatment cost, setup cost, management cost as well as preventive cost (public education campaigns etc). Most studies however restrict their scope to the determination of diagnostic and treatment cost while a small number includes setup cost and management cost and others preventive cost (cost of BCG vaccine for infants).

Results are presented in average per unit cost of treatment though other studies report the unit cost of items such as drugs, x-ray, sputum smear and cost of volunteer time among others.

The healthcare or provider unit cost per TB patient ranges from a low of $30 in the India (Muniyandi et al. 2006) to a high of $758 in Rio de Janerio, Brazil (Steffen et al. 2010) which depends on the type of facility (hospital based, community/home based, self administered) administering the DOTS. Estimates from various studies (Kamolratanakul et al. 2002; Peabody et al. 2005; Costa et al. 2005; Karki et al 2007; Steffen et al. 2010; Wyss et al. 2001; Wandwalo et al. 2005 ; Elamin et al. 2008; Islam et al. 2002; Khan et al 2002; Hausler et al. 2006; WHO 2005 etc) fall within the above mentioned range. Of the overall unit provider cost, about 70% was spent on personnel, 25% on drugs and 5% on diagnosis (Muniyandi et al. 2006).

Per unit cost in the developed countries are higher (Wurtz and White 1999; WHO 2005; Migliori et al. 1999) compared to developing countries. The health care cost attributed to smear positive TB averages $362.21 in Thailand (Kamolratanakul et al. 2002) and $103 in Brazil (Costa et al. 2005) but higher in the developed countries (Migliori et al. 1999). Smear negative TB costs the public health system between $145 and $267.67 (Kamolratanakul et al. 2002) in the developing countries whiles costing $1407 (Migliori et al. 1999) in the developed countries.

Retreatment cost is $155 in Brazil (Costa et al. 2005) whiles in Thailand the estimated cost vary from $3071.59 and $617.74 (Kamolratanakul et al. 2002). Provider cost of MDR-TB poses the highest cost to the public health system (Kamolratanakul et al. 2002; Muniyandi et al. 2006; Floyd et al. 2006; Peabody et al. 2005; Costa et al. 2005) and 95% of this amount was due to the expenditure on medications alone. This magnifies the potential cost burden on public health system if the completion of TB patient on DOTS does not improve as a matter of urgency to prevent the development of drug resistant TB.

The cost of HIV/AIDS co-infection is estimated to be between $309.96 and $559.56 (Kamolratanakul et al. 2002). Hospitalisation and inpatient stay has been cited as contributing about 37% to 62% of cost components of the health system at the intensive stage of the illness (WHO 2005). It makes up substantial amount of provider cost in Malaysia and Brazil respectively (Elamin et al. 2008; Costa et al. 2005). In the USA, the total provider cost of TB per inpatient case was estimated at $1,915,757 with the cost of hospitalisation been the major component contributing 86.6% (Wurtz and White 1999).

Other studies estimated the cost of treating all suspected TB cases. In the Philippians, the costs of treating all known, albeit partially treated, cases were found to be between $2–7 million in annual direct costs to the health provider. Treating all expected cases according to the study would require between $8–29 million annually (Peabody et al. 2005). Tuberculosis imposes additional cost to society including indirect costs in the range of $1800 to US$ 4200. The possible savings at the national level were in the order of $50 million per year (Migliori et al. 1999). Overall, the economic cost of per TB prevented was found in the range $178 and $962 in South Africa (Hausler et al. 2006).

The proportion of cost borne by the public sector is between 12% - 62% ((Mesfin et al. 2010, Wyss et al. 2001, Costa et al. 2005) of the total cost of managing TB. Wandwalo et al. (2005) indicates that community DOT reduced providers cost by 27%, patients cost by 72%, and combined patients and treatment supporter cost (community cost) by 55%. The two main expenditures in TB management program are salaries and drugs (Islam et al. 2002).

In conclusion, TB deprive households of income which affects both present and future consumption patterns as well as causing considerable time and productivity looses. Coping strategies such as borrowing, dis-savings and assets disposal can push low and middle income households into impoverishment and poverty trap with dire consequences for household welfare. The communicable nature of TB makes the potential for these adverse economic effects on the household a certainty and with catastrophic outcomes. TB imposes cost of varying magnitude on patients, households, community, public health systems and the society as a whole. Interest in these costs has been explored to inform policy formulation and direction in other countries but has not been the case in Ghana hence the need for this study. This can serve as a justification for budget allocation among many competing programs in the health sector and a baseline for conducting cost effectiveness of TB management in Ghana in the future.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter include the characteristics of the study areas, data to be collected, data collection, sampling techniques and methods of analysis.

3.1 Overview of the Study Area

The Sekondi Takoradi Metropolitan Area occupies the south-eastern part of Western Region. It shares boundaries with Ahanta West, Mpohor Wassa East and Shama districts. It is located on the coast, about 200km west of Accra. The metropolis is the third most important one in Ghana in terms of industrialization and contribution to economic activity. The area has the highest concentration of health delivery facilities and services in the region. Apart from the Effia Nkwanta Hospital which is a regional referral hospital, the metropolis has the Takoradi Hospital, Kwesimintsim Hospital and Essikado Polyclinics. There are also 31 private hospitals, five government health centres and another five community clinics/maternities (Metropolitan Assembly website 2010).

Ahanta West district has an estimated population of 155,385 but considered rural because 80% of its populace lives in rural settlements with only two urban localities, which is Agona Nkwanta and Apowa (UNDP 2007). It is located in the south-western part of the country and borders the Atlantic Ocean. Fishing and agriculture are the main occupation; cultivation of palm fruit, rubber trees, coconut, maize, vegetables, and citrus is common. Beach tourism is popular and the area has become known due to the development of the oil industry. In terms of health facilities, the district has 12 in total; one public hospital located at Dixcove - Nana Hima Dakyi Hospital which serves as the district hospital, 5 public health centres, 2 Community and Health Planning Services (CHPS) zones and 4 clinics.

3.2 Data Collected

Consistent with the objectives of the study of estimating the economic burden of TB, facilities that are managing TB in the two districts was visited to identify smear positive and smear negative TB patient who are self identified and have been on treatment for at least one month. Demographic characteristics, income and employment data, information on cost of transport to treatment centres/health facilities, non-TB drugs (since TB treatment is free), consultation charges and other expenses due to seeking treatment were collected for analysis. WHO (2002a) guidelines on estimating the patient, family and community cost of TB was followed. Also perception of the patients on TB was gathered to enable the researcher to estimate the intangible cost of TB to the household. Information on family/household size and type of accommodation was collected to aid in the estimation of the probability of transmission of TB within households.

To estimate the institutional/health care cost of TB, only funds from the major sponsor of the program, Global Fund, for the year 2010 was accessible for evaluation. Cost data on other essential inputs of the program such as drugs, laboratory equipments and materials, office administration and supplies (folders and records keeping), utilities and others were unavailable at either the districts or the regional levels. Though the salaries of TB team members were available, estimating their time on TB activities was difficult since all of them multi-task. Therefore full evaluation of the cost of TB from the provider perspective was not carried out in this study.

3.3 Sampling

Multiple sampling techniques were used. The districts were chosen based on the disease prevalence, accessibility, socioeconomic conditions, financial and time constraints.

Having taking into consideration the disease prevalence, accessibility, financial and time constraints, the districts were selected with the help of the Regional TB coordinator. Sekondi-Takoradi Metropolitan and Ahanta West districts were chosen. A total of 106 respondents were obtained from both districts for the study as a result of difficulties in having access to a superior number of households (patients and their treatment supporters (relatives)) with confirmed TB cases.

On the bases of socioeconomic conditions (population, health indicators and facilities), Sekondi-Takoradi is an urban locality whiles the other is rural area (Ahanta West district). This is done to aid bring out clearly the disease burden peculiar to different settings based on income, geographical location, education, population and availability of health facilities.

The household was the unit of analysis because it was considered an important socioeconomic unit and a TB illness on a member was likely to be a drain on the resources of the household.

After the TB patients have been identified through medical records, random sampling was applied to give all respondent equal chance of been interviewed and thus minimising sampling bias. Questionnaires were administered to patients and their treatment supporters (relatives) as they report to health facility / DOT centres for the collection of their monthly drug rations. Some contact tracing were done to identify households for interviewing in the Ahanta West district.

3.4 Variables

Patient's characteristics such as demographic and socio-economic variables as age and gender of respondents (patients), age and income of household head, years of formal education, number of dependents, primary occupation, household income when ill (income with TB), household income before illness, household size, location of respondents, type of building, number of rooms, assets of households (patients/family), effects on illness on normal activities and employment, effect of illness on non-market household production with special emphasis on child schooling. Expenditure on seeking treatment for TB which includes transportation, food, medication, consultation charges, borrowing, assets sales and sources of finance for expenditures during illness was collected. Reported TB cases in the two districts were also collected.

3.5 Instruments of Data Collection

Questionnaires and interviewing were the major tools for data collection. Structured questionnaires were administered face-to-face to TB patients and their treatment supporters (relatives) to elicit information relating to various costs incurred from pre-diagnosis period through to the time of interview. Facility administrators, medical supervisors, the regional TB coordinator and TB coordinators in participating facilities were interviewed and information on the cost of TB to the health facilities extracted.

3.6.1 Methods of Analysis

The study adopted the societal perspective and employs the prevalence-based approach. Review of relevant literature identified various methods that have been employed in cost of illness studies (Malaney 2004, Koopmanschap et al 1995, Johannesson et al 1997, WHO 2009). As a result of lack of prescribed methodology and varying description of cost components (direct, indirect and intangible costs) for estimating the cost of TB, results are difficult to compare and thus limit the usefulness of such studies other than the original locality where the research was staged.

To rectify this problem, WHO (2002a) has develop a standard and comprehensive guidelines for cost and cost effectiveness analysis of tuberculosis control. The guidelines includes protocols for assessing the cost associated with individual components of tuberculosis diagnosis and treatment services (health systems/ provider perspectives) and patient, family and community costs associated with the use of tuberculosis services (patient and community perspective). Most methodological controversies identified in literature have been discussed and appropriate recommendation offered based on approaches suggested by two most widely used textbooks (Gold et al, 1996; Drummond et al, 1997) on healthcare evaluation.

- *Cost of TB – Patient Perspective*

A. Total direct costs of TB patients/households (pre-diagnostic, diagnostic, treatment) includes

1. Direct costs to patient before and during diagnosis
   - Direct costs before and during TB diagnosis
   - The type of provider that was consulted before the patient reached the public facility

2. Direct costs of patients during treatment
   - Direct costs during TB treatment
   - Total direct costs due to TB
   - Costs of hospitalization for TB patient

3. Guardian/Treatment Supporter costs
   - Direct costs of guardians

4. Additional healthcare costs (including HIV)
   - Additional costs due to other diseases

B. Total indirect costs of TB patients/households (pre-diagnostic, diagnostic, treatment) includes

5. Indirect costs before & during diagnosis
   - Indirect costs before and during TB diagnosis

6. Indirect costs during treatment
   - Indirect costs during TB treatment

7. Guardian/Treatment Supporter costs
   - Indirect costs of guardians

8. Cost of TB on welfare of the household (willingness to pay)

   - Costs due to interest on loan
   - Type of assets sold
   - Extent of reduction in food consumption

Total costs of TB patients (indirect + direct before diagnosis, during diagnosis, during treatment) (B+A)

C. Intangible Cost of TB (Willingness and ability to pay) – (C)

- Cost of TB including pain, suffering and other attributes of ill-health (willingness to pay)

Economic Burden of TB for household = A + B + C

- *Direct Cost of TB – Household Perspective*

Direct cost of TB is the sum of all payments made (medical and non-medical) by patients/households both out-of-pocket and otherwise associated with seeking TB care before and during the duration of the illness.

- *Indirect Cost of TB – Household Perspective*

Indirect cost of TB includes income reduction due to missed work days/hours, lost job, loss of time to seek job, uptake of less paid labour due to illness; reduced household activities (or cost of other household member replacing household work); missed work for guardian/DOT supporter; decreased productivity; coping costs: use of savings, assets are sold, extra job, kids drop out of school to work, debt/loans among others.

The opportunity cost of time for patient is the average income of the population group that receives the intervention whiles that of the treatment supporter is reported daily or monthly wage. The conservative approach to cost was adopted in valuing the time of unemployed and patients outside the labour force (WHO 2002a) due to serious criticism of the relatively generous approach (WHO 2009, Chisholm et al 2010).

- *Calculating Indirect Cost of Patient Before and during Diagnosis; and During Treatment*

The indirect costs before and during diagnosis are calculated by multiplying the time that the patient did not work with the average individual take home earning before TB or household replacement costs. The indirect cost of patient during treatment is calculated by adding the time spent on health facility DOT to the time spent on medicine collection and to the time spent on follow-up test visits and multiplying this with the average personal take home earning that the patient earns now, that is at the time of interview.

- *Calculating Indirect Cost of Guardians (Treatment Supporters and Relations)*

The indirect cost is determined by the length of the visit (in hours) times forgone wage (per day) times the number of visits (assuming that each visit takes place at different days). Forgone wage can be then either calculated per hour or per half day lost. Assuming that the official working hours in Ghana is 8 hours, guardian indirect cost is calculated as follows;

Total Guardian indirect costs: (total time investment in treatment support in hours / 8 x personal income per day) + (number of days stayed in hospital x personal income per day) + (number of visits to hospital x length of visit / 8 x personal income per day).

➢ *Intangible Cost of Patient and Household*

Intangible cost of TB is the “bad feeling” associated with illness such as pain and suffering, side effects of drugs, stigma, anxiety and fear of death as well as adverse psycho-emotional effects. Assuming unlimited income – how much is the patients willing to pay, that is, how much value he/she associates with avoiding the disease. This figure (economic terms) is then related to the information on personal income to establish the differences in ability and willingness to pay. Willingness to pay is not equal to ability to pay for the poor, because they might be willing but unable and therefore compensating by sacrificing on nutrition and other important items.

➢ *Cost of TB – Health Care Perspective*

The protocols in the WHO (2002a) guidelines on cost and cost effectiveness of TB management were applied in the estimation of the institutional cost of TB. Inputs based approach or the ingredient approach where all inputs that goes into the provision of TB services to patient and the society is evaluated. Ingredients into the provision of the following TB services were appraised; drugs regime, chest x-ray, sputum smear examination, DOT management at the participating health facilities and DOT management (volunteers/treatment supervisors) at the community level. Additional information on overhead and joint cost as well as administrative cost was also be assessed and the figure added to the cost of the ingredients outlined above to estimate the institutional cost of TB.

Cost of staff training, preventive (cost of BCG) as well as public education and awareness of TB were not included due to difficulty in assessing reliable data within the limited time span.

- *Probability of Infection*

In determining the probability of infection and potential for the disease to spread in the two districts, the Wells–Riley model was employed. The equation is based on the concept of _quantum of infection_ as proposed by Wells (1955) and these infectious particles are assumed to be randomly distributed throughout the air of confined spaces. The Wells–Riley model has been extensively used in analyzing ventilation strategy and its association to airborne infections in clinical environments (e.g., Escombe et al., 2007, Fennelly and Nardell 1998, Nardell 1991, Noakes et al 2008, Furuya et al 2008) and was employed in the determination of probability of infection within participating households.

Together with the Poisson probability distribution describing the randomly distributed discrete infectious particles in the air, the Wells–Riley equation was derived as follows;

$$P_I = \frac{C}{S} = 1 - \exp^{-Iqpt/Q}$$

where P_I is the probability of infection, C is the number of infection cases, S is the number of susceptible, I is the number of infectors, p is the pulmonary ventilation rate of a person, q is the quanta generation rate, t is the exposure time interval, and Q is the room ventilation rate with clean air. The quanta generation rate, q, cannot be directly obtained, but estimated epidemiologically from an outbreak case where the attack rate of the disease during the outbreak is substituted into P_I.

3.6.2 Regression Estimation

The study assumed household income from a variety of sources (wage income, self-employment income, in-kind income, remittances, sale of agricultural produce, and investment income) is an appropriate measurement of household welfare. Household income was used as a proxy for household welfare. Household income refers to the aggregate income earned by all persons who live in the same household as the person who has the TB infection.

Theory indicates that household income and welfare deteriorate with illness (TB) without disability insurance or appropriate safety nets for affected households (WHO 2009). It follows that the first difference between income of household with illness and income without illness represent a fall in household welfare assuming the income fall is due solely to the presence of TB. If days off work translate directly into loss of household income which is usually the case in the agriculture and informal sectors, it indicates that that household bears the greater burden (part of direct cost and all of indirect costs) of TB otherwise society bears the indirect cost if household income remains unchanged (as in the case of formal sector employees) even when the sick member stay away from primary occupation. The depreciation in household income with the presence of TB was used to proxy deterioration in household welfare.

Multiple linear regression analysis using ordinary least square (OLS) was the technique employed. Theoretically, the direct relationship between ill-health and household income (WHO 2009) and the ability of the linear model to measure the direct marginal effects of tuberculosis on household income and welfare makes it the preferred choice. The linear model also handles data sets with zero integers well (Gujarati 2004). The choice of the explanatory variables in the model followed the suggestions by Persaud (2005) and welfare economics theory (WHO 2009).

- ***Model Specification***

The implicit function is given as Q = f (X_1 ………..X_n, μ) where;

Q = household welfare variation (fall); X_1 …………X_n = explanatory variables; μ = error term.

The general form of the linear model is $Q = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + ... + \beta_{12}X_{12} + \mu$ where

Q = Household welfare variation (fall) (HWF)

X_1 = Age (AGE)

X_2 = Years of formal education (YRSEDU)

X_3 = Household burden of TB (HBOTB-Dir/Indir)

X_4 = Household lost workdays due to TB (LOSTD)

X_5 = Debt value (DV)

X_6 = Stigma (D1STG)

X_7 = Female (D2FEM)

X_8 = Rural (D3RUR)

X_9 = Formal Sector (D4FOR)

X_{10} = Agriculture Sector (D5AGR)

X_{11} = Informal Sector (D6INF)

X_{12} = Unemployed Patients (D7UNE)

X_{6-12} are dummies and are defined as follows; X_6 =1 if stigma, 0 if otherwise; 0 if otherwise; X_7 = 1 if female, 0 if otherwise; X_8 = 1 if rural, 0 if otherwise; X_9 = 1 if formal sector, 0 if otherwise; X_{10} = 1 if agriculture sector, 0 if otherwise; X_{11} = 1 if informal sector, 0 if otherwise ; X_{12} = 1 if unemployed, 0 if otherwise. Patients who were not seeking jobs and those outside the labour force were controlled.

- ***Selection of Variables***

The study expects age of patient (X_1) to predict positively with household welfare deterioration and thus the sign of β_1 is expected to be positive. The older the patient, the higher the possibility of household income fall when ill since TB usually affects those in the economically active segment of the population. This is because TB causes sufferers and caregivers to loss days off from primary occupation and normal activities which could translate directly into loss of household income with negative implication for household welfare.

Years of formal education of patients (X_2) should predict positively with household welfare deterioration and therefore expect the sign of β_2 to be positive. Patients with longer years of schooling have a greater capacity to generate and contribute to total household income, therefore any illness or shock that will impede their working pattern is likely to cause a large reduction in household income which will affect household welfare adversely.

The expected sign of β_3 is positive implying that household economic burden of TB (X_3) is expected to predict positively with depreciation in household welfare. Financial resources committed into care seeking for TB and other like activities makes these resources unavailable to affected households which could affect decision making in relation to consumption and investment in current and future periods. The situation could be dire for poor households who have barely enough to enable them afford basic needs of life.

The fall in household welfare with infection is greater when household workdays lost due to TB (X_4) is high and therefore expects the sign of β_4 to be positive. Long days of incapacitation and convalescence with the associated care giving imply the inability or reduced ability of both patients and treatment supporters to generate income, thereby causing a considerable fall in household income and welfare.

The study expects the value of household debt attributable to TB (X_5) to predict positively to household welfare depreciation. The expected sign of β_5 is positive. This is because resources that are used to pay and service the debt deprive households of its uses with implications for consumptions and investment decisions especially for low income households.

Stigma (X_6) is expected to contribute positively to reduction in household welfare, thus the expected sign of β_6 is positive. This is because stigmatisation of household with TB patient can lead to loss of trading clients or job with implications for household income generation. Stigma can also lead to loss of confidence for affected household members to engage in economic activities in societies where stigmatisation is very endemic thus contributing to a considerable deterioration in household income with welfare implications.

Traditionally, the illness of a female (X_7) affects the value of home production and management (non-market goods and services). The sign of β_7 is expected to be negative since most females are not the major income providers in most Ghanaian households implying that the depreciation in household welfare will be moderate. However females have also become crucial source of household income as a result of their participation in mainstream economic activities while others head some households. The illness of a female household member is likely to affect household income since the regular pattern of income (supplementary in households headed by men) generation activities will be interrupted.

Location of household is critical because it has a significant influence on income opportunities as well as the volume of income available to households. Rural (X_8) households have limited income opportunities, generally low level of incomes and unstable sources of incomes which follow the seasons and thus expect the sign of β_8 to be positively related to deterioration in household welfare. An illness shock to rural household will result in greater fall in household incomes since a greater percentage of household income will be used up in care seeking with implication for consumption and investment decisions in the present and future periods.

The sign of β_9 is expected to be negative, indicating household welfare fall will be moderate. Household with patients in the formal sector (X_9) are expected to experience their total household incomes remain unchanged or depreciate marginally due to the availability of income insurance or disability benefits. Therefore an illness to a household member in this sector will not contribute directly to a fall in household income but indirectly through the diversion of financial resources away from non-health consumption and investment to consumption of health inputs.

The study expects X_{10} and X_{11} to predict positively with deterioration in household welfare while the signs of β_{10} and β_{11} are expected to be positive. Households with patients in either the agriculture sector (X_{10}) or the informal sector (X_{11}) are expected to experience a considerable fall in household incomes due to the generally low levels and erratic nature of incomes in these sectors of the economy. Unavailability of any income insurance or disability benefits in the sector implies that any loss of work due to illness is translated directly into loss of income with serious adverse welfare implications for low income households.

The study expects the sign of β_{12} to be positive. Households with unemployed patients (X_{12}) are expected to see depreciation in household welfare with illness since household financial resources will be diverted into care seeking with its associated opportunity cost. The effects of loss in income for such household could be prolonged since the sick member of the household does not have any ability of working to contribute to income once treated due the status of been an unemployed.

3.7 Data Analysis

Statistical software such as Microsoft Excel, SPSS version 16 and Microfit 4.1 were employed in the analysis of data. Descriptive statistics such as figures, tables and cross-tabulation were used to summarize and describe the data collected. Estimation was done using Microfit 4.1 software.

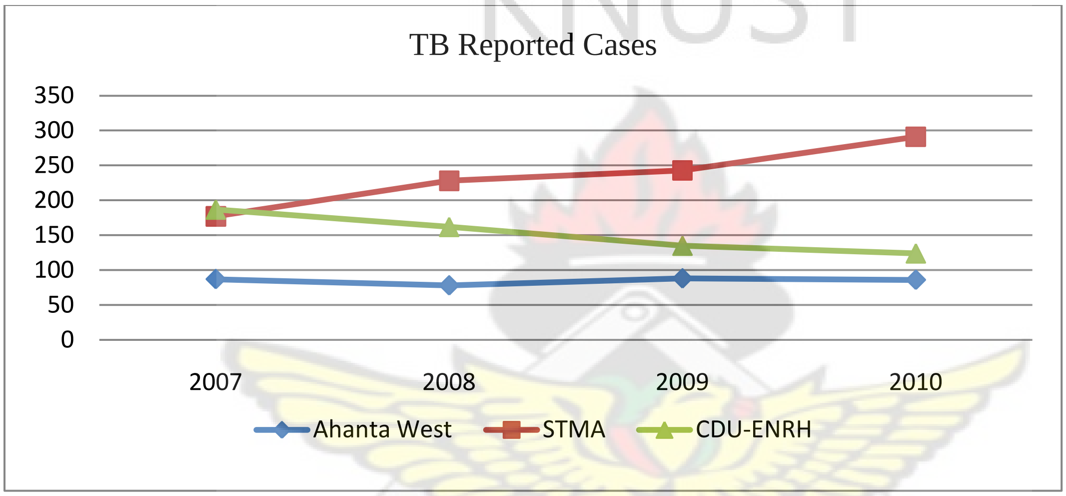
CHAPTER FOUR

EMPIRICAL RESULTS AND DISCUSSION

4.0 Introduction

This chapter include presentation and analysis of data as well as discussion of empirical results.

Figure 1: Trend in Reported Tuberculosis (TB) in the Districts



Source: Regional Public Health Directorate 2011

The study used data from the Sekondi-Takoradi metropolitan and Ahanta West districts. However for operational purposes, Communicable Disease Unit (CDU) of the Effia-Nkwanta Regional Hospital is treated as a separate "health district" by the National Tuberculosis Control Programme (NTCP) and their partners because of it being a referral centre, hence the separation of the TB reported cases of CDU-ENRH from the STMA as presented in Figure 1. The reported cases in the two districts have been increasing generally which could be attributed to the disease spread as well as an improved case detection mechanisms being implemented. Figure 1 indicate a steady rise in reported cases in the Sekondi/Takoradi metropolitan area while that of the

Communicable Disease Unit (CDU) of the Effia-Nkwanta Regional Hospital is on the decline. The observed decline could be due to the decentralisation of TB services to districts and primary healthcare levels which has eased the disease burden at the regional hospital. The low cases reported in the Ahanta West according to program managers has been attributed to the heavy utilisation of religious camps (Prayer Centres and Healing Gardens) and the use of traditional remedies which makes a high number of cases go unreported in line with observation at the national level where 60% of cases go unreported (GNA 2011). Aside CDU, TB services are provided for free of cost to patients in 6 public health facilities, 1 private facility and the main prison within the metropolis and 3 public health facilities in Ahanta West district. According to the Metropolitan Health Directorate Annual Report 2010, the major challenges of the TB program include low case detection rate, diagnosis delays by traditional healers and chemical sellers as well as weak TB teams at the facility levels.

Treatment and cohort outcome analyses for the year 2007 to 2009 of the two districts show an average of 67.2% cure rate, 87.6% success rate (above the target of 85%, WHO 2006a), a default rate of 4.2% and 8.1% dead rate. The dead rate which is lower than the national average of 9% but higher than the African average of 7% (MACRO 2009) imposes permanent economic burden on households and the country in general since TB affects the most economically active segment of the population. The defaulted cases results in drug resistance while the unreported cases combined with treatment defaulters continue to fuel the spread of the disease (Madariaga et al 2008) within households, communities and the nation with its adverse effect on scarce resources and development.

4.1 Patient and Household Characteristics

A total of 106 valid questionnaires out of 125 representing 84.8% responds rate were processed for analysis. The smear positive and smear negative TB patients were identified through their medical records and interviewed over a period of two months; 57 at the Sekondi/Takoradi Metropolitan district (urban) and 49 at Ahanta West district (rural). These districts were chosen purposively to aid depict the burden of TB in the urban and rural areas respectively.

4.1.1 Patients Characteristics

The age classification used by National Tuberculosis Control Programme (NTCP) was adopted for this study so as to aid data interpretation. Over all, TB is markedly among the most economically active population between the ages of 15-64years old as presented in Table 1. The incidence of the disease is pronounced within the 25-34 and 45-54 age groups in the urban areas while the 15-45 age groups bears the heaviest burden of the disease in the rural areas. The trend could be as a result of increased mobility of the active population for purposes such as economic, social and academic which expose them to infectious TB patients (Lönnroth et al 2008).

Table 1: Age, Location and Sex Distribution of Patients

	Urban	Rural	Both Districts	Male	Female	All Sexes
15-24	9 (15.8%)	9 (18.1%)	18 (17.0%)	8 (13.1%)	10 (22.2%)	18 (16.9%)
25-34	15 (26.3%)	10 (20.4%)	25 (23.6%)	15 (24.6%)	10 (22.2%)	25 (23.6%)
34-44	10 (17.5%)	15 (30.6%)	25 (23.6%)	13 (21.3%)	12 (26.7%)	25 (23.6%)
45-54	14 (24.6%)	8 (16.3%)	22 (20.8%)	15 (24.6%)	7 (15.6%)	22 (20.8%)
55-64	6 (10.5%)	6 (12.2%)	12 (11.3%)	7 (11.5%)	5 (11.1%)	12 (11.3%)
65+	3 (5.2%)	1 (2.0)	4 (3.8%)	3 (4.9%)	1 (2.2%)	4 (3.8%)
Total	57	49	106	61	45	106

Source: Field survey data 2011

Most respondents in both districts were males 57.5% overall while constituting 56.1% and 61.2% in the urban and rural areas respectively. This difference is partly due to the fact that women have less access to diagnostic facilities in some settings, but the broader pattern also reflects real epidemiological differences between men and women, both in exposure to infection and in susceptibility to disease (Borgdorff 2000). Lönnroth et al (2008) attributes this trend to alcohol and substance abuse among men.

Data indicate that overall 74.5% of the respondents have either primary or secondary education whereas 12.3% and 13.2% has no formal education and tertiary education respectively. In urban suburbs, respondents have either tertiary (42%) or secondary (24.6%) compared to the rural areas where none of the respondent had tertiary education but 32.7% have had secondary level education. 53.1% of respondents in rural areas have primary education compared to 22.8% in urban areas whiles 6% in urban and 7% in rural areas had no formal education.

Unemployment among patients is 15% overall with 59.5% engaged in either agriculture sector (29.2%) or the informal sector (29.2%). Students make up 8.5% of respondents while 11.3% and 6.6% were in the formal sector and security agencies respectively. Unemployment in the urban areas is 14% with 50.9% found in either agriculture sector (21.1%), the informal (29.8%), formal (15.8%) or the security agencies (8.8%) whiles 10.5% were students. The agriculture and informal sectors were largest sources of employment in the rural district contributing 67.3%; agriculture sector employs 38.8% of patients whiles the informal sector follows with 28.6%, 6.1% of respondents were students and formal sector employees respectively. Rural unemployment was 16.3%, 1.3% higher than the urban rate.

The result implies that TB affects individuals irrespective of sex, age, educational level, employment status and location. Tuberculosis afflicts all sectors of the economy but is more concentrated in the agriculture and informal sub-sectors which could be due to high mobility and greater interactions among players. Higher unemployment levels among patients compare to the national average of 11% (GSS 2010) signal a higher economic burden of TB on households with unemployed patients.

4.1.2 Income Characteristics of Households

The research tool captured total household income from a variety of sources such as wage income, self-employment income, in-kind income, remittances, sale of agriculture produce and investment income. Total household incomes before TB and during illness period were collected.

The household was considered an important socioeconomic unit and an attack of TB illness on a member was likely to be a drain on the resources of the household. Therefore the household is the unit of analysis of the study. Household income and patient's income did not differ much since 83% of respondents were household's sole or major income contributors.

Table 2: Household Income before Tuberculosis (TB)

	Urban	Rural	Both Districts	Male	Female	All Sexes
0-50GH	18 (31.6%)	16 (32.7%)	34 (32.1%)	15 (24.6%)	19 (42.2%)	34 (32.1%)
51-150GH	10 (17.5%)	20 (40.8%)	30 (28.3%)	16 (26.2%)	14 (31.1%)	30 (28.3%)
151-250GH	7 (12.3%)	8 (16.3%)	15 (14.2%)	11 (18.0%)	4 (8.9%)	15 (14.2%)
251-350GH	9 (15.8%)	5 (10.2%)	14 (13.2%)	10 (16.4%)	4 (8.9%)	14 (13.2%)
351-450GH	7 (12.3%)	0	7 (6.6%)	4 (6.6%)	3 (6.7%)	7 (6.6%)
451-550GH	4 (7.0%)	0	4 (3.8%)	4 (6.6%)	0 (0%)	4 (3.8%)
551+ GH	2 (3.5%)	0	2 (1.9%)	1 (1.6%)	1 (2.2%)	2 (1.9%)
Total	57	49	106	61	45	106

Source: Field survey data 2011

As presented in Table 2, overall, 60.3% of the respondent earned up to GH¢150 with 27.4% within the GH¢151-350 income bracket. Only 1.9% of sampled had income above GH¢550 confirming the low levels of income in the districts. Incomes among rural folks are generally lower compared to the urban population and more females are found in the low income bracket as against males implying that females face a higher economic burden of TB than male. No patient reported a monthly income above GH¢350 in the rural district even before the onset of tuberculosis (TB) implying that TB is generally found among the low income group and exacerbates the economic situation of the rural households considering the low levels of income generally and long treatment period. Economically poor and vulnerable groups are at greater risk of infection with TB compared with the general population because of overcrowded and substandard living or working conditions, poor nutrition and intercurrent illness such as HIV/AIDS (WHO 2005).

Table 3: Household Income with Tuberculosis (TB)

	Urban	Rural	Both Districts	Male	Female	All Sexes
0-50GH	38 (66.7%)	43 (87.8%)	81 (76.4%)	46 (75.4%)	35 (77.8%)	81 (76.4%)
51-150GH	6 (10.5%)	2 (4.1%)	8 (7.5%)	5 (8.2%)	3 (6.7%)	8 (7.5%)
151-250GH	1 (1.8%)	1 (2.0%)	2 (1.9%)	1 (1.6%)	1 (2.2%)	2 (1.9%)
251-350GH	5 (8.8%)	3 (6.1%)	8 (7.5%)	5 (8.2%)	3 (6.7%)	8 (7.5%)
351-450GH	5 (8.8%)	0	5 (4.7%)	3 (4.9%)	2 (4.4%)	5 (4.7%)
451-550GH	1 (1.8%)	0	1(0.9%)	1(1.6%)	0 (%)	1 (0.9%)
551+ GH	1 (1.8%)	0	1(0.9%)	(0%)	1 (2.2%)	1(0.9%)
Total	57	49	106	61	45	106

Source: Field survey data 2011

With TB, the overall respondents within the income bracket below GH¢151 increased to 83.9% with 76.4% of them earning less than GH¢51. This trend is duplicated in both districts but is more prevalent in the rural areas where 92% of respondents reported incomes below GH¢151 with 87.8% earning less than GH¢50. The income losses is as a result of majority of the respondents been in the agriculture and informal sectors of the economy where days of work lost due to illness translates directly into reduced productivity and loss of income. Loss of income was slightly higher for females where 77.8% earn less than GH¢50 with TB as compared to males (75.4%). Rural median incomes are half that of the urban areas whiles median income when ill with TB is zero compared to GH¢30 in the urban areas as presented in Table 5; revealing the vulnerability of rural patients and households to complete loss of income with illness, debt accumulation and assets selling creating the phenomena of "medical poverty trap", a situation where direct and indirect cost of illness trigger a spiral into (deeper) poverty for many families (Dahlgren et al 2006). It follow that TB causes drastic reductions in the ability of patients and households to generate income and worsen the plight of the rural homes and urban low income households. The socioeconomic consequences of TB are considerable for all income groups and may even push the non-poor towards poverty (WHO 2005).

Table 4: Households Average Monthly Income and Daily Wage Rate (GH¢)

	Average Monthly Income				Average Daily Wage Rate	
	TB Income	Income	Difference	% Fall	TB DWR	DWR
Both Districts	79.06	168.54	89.48	53.09	2.64	5.62
Rural	36.53	117.86	81.33	69.0	1.22	3.93
Urban	115.61	212.11	96.49	45.49	3.85	7.07

Source: Field survey data 2011

Note: TB DWR = Daily Wage Rate with TB; DWR = Daily Wage Rate; TB Income = household income with TB

TB illness results in a plunge of income of affected households by 53.09% overall, with the phenomena been more pronounced in the rural areas where incomes fall by 69% as presented in Table 4. This implies that TB impoverishes households due to the fall in income of between 45.49% - 69%. It should be noted however that income fall could also be due to other shocks to the household economy and not necessarily TB, making the above conclusion fairly subjective. The income fall forces households to adopt coping strategies which further exacerbate their economic situation. TB hinders socio-economic development and imposes substantial costs to households (Dye 2006).

The fall in income associated with TB potentially have adverse impact on household welfare whose average size and average number of dependants is 6 and 3 in that order overall and rural areas but 5 and 2 in the urban areas respectively. Majority of respondents indicated a household size of 5-6 members and the number of dependants of 3-4 members in all districts with only 0.9% reporting household size above 10 people; implying that on the average 5-6 people are at risk of being infected with TB per each infectious patients within households.

Though the crude probability of transmission of TB as estimated using the Wells–Riley equation is 18%, the high number of patients (50% overall) who indicated residing in rented one-room compound house means that the infection risk could be much higher. This implies that most patients sleep with susceptible household members in an enclose room for 8hours or more thus increasing the potential of TB diffusion. Commercial vehicles which are used by 90% of patients is the most frequently mode of transport for assessing TB care which also creates the avenue for the transmission of TB outside the household setting considering the non adherence of the average Ghanaian to basic health precautions (e.g. indiscriminate spiting, indiscreet sneezing, shouting and coughing in public and vehicles). Left untreated, a person with active TB will infect an average of 10 to 15 other people every year (Dye 2006).

Approximately 92% of respondents overall self medicated imposing varying days of work lost and pre-diagnostic costs among households. Self medication is largely behavioural considering the fact that averagely 71%, 53% and 63.8% are active members of National Health Insurance Scheme (NHIS) in urban, rural and overall respectively. The overall median patient delay period is 5weeks with the maximum being 12 weeks. Among the patients, 66%, 21.7% and 3,8% resorted to chemical/pharmaceutical shops, traditional remedies and spiritual help when symptoms of the disease were first noticed. Patient delay is 2 weeks longer in the rural compared to urban areas as shown in Table 5. It is evident that patient delay is widespread in the districts resulting in medical complications which are expensive to manage, that are requiring more time and resources from affected household and healthcare provider. The long patient delay also contributes to TB spread among susceptible population. Health system delay is 1-3weeks and is shorter than patient delay which is contrary to the finding of Lawn et al (1998). The quick institutional respond could accounts for the high success rate above WHO's target of 85% (WHO 2006a) and increase in reported case of TB since 2007.

Table 5: Descriptive Statistics of Selected Household Variables

	Urban		Rural		Both Districts	
Variable	Mean	Median	Mean	Median	Mean	Median
Age	39.9	40	37.8	38	38.9	39
Income	212.1	200	120	100	168.5	135
TB income	115.6	30	37.3	0	79.1	5
HH Welfare Variation	96.5	0	83.0	80	89.5	60
Household Size	5.4	5	5.6	6	5.5	6
No. of Dependents	2.5	2	2.7	3	2.6	2
Patient Delay	4.2	4	5.9	6	5.1	5
Total Days Lost	58.6	55	97.1	80	76.4	66
Direct Cost	73.6	67.8	59.7	55	69.4	63.8
Indirect Cost	225.8	211.6	118.3	97.6	201.6	174.2
Intangible Cost	285.1	200	165.8	100	229.9	200
BOTB (Dir/Indir)	299.4	277.6	178.1	156.8	271.0	236.7
BOTB (All)	584.5	541.2	343.8	307.1	500.9	440.7
HBOTB (Dir/Indir)	342.9	284.1	207.7	161.9	308.7	257.1
HBOTB (All)	628.0	593.6	373.5	343.9	538.7	467.9
Total Days Lost (HH)	62.4	56	101.3	81	80.3	72.5
Debt Value	52	0	117.9	90	85	0

Source: Field survey data 2011

***Note: HH = Household; BOTB = Burden of TB (Direct + Indirect Cost); BOTB (All) = Burden of TB (Direct + Indirect + Intangible Cost); HBOTB = Household Burden of TB (Direct + Indirect Cost); HBOTB (All) = Household Burden of TB (Direct + Indirect + Intangible Cost). ***

Direct cost is estimated in an accounting sense by summing up all financial resources both out-of-pocket and otherwise that have being used up in care seeking by households from the pre-diagnosis period to the time of interview. Direct cost involve costs of transportation, drugs (both self treatment and at health facilities) consultations, laboratory tests and all other monetary payments made. Median direct cost is higher in the urban centres than rural areas due to disperse nature of settlements and the availability of car hiring services with high charges.

The indirect cost is estimated by quantifying in monetary terms the opportunity cost of time spent in seeking treatment for TB by households (patients and relatives). Days off normal activities and primary occupation includes time spent in travelling by households, incapacitation, convalescence, waiting at the health facility and any other time and days spent in treatment seeking. The total number of days lost are multiply by the value of time (reported household daily income obtained from field survey) to obtain indirect cost.

Indirect cost and household burden of tuberculosis (TB) is higher among urban patients due to higher wage rate implying that urban household loose more income in absolute terms while those in the rural areas loss a higher percentage of their income due to TB as presented in Table 6. Household burden of TB is obtained by adding direct and indirect costs whiles the household burden of TB (all) is the sum of direct cost, indirect cost and intangible cost of the household attributable to the illness. Intangible was estimated by asking the household (patients and treatment supporters) how much they are prepared to pay to do away with the pain and suffering, stigma, side effects and all other “bad feelings” associated with the illness assuming unlimited income. 63% of households indicated that stigma was the major contributor of intangible cost followed by side effect of drugs and fear of death.

Overall mean household total days lost of 80.3 days is slightly lower compared to 83days in India (Rajeswari 1999) and 4-12 months in Tanzania (Wyss et al 2001) while debt value is greater in the in rural areas. These indicate that TB results in a decrease ability of patients and their escorts to generate income and thus impact on welfare adversely. Tuberculosis has the potential of impoverishing households irrespective of geographical location.

Table 6: Breakdown of Household Burden of TB and Ability to Pay

	Urban (%)			Rural (%)			Both Districts (%)		
	Patient	Escort	Total	Patient	Escort	Total	Patient	Escort	Total
HHDC	21.46	5.04	26.50	28.74	6.15	34.88	22.50	4.92	27.42
HHINDC	65.84	7.67	73.50	56.97	8.15	65.12	65.31	7.27	72.58

	Urban (% of Income)		Rural (% of Income)		All (% of Income)	
	Income	TB Income	Income	TB Income	Income	TB Income
HH Direct Cost	42.84	78.60	61.46	198.27	50.22	107.06
Ability To Pay	74.40	40.56	71.07	22.03	73.29	34.38

Source: Field survey data 2011

Note: HHDC = Household Direct Cost; HHINDC = Household Indirect Cost; HH Direct Cost = Household Direct Cost

Table 6 shows households in the rural areas bear a higher burden of direct cost as a percentage of income (34.88%) compared to 26.50% in urban districts reinforcing the reason why debt accumulation (55.1%) which is lower than in China (Jackson 2006) and India (Muniyandi 2005); is higher in the rural districts with its adverse impacts on welfare and development. Household direct cost as a percentage of monthly income when ill with TB is 198.3% for rural patients which is lower compared to Malawi (Kemp et al 2007); making the burden of the disease to be catastrophic whiles exposing rural patients to assets disposal and debt accumulation. The burden of TB is heavier in terms of direct cost as percentage of income on rural folks and urban poor (Russell 2004, Kamolratanakul 1999, Rajeswari 1999). In urban areas, direct cost as a percentage of TB income is 78.6% while the two districts combined is 107.1% overall depicting the huge economic burden TB imposes on households.

Ability to pay is not equal to willingness to pay when sick (Russell 1996). Ability to pay for the direct cost of TB as a percentage of willingness to pay (WTP) on the average falls with ill with the most variation experienced in the rural areas that is from 71.1% to 22%. This enforce the earlier observation that the rural patients face a higher disease burden in terms of direct cost as a percentage of income than the urban residents.

4.3 Provider Cost of Tuberculosis (TB)

The management of tuberculosis (TB) is integrated into the general public health system. There are neither centres nor personnel in either of the districts designated solely for TB even though the Communicable Disease Unit (CDU) with a Chest Clinic serves as the regional referral point for complicated strain of the bacterium. Determining the time of coordinators and team members spent on TB activities for evaluation was difficult and complicated since all of them multi-task and only attend to TB clients as and when they trickle in considering their small number relative to other reported cases such as malaria.

A total of GH¢23506 was allocated to the two districts from the Global Fund through the National Tuberculosis Control Program (NTCP) in 2010 as presented in Table 7.

Table 7: TB Funds 2010 from Global Fund

District	Supervision	Quarterly	Number	Amount	Number	Provided	Total

	and Monitoring	Review Activities	of Enablers	to CBTB	of Patients	Enablers to Patients	
Ahanta West	718	2464	14	700	40	1200	5082
STMA	718	2464	39	1950	117	3510	8642
CDU-ENRH	718	2464	48	2400	140	4200	9782
TOTAL							23506

Source: Regional Public Health Directorate 2011

The study used data from the Sekondi-Takoradi metropolitan and Ahanta West districts. For operational purposes, Communicable Disease Unit (CDU) of the Effia-Nkwanta Regional Hospital is treated as a separate "health district" by the National Tuberculosis Control Programme (NTCP) and their partners because of it being a referral centre. This criterion was applied in the allocation of resources from government and donors (Global Fund) for TB management as presented in Table 7.

Apart from GH¢8910 that was allocated to patients directly in the form of treatment incentives (enablers), 62.1% of the funds went into human resource cost component of the program in the two districts compared to 70% in India (Muniyandi et al. 2006). Each enabler cost GH¢87.76 on the average but the TB team redistribute the items to cover many more patients bringing the cost per patient of an enabler to GH¢30.

Cost data on other essential inputs of the program such as drugs, laboratory equipments and materials, office administration and supplies (folders and records keeping), utilities and others were unavailable at either the districts or the regional levels. According to the TB Regional Coordinator, the essential inputs are supplied to the region upon request from Global Fund through the National Tuberculosis Control Program (NTCP) without any cost details. This makes the complete evaluation of the TB program in the districts cumbersome, time consuming and capital intensive since data would have to be built from diverse sources. Therefore the full evaluation of cost of TB from the health provider perspective was not conducted within this study due to financial and time constraint as well as non availability of cost of inputs details even at the regional level.

However the resource commitment in TB management in the country is could be justified considering the fact that WHO's DOTS strategy, which is by far the most effective tuberculosis control strategy currently available reduces the grim case fatality ratio of 60-70% in smear positive patients without HIV to only 5% while that of the smear negative patient is reduced from 20% to less than 5%. DOT also reduces TB transmission by 73% among smear positive cases whiles preventing 10% future cases of smear negative cases (Borgdorff et al 2002).

4.4 Regression Analysis

Presented in Table 8 is the result of the regression estimation. HWF is the dependent variable defined as a fall in household income due to TB, which represent deterioration in household welfare due to illness. The choice of the explanatory variables in the model followed the suggestions by Persaud (2005) and were also guided by the theory of welfare economics which postulate that the burden of illness are a shock to the household economy and affects current and future decisions adversely (WHO 2009).

Table 8: Estimation Results of the Linear Model

Variables	Coefficients	P-value
Constant (C)	-37.6371	0.4381
Age of Patient (AGE)	0.9692	0.2071
Years of Formal Education (YRSEDU)	4.5639	0.0502
Household burden of TB (HBOTB-Dir./Indir.)	0.06173	0.6913
Household lost workdays due to TB (LOSTD)	-0.3334	0.5776
Debt value (DV)	-0.0151	0.8707
Stigma (D1STG)	-20.0013	0.2434

Female (D2FEM)	-48.3932	0.0089
Rural (D3RUR)	-17.6390	0.3852
Formal Sector (D4FOR)	-24.4335	0.5053
Agric Sector (D5AGR)	153.6201	0.0002
Informal Sector (D6INF)	155.9277	0.0000
Unemployed Patients (D7UNE)	21.1931	0.5948

Source: Author's estimation 2011 using Microfit 4.1 Econometric Software

$R^2 = 0.533515$ DW-statistic = 2.2589

According to the estimation results as presented in Table 8, though most of signs of the variables are expected, only four were statistically significant indicating that deterioration in household income during illness (TB) is influence only by patient's years of formal education, gender and either the patient is engaged in the agriculture sector or the informal sector. The statistical insignificance of most of the variables suggests that these factors do not contribute substantially to a fall in household income and that other factors not included in the model could be responsible.

The coefficients of agriculture and the informal sectors are 153.6201 and 155.9277 respectively and statistically significant indicating that household income fall significantly if patients are engaged in either the agriculture or the informal sectors.

The positive sign of the coefficient of agriculture sector could be attributed to income volatility following the seasons. The labour-intensive nature of work in the sector means that any illness including TB can critically affect productivity and output in general. Again the long treatment period (six months or more) of TB which causes loss of workdays has the potential of translating directly into reduced work output and therefore contributes significantly to a fall in household income. With depreciated incomes, households do not have the ability and the luxury to hire replacement labour thereby creating the risk for the affected households to be push into "medical-poverty trap". Lack of any form of income insurance and disability benefits in the sector could also be the cause of the fall in household income with the presence of TB.

The positive sign of the coefficient of the informal sector could be due to the general low levels of wages/income and their volatility following the seasons. The deterioration of household income could be attributed to the fact that most workers in the sector are self employed which creates a high potential for direct translation of loss of workdays into income losses, loss of trading clients, capital depreciation and loss of job due to non-existence of any form of social income insurance or disability protection for workers. The household income fall could also be due to the unwillingness of affected households to hire replacement labour due to perceived high nature of financial risk in the sector. The fall in income can deprive households the ability to hire competent labour to handle their business whiles on treatment.

TB contributes significantly to a fall in household income, thus household welfare of most patients considering the descriptive result of the data set which show 67.3% and 50.9% of patients in the rural and urban districts respectively and 59.5% overall are engaged in either the agriculture or informal sectors of the economy.

The coefficient of years of formal education is 4.5640 and marginally statistically significant at 5% error level indicating that patients with longer years of schooling when ill with TB results in significant fall in household income. This could be due to the greater contribution of people with higher education to household income. Multiple occupation and social engagements could cause patient delay resulting in illness complications which requires more financial resources and time (indirect cost) to manage thereby causing considerable fall in household income.

The coefficient of the female is -48.3932 and statistically significant indicating that the presences of a female TB patient result in a considerable deterioration in household income. However the negative sign of the coefficient suggest that the fall in household income is fairly moderate and this could be due to low contribution of females in general to household incomes compared to males.

In conclusion, TB causes significant deterioration in household income and welfare. Households are burdened with various costs due to tuberculosis. The regressive nature of these expenditures creates huge potential for the urban poor and rural households to sink into “medical-poverty trap” with its adverse effect on current and future development. Considerable resources from the government and the donor community are committed into TB management with its associated opportunity cost.

4.5 Constraints and Limitations of the Study

The major constraint is lack of cost data details of essential inputs of the program such as drugs, laboratory equipments and materials, office administration and supplies (folders and records keeping), utilities and others at either the districts or the regional levels. This makes costing of inputs into TB care and management time consuming, expensive and very cumbersome. The study did not estimate the number of life years gained as a result of TB treatment and only patients on DOT were captured with the research tools. Useful time-sequence prompts were employed to minimise memory bias which is inherent in all studies that seeks recollection on information from the past through questionnaires and interviews. Estimating monetary incomes was difficult for those without regular salaries. Disaggregated costing questions about everyday amounts would be more understandable. It was difficult to ensure that patients reported incomes and not turnover from business in relation to patients outside the formal sector.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.0 Introduction

The main objective of the study is to estimate the economic burden (direct cost, indirect cost and intangible cost) and household welfare impact of tuberculosis (TB) in the western region of Ghana.

This chapter include the major findings from the data analysis, the overall conclusion and recommendations.

5.1 Summary of Major Findings and Conclusions

The study confirmed that tuberculosis (TB) causes a significant depreciation in household welfare which is proxy by household income.

Estimation of the costs found a substantial economic burden of TB on households and a considerable direct cost as a percentage of overall household monthly income. This cost is more pronounced at the pre-treatment period of TB (since TB treatment is free of cost to patients) with long patient delays characterised by self medication (92%) as well as days lost from work. Direct cost as a percentage of pre-illness monthly income is 50.22% overall but higher among rural (61.46%) households. Direct cost due to TB is regressive since the rural patients and urban poor households spend a higher percentage of the monthly income on consumption of health inputs. Direct cost as a percentage of monthly income with TB is 107.06% overall but higher among rural (198.27%) households. Income lost due to TB is substantial and affect rural and urban low income households considerably. Monthly incomes fall averagely between 45.5% - 69% due to TB but detailed scrutiny shows 100% fall in the rural areas confirming the potential for TB to impoverish households and push them into “medical-poverty trap”.

The study established that indirect cost is the main cost burden experienced by households similar to findings of other studies (e.g. Wyss et al., 2001, Russel 2004, Kamolratanakul et al., 1999, Rajeswari et al., 1999). TB causes considerable loss of household workdays away from primary occupation resulting in income and productivity losses. Indirect cost of TB as percentage of household burden of TB is very high overall (72.58%) but higher in the urban areas (73.50%) confirming the overwhelming negative effect of illness on household welfare irrespective of geographical location. Stigma is the major contributor of intangible cost of TB to household welfare among drug side effects, anxiety, fear of infection and fear of death. TB leads to debt accumulation among rural patients which threatens the sustainability of the household economy over the medium to long term.

Reported TB cases are on the increase which is indicative of progress in the awareness about the disease. However the default rate pose a great obstacle to its management (GNA 2011) whiles the high death rate result in permanent loss of household income and labour in the country. Though most factors that affect the transmission of infectious diseases (Sze To et al., 2010) were controlled, the infection risk of TB was 18% among affected households, which is very high and shows the potential for the disease to spread rapidly.

In conclusion, tuberculosis causes a considerable economic burden and a significant deterioration in household income impacting negatively on welfare and utilises scarce national resources in terms of its management. Deaths due to TB results in household and by extension national loss of income and human resources permanently. The cost burdens of TB is extremely high for poor households, forcing risky coping strategies that reduce their asset portfolios, increase vulnerability to future shocks and raises questions about the sustainability of coping strategies.

5.2 Policy Recommendations

The study recommends that education and awareness about tuberculosis be widened, deepen and be more visible at all public places. This will help to minimise the common operational constraint in case detection and management such as long patients delay in seeking care, unreported cases, misconception which fuels stigma and to help create the needed atmosphere for the public to treat coughing as an emergency. Targeted education and training should also be given to chemical sellers, traditional "doctors" and healing/prayer camp operators to identify TB symptoms for early referral to health centres for diagnosis and treatment. Continuous patient education on basic health precautions will help minimise the infection risk of TB generally.

Safety nets in the form of social income insurance or disability benefits should be establish for TB patients in the agriculture and informal sectors to help mitigate the substantial deterioration of household income. Policy debate and formulation should also focus on innovative ways of mitigating the catastrophic pre-diagnostic and non-medical costs that TB imposes on households as well as finding ways of supporting the coping mechanism used by affected household.

It is also recommended that cost details and data of essential inputs (e.g. drugs, laboratory equipment and materials, office administration and supplies, utilities) into tuberculosis program be made available at the regional and district public health directorates to make research into the economic cost of TB from the health provider perspective at the district and the regional levels less cumbersome.

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APPENDICES

APPENDIX 1

Regression output of the Linear Model

```
******************************************************************************
 Dependent variable is HWF
 106 observations used for estimation from    1 to  106
******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 C                        -37.6371            48.3273            -.77880[.438]
 AGE                        .96924             .76298             1.2703[.207]
 YRSEDU                     4.5640             2.3007             1.9837[.050]
 HBOTB                     .061730             .15500             .39826[.691]
 LOSTD                     -.33338             .59651            -.55889[.578]
 DV                       -.015148            .092793            -.16324[.871]
 D1STG                    -20.0013            17.0385            -1.1739[.243]
 D2FEM                    -48.3932            18.1017            -2.6734[.009]
 D3RUR                    -17.6390            20.2185            -.87242[.385]
 D4FOR                    -24.4335            36.5360            -.66875[.505]
 D5AGR                    153.6201            39.7886             3.8609[.000]
 D6INF                    155.9277            32.4018             4.8123[.000]
 D7UNE                     21.1931            39.7077             .53373[.595]
******************************************************************************
 R-Squared                     .53352   R-Bar-Squared                   .47332
 S.E. of Regression           83.2348   F-stat.    F( 12,  93)    8.8636[.000]
 Mean of Dependent Variable   89.4811   S.D. of Dependent Variable    114.6920
 Residual Sum of Squares     644307.3   Equation Log-likelihood      -612.1696
 Akaike Info. Criterion     -625.1696   Schwarz Bayesian Criterion   -642.4819
 DW-statistic                  2.2589
******************************************************************************
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APPENDIX 2

HOUSEHOLD TOTAL COST OF TB (GH¢)

	Urban	Rural	Both Districts
Direct Cost	4194.75	2923.7	7361.45
Indirect Cost	12870.55	5796.22	21368.16
Intangible Cost	16249	8126	24375
BOTB (Dir/Indir)	17065.3	8719.92	28729.61
BOTB (All)	33314.3	16845.92	53104.61
HBOTB (Dir/Indir)	19549.14	10174.55	32717.27
HBOTB (All)	35798.14	18300.55	57092.27

Source: Field survey data 2011

***Note: BOTB = Burden of TB (Direct + Indirect Cost); BOTB (All) = Burden of TB (Direct + Indirect + Intangible Cost); HBOTB = Household Burden of TB (Direct + Indirect Cost); HBOTB (All) = Household Burden of TB (Direct + Indirect + Intangible Cost). ***

APPENDIX 3

QUESTIONNAIRE - PATIENTS

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF ECONOMICS

Information provided by you will aid the researcher in completing a thesis work titled:

The Economic Burden of Tuberculosis (TB) in Ghana - Case Study: Sekondi/ Takoradi Metro. Area and Ahanta West District

Confidentiality of information and anonymity of respondents is assured.

A. PATIENT CHARACTERISTICS

1. Age....................... 2. Gender 1=Male [ ] 2= Female [ ]

3. Marital status: 1=Single [ ] 2=Married [ ] 3=Divorced [ ] 4=Separated [ ] 5= Widowed [ ]

4. Are you the head of the household? 1=Yes [ ] 2=No [ ]

5. Number of dependants................................. 6. Household size..

7. Educational level: 1=No schooling [ ] 2=Primary [ ] 3=Secondary [ ] 4=Tertiary [ ]

8. Primary occupation: 1=Agric sector [ ]; 2 = Formal sector [ ]; 3= Informal sector [ ]; 4=Security agencies [ ]; 5= Student [ ]; 6= Unemployed [ ]

9a. State your monthly income; before TB................................; with TB.................................

9b. State household income..; with TB.................................

10. How many sources of income do the household have? What assets do you/household have?

10b. List them..................................……...

11. What mode of transport does your household have and use when assessing TB care? 1=none [ ]; 2=bicycle [ ]; motor cycle [ ]; 3= car [ ]

12a. Where do the family stay? 1=own house [ ]; 2= family house [ ]; 3= rented compound [ ];-flat [ ]; 4= employer apartment [ ]

12b. What type of building do the household reside? 1= thatched [ ]; 2= wooden [ ];

3= brick [ ]; 4= block [ ]; others.......................No. of rooms............................

B. ILLNESS HISTORY AND TREATMENT SEEKING BEHAVIOUR (PDC)

13. How did you realised you were not well? Specify..

14a. What did you do when you notice you were not well? 1= *Self medication** [ ]; 2= Went to the hospital the very 1st time [ ]

14b. During self medication...1=Chemical/pharmacy shop [ ]; 2= traditional/herbalist [ ]; 3= spiritual (ist) leader [ ]; Used sick relative's drugs [ ]. ***Tick where apply***

14c. How many visits did you made to the above ***ticked*** places...

14d. *How much did each visit cost (consultations, fares and drugs)...

15a. How long did take you to go to hospital after you 1st noticed symptoms............................

15b. What type of health facility did you 1st reported? 1=Public government facility [ ]; 2= Private facility [ ] Hospital cost..

15c. Were you referred to another facility? 1= Yes [ ]; 2=No [ ]

15d. How many visits did you made before you were referred? Specify....................................

16a. How long does it take you to get to the health facility/personnel.......................................?

16b. How much does transportation cost on each visit?

16c. How do you get to the health facility? 1= Walking [ ]; 2= Bicycle [ ]; 3= Motor cycle [ ]; 4= Commercial vehicle [ ]; Private vehicle [ ]

17. How many days of work did you lose during this initial period of treatment seeking...........

18. Are you an active member NHIS? 1= Yes [ ]; 2= No [ ]

19. How did you finance these expenditures (medical and non-medical)? 1= self from income [ ]; 2= dis-savings [ ]; 3= borrowing [ ]; 4= sold assets [ ]

20a. Did anyone accompany you during these visits? 1= Yes [ ]; 2= No [ ] No of days...........

20b. Specify the relationship.............................Age..............Occupation.................................

C. DIAGNOSTIC COST

21. How long did it take from the time of 1st visit to a health facility and when told you were having TB? 1= <1week [ ]; 2= 1 to 3weeks [ ]; 3= 3 to 5weeks [ ]; 4= > 5weeks [ ]

22a. How many visits did you made during this period................................

22b. How do you get to the health facility? 1= Walking [ ]; 2= Bicycle [ ]; 3= Motor cycle [ ]; 4= Commercial vehicle [ ]; Private vehicle [ ]

22c. How much did each visit cost? 1= transportation.............; 2= food..............; 4= others, specify......................

22d. How much did you pay at the hospital? 1= Drugs.............; 2 =Lab.....................; 3= x-ray...................; 4= Consultation.................. 5= others- specify... Are you an active member of NHIS 1= Yes[ ]; 2= No [ ]

22e. How did you finance these expenditures (medical and non-medical)? 1= self from income [ ]; 2= dis-savings [ ]; 3= borrowing [ ]; 4= sold assets

22f. Were you accompanied? 1= Yes[ ]; 2= No[ ]. Age................Occupation.....................

D. TREATMENT COST

23. How long did it take between the time you were told you have TB and when you started treatment 1= < 1week [ ]; 2= 1 to 2weeks [ ]; 3= 2 to 4weeks [ ]; 4= > 4weeks [ ]

24. Were you hospitalised before you began treatment? 1= Yes [ ]; 2= No [ ]. For how long...

25a. Where do you receive your treatment- drugs? 1= Hospital [ ]; 2=Health centre/clinic [ ]; 3= Community volunteer [ ]; 4= others – specify..

25b. How long does it take you to go and collect your drugs on each visit.................................

25c. How much do transportation cost on each visit?..

26a. Do you have a treatment supporter 1= Yes [ ]; 2= No [ ]. Gender: Male / Female

26b. What is the relationship........................Age:.....................Occupation.............................

27a. How long have been on treatment?...................................

27b. Have you been on TB treatment before? 1= Yes [ ]; 2= No [ ]

27c. Why did you not complete the previous treatment 1= no money [ ]; 2= no time [ ]; 3= stigma [ ]; 4= long distance [ ]; 5= disrespectful health workers [ ]; others..............................

28a. Do you know anybody who is having or had TB before? 1= Yes [ ]; 2= No [ ].

28b. What is the relationship? 1= Close [ ]; 2 = Not close [ ] Specify...

29. How many days of work do you lose in a month since you started TB treatment.....................

30a. How did you finance all expenditures during these periods (medical and non-medical)? 1= self from income [ ]; 2= dis-savings [ ]; 3= borrowing [ ]; 4= sold assets [ ]

30b. Have you incur any debt as a result of seeking treatment for TB...

30c. How much?................................ How do you intend to pay?.......................................

E. PERCEPTION OF PATIENTS/HOUSEHOLD OF TB ILLNESS

31a.What causes TB..

31b. How is TB spread...

31c. Is it treatable...

32a. How has TB affected your social life and how the community relates to your household? 1= Never [ ]; 2= Somehow [ ]; 3= Seriously [ ]; 4= Very serious [ ]

32b. Rank the following in a matter of contributing to 'bad feelings' – Side effect of drugs [ ]; Pains [ ]; Stigma [ ]; Fear of death [ ]; Anxiety [ ]; Others - Specify...................... [ ]

32. How much are you willing to pay to do away with / accept to maintain TB 'bad feelings'. (Assuming unlimited income)...

33. Effect of TB on household welfare1= schooling [ ]; 2= child care [ ]; 3= chores [ ]; 4= consumption [ ]; 5= loss/change of jobs [ ]; others.....................................***Tick where apply***

34a. Has a child stopped schooling and working to support the household 1= Yes [ ]; 2= No [ ]

34b. Age................ Type of work.................................. Level of schooling...........................

35. Are you satisfy with TB care? Yes/ No.
Comment...

....

36. How can TB services be improved...

....

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