CHOLERA OUTBREAKS IN GREATER ACCRA REGION, GHANA: THE ECONOMIC COSTS TO THE HEALTH FACILITY AND AFFECTED HOUSEHOLDS

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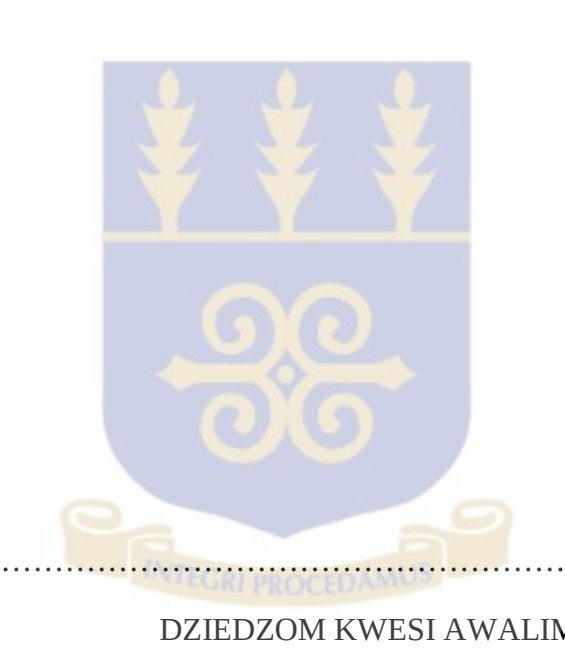
DECLARATION

This is to certify that this thesis is the result of research undertaken by Dziedzom Kwesi Awalime towards the award of the Master of Philosophy (M.PHIL) degree in Economics at the Department of Economics, University of Ghana.



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DEDICATION

I dedicate this work to my brother Mr. Walter Awalime and sister Mrs. Cynthia Boateng whose love and support is without measure.

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Special recognition and thanks to my Father and Lord Jesus Christ for health, strength and insight to reach this height in my life. The completion of my thesis would have been with much difficulty without His constant provision.

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May God Almighty bless you all.

ABSTRACT

Ghana experienced its worst cholera outbreak in the last three decades in 2014. However, evidence of the economic costs of the disease on the health system and affected households has not been fully documented. This study therefore sought to determine economic cost associated with recent outbreak the disease.

Two districts which were high and low incidence areas (HIA and LIA) were selected for comparative cost studies. A total of 418 (282 HIA and 136 LIA) households which experienced at least one case of cholera infection were interviewed. The Cost of Illness (COI) method was adopted to identify and cost the disease at household and health facility levels. The Tobit Regression model was employed to determine the correlates of cholera incidence. STATA 13 software was used for analysis.

The average direct cost to households in the HIA amounted to GH¢342.00 (USD 106.88), almost 2 folds higher than in the LIA GH¢198.47 (USD 62.02). Total cost saving of the episode of cholera was GH¢317,444.10 (USD 99,201.28) in the LIA but rose to almost 8 folds more in the HIA (GH¢2,504,357.12; USD 782,611.60). Total cost of treatment in health facilities were above 10 folds more in the HIA (GH¢66,745.00; USD 20,862.58) compared with LIA (GH¢6,300 USD 1,968.75). Households with the lowest income category had the greatest incidence of cholera (0.073) compared to other categories and drinking water sources such as from neighbouring homes as well as marital status of individuals were significant in the incidence of cholera.

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List of Abbreviations

CFR Case Fatality Rate

COI Cost of Illness

GHS Ghana Health Service

GSS Ghana Statistical Service

HIA High Incidence Area

LIA Low Incidence Area

UNEP United Nations Environmental Programme

WHO World Health Organization

CHAPTER ONE
INTRODUCTION

1.0 Background of Study

Economic measurements of disease complement clinical and epidemiological approaches in assessment of disease burden. Economic analysis seeks to address a number of policy questions on consequences of disease or injury (WHO, 2009). Such questions normally fall within either microeconomic or macroeconomic remit of a study. Under microeconomic analysis, impact of illness is measured on household income or a firm's profit while the macroeconomic analysis aggregates impact of the disease on the country's Gross Domestic Product (GDP) or its future growth prospects. Such estimates for diminished health status due to specific illnesses can usefully inform decision makers about the overall magnitude of economic losses and their distribution across a number of key drivers or categories of costs. These costs can ultimately be viewed as benefits from health improvements in the form of avoiding adverse health effects.

Morbidity and mortality measures provide key features in estimating disease burden but such considerations are limited in accounting for health 'shocks' such as unexpected increases in health expenditure, reduced functional capacity and lost income and productivity which are primary risk factors for impoverishment (WHO, 1999; Xu et al., 2003). Ultimately, economic burden studies may help identify possible strategies for reducing the cost of disease via appropriate action, prevention or treatment strategies.

Cholera still remains a major public health concern in many parts of the world but especially in developing countries. However, it seems to receive attention only with the on-set of an outbreak where large populations are affected. In 2014, there were 58 public health events within the World Health Organization (WHO) African Region and out of these, infectious diseases formed 95% of all these events with Cholera being the most frequently reported (31%), ahead of Ebola (13%) which has seen its biggest epidemic in history recently (WHO, 2014). According to the WHO, there were 101,987 cholera cases of which 1,881 resulted in deaths giving rise to a Case Fatality Rate (CFR) of 1.8% within the African Sub region (WHO, 2014). These reported cases were more than double that of the previous year 2013. In total, 16 countries reported cholera cases of which Ghana was the second most affected country only topped by Nigeria. Ghana, Nigeria plus DR Congo accounted for 85% of all cases reported in 2014. Figures 1 and 2 give details of distribution of cholera cases across the African sub-region during the 2014 outbreak.

Worldwide, there have been many advances in methods and development of new drugs and vaccines before the turn of the 20th century, despite this, there has been an apparent increase in the emergence of many new as well as more ancient infectious diseases throughout the world of which cholera is one (Smith et al., 2005). Cholera was eradicated from the developed world well over five decades now but in Africa, poor sanitation as well as unsafe drinking water sources driven by poverty creates huge causal linkages between the frequent incidences and easy spread of the disease. According to United Nations Environmental Programme

(UNEP, 2005), Cholera though an ancient disease, is at present, one of the most important resurgent diseases plaguing the world.

Cholera is an acute intestinal infection caused by the ingestion of food or water contaminated with the bacterium *Vibrio Cholera* serogroups O1 or O139. It has a short incubation period and produces watery diarrhea in patients that can quickly lead to severe dehydration. The disease condition is nearly unrivaled in terms of the speed with which it kills. Healthy adults can die in as little as three to twelve hours after the first showings of symptoms if treatment is not promptly administered (Briggs, 2002).

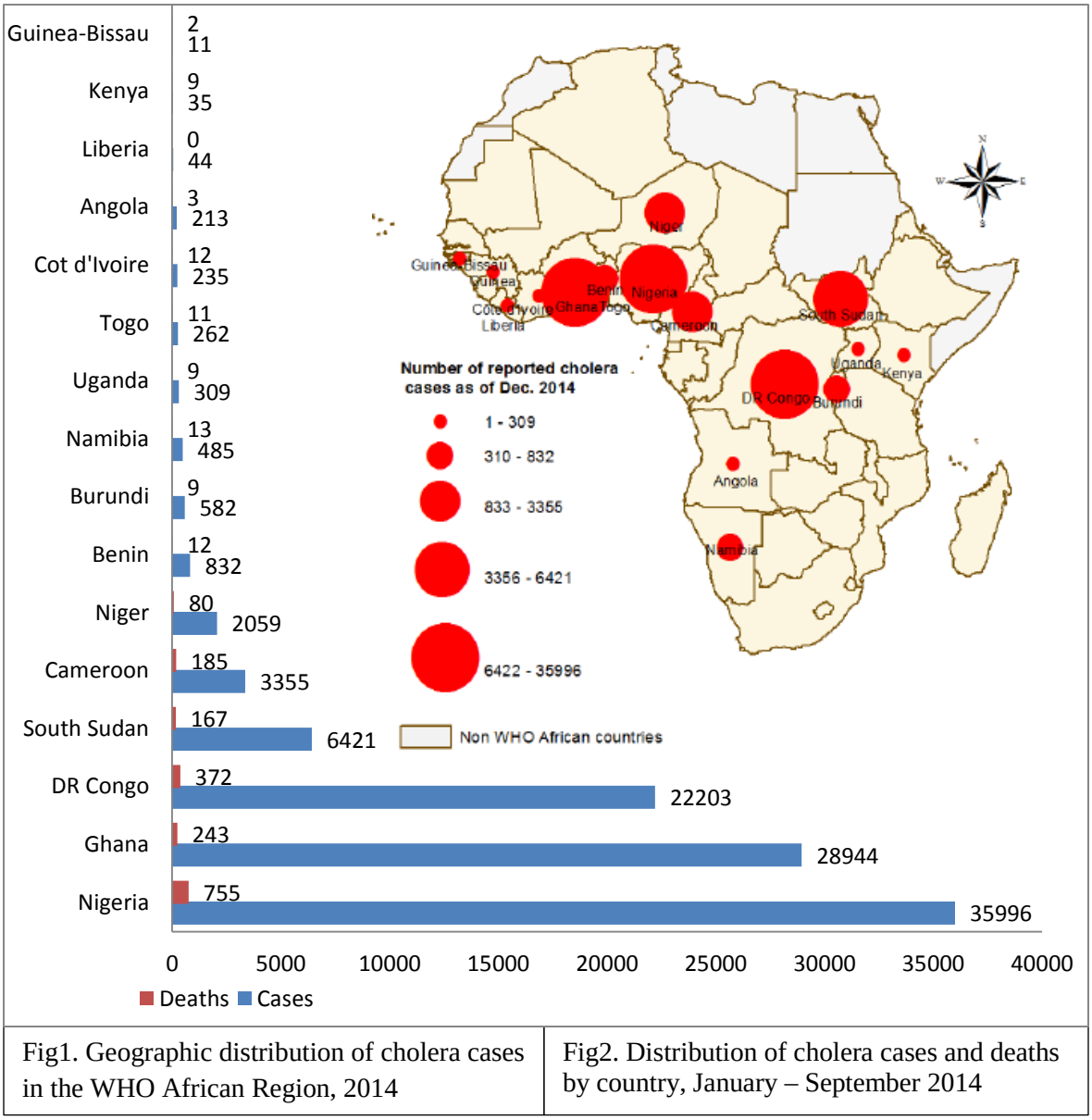


Fig1. Geographic distribution of cholera cases in the WHO African Region, 2014

Fig2. Distribution of cholera cases and deaths by country, January – September 2014

Figure 1.1 & 1.2 Overview of Cholera cases and deaths in WHO African sub-region

Source: WHO, 2014 Outbreak Bulletin Vol. 6

Cholera remains a serious public health disease because outbreaks can spread easily over large regions and quickly overwhelm the health services system. Despite these facts, approximately 80 percent of all persons infected with the cholera never develop symptoms. However, the bacterium stays in their fecal matter for 7 to 14 days, leaving others at risk of infection when proper fecal

matter disposal and personal hygienic practiced are not observed. Also, of all those who develop symptoms, up to 80 percent only develop mild to moderate watery diarrhea while between 10 and 20 percent develop severe watery diarrhea. Case fatality quickly rises to as high as 50 percent if symptoms are left untreated (WHO, 2014).

"Cholera represents an estimated burden of 1.4 to 4.3 million cases, and 28,000 to 142,000 deaths per year worldwide" (WHO, 2015). However, WHO claims that there could be as much as 100,000 to 120,000 deaths due to cholera every year but countries normally fail to report actual numbers because of fear of external implications on their economics in sectors like trade and tourism. Coupled with this are poor surveillance systems and weak public health systems in most developing countries which are normally the worst hit regions. Such estimates are supported by Ali et al. (2012) who has reported the same case numbers annually worldwide.

In addition to human suffering caused by Cholera, outbreaks of the disease cause panic, disrupt social and economic structures of families and can impede development in affected communities. In some instances, it may result in panic-induced reactions by other countries that curtails or restricts trade and travel from countries where the outbreak is occurring. For example, in 1991 the outbreak in Peru cost the country US$ 770 million due to food embargoes and adverse effects on tourism (WHO, 2014).

Outbreaks may also result in catastrophic health expenditures by affected households in addition to over-stretching health system services with the rapid spreading of the disease. In Ghana, this was particularly evident in the 2014 outbreak where some health facilities reported overwhelming number of cases daily. In some of these facilities like the La General Hospital, the Out-Patient-Department (OPD) had to be converted into a makeshift ward for cholera patients.

Table 1.1 Cholera Cases in Ghana by Region by Week, 2014

Region	Cases														
	1-Jan to 13-Jul	20-Jul	27-Jul	3-Aug	10-Aug	17-Aug	24-Aug	31-Aug	7-Sep	14-Sep	21-Sep	28-Sep	5-Oct	1-Jan to 5 Oct	1-Jan to 28-Dec
	W1-28	W29	W30	W31	W32	W33	W34	W35	W36	W37	W38	W39	W40	W1-40	W1-W52
Ashanti	0	0	0	0	0	0	30	0	0	130	13			173	287
Brong Ahafo	0	0	0	1	4	1	4	19	20	17	27	16	67	176	1056
Central	0	6	2	22	148	155	160	262	306	487	163			1711	3846
Eastern	0	16	50	92	107	154	117	125	180	145	165	180	27	1358	1875
Greater Accra	**99**	**251**	**436**	**947**	**1873**	**1640**	**2188**	**2386**	**2044**	**1745**	**1425**	**1099**	**837**	**16970**	**20199**
Northern	0	0	0	0	0	0	0	0	0	0	0	0	0	0	282
Upper East	0	0	0	0	0	0	0	0	3	0	2	5	22	32	294
Upper West	0	0	0	0	0	0	0	0	0	1	1	5		7	36
Volta	0	0	0	33	6	57	39	69	33	32	16	72		357	651
Western	0	0	4	2	8	7	13	17	12	47	28	31	2	171	429
Ghana	**99**	**273**	**492**	**1097**	**2146**	**2014**	**2551**	**2878**	**2598**	**2604**	**1840**	**1408**	**955**	**20955**	**28955**

Source; WHO Country Office Ghana: Situation Report on Cholera Outbreak in Ghana as of 05 October (Week 40) and 28 December, 2014 (Week 52).

1.1 Problem Statement

In parts of Ghana, cholera has now become endemic and the country has been experiencing outbreaks of the disease about every five years since 1970 (Amankwah, 2011). In June 2014, the country reported its first 6 cases of the disease in the Greater Accra region. Within two weeks the number of reported cases had risen above 250 and began spreading to other regions. Impoverished

communities within the capital city of Accra which lack adequate plumbing and where open defecation is normally rampant appeared to be the epicenter of the country's outbreak of Cholera. By the close of 2014, a cumulative total of 28,955 cases with 243 deaths and a CFR of 0.8% were recorded. All ten regions in Ghana reported cases with 70% of all the cases from the Greater Accra region alone. The economics surrounding Cholera have always shown poverty, social amenities like portable water and poor sanitation plus personal hygiene nexus.

A desk study carried out by the Water and Sanitation Program (WSP) estimated that poor sanitation costs Ghana GH¢420 million (USD 290 million) each year. This sum is equivalent of USD 12 per person per year and forms 1.6% of the national GDP (WSP, 2012). Usually, the highest economic burden falls disproportionately on the poorest and costs of poor sanitation are inequitably distributed. For example, the average cost associated with poor sanitation, constitutes a much greater proportion of a poor person's income than that of a wealthier person. The Water and Sanitation report on the economic impact of sanitation also reports that the poorest 20% of the population are 22 times more likely to practice open defecation than the wealthiest 20% of the population. For the poorest therefore, poverty cuts in two ways; not only are they more likely to have poor sanitation but they have to pay proportionately more for the negative effects that are resultant from these practices.

"An efficient and hygienic method of human waste disposal available in a dwelling unit is a critical indicator of the sanitary condition of the unit and is an indirect measure of the socio-economic status of a household" (GSS, 2013 p.388).

In 2010, public toilet was the highest reported facility in urban localities while in rural areas the highest was the use of bushes, fields and beaches which are all forms of open defecation. Public toilets were used by 38.4 percent of urban dwelling units and 29.8 percent in rural localities (GSS, 2013). These statistics are not entirely reflective of the cholera incidence situation in Ghana; because the largest numbers of cases are normally reported in urban areas which equally lack sanitation facilities as rural areas and unhygienic practices such as open defecation are also common.

One intractable challenge of both urban and rural areas in Ghana is adopting modern and hygienic solid waste disposal systems. People are stuck to traditional ways of disposing off refuse such as burying and burning. A modern method such as collection by waste management companies is normally shorn especially by poor communities because of cost implications. Appropriate waste management helps to prevent the spread of infections including cholera and improves the quality of the environment. Poor sanitation however undercuts households and communities economically causing sanitation-related diseases burden, force adults out of work, children out of school, lowering productivity and household incomes.

The burden of Cholera during an outbreak is easily noticeable with increases in diarrheal related cases at health facilities, increased deaths of patients presenting symptoms and a rapid spread of the disease to other localities. Despite these observable features, without estimation of real costs, the disease burden of Cholera will remain mostly observatory without much ‘teeth’ to show actual

impact of the disease. Costs of the disease normally comprise epidemiological costs where government health systems and other agencies must respond quickly in curbing the outbreak. WASH response to Ghana's cholera outbreak is estimated to be USD 1.2 million each year (WSP, 2012). Productivity losses are also significant due to either debilitating impact or premature death of patients as well as losses attributed to their caregivers.

Outbreaks also lead to the diversion of expenditures from other essential sectors which have more direct impact on the economic development of communities rather than outbreak management. Trade and tourism is normally hampered by Cholera because it is a disease associated with flirt plus being communicable. Hence, the government experiences revenue losses due to reductions in both trade and tourism.

The economic costs of Cholera in Ghana; direct, indirect or intangible have received very little attention despite the fact that the government, households and health facilities are all impacted at various levels and in various degree by the disease. Though most facilities have data on costs incurred, these usually cover only direct costs and in most instances these costs are shared costs for all services rendered at the facility without conscious effort in segmenting them for various disease impact. Additionally, costs borne by households in seeking care are completely missed and in this situation, the true cost of the disease is lost or underestimated because these key components are excluded.

Additionally, the suddenness of Cholera's emergence and its ease of spread can quickly drive both households and the whole health system into catastrophic expenditure. This situation is a cause for concern to all stakeholders involved.

1.2 Objectives of the Study

The study is to generally assess the economic costs of 2014's outbreak of Cholera on households and health facilities in the Greater Accra region of Ghana.

Specifically the study seeks;

- To estimate comparative costs in one low and one high cholera incidence area.
- To determine correlates of cholera affected households with key interest on income quintiles plus other characteristics.

1.3 Relevance of the Study

The relationship between socioeconomic status and health indicators has been widely studied, and it is recognized as a cause-effect relationship and access to social services such as education, housing, food, as well as equitable income distribution are important determinants of individual health conditions. Research on cholera in Ghana has focused more on determinants and risk factors of outbreaks, without much attention to economic costs of such outbreaks. Some of these studies include; (de Magny et al. (2006) who observe the relationship between disease's temporal patterns and climate; Osei et al. (2010) studied spatial dependency of cholera prevalence on potential cholera reservoirs in Kumasi. These two studies reviewed the environmental factors influencing cholera

incidence in particular locations. Thompson et al. (2011) sought to understand the evolution of the cholera epidemic in Ghana by analyzing a collection of Cholera strains from the beginning of the seventh cholera pandemic in Ghana.

To the best of my knowledge and literature searches done, there is no known research on Ghana measuring economic costs of cholera outbreaks even though outbreaks have now become nearly perennial during every rainy season. The closest study of this kind was one done by Aikins et al. (2010) which measure health care costs of diarrheal disease in Northern Ghana. Studies of this nature however, lack the specificity needed in assessing disease-specific interventions which normally is the central focus of most costing studies. In addition, studies such as this that mainly present a provider based perspective greatly limit the study by ignoring the burden that disease pose to families. These all buttress the point of an existence of an important gap in the literature on Ghana especially with the regard of economic perspective on cholera. On the African front, Kirigia et al. (2009) proposed the urgent need for further studies to determine localized-level economic burden of cholera. The present study aims to fill the gap and increase global knowledge on costing of cholera in Ghana. This shall highlight a number of relevant policy implications and applications;

- Cholera is an acute disease and can quickly lead to death within hours when left untreated. But up to 80% of cases can be successfully treated with Oral Rehydration Salts (ORS) (WHO, 2014). Most cases of deaths result from late arrival of patients at the health facilities to seek care.

Knowledge in household's cost drivers and importance of economics in early healthcare seeking is immensely critical in reducing CFR.

- Households' economic status can have an important influence on lifestyle, prevention and treatment of cholera. The a-priori expectation is for households that are relatively wealthier to live healthier life-styles and hence having lesser infection rates or faster recoveries from the disease. Having knowledge on the distributional effects of cholera on various income quintiles can guide policy makers in using targeted approaches to alleviate the burden of the disease where it is heaviest felt.
- During emergencies like a cholera outbreak, there is increased collaboration between health agencies like the Ghana Health Service (GHS), Ministry of Health (MOH), WHO, UNICEF, the Red Cross, etc. In these collaborative efforts it is important that such organizations know the severity of the disease not just in human suffering but economic consequence within affected localities. This guides the channeling of collaborative efforts in combating such outbreaks.

1.4 Organization of the Study

The study is structured into six chapters. Chapter one gives a general introduction, statement of problem, objectives, relevance, methodology and the organization of the study. Chapter two looks at cost of illness study, the history of the disease and its implications. Chapter three reviews existing literature on the both theoretical and empirical studies done on cholera. Chapter four profiles the two districts being studied, the theoretical framework and the empirical model that underpin

analysis of data. Chapter five presents analysis and discussions of the data collected and entered from the field. Finally chapter six deals with summary of findings, recommendation and policy implications of the study.

CHAPTER TWO
OVERVIEW OF CHOLERA IN GHANA

2.0 Introduction

Industrialization and development is lessens poverty and makes access to basic social amenities such as safe drinking water and sanitation improvements a reality. Sanitation and water are two key features in in the fight against infectious diseases such as Cholera. Due to these same features resulting from development, cholera has been eradicated from the developed world for over half a century now. Sadly, the situation seems to be worsening in the developing world and has been aided by proliferation of urban slumps, poor housing conditions, poor sanitary practices like open defecation among other factors. Cholera has been evidently predominant in communities or countries where poverty levels are still quite high. A study done by Talavera & Pérez (2009) showed that countries with low Gross National Income per capita reported the highest numbers of cholera cases in contrast with middle and high income per capita countries that reported 34% folds lower incidence. This underscored the statement that “cholera is a disease of poverty”.

Cholera reached Africa in the 1970’s, and since then has become endemic in many African countries especially causing many deadly, multinational epidemics in many sub-Saharan countries. The incidence has also shown a growing seasonal pattern with onset of rainy seasons where poor sanitary conditions within these countries are exposed including large prevalence in refugee camp situations within the region which are plagued by many wars displaced persons.

In 2005, 31 (78%) of the 40 countries that reported indigenous cases of cholera to WHO was in sub-Saharan Africa. The reported incidence of indigenous cholera in sub-Saharan Africa in 2005 (166 cases/million population) was 95 times higher than the reported incidence in Asia (1.74 cases/million population) and 16,600 times higher than the reported incidence in Latin America (0.01 cases/million population). In that same year, the cholera case fatality rate in sub-Saharan Africa (1.8%) was 3 times higher than that in Asia (0.6%); no cholera deaths were reported in Latin America.

2.1 History of Cholera

There have been records of cholera-like diseases as far back as in the time of Hippocrates (460-377 BC) and Galen (129-216 AD) and numerous cholera-like maladies were also known in the plains of the Ganges River since antiquity. However, modern knowledge about cholera dates only from the beginning of the 19th century when researchers such as John Snow began to make progress towards a better understanding of the causes of the disease and its appropriate treatment. But since that period great advances have been made in identifying root causes, spread, treatment and prevention of the disease.

So far, throughout history there have been 7 cholera pandemics starting from 1817 and which have always originated from Asia and spreading to the rest of the world. The first six pandemics all seem to have originated from Ganges in Bangladesh, and are thought to be caused by infection of the Classical O1 biotype strain of the disease (Laws, 2006). In 1961 the current cholera pandemic started and unlike the previous six which began in Bangladesh this began in Indonesia

spreading through Asia to Africa, Europe and finally to Latin America and resulting in large number of cholera cases and deaths per year since that time (Colwell, 2002). Currently, the disease affects 3 to 5 million people every year predominantly in Africa and Asia (WHO, 2010).

The pandemic reached sub-Saharan Africa in 1970 and has remained entrenched ever since. Latin America recorded its first cases in 1991 and within 3 years the number of recorded cases had risen to nearly 1 million. Though there was a great explosion of the disease within the first few years of it reaching that region, in contrast to Africa, cholera was largely eliminated from Latin America within a decade but in Africa it remains a persisting problem.

2.2 Clinical Features of Cholera

Cholera is an acute diarrheal illness caused by infection of the intestine with the bacterium Vibrio cholerae serogroup O1 or O139. Infection can be asymptomatic, mild, or severe: approximately 1 in 20 infected persons have severe disease characterized by profuse watery diarrhea, vomiting, and leg cramps. In these persons, rapid loss of body fluids leads to dehydration, electrolyte disturbances, and hypovolemic shock. Without treatment, death can occur within hours but treatment is simple and inexpensive for most cases. In severe cases, vigorous oral or intravenous fluid and electrolyte replacement is key to recovery and overall mortality can be reduced from as much as 50% to less than 1%, even in makeshift rural treatment centers.

2.3 Transmission of Cholera

Two routes of transmission of cholera have been recognized; the first one occurs from aquatic reservoirs in the environment (primary transmission) and the second occurs from previously infected individuals (secondary transmission); once the primary transmission has initiated an outbreak, secondary transmission depends the problem by causing epidemics in the endemic areas (Ruiz-Moreno et al. 2010).

Patients infected who have no symptoms will generally shed-off the organism for only a few days; however, patients who are symptomatic shed-off the organism between 2 days and 2 weeks (Nelson et al. 2009; Weil et al. 2009). Transmission of cholera within households has been documented (Weil et al. 2009) this increases the risk of infection among household members. Vibrio cholerae are present in human stool and when proper fecal disposal is not practiced there is the likelihood of pollution of water sources which are used by poeple (Nelson et al. 2007; Faruque et al. 2006). In environmental water, organisms convert to conditionally viable environmental cells within 24 hours (Nelson et. al. 2008). These organisms are infectious upon reintroduction into humans, although the infectious dose in this form is not known. Thus, the major source of Vibrio cholerae is feces of persons acutely infected with the organism that reaches water most often through sewage. Individuals with reduced gastric acidity and blood group O are more susceptible to the infection, and in situations where poor environmental sanitation is coupled with poor domestic and personal hygiene, transmission results from ingestion of faecally contaminated water (as well as

food), and hence it is usually a disease of developing countries or areas where improved water and adequate sanitation are lacking.

In endemic areas, water is usually the main vehicle of transmission, although this may occur through food, and thus infection due to Vibrio cholerae begins with the ingestion of contaminated water or food. Transmission of cholera in non-endemic areas is more commonly associated with consumption of foods, such as raw or undercooked seafood, imported from cholera-endemic regions and also due to migration of persons from affected regions.

2.4 Cholera Treatment

Without treatment the case-fatality rate for severe cholera is about 50%. However, treatment is very effective and simple and is based on the concept of replacing fluids as fast as they are being lost. It is required that replacement fluids be similar to electrolyte composition of the fluids being lost. Initially, the fluids must be given sufficiently and rapidly to make up for the volume that has already been lost so that blood circulating volume can be restored. Additionally, maintenance fluids are given to replace continuing losses as they occur this will forestall any deaths when fluids are given promptly and efficiently.

Normally, signs of dehydration are not clinically apparent until the patient has already lost about 5% of his or her bodyweight. A patient with severe dehydration requires emergency intravenous polyelectrolyte solution for rehydration followed by oral rehydration solution (ORS) for maintenance hydration. In milder cases, ORS can be used for both rehydration and maintenance. Patients who are severely

dehydrated are assumed to have lost 10% of their bodyweight, and this is the volume that needs to be replaced. There are cases where patients have no pulse but in such situations patients are to be given fluids as rapidly as possible and more than one intravenous line may be needed to infuse the fluid rapidly enough to restore the pulse. In patients with lesser degrees of dehydration, the simple use of ORS is effective for rehydration.

2.5 Prevention of Cholera

Contaminated food and water are normally the main routes for infection and much can be done to keep transmission rates to a minimum. The measures include ensuring a safe water supply, improving sanitation, making food safe for consumption by thorough cooking, and health education through mass media. Some important messages for the media during outbreaks include the importance of purifying water and seafood, washing hands after defecation and before food preparation, recognition of the signs of cholera, and locations where treatment can be obtained to avoid delays in case of illness. Filtration of water through sari cloth is quite effective and reduces cholera transmission by nearly 50% (Colwell et al. 2003). The long-term prevention of cholera will require improved water and sanitation facilities, but these improvements are not happening rapidly in most regions where cholera is prevalent because many needs usually ‘juggle’ for the same limited resources.

2.6 Cholera Epidemic and Outbreak

Epidemics or explosive outbreaks generally occur in underdeveloped areas with inadequate sanitation, poor hygiene, and limited access to safe water supplies,

whereas in some countries, a seasonal relation for cholera epidemics has been observed (Koelle et al. 2005; Faruque et al. 2005). WHO described a dramatic increase in the number of cholera cases and outbreaks, in new communities and in communities where the disease had been absent for emerging disease.

2.7 Cholera in Ghana

In West Africa, Guinea was the first country to report cases of cholera and though the government initially denied it, the WHO had to break protocol and establish for the first time that "the health of the world's people is more important than the sovereignty of member countries" (Ofori-Adjei & Koram, 2014).

The first case of cholera in Ghana occurred on September 1, 1970 when a Togolese national in transit from Guinea collapsed at the Kotoka International Airport and was later diagnosed with cholera (Pobee & Grant 1970). Two of the worst hit sites in Ghana, subsequently, were the fishing villages of Akplabanya (in the then Ada District) and Nyanyano (Winneba District). Cholera in these areas appeared to have been "smuggled in" by relatives of dead Ghanaian fishermen from Togo and Guinea, respectively, for burial despite a sanitary cordon on Ghana's borders. By July 1971, the Ashanti region began to report cases, indicating that cholera had spread across the country (Ashitey, 1994). Since then there has been focal outbreaks every 4 to 6 years.

In recent years outbreaks have become more frequent and protracted and now believed to be endemic in Greater Accra, Central and Western Regions. A pilot study by GHS (2014) within Accra Metropolis found that 3 out of every 10

diarrhea cases proved positive for Vibrio cholera stamping rife of the disease. Attempts at controlling cholera have not been successful because needed long term approaches, such as potable water supply, proper disposal of solid waste etc. have been grossly inadequate and inequitably distributed to capture disadvantaged populations. Cholera is now endemic parts of Ghana with cyclical epidemics. These epidemics are now predictable but sanitary reforms have been inactive, ineffective and local authorities have failed in applying necessary bye-laws on food hygiene, sanitation, environmental health and waste disposal.

Cholera in Ghana is mainly an urban problem with high impact on the urban poor. The unprecedented unregulated growth of urban slums has resulted in poor environmental conditions, lack of access to clean potable water and extreme challenges in waste disposal. Hence, the routes of cholera problem Ghana is well-known.

2.7.1 Historical Trends

With the current outbreak inclusive, there have been 5 major outbreaks in Ghana since 1980 and the current outbreak being the worst ever to affect the country. Figure 2.1 below shows incidences of outbreaks from 1980 to 2014 giving a picture of its resurgence every 4 to 6 years. Most of the outbreaks have normally shown a steady rise of the outbreak from the previous year but the 2014 outbreak had a sudden trend rising from an almost zero cases in the previous year to become the worst outbreak in 30 years in a short span of six months. Out of the 5 major outbreaks, 3 recorded over 10,000 cases of the disease. The years between 1985 and 1989 was the longest period recorded with less than 200 cases.

However, the years 1988, 1998 and 2013 had the lowest number of cases in the history of the disease in Ghana, reporting less than 20 cases. Finally, apart from the year 1998, which had zero cases of the disease, all other years have reported cases of the disease.

The Greater Accra region has consistently reported the largest number of cases in the country and within the region Accra Metro, Ga West, Ga South and Ledzokuku Krowor districts have recorded the highest number of cases over the past 3 years. In the recent outbreak, the region recorded 70% of all reported cases and 50% of deaths.

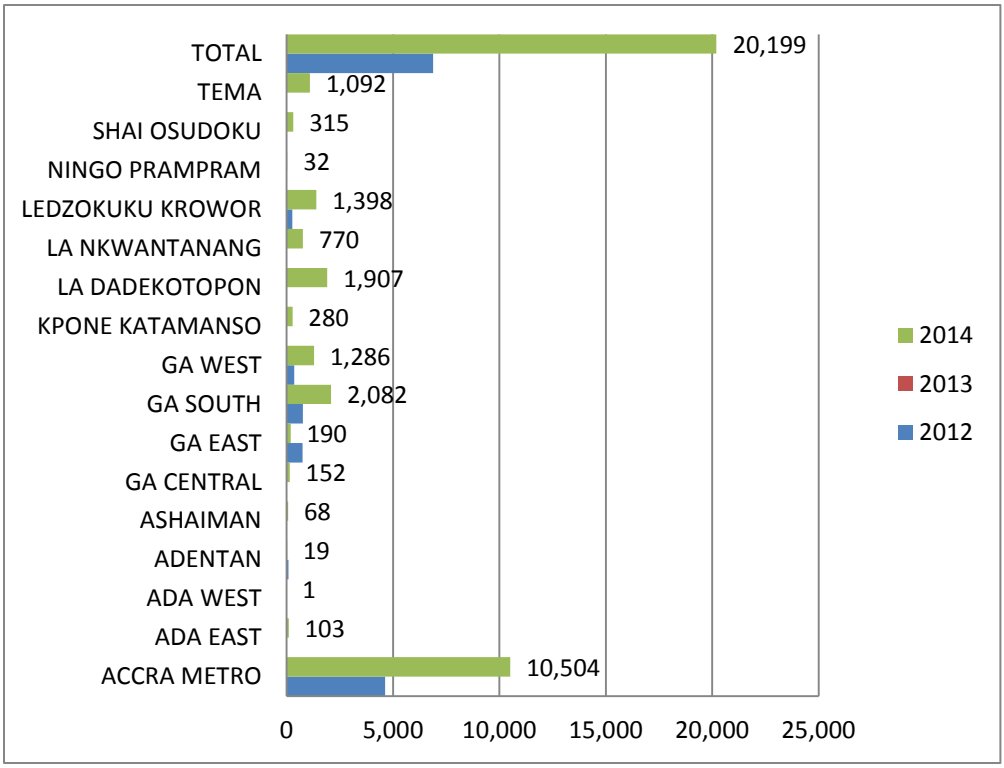


Figure 2.1Cholera cases within 16 districts of the Greater Accra between 2012 and 2014.

Source: Author's computation
Data Source: GHS, 2015. Regional Disease Control Unit.

Table 2.1 Cholera cases and deaths by region, Ghana 2014

Cholera Cases and Deaths by Region, Ghana 2014			
Region	**Cases**	**Deaths**	**CFR (%)**
Ashanti	287	3	1.05
Brong-Ahafo	1056	26	2.46
Central	3868	64	1.65
Eastern	1875	6	0.32
Greater Accra	20199	121	0.6
Northern	282	2	0.71
Upper East	294	9	3.06
Upper West	36	1	2.78
Volta	651	8	1.23
Western	429	7	1.63

Source: GHS, 2015. Regional Disease Control Unit.

Table 2.2 shows the distribution of cases in the recent 2014 cholera outbreak by region. Apart from Greater Accra, Central region had the second highest number of cases recording over 3800 cases over the period. Though Greater Accra reported the largest number of deaths over the entire period, it reported the least CFR (0.6) and the Upper East Region which recorded 294 cases had the highest CFR (3.06) in the country. This might be attributable to the relative ease in accessing health facilities, proximity of health facilities and education on the disease which might all be better in Greater Accra compared to the other regions.

The cholera outbreak in 2014 recorded 28,975 cases 243 deaths (CFR=0.8%) with all the 10 regions of the country reporting cases. Some triggering factored identified by the GHS as the cause of the cholera outbreak include; Shortage of potable water supply, Breakdown of waste management systems, Poor personal hygiene and poor food hygiene. Accra was the epicenter of the outbreak and all

cases reported within the country were due to internal migration. Identifiable challenges in dealing with the outbreak were due to persistence of risk factors (personal and environmental), slow response by stakeholder agencies, overwhelming large number of cases during outbreak and inadequate cholera logistics and treatment centers.

Between December 2010 and 2012 nine out of the ten regions of Ghana experienced a protracted outbreak and though very few cases were reported in 2013, 2014 saw an unprecedented surge in cases giving a clear indication that the situation is far from being abated.

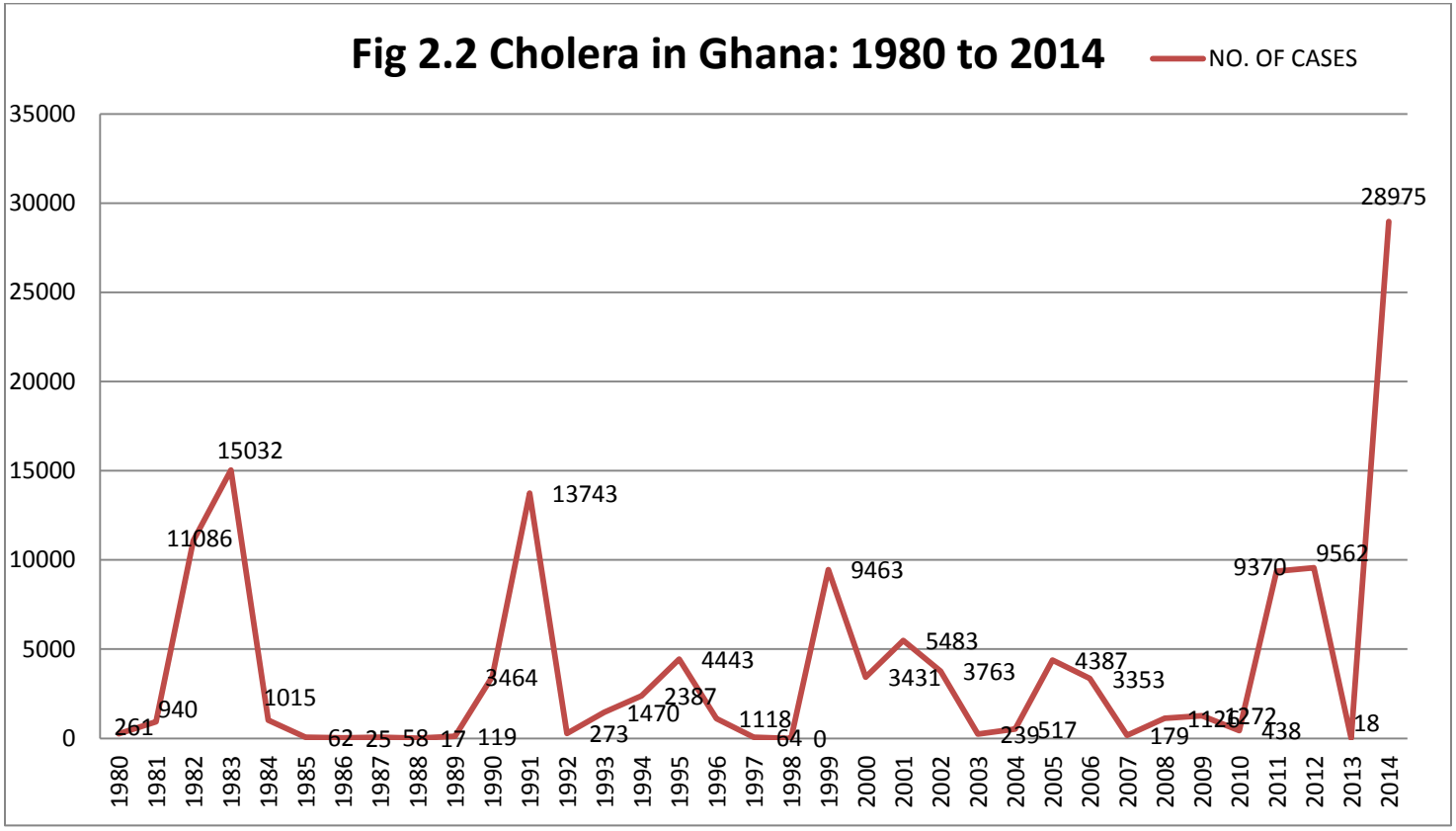


Figure 2. 2 Cholera in Ghana: 1980 to 2014
Source: Author's computation

Data Source: GHS, 2015. Regional Disease Control Unit.

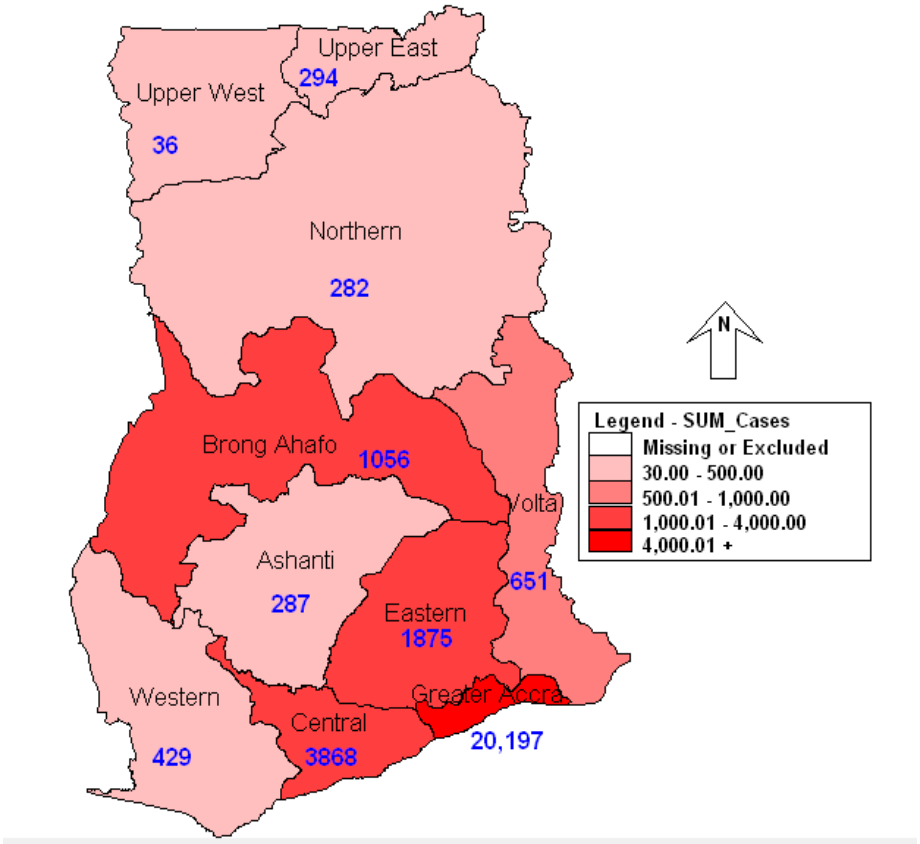


Figure 2.2 Distributions of Cholera Cases by Region, Ghana 2014.
Source: GHS, report on cholera outbreak in Ghana, 2014.

CHAPTER THERE
LITERATURE REVIEW

3.0 Introduction

In this chapter, the theoretical foundations of economics of ill-health and its impact on households is presented. The concept of economic cost is defined and the different methods recommended by WHO guidelines to identifying the economic consequences of disease are expounded. The Cost of Illness (COI) method as developed by Rice (1966) and modifications by Shepard et al. (1991) is reviewed and its application to identifying cost components and its estimation. Also, Grossman's (1972, 2000) model on the demand for health including its application as human capital is discussed.

Finally, an empirical review is done in two parts. The first part reviews studies using different cost approaches in measuring costs of cholera and the second part delves into the linkages of poverty, sanitation, access to portable water and the incidence of cholera.

3.1 Theoretical Foundation

Health care utilization and health seeking behaviour modeled by Andersen (1995) has been widely used in public health circles. It is assumed by the model that health seeking behavior results from interaction of individual's characteristics, population and his environment, and that the use of medical service is dependent on three main factors namely; predisposing, enabling and need factors. Predisposing factors are features that influence an individual's health as a result of certain peculiar behaviour patterns which include demography (sex, marital

status, household headship and past ailments); social structure (education, race, occupation and religion); and lastly, belief systems (such as culture). Enabling factors are related to issues of availability, equity, accessibility, quality and costs. These tend to promote, inhibit or limit the use of health services. The third factor; need, encompasses the individual's health use that is necessitated by disease or impairment such as intensity of illness measured by the number of sick days. Thus, Andersen's model estimates the use of health care services as a function of these three factors.

However, economic theories on the use of health services focus on the how individuals make decisions in consuming health care to produce health as in the case of Grossman (1972) and with further simplifications by Wagstaff (1986). "The theory develops a conceptual apparatus for analyzing the interaction of socioeconomic determinants of health and indicates how this can be used to shed light on a variety of policy issues such as socioeconomic inequalities in health and the design of prevention policies" (Wagstaff, 1986, p.1). Wagstaff hinges his theory on three basic economic concepts; the indifference map, the health production function and the budget constraint. An individual's indifference map is made up of several indifference curves of which these curves are formed from the individual's combination of commodities that gives him or her a certain amount of utility. Under the theory, the individual views 'good health' as a desirable commodity in addition to other commodities from which utility is derived but the individual does not place an overriding value on 'health' relative to the other commodities. The individual will therefore end up with an indifference curve

showing a combination of health consumption as well as other goods that brings him or her maximum satisfaction.

In the 'health production function', it is postulated that an individual produces an output 'health' by combing health inputs. These inputs include; education, medical care, food, exercise etc. and the interaction between these inputs in producing the output forms the 'health production function'.

Thirdly, the theory assumes the existence of a budget constraint resulting from costs of health inputs and its consumption process. Meaning the consumption of health inputs is not limitless and the quantity that can be accessed by an individual will be dependent on his or her income and the prices of the inputs.

Deducing from these three principles, it can be assumed that an individual's production of health will depend on factors such as his utility, technical know-how (education) and income.

3.1.1 Economic Consequences of Illness on Households

Welfare economic theory suggests that individuals seek to maximize their utility or economic welfare subject to some constraints which include income and time. This is achieved by combining a range of goods and services; some of which can be bought or sold (including health care) and some of which cannot but still have value.

Health, unlike other economic goods and services that yield direct utility, has an indirect utility, because consumers of health would have preferred not to incur

these expenses in terms of money and or time. Therefore, health contributes to the individual's utility in three ways. One, people prefer more healthier days to less healthier days. Two, the level of health partly influences the consumption of other goods and services. Three, poor health inhibits economic objectives like making income that allows people to consume market goods.

Poor communities normally have high proportion of out-of-pocket health expenditure and ill-health drives up household's consumption of health goods whilst lowering that of their basic needs such as food, clothing, housing and children's education. For example, in Germany where per capita GDP is US$ 32,860, households bear 11.3% of all medical expenses and the rest by a social health insurance or by the government. In contrast, in DR. Congo where GDP per capita is only US$120, households bear about 90% of health care costs directly. This situation creates the tendency of deterring poorer people from seeking orthodox health services, truncating treatments or resorting to other unorthodox methods of treatment which sometimes leaves fatal results.

Time spent seeking care further inhibits work and lowers financial earnings. Financing healthcare might transcend current income into households' savings if available or if not, through a loan or sale of family assets. Reduced income, savings and assets will deplete investment and eventually affect future consumption possibilities. Xu et al. (2003, 2007) estimate that 44 million households worldwide are plunged into catastrophic health expenditures (40% of a household's none-subsistence income on healthcare payments as defined by Xu et al. (2003) and about 25 million pushed into poverty each year. Clearly defined,

Xu et al. (2003) states that health expenditure as being catastrophic if a household's financial contributions to the health system exceed 40% of its income remaining after subsistence needs have been met. Wyszewianski (1986) alludes to the fact that, high medical costs were not necessary synonymous to catastrophic expenditures to households especially when there is the existence of medical insurance policy to cover either all or large portions of the costs. But conversely, small medical bills for common diseases could become financially dangerous to poor households with no insurance cover. A recent WHO report also noted that the likelihood of financial catastrophe is negligible if 15-20% of household's total health expenditure is out-of-pocket (OOP). However, the average OOP is 40% for African countries, indicating the higher possibility and plausibility of financial catastrophe and resultant poverty.

From the aforementioned, Cost of Illness studies try to answer a number of health policy questions under macro or micro levels of the economy. Table 3.1 captures questions at their respective levels and the economic unit these questions apply to.

Table 3.1 Illustrative health policy questions addressed by economic impact studies.

LEVEL	QUESTION
MACRO	1. What impact does ill-health have on gross domestic product or its rate of growth?
Society	2. How much does society pay for medical and other expenses because of illness?
	3. What is the impact on social product (i.e., both market and non-market consumption lost opportunities), or on social welfare more generally?
MICRO	
Households	1. What impact does ill-health have on a household's income or consumption patterns (over a single year, or for a longer period of time)?
	2. How much do households pay for medical or other expenses because of illness (for an episode, over a year, or over a lifetime)?
Firms	1. What impact does ill-health have on a firm's operating costs, output or profit?
	2. What is the impact of ill-health on productivity in the work place (including impaired performance while still at work, as well as absenteeism) ?
Government	1. What proportion of government expenditure could have been saved and directed to an alternative use in the absence of illness? (e.g. what social security payments could be avoided by the prevention of or cure for disease?)
	2. What impact does ill-health have on the government workforce and on the government's ability to provide services?

Source: WHO guide to identifying the economic consequences of disease and injury (2009).

3.1.2 Health as component of Human Capital

In the broadest definition of the term asset, economists define an asset as a resource with economic value that an individual, corporation or country owns or controls with the expectation that it will provide future benefit. This asset can either become depleted with time or produce gains. In this sense, health can be viewed as economic asset capable of either depletion with time and other factors like high risk behaviour or enhanced through investments like healthy dietary practices and exercise. Hence health has the capacity to be produced through investments and also viewed as capital consumption due to aging and lifestyle. Health investment can also be seen through either curative or preventive methods.

Curative is where upon the onset of ailment, medical services are purchased to ensure the return to good health and preventive in the form of one introducing exercise to lifestyle and healthier eating habits that reduces the risk of certain disease conditions. The return on these health investments is lesser time spent in bad health. The healthy time gained can in-turn increase labour income and thus increase consumption or leisure. In economic theory rational beings prefer more utility to disutility and will seek to maximize this utility. This model is theorized by Grossman (1972) which suggest that given an individual's initial stock of health inherited from their parents and their environment, the individual will make informed choices regarding their health improvements over their life cycle. The individual does so by investing in healthcare and practicing health enhancing behaviours to maximize utility but will be constrained by a budget.

3.1.3 Application of Grossman Model to Study

According to Grossman (2000), the demand for health is split into two based on either for 'Pure Consumption' or 'Pure Investment' purposes. With pure consumption purpose, the return is mainly 'psychic' granted that it reduces disutility in terms of fewer sick days. On the other hand, pure investment in health is mainly for the purposes of increasing healthy days to participate in market and non-market activities. This study assumes based on this model that wealthier persons have greater positive returns on health and will hence face a lesser burden when an outbreak of cholera occurs. Grossman further postulates that price of medical goods have a negative effect on both consumption and investment into health. This is directly linked to factors of affordability and access. Wealthier

homes are able to utilize and make investments into their health better than their less wealthy counterparts due to these factors and hence poorer homes continually face greatest burden of diseases.

On education, similar arguments are put forward by the model. Stating that with improved education, individuals are more efficient in producing health, that is; more educated people are better off following instructions for medications and or are more knowledgeable about what is bad for their health. It has been empirically observed that population level (local-level) risk factors of cholera include poverty, lack of development, high population density, low education, and lack of previous exposure (Ackers et al., 1998; Ali et al., 2002). Penrose et al. (2010) also suggest that global urbanization plus urban poverty are associated with high risk of infectious diseases such as cholera among other studies.

This study hinges on these assumptions and tries to determine the impact of the cholera outbreak based on the costs that result from treatment of the disease and its predisposing factors resulting from the income strata of cholera affected households. The COI method is used to identify costs and a Tobit model in determining the correlates of cholera for these households.

3.2 Cost of Illness Approach (COI)

Cost of illness (COI) studies is a type of economic study common in medical literature, particularly in specialist clinical journals (Byford et. al., 2000). It is most usual to these studies when the economics of health is being observed. COI studies seek to identify and measure all costs of a particular disease; direct and

indirect as well as intangible dimension in some cases. The determination of total cost of an illness provides two critical useful pieces of information. One, it tells us how much society is spending on a particular disease, and by implication the amount that would be saved if the disease were curtailed. Two, it identifies the different components of cost and the size of the contribution of each sector in society. Such information, it is argued, can help to determine research and funding priorities by highlighting areas where inefficiencies may exist and savings may be made (Rice, 1994; Ament & Evers, 1993).

COI was formulated by Dorothy Rice and colleagues in the late 1960's and subsequently revised (Rice, 1966, 1967; Cooper and Rice, 1976; Rice et al., 1985). A bulk of economic impact studies in health use some version of COI approach and it remains the most common measurement of illness approach. In its original form, measurements of costs associated with pain or suffering were not considered though they were described as 'intangible costs'. The traditional COI approach estimates the societal impact of disease and injury combining 'direct costs' (medical diagnosis, treatment, transportation, follow-ups care, etc.) and 'indirect costs' (the value of lost production because of reduced working time).

Two methods of COI have evolved; Prevalence and Incidence approaches. The commonest is the prevalence method and it estimates the total cost of a disease incurred in a given year. Incidence approach calculates the lifetime costs of cases first diagnosed in a particular year (Rice, 1994). In this study a prevalence

approach is applied for the costs associated with the incidence of cholera within the 2014 outbreak.

An important factor for consideration in estimating households' direct and indirect costs in seeking healthcare is households' 'coping strategies' in mitigating the impact of 'shocks'. These strategies include adjustments of labour supply within the household to preserve production and income flows, drawing on savings, borrowing, social or health insurance and disposal of assets (Sauerborn et al., 1996). On the other hand, Russell (2004) shows that most of these coping strategies come with future repercussions and might in the long-run be more costly to the household's livelihood. For this reason, coping strategies though might mitigate impact of disease burden in the short term, have long term effects which are equally problematic for households. Hence coping strategies are concluded as having little to no effect in the long-run.

3.2.1 Costs Definitions

Economists define costs as opportunity cost. That is, a forgone benefit in using resources in their next best alternative. This concept is fundamental in economics because resources are scarce and choices need to be made among alternative uses. For example, during the 2014 cholera outbreak, the Out-Patient-Department (OPD) of the La General Hospital became a mid-shift admission ward and all other medical services suspended except emergencies. Hence, the opportunity cost of the outbreak was all other unattended health cases which were less acute. Therefore, opportunity cost presents a picture of competing needs and scaling of priorities.

On the other hand, accountants' costs comprise of only physical expenditure on goods and services such as payments for medical supplies, staff salaries, equipment etc. But accountants' costs tend to underestimate costs because it does not capture costs of resources being used in other capacities as well as costs such as volunteers' time and auxiliary services like free treatment of medical staff. Therefore economic costs capture both financial monetary costs as well as non-monetary costs.

Costs studies are crucially dependent on the viewpoint of the measurements of interest. As in Table 3.1, economic impact on the whole economy might differ from that on a firm or a household. For example, the effect of disease or injury on a household's income or consumption opportunities (household question 1 in Table 3.1) could be interpreted to include only market production and cash purchases, in which case the quantity of interest is the value of market consumption opportunities foregone because of illness. On the other hand, the quantity of interest could be redefined to include the economic losses associated with both market and non-market production or consumption opportunities. Finally, it could be defined even more broadly to include the value of the lost welfare associated with illness, which would include not just the lost production and consumption, but the value of the changes in leisure and the decrement in welfare. Each of the questions measure different quantities of interest and estimates derived from each are normally viewed separately.

3.2.2 Healthcare evaluation costs concepts

- **Cost analysis**

Cost analysis break down a cost summary into its various constituents and investigate the parts of the whole and their relations in making up the whole. It 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. It also provides useful understanding of incremental costs of interventions and the total resource needed to support current and future strategies. Cost analysis does not consider the effectiveness of an intervention or service.

In its application in health economics, it identifies the key drivers of costs for particular diseases and measures its impact at the individual, household, firm, government or the entire society level. It is also relevant to conduct when a new intervention is sort to be introduced like a vaccine to deal with a health related problem. It provides useful information on where costs are heaviest felt and therefore needs policy focus.

- **Cost-minimization analysis (CMA)**

Cost-minimization analysis is used when identifying the least cost among alternative choices that produce similar outcomes in terms of benefits or effectiveness. It is a comparison of two or more strategies which have the same effectiveness but which are assumed to have different costs. It aims at achieving 'value for money' either through a desire to achieve a predetermined objective at least cost or a desire to maximize the benefit to the population of patients served from a limited amount of resources. It is a useful tool when benefits from alternative measures are considered to be equal. It becomes however challenging especially among human rights activists when priority of 'value for money' is placed above saving lives. This aside, this method seeks to achieve the best use of

resources in producing maximum outcomes without compromising quality of healthcare.

- **Cost-effectiveness analysis (CEA)**

A cost-effectiveness analysis compares relative costs and outcomes/effects of two or more courses of action. 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 the health services field, it is normally useful in situations where it may be inappropriate to monetize health effect. It is expressed in terms of a ratio where the denominator is a gain in health such as years of life, sight years, premature births averted etc. and the numerator, the cost associated with the health gain. The effectiveness indicator is the same for each strategy being compared, and consists of a health outcome measure.

- **Cost-utility analysis (CUA)**

Cost-utility analysis is relevant when the aim of the study is to compare alternative health services or interventions that are associated with different costs and different outcomes especially with procurement decisions. In health economics it estimates the ratio between the costs of a health related intervention and the benefits it produces in terms of the number of years lived in full health by beneficiaries. 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. This procedure allows for comparison across different health programmes and policies by using a common unit of measure and it also takes into account the quality of life of the individual has.

- **Cost-benefit analysis (CBA)**

Cost-benefit analysis is credited to the French Economist Jules Dupuit. He theorized this analysis by comparing the total expected costs of alternative intervention programmes against its benefits to see whether the benefits outweighed the costs. This technique determines the option that provides the best approach for adoption in terms of benefits or effectiveness. CBA assigns monetary value to health improvements which differ from other cost analysis like Cost Effective Analysis and Cost-Utility Analysis which mostly assigns Quality Adjusted Life Years (QALYs) as the unity of analysis.

Cost analysis procedure is most suitable for this study because the study attempts to identify all cost components associated with of an episode of cholera outbreak and how each component contributes towards the overall costs of treatment to households and health facilities in dealing with the disease. Though direct costs are important and shows an obvious impact of illnesses on the unit under study, some studies such as Akazili et al. (2007), Poulos et al. (2012), Sachaetti et al. (2012) & Sarker et al. (2013) all found indirect costs to be higher than direct costs. Specially, Akazili et al. (2007) found indirect cost to be as high as 71% of the total cost of treatment of malaria within households in Northern Ghana.

Cost analysis also measures the amount society spends in total upon an episode of the disease and in effect the cost-savings of the eradication or minimizing of infections of the disease.

Other cost analyses don't make conscious effort breaking down the costs into its base components to check its impact on specific units for example, CBA will weigh the costs and benefits of a programme to choose the programme but not consciously seeking to find impact on various cost components. CMA seeks the least cost in undertaking a venture while CEA seeks to maximize a given budget. But because this study seeks to identify the impact of costs on households especially identifying other none-direct costs which might play a significant role in impacting these households Cost analysis is the best method for analysis.

Finally, this study does not examine the impact of an intervention like the introduction of a Cholera vaccine or interaction of various interventions such as combination of water source improvements with either a vaccination programme which all the other cost analysis might be suitable in providing relevant measures, they are not used here.

3.3 Theoretical Framework

Mortality, morbidity and debility are costs associated with cholera but this study focuses on the impact of morbidity and to a lesser extent mortality (burial cost). Debility which deals with the impact of an inability to engage in work due to physical weakness is not investigated separately in this study but captured under morbidity. This is peculiar with cholera studies as the idiosyncrasies of the disease make all cases admission cases. Shephard et al. (1991) categorize various

costs components borne by the individual, the household, the health facility, the government and or the economy into direct, indirect and intangible. Malaney, (2003) further comprehensively expressed by as:

COI = Private Medical Cost + Non Private Medical Cost + Labour Loss + Risk Related Behavior Modification + Investment Lost + Non Economic Personal Burden

Figure 3.1 shows the COI due to cholera is conceptualized in a framework adopted from Asante & Asenso-Okyere's (2003) Economic Burden of Malaria in Ghana but with modifications to suite this study. These modifications exclude intangible costs and other direct costs to institutions such as Non-Governmental Organizations because they don't fall within the scope of this particular study.

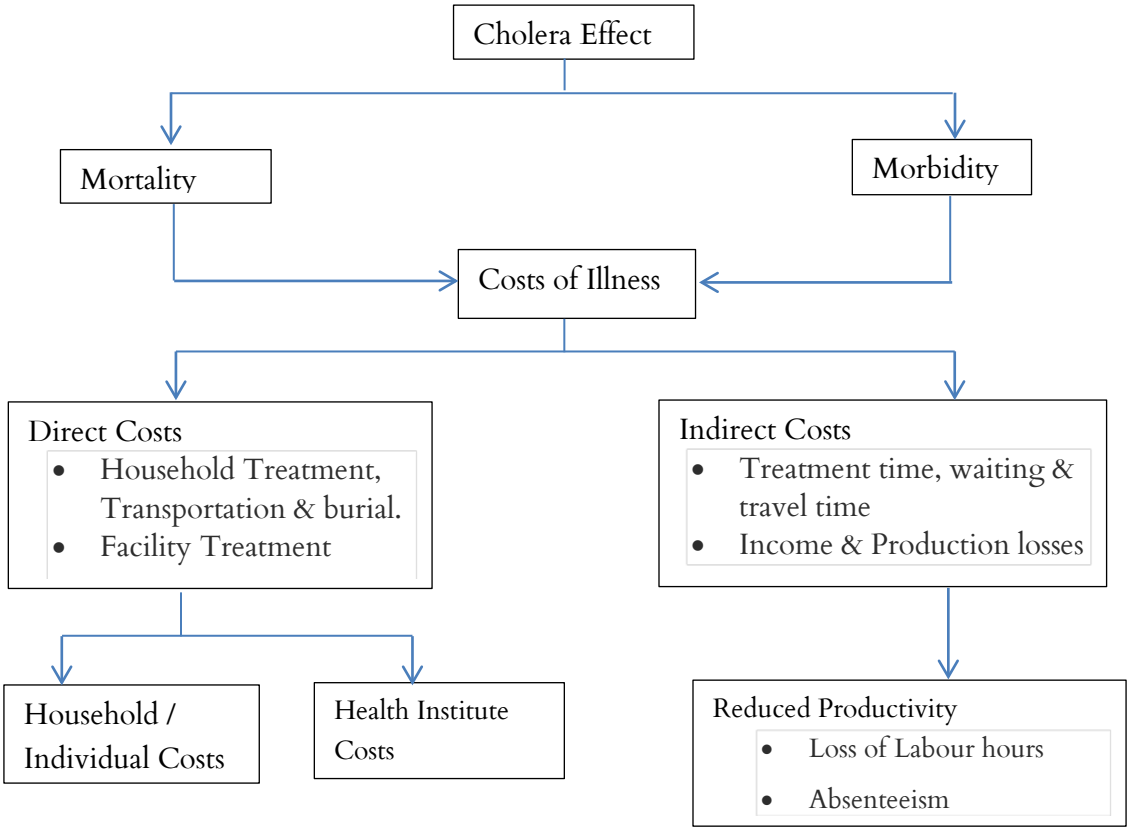


Figure 3.1 Conceptual Framework for Costs of Cholera.

Source: Asante & Asenso-Okyere (2003) with modifications by Author.

3.3.1 Direct Cost

Direct costs are costs that can easily be identified and completely attributed to specific items in the production of specific goods or services but in this study it is seen as in the production of health by households and health facilities. The process of seeking treatment involves cost to the individual and his household. In addition, facilities giving out treatment also bear costs in providing such services to its consumers and these are also captured under the direct cost.

Cash expenditures made by households in seeking care form the root of most direct costs in health economics and these costs normally include; medical expenses, cash expenditures on special foods, transportation and provisions for burials in event of deaths. On the other hand, facilities bear direct cost through both medical and non-medical supplies and services. Both households and facilities costs constitute resource consumption costs for the seeking and provision of healthcare. Direct costs to households can easily be obtained through recalls but that of health facilities become more complex due to how health systems are setup. Costs within such establishments are mostly shared among several activities which are not easily distinguishable. For the purposes of this study, only costs that went directly into logistical supplies in dealing with the outbreak at the facility level were considered. These supplies were items used directly in addressing the problem of the cholera outbreak in the facility.

3.3.2 Indirect Cost

There is a usual debate about the inclusion of indirect costs in costing procedures since it is not mostly tangible or directly associated with an event. But when included in studies they show the bigger view and truest costs because they mostly comprise opportunity costs which are fundamental costs to economists. Indirect costs are very significant with the incidence of cholera. Cholera unlike other diseases leaves the patient acutely dehydrated and unable to partake in any meaningful work, school or social activity. Additionally, caregiving for patients is crucial towards the full recovery of patients because patients are critically weak and need constant attention and sometimes special feeding. These characteristics of the disease condition make both patient and caregiver loose valuable hours which hitherto could have be engaged in participating in productive venture. Oxfam's Cholera outbreak guidelines (2012) suggests that children under the age of five are among the three most vulnerable groups during an outbreak and these children mostly will require constant caregiving for the entire duration of their ailment until recovery.

Indirect costs hence include costs incurred not for its own sake but as a result of another item or activity. These costs sometimes go beyond monetary expense to include productivity and time losses. Therefore, they are difficult to assign to or identify with a specific cost objects. In definition, indirect costs are '…costs associated with lost or impaired ability to work or to engage in leisure activities due to morbidity and lost economic productivity due to death' (Gold et. al, 1996.

p.181). It is simply defined as the value of time lost due to illness or death. These productivity loses will differ according to the age and occupation of an individual.

During the period of sickness patients and their caregivers incur an opportunity cost in time spent on treatment, waiting and travel. This is not an out-of-pocket expenditure but productive time loss that could otherwise be used for attaining both economic and non-economic goods. Such productivity losses result from incapacitation, occupational disability, caregiving and premature death. Indirect costs are made up of basically three components; absence from paid work, reduced productivity at paid work and unpaid production such as reduced possibilities of performing usual activities at home. The first two components apply to the adult productive group normally between the ages of 15 years (age for employment under the Ghana Children's Act 1998) and 60 years (retirement age in Ghana). Indirect costs become importantly crucial when the sick household member is the bread-winner or contributes substantially to the household income and his or her incapacitation results in huge financial strains on the family.

The commonest measure of indirect cost is through the human capital approach based on the Neo-classical viewpoint that wage rate is equivalent to the value of marginal productivity of labour. Concluding that incomes earned can be equated to monetary value of production lost and therefore calculates the indirect cost using the individual's gross wage that would have been earned except for the onset of disease multiplied by the duration of absence.

A more recent approach is the friction method. This came in response to the assumption of full employment adopted by the human capital approach which did not take into account certain realities. A more societal view is to look at the gap between unemployment and frictional unemployment. In this case, an absentee worker is replaced by a previously unemployed person and hence his lost income transferred to the newly employed. On a societal level, there is no loss of income or productivity, the only loss of productivity is the period it takes to replace the sick individual and this is called the 'friction cost'. This makes the friction method provide a less exaggerated production cost compared to the human capital approach.

A second recent method recommended by the Washington Panel's guidelines incorporates indirect non-medical cost as health effects rather the traditional methods of productivity losses due to ailment. It jumps a step further ahead of the friction approach by supplementing a friction effect with health effect. It recommends that productivity losses be measured through its impact on quality of life in terms of health effects plus friction costs. Unlike the human capital approach and the Friction methods which both capture in monetary terms indirect costs through productivity losses and income reduction, the Panel method further breaks into two the impact of reduced productivity; one, impairment in role functioning and two, reduced income conditioned by disease effect. The Panel's method theorizes that quality of life of an individual is in part dependent on their role functionality in society or specifically on the job they are involved in. Therefore, the impact of role functioning is measured as health related quality of

life-effects and the relationship between productivity and quality of life runs partially through the patient's income. The Panel concludes that patients will base their estimation of quality of life reduction on their loss of income rather than directly on the loss of production.

However, in response to this model, Brouwer et al. (1997) criticized the Panel's method on three key issues; one, direct health effects might not be meaningful monetized on the quality of life and should only be considered as health effects and not productivity losses at the societal level. Two, the model does not take into account compensational facilities such as social security and private health insurance which can mitigate the impact of income losses. And finally, the model becomes most useful from the patient's (individual or household) perspective when measuring the impact on quality of life and not for productivity costs from a societal viewpoint.

From the above-mentioned, the traditional human capital approach has the greatest tendency of overestimating indirect costs because it assumes away many real life possibilities. The friction method deals with this potential overestimation by incorporating an augmenting factor of replacement of sick worker but is most useful in macro-level studies where a firm's reduced productivity is being measured. Brouwer et al.'s third criticism of the Washington Panel's method show this method has rather has advantages when doing micro level studies.

Finally, other studies measure costs through a willingness-to-pay approach. This approach seeks to capture either the entire household by including adult

household members who are not working and yet can incur some form of indirect cost. It normally focuses on individual's own weighted perceived costs. Studies like Asante & Asenso-Okyere (2013) go further in using this approach in measuring intangible costs for burden of malaria in Ghana but this measure is clearly subjective and mostly criticized for not having any economic implication. WTP attaches monetary weights to costs which are not easily measurable such as psychological effects of ill-health and because it is subjective it can be influenced by many multiple factors.

3.3.3 Intangible Cost

Intangible costs are costs which are not easily measured and associated with costs of pain, suffering, stigma and the fear of death as a result of a health condition. These costs are mostly subjective; limited to feelings and so might vary from person to person. In addition, there are difficulties in attaching real costs to them. Therefore, due to these measurement difficulties, this type of cost measurement is excluded from the study.

3.4 Empirical Review

Literature on Cholera seems to lean towards its epidemiology, environmental, risk factors and socioeconomic correlates of the disease. This situation is no different for studies on Ghana, which have examined topics on cholera related to; climatic changes (global and regional) and its effects on cholera patterns observed in Ghana (de Magny et al. 2006). This study used cholera data from the WHO Weekly Epidemiological Record for Ghana from the years 1975 to 1995 and employed a wavelet analysis in running for its results. They found strong

statistical coherence between cholera outbreak resurgence, temporal patterns of incidence and climatic parameters from the end of the 1980's. The study revealed that there were two cyclical patterns of incidence every 4-5years and 7-8 years. However, this study just like others, presented only an environmental linkage with cholera incidence but recognizes in its literature review that other factors such as poverty and human density, may influence the spatial and temporal distribution of cholera cases.

A similar work by Osei & Duker (2008), carried out a Geographic Information System based spatial analysis and statistical analysis to determine clustering of cholera in the Ashanti region of Ghana. Their study showed high cholera rates clustered around the Kumasi Metropolis (the central part of the region) showed direct relationship between cholera and urbanization as well as overcrowding but an inverse relationship with other neighborhood towns away from Kumasi. A later study by Osei et al. (2010) also did similar work on the relationship between cholera prevalence and environmental factors such as exposure of surface water to potential cholera reservoirs (like dump sites) in Kumasi the second largest city in the Ghana. This study set out to look for the impact of surface water contamination on cholera infection and spatial mapping of surface water to determine the relationship between cholera prevalence and proximity of upstream potential cholera reservoirs. Making use of statistical Ordinary Least Squares (OLS) and GIS spatial analysis they established that surface water pollution through run-offs from dump sites play significant role in cholera infection. It

concluded that communities that were closer to dump site showed greater incidence of cholera compared with those further away.

The closest attempt at observing an economic implication of cholera was a study by Davis-Teye et al. (2014) who looked at the socioeconomic factors associated with cholera outbreak in Southern Ghana. In their study, they conducted a descriptive and unmatched case-control study for persons who suffered from cholera during the 2012 outbreak within the Osu-Klottey district. Information on individual's socio-economic, hygiene, food and water exposures were collected and used to determine the socioeconomic implication. They found that persons aged below 18 years, persons with educational level below tertiary, households that have exclusive toilet facility, the eating of cold or warm food either from home or outside home, eating food from home and access to pipe-borne water were associated all with cholera. But the study earns here and does not look at the impact in terms of the costs that households bore but only the socio and economic causal relationship of the disease within that district.

This current study adds on to the thin number of studies of this nature by establishing an economic dimension of the disease in terms of its costs and going a step further to assessing its impact rather than only observing its causal routes.

3.4.1 Costs Methods in the measurement of Cholera

From my literature search, I observed that studies focusing on the economic impact of the cholera is scant compared to that on other infectious diseases such as malaria. Most literature measuring economic impact of cholera has measured

its impact at the macro level. These have mostly looked at the loss to Gross Domestic Product (GPD) or the impact on certain sectors of the economy like tourism, exports and domestic consumption. (Suarez & Bradford, 1993; Kimball et al., 2005; IVI, 2010). At the micro level, the impact are usually measured by either households' or individuals' expenditure during an outbreak (Sarker, 2013).

Measurement of cholera's economic impact have been done through different costing procedures including; Cost analysis, cost effectiveness analysis, cost benefit analysis and cost minimization analysis. A firth method of measurement; cost utility analysis, seems to be the rarely used as my literature search did not come across the use of this measure on assessing the impact of cholera.

The earliest real attempt to measure cholera was a work done by Suarez and Brandford (1993) who conducted an extensive study of the costs on the Peruvian 1991 and 1992 cholera epidemic. They adopted a cost of illness approach in identifying the costs components of the outbreak at the macro level of the economy. They further calculated the impact on the supply channels and three demand effects: revenue from tourism, revenue from exports of goods and impact on domestic consumption. The total economic impact of the study was found to be about US$ 96.6 million; and when mortality costs are included the costs of illness increased to US$ 176.9 million. A drawback of the study however, is the use of secondary data from only public health institutions under the Peruvian Ministry of Health for its analysis. Private health facilities are not covered under the MOH and hence all patients treated in such facilities and all other facilities are

completely missed. This has a potential of underreporting and hence underestimating the actual costs.

Poulos et al. (2012) determined private (individual/household) and public (government) costs of Cholera by using a combination of hospital and community based studies in Mozambique, Bangladesh, India and Indonesia. The community based aspect of the study capture both slum and middle class neighbourhoods to present a more representative view of the study. Private costs were defined under treatment and hospitalization costs in the facility and public costs as payments for medical care and loss of earning of the patient and caregivers. They found that costs borne by the public sector was higher than private costs but private costs became significant when patients had been hospitalized. Costs of the illness to the patient formed 21% of the average monthly income and rises to as much as 65% when there is hospitalization. Direct costs among the children group exceeded indirect costs for both children and adults. This was explained by the fact that children engaged in less economic activity and therefore had lesser indirect impact in terms of costs incurred due to productivity losses. The study also found patients and caregiver lost productivity forming the largest component of indirect costs.

A study by Kirigia et al. (2009) took another dimension by calculating the short-term and long-term costs of Cholera in WHO African region. Their estimates proved a total economic loss of US$53.2 million as a result of the 125,016 cases reported in the region in 2005. Their costs included; hospitalization and treatment, laboratory diagnosis of the disease, short-term loss of earnings of patients and

their families and loss of productivity and output due to limited working ability and premature death. Similar to the work done by Suarez and Brandford (1993), reported cases were obtained from secondary sources but this time from the WHO but this presents a huge potential for underestimation due to large numbers of unreported cases. Underreporting of cholera cases to the WHO has come about as a result of a number of factors which include; challenges in conducting cholera surveillance in the developing world due to weak or poor health systems and concern in some countries about economic and social ramifications of reporting cases such as reduction in tourism and export of some goods (WHO, 2000).

Naficy et al. (1998) used cost-effective analysis to assess alternative strategies in the control of cholera in a hypothesized Sub-Saharan refugee of 5000 persons. Refugee camp situation was hypothesized because of the frequent reporting of cholera within such camps. The study tested three intervention; Preemptive therapy, Reactive therapy and Adding vaccination to either therapies. The preemptive therapy sets in motion an intervention before even a cholera outbreak begins. The reactive therapy was interventions that were adopted once an outbreak occurs. Their results showed that a Reactive therapy cost almost $270 more per death averted compared to the preemptive therapy. The combination therapies of vaccination plus preemptive and vaccination plus reactive showed a cost of $1745 and $3833 respectively per death averted. These were hugely expensive. However, the combination became more cost-effective than the single therapies when the price of vaccine fell below $0.22 per dose.

In 2009, there was an Oral Cholera mass vaccination campaign in Tansania to aid traditional preventive and treatment methods of Cholera in endemic parts of Zanzibar. To assess the cost-effectiveness of this campaign, Schaetti et al., (2012) estimated the health care provider and household costs of illness from cholera outbreaks and the costs of the mass vaccination campaign that used the two-dose Oral Cholera Vaccine (OCV) Dukoral. The results showed that the campaign was not cost-effective due to the pricing of the vaccine and the relatively low incidence of cholera.

In 2010, the International Vaccine Institute conducted similar studies in Mozambique and Bangladesh. In this study, GDP is lowered by around 2-2.5% in the year of the epidemic and 0.5-1% in the following year. This represented a loss of more than US$ 2 billion for Bangladesh and US$257 million for Mozambique. The study concluded that the shocks to labour supply resulting from the cholera epidemics in these countries was very small and was unlikely to represent significant cost.

On the other hand, Sarker et al., (2013) estimate the economic burden of cholera at the micro level focusing on costs incurred during treatment by households without looking at facility costs of treatment. The study was carried out in response to a large vaccine trial in an urban area in Bangladesh. Productivity losses due to forgone non-market activities including household chores, child care and leisure were captured by adopting either age-specific wage or an occupation-specific wage. But they ignored costing intangibles such as suffering and grief because these costs do not represent any tangible economic impact. The cost

analyses used both prospective (likelihood of cases occurring) and retrospective (occurred cases) incidence-based analyses of cholera illness per episode per household. The study found that by preventing an episode of cholera, a total cost of US$ 30.40 is averted per household. Medicine costs formed the largest share of direct medical costs and transportation costs that of direct non-medical costs. For indirect costs caregiver lost productivity were found to be greater than that of patients. This particular study is largely similar to this current study but only differs in the addition of facility level costs and addition of an assessment of the impact of cholera by income groupings.

On Ghana, Aikins et al. (2010) used cost-analysis on hospital health care cost of diarrheal disease in Northern Ghana. This study focused on the health sector perspective and captured only direct medical costs. Estimation of costs only focused on direct medical costs and only children below the age 5 were included in the study. The analysis was based on the WHO guidelines for estimating the economic burden of diarrheal disease and took a prospective approach in identifying costs. But studies like this have two main weaknesses; they are limited in capturing costs since household impact is lost and they are too generalized because diarrheal diseases are composed of different forms of intestinal diseases.

These studies have estimated the impact of cholera using different costing approaches. My study goes a step further from estimating the economic costs of cholera in Ghana, it will seek to provide comparative costs of the 2014's Cholera outbreak in Ghana using costs from one low and one high incidence district. Finally, in addition, the study will aim at assessing the burden of the outbreak on

various income groupings by observing the individual and household characteristics that causes the individual's likelihood of belonging to particular income strata.

3.5 Cholera, Portable Water, Sanitation and Poverty linkages

Between 1848 and 1854 cholera caused a quarter of a million deaths in Great Britain, primarily among the poor who regularly had limited choices in using water that were contaminated with human and animal wastes in their everyday lives (Anbarci et al. 2006). In 1993, 70% of Brazil's states reported confirmed cases of cholera with the hardest hit areas being the mostly impoverished North-eastern parts. These areas reported 87% of all cases and a 3 times higher probability of death over the national average once disease was contracted (Lima, 1994).

These four features; cholera, portable water, sanitation and poverty are intertwined and have strong linkages. Poor sanitation, portable source of water supply and the incidence of cholera all seem to stem from poverty and is evidenced by the occurrence of cholera amongst poor slum communities. The eradication of cholera is one of the key indicators of social development and yet the disease remains a global threat especially in the developing world. While the disease no longer poses a menace to countries with minimum standards of hygiene, it remains a serious challenge to countries where access to safe drinking water and adequate sanitation cannot be guaranteed (Talavera & Perez, 2009). Access to portable water is a major determinant of good health and prevention of many diseases including cholera. Inadequate drinking water does not only result

in much sicknesses and deaths but also increases health care expenditures, lowers worker productivity and school enrolment (World Bank, 1994). Talavera and Perez (2009) buttress this point stating that economic development is an important factor in the morbidity and mortality of cholera.

Furthermore, Anbarci et al. (2006) concludes that cholera and other diarrheal diseases account for 11.3% of all deaths among the poor globally marking such illnesses the second leading cause of death among the poor. This study was at a macro level and it tested the theoretical model of the need for a collective action in fighting against cholera having an increasing function of both a country's level of income and the income inequality distribution within the country. The analysis was done on 1032 annual observations from 17 relatively poor countries between the years 1980 and 2002. They found for example that collective action in providing clean portable water is an increasing function of income and inequality.

Diarrheal diseases are caused by poor environmental hygiene of water and food. Water based disease transmission by drinking contaminated water is responsible for significant outbreaks of faeco-oral diseases such as cholera, typhoid, dysentery and diarrhea (Nketiah-Amponsah et al., 2009). But poverty seems to perpetuate these conditions were due to lack of portable water supply people are faced with increased risk of contracting diseases such as cholera.

Naidoo & Patric (2002) also introduce another dimension stating that health education is difficult in countries with low literacy rates which is a common feature in developing countries. This evidence is supported in Grossman's (2000)

model which suggests that people with higher forms of education are better placed in understanding health implications and therefore make better choices regarding their health. It must be stated here that, though cholera is easily preventable if certain simple hygienic principles are followed but poor assimilation of education on the prevention and identification of the symptoms of the disease in low educated areas makes its impact great within such communities.

Further, they state that poorer countries do not have sufficient resources to provide relief during an outbreak of cholera, let alone provide education to plan for one. Contrary to this, Nations and Monte (1996) did a study on reactions towards mass media campaigns and government efforts in controlling cholera outbreaks in Northeastern Brazil. Using intensive ethnographic interviews and participant observations the found out that the non-compliance with recommended regiments had more to do with impoverished residents revolting against accusatory attitudes and actions of the elite than an outright rejection of care by the poor. Therefore education is key in the battling of the disease but in some cases certain socio-cultural factors hinder the level of influence of education.

In Ghana, Fobil et al. (2010) investigated the relationship between socioeconomic conditions and urban environmental quality in Accra drawing socioeconomic and environmental variables from the 2010 census data. The study established strong socioeconomic predictions of urban neighbourhood environmental quality and suggested that widening socioeconomic inequalities (e.g., urban unemployment,

income gaps, etc.) at household level could worsen existing urban environmental health inequalities at the community level.

GHS report of cholera outbreak in the Greater Accra (2014) identified these six risk factors; poor sanitation, unsafe drinking water, increased person to person transmission, poor personal hygiene, poor food hygiene, floods leading to contamination of domestic water sources, broken down water and waste disposal systems. All of these have their roots in poverty.

3.6 Summary of Chapter

The chapter opened with the theoretical review underpinning the study. The Grossman (1972) model and modifications by Wagstaff (1986) were discussed and its application to this study. The COI approach was thoroughly discussed and the theoretical framework for this established. From empirical review, a close association was established between cholera incidence, poverty and the lack social amenities. Despite this, there exist a gap in literature on the costs of cholera in Ghana and the impact it has on various income strata for which this study is initiated to fill.

CHAPTER FOUR
METHODOLOGY

4.0 Introduction

This chapter outlines the methodology used in the study on the costs of cholera. It describes the characteristics of the study sites, explains the selection procedure of the population and the sample size, the data collection procedure, sampling technique, ethical considerations for the work and finally, the method of analysis adopted.

4.1 Characteristics of Study Area

The Greater Accra region is the capital city of the ten administrative regions of Ghana with a population of 4,530,905 (GHS, 2014). The region has remained the most densely populated region since 1960 and has increased from 167 in 1960 to 1,236 in 2010, nearly an eightfold increase. It lies in the South East of the country along the gulf of Guinea and has miles of coastline especially in the rural parts of the region. The shores in the capital city, Accra are however mostly polluted and sanitation practices within shoreline communities are poor. The Greater Accra region is challenged by problems of equitable access to an acceptable quality of health service. The number of households sharing a single room form 20.3% of the population and 8% of all the households has no toilet facility in their homes and the practice of open defecation is mostly common (GSS, 2012).

La Dadekotopon Municipality was carved out of the Accra Municipal Area and forms part of the newly created municipalities in June 2012. The Municipality

covers an area of 36.033 square kilometres. It shares boundaries with Accra Metropolitan to the west, east: Ledzokuku-Krowor Municipal, north: La Nkwantanang-Madina Municipal and south: Gulf of Guinea. The Municipality is entirely urban and is populated by 183,528 of which 52.7% are females. It has a total of 51,154 of households and an average household size of 3.6 persons per household. Within these households children constitute the largest proportion (35.2%). One room constitutes the highest percentage of room occupancy by households with about 18.1% of households with 10 or more members occupying a single room. The main source of drinking water for these households is pipe-borne water inside dwelling (31.9%) which are complemented by other sources of usually tap water (pipe-borne outside dwelling, 30.5%; Sachet water 24.0%, Public Standpipe; 9.2% and others 4.4%). Of the population 11 years and above, 94% are literate and 6% not literate. The proportion of non-literate female (6,712) far outnumbers their male counterparts (1,887) by more than three times. The main economic activity for men involves the operation of public transport system business while majority of the women are into petty trading as well as hawking. About 60 percent of the population of La Dade-Kotopon are self-employed and are mostly into food vending, mechanical works, hairdressing, tailoring and carpentry (GSS, 2014).

Shai Osudoku district formerly Dangme West was carved out of the former Dangme district in 1988 as a result of a national re-demarcation exercise carried out in relation to decentralization reforms in the country. It is boarded by the Yilo Krobo, Manya Krobo and Asuogyaman districts in the north, to the east: Ada

West, south: Ningo-Prampram and west: Akwapim North Municipal and Tema Metropolis. It has a total land area of 1,442 square meters representing 41.5% of the regional land, making it the largest of all 16 administrative districts. According to the 2010 population and housing census the population of the district is 51,913 with males making up 48.7% of the population. About 78.7% of the district population resides in rural communities. The housing stock in the district is 8,351 and the average number of persons per house is 6.2. Literacy in the district is fairly high with 70.7% of the population 11 years and older literate. The predominance of the rural population reflects in agricultural activities forming the largest type of occupation. Although agriculture dominates the district, the leading sectors in terms of provision of revenue to the District are the quarries. The main source of drinking water is pipe-borne water outside dwelling (37.3%) and the main type of toilet facility used is bush/beach/flied (31.2%), Public toilet (30%) followed by Pit latrine (21.1%).

The Greater Accra region has been the epic-center of all outbreaks of cholera in the country since it was first reported in the country in 1970.

4.1.1 Study Sites

The study is conducted within La-Dadekotopon and Shai-Osudoku districts of the Greater Accra Region. By the close of the year 2014, health facilities within La-Dadekotopon and Shai-Osudoku had recorded 1,907 and 315 cholera cases respectively. Among the top ten affected districts in Ghana, La-Dadekotopon ranked second while Shai-Osudoku rank second from bottom. Cholera incidence in the two districts, its costs plus other considerations such as accessibility, socio-

economic conditions, rural-urban considerations, financial and time constraints of the study aided the selection criteria. Facility studies are conducted in the La General Hospital and Shai-Osudoku District Hospital. Both hospitals have same status as district hospitals for their various catchment areas and received the largest cases of patients reporting of suspected cholera symptoms throughout the outbreak period.

4.2 Data and Sampling

Household data of patients were obtained from the GHS line list for cholera outbreak. This contained names, place of residence, sex, age, laboratory test result, outcome of treatment and the telephone contact of patient. The GHS used this database in their contact tracing of cases and this same tool was used in tracing patients to their households.

For the purposes of this study, population is defined as all positive cases of cholera reported from a particular district. These form the bases for the inclusion criteria and all other households which did not suffer cases are excluded.

A purposive sampling procedure is adopted in selecting a total of 418 households; 282 and 136 from a high and low incidence area respectively (See Appendix A for the calculation of the sample size). More specifically, the sampling technique takes the form of a homogenous purposive sampling because all households within the selection must have suffered at least a case of cholera to help answer the research objectives of this study. This sampling technique is adopted because costing of a specific disease requires only households that suffered cases to be

sampled. The sampling technique is not wholly purposive as the total number of cases reported from these two districts forms the populations out of which the appropriate household samples are randomly selected.

4.3 Data Collection Procedure

Field workers were selected and trained on the structured questionnaire. A pilot survey was then conducted for all loose ends and ambiguities within the questionnaire clarified. This ensured increased consistency among field workers and increased accuracy of responses. Contacts of patients or their caregivers were selected from the GHS cholera outbreak line list and were contacted. Facility level costs were obtained from hospital administration and the district public health officer interviewed. These costs were obtained from the hospital pharmacy cost list or from their records.

4.4 Ethical Considerations

The study sought Ethical Approval from the Institutional Review Boards of the Institute of Statistical Social and Economic Research (ISSER; clearance number - ECH 033/14-15) and the Dodowa Health Research Centre (clearance number - DHRC/IRB/15//03). A letter from the Department of Economics and a copy of the proposal of the study were sent to the Greater Accra Regional Health Directorate who gave approval for participation of selected facilities.

Ethical consideration is therefore given to all households where data would be collected. Consent was sought from members of households providing

information in the form of oral and written, signed consent forms. During interviews, privacy of individual is assured and all responses were confidential.

4.5 Theoretical Framework

Health is determined by several factors of which medical care is one. These factors range from social settings within families, environmental factors such as settlement patterns, incomes, education, diet and lifestyle, to mention a few. The main crux of this study is based on Grossman's (2000) modeling of demand for health. In the model, an individual is assumed to be born with an amount of health stock that depreciates over time but can be augmented through investments in health. Health is not passively purchased from markets but is produced in combining time with purchased medical inputs. The model assumes health care to be state-dependent when an individual is in sub-optimal health. Demand for health is considered as a consumption good that is; the demand for "good health" because health is seen as a productive good by individuals that produces healthy days. On the other hand, demand for healthcare is considered as an investment good that is; demand for medical services to produce good health.

On the bases of this an inter-temporal utility function for cholera patients adopted from Grossman (2000) is represented as;

$$U_i = U(\emptyset_t H_t, H_0, Z_t), t = 0,1,2, \ldots, n \quad \ldots\ldots\ldots (1)$$

Where;

H_t = Health stock of the individual at time t

$\emptyset_t$ = Service flow per unit of stock at time t

$\emptyset_t H_t$ = Total consumption of health services at time t

Z_t = Consumption of other commodities at time *t* and

H_o = Initial stock of health

Grossman (2000), states that the length of life is determined by the quantities of health capital that is maximized subject to the production and resource constraints. Death therefore occurs when an individual health stock at a particular time is less than or equal to some minimum amount of health stock required to survive. Owing to this assumption, the individual is assumed to produce health by the amount of time he/her spends making appropriate investments in his/her health in order to live. The health of the individual however depreciates by a certain rate 'δ' which is exogenous but is a function of individual's age. The net investment in the stock of health is defined as the gross investment less depreciation of the health stock. That is;

Net $I = I_t - \delta_t H_t = H_{t+1} - H_t$ …….. (2)

I_t = Gross investment at time *t*

δ_t = the rate of depreciation at time *t* ($0 < \delta_t < 1$)

H_t = the amount of health investment the individual makes at time *t*

H_t = the amount of health investment the individual makes at time *t+1*

Similarly, consumers are assumed to produce gross investments in health and other commodities that enter into their production function as;

$I_i = I_i (M_t, TH_t; E)$……. (3)

$Z_t = Z_t (X_t, T_t; E)$…….. (4)

Where;

M_t = a vector of medical inputs purchased from healthcare system that contribute to gross investment in health.

X_t = a vector of inputs that contribute to the production of other goods (Z)

TH_t = time inputs in the production of health

T_t = time inputs for Z at time t

E = human capital or an individual's stock of knowledge that is assumed to be exogenous.

The budget constraint for goods is equal to the present value of expenditure on goods and to the present value of income over the life cycle plus the consumer's initial assets can be stated as;

$$\sum_{t=0}^{n} \frac{P_t M_t + Q_t X_t}{(1+r)^t} = \sum_{t=0}^{n} \frac{W_t TW_t}{(1+r)^t} + A_0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where;

P_t = price of medical inputs (M_t)

W_t = hourly wage rate

TH_t = Time input for health at time *t*

T_t = Time input for other communities (Z_t)

TL_t = Time lost due to illness at time *t*

A_0 = initial assets

To attain the optimal health capital from the health investments, we maximize the utility function in equation (1) subject to equations (3) to (6). Grossman (2000) finally arrives at a reduced form equation for the healthcare as;

$$InH = \alpha InM_t + \rho_H E - \delta_t - In\partial_0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (7)$$

Where ρ_H measures the percentage increase in the health production function due to a unit increase in stock of knowledge (E) and ∂_0 as the disturbance term. From equation (7), the health production function is a function of health inputs represented by M_t, human capital given by E and the depreciation rate of health (δ_t) based on age. Grossman (2000) states that wealth, wage rates, the price of medical care and age can influence health. Wealth and wage rates he said influence health positively by increasing the demand for good health but costs of medical care decrease demand for good health due to price. The effect of age and education is not so clear and ambiguous. Provided the rate of depreciation of health stock rises with age then ageing reduces both amounts of health stock demanded and health capital supplied by individuals.

Based on these assumptions under the Grossman (2000) model, price of medical goods is equated to costs of cholera treatment which are captured with the COI method. These cost components are identified and their magnitude on households and facilities determined. In determining the impact of the disease based on proportion of infection, the Tobit model presents a good advantage with the premise by the Grossman model that factors such as wealth, education and age all influence health.

4.6 Methods of Analysis

The study makes use of standard Cost-of-Illness (COI) by Rice (1966) and the WHO guidelines for estimating the economic consequences of disease and injury

(WHO, 2009): (a) the direct medical costs including institutional costs, i.e. those directly borne by affected families in addressing cholera and those borne by the health providers; and (b) the indirect costs, i.e. loss of productivity caused by cholera, which is borne by the individual or the household.

The study further examines the relationship between cholera affected households using a Tobit Regression model by observing the relevance of income categories and other household characteristics in relation to the proportion of household contraction. Household's characteristics are examined within this framework testing which income groupings bore the greatest burden of the outbreak.

The data is collected by the use of a structured questionnaire to determine households' direct and indirect costs as a result of the episode of cholera. These include costs of medical treatment, drugs, laboratory tests, transportation etc. Indirect cost is estimated based on the time lost in seeking treatment or giving care to affected household members multiplied by the average earnings of the household to determine amount of productivity loss. Household average income is determined by the summing the incomes of employed household members and then divided by the household size.

4.6.1 Direct Costs

Direct costs to the household include; first aid given to patients before the visit to the health facility; transportation costs for both patients and caregivers; consultation fees, drugs purchased, laboratory tests and treatment costs at the facility; under-the-table payments which are unofficial payments made either to

receive preferential or early treatment; feeding costs for patients; admission costs and finally, burial costs in the event of death. Summation of these costs components will give the total cost attributable to the individual and by extension the household.

Facility direct costs are measured on items used directly in the treatment of the condition including intravenous fluids, gloves (surgical and examination), given set, cannula and cotton wool. Other facility direct costs captured includes costs on Health education, supervision of burial, intervention programmes (such fumigation of toilets), disinfectants, fuel and any other payments to staff for extra hours working on patience.

4.6.2 Indirect Costs

This study draws from the Washington Panel approach in measuring indirect costs of cholera on the household. This model recommends measurement of productivity losses through quality of life measurement in terms of health effects combined with some form of friction cost. The traditional Human Capital approach which use wage rate to value productivity losses drawing from the neo-classical view that wage rates are equivalent to marginal productivity and hence all incomes earned can be equated to productivity loss. This approach has a huge drawback and removed from reality because it assumes full employment of resources. The model also assumed that replacement of workers was impossible and hence production losses continue until recovery of patient or in the case of impairment of workers ability to work in full capacity then production losses will continue until retirement. It therefore uses various proxies in the measurement of

indirect costs including average agricultural wage, income per capita, salaries, legislated minimum wage, marginal productivity calculated from a Cobb-Douglas production function among others. These methods are however poor in representing actual marginal product of labour and must be used with caution (Prescott, 1999).

In addressing this problem within the human capital approach, the Friction model evolved. This model took account of the reality of less than full employment within an economy and therefore the possibility of replacing workers. Hence, production losses were measured up until recovery or when the worker is replaced and the possible costs of replacement such as training costs.

Though the Friction model presents a useful way of capturing indirect costs with less likelihood for exaggeration of costs, it is most useful when measuring the societal impact of indirect costs. This is because the method takes a holistic view of the economy and when there is loss in production due to a worker's ailment, that worker's lost productivity and hence lost income is compensated for by the employment of a replacement. The method concludes that one's loss of income is gained by another in the economy therefore there is no loss of income within the economy but the loss is reduced to the period it takes for a replacement to be found and the costs incurred in training the replacement. This method is not most complementary to this study because the study focuses on the individual and the household's micro level cost plus facility costs. Brouwer et. al (1997) suggests that the Panel method represents the most useful approach in measuring the impact on quality of life at such a level.

The Panel method is calculated on the time lost in seeking treatment or giving care to affected household members multiplied by the average earnings of the household to determine amount of productivity loss. This method is similar to that adopted by Sarker et al. (2013) in measuring indirect cost. The time components include; travel time to facility, time spent at facility till recovery and the number of work or school days missed after recovery. Waiting time with cholera treatment is reduced to zero because all cases brought into facilities are treated as emergencies and hence are not significant to this study. To ensure that time loss estimates are not overweighed, during data collection only actively employed patients and caregivers were assumed to be losing productive hours and unemployed patients and caregivers time loss assumed to be zero. Some studies like Sacker et al. (2013) and Asenso-Okyere and Dzator (1997) monetize loss associated with children using age-specific wages calculating the loss of productivity to teenagers by halving the average daily wage of their parents and for children three forth of the parent's age. This calculation though could be useful these studies did not provide the bases for the choice of one half parent's wage for teenagers and three forth for children. Therefore these estimates cannot be assumed as a standardized generalized loss of productivity to children. In addition, loss of productivity of children might vary from country to country because the value of children's loss might be greater weighed in some countries than others. Hence, this kind of calculation is not considered in this study.

4.6.3 Model Specification (Objective 1)

The specification is based on work done by Asante & Asenso-Okyere (2003) but with modifications to suite this study. The cost of illness due to cholera constitutes resources spent on treatment, control and prevention of cholera by households and health institutions. It also includes the monetary value of output and services that are not performed as a result of the illness. These costs can be categorized into direct and indirect. The cost of illness can be expressed as;

$C = X + Y$

Where: C = Cost of Cholera, X = Direct costs associated with cholera, Y = Indirect costs.

The direct cost of illness (X) is the combination of personal, household and institutional expenditures on both treatment and control of cholera. The direct cost is expressed as;

$X = H + I + G,$

Where; H = the household costs of cholera treatment, I = the institutional cost of cholera not borne by patients and G = costs borne by government in cholera control and supplies to facility.

The household direct cost is expressed as;

$H = h_1 + h_2 + h_3 + \ldots + h_9.$

Where; h_1 = cost of first aid

h_2 = fees paid for registration and consultation

h_3 = laboratory test fees

h_4 = drugs

h_5 = transportation for patient and caretaker

h_6 = admission costs

h_7 = cost of feeding (special feeding and water)

h_8 = under-the-table payments; when there were such occurrences

h_9 = burial costs; in the event of death of patient

The institutional cost of cholera is also expressed as;

$I = b_1 + b_2 + b_3 + b_4 + \ldots + b_n$.

Where; b_1 = cholera treatment items

b_2 = extra payments to staff for overtime work where applicable

b_3 = intervention costs; Health education, supervision of burial, Fuel cost for case tracing and drugs given during outreach.

The indirect cost of illness (Y) due to cholera is the cost incurred by persons in households because they could not participate in normal working activity or the hours dedicated for these activities were limited because they were sick or caring for the sick. The indirect cost due to cholera morbidity is expressed as:

$Y = \mu (y_1 + y_2 + \ldots + y_4)$

Where; y_1 = Days of incapacitation without admission days

y_2 = time spent by patient on admission at the facility,

y_3 = time spent by caregiver caring for the sick,

y_4 = travel time to and from facility

μ = average household income's daily wage

The sum of y_1 to y_4 gives the value of productive time lost by the patient and the caregiver attributed to cholera morbidity. To do this estimation, the number of

days lost from work is multiplied by the average household income. To ensure that costs are not overestimated, estimated earnings is used to calculate this value rather than an across board daily minimum wage. All household incomes is pooled and divided by the household size to obtain the average household income. All average household incomes are summed for the two districts separately and divided by the number of households per district to obtain district average incomes. Since household incomes are collected on monthly bases and the indirect cost were being estimated on daily bases this is then divided by 8 hours to obtain the household daily wage. This ensures a standardized measure for all individuals' indirect cost calculation. This will be used in calculating the amount of wage loss or opportunity cost resulting from an episode of sickness or caregiving.

In this study, we assume a working class aged between 15 years and 60 years. All ages below 15 years and above 60 years are classified as dependent group and hence in calculating indirect costs for the dependent groups, we assume that they are not formally employed and therefore have an opportunity cost of labour of zero. This procedure has been used in similar studies such as Akazili et al. (2007). Also, household members that fall within the working class but are currently unemployed or in school will also have a zero opportunity cost of labour.

Indirect costs also include productivity lost due to premature mortality. This is defined as any death occurring before the age of 61 years, which is the average Human Development Index life expectancy at birth for Ghana. To obtain the mortality cost of cholera, the Years of Potential Life Lost (YPLL) method could

be used to estimate the value of life lost but contrary, there have been both methodological and ethical criticisms to this method because it places monetary value to human life. This has been found to be very problematic. The focus of this study is not to consider the value of individuals as a production factor and thereby equating monetary value of their output to their life.

4.6.4 Model Specification (Objective 2)

Tobit Regression model was adopted in the determination of the burden of cholera on affected households. This model is useful because of its ceiling effect and generating a model that predicts the outcome variable within the specified range. It supposes that there is an unobserved latent variable (y^*) that is linearly dependent on x_i via a parameter vector β plus an error term u_i that is normally distributed.

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

Where y_i^* is the latent variable.

$$y_i^* = \beta x_i + u_i \sim N\,(0, \sigma^2)$$

The dependent variable in this study is the proportion of household infected which is set between 0.09 (least proportion of household infection) and 1(complete household infection). This model is advantageous over models such as normal Binary models which only capture zeros or ones responses of the dependent variable and cannot cater for multiple responses. It is also a better model

compared to truncated models because it takes into account the unobserved observations within the dependent sample rather than simply cutting off data as the truncated models do. Also unlike the Ordinary Least Squares method, this model yields unbiased coefficient estimates for each of the independent variables.

The regression is modeled over a number of demographic and income category of households that were affected by the outbreak in order to access the impact of the outbreak. The general model is specified as;

$$iC = X_i\beta + \varepsilon \qquad \text{(I)}$$

$$iC = \frac{n}{N} \rightarrow \frac{Number\ of\ HH\ members\ Infected}{HH\ Size} \qquad \text{(II)}$$

Where;

iC, the dependent variable is proportion of the household members that contracted cholera during the outbreak.

The key variable of interest is household income category and additional demographic characteristics examined which include, sex, marital status, relationship with household head, age, education, health insurance status and access to portable water.

X_i is specified as $X_i = X_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots X_n$

Following the Tobit Regression model, the empirical model is specified as:

$$iC = \beta_0 + \beta_1 INC + \beta_2 SEX + \beta_3 MS + \beta_4 RHH + \beta_5 AGE + \beta_6 EDU + \beta_7 HI + \beta_8 DWS \quad \text{(III)}$$

$iC =$ Proportion of Household Infected

$INC =$ Income category

$SEX =$ Sex

$MS =$ Marital status

RHH = relationship with household head

AG = age

EDU = education

HI = health insurance status

DWS = drinking water source

4.6.5 Marginal Effects and Cross Tabulations

Marginal effects of the censored sample are calculated for the Tobit model to capture how the observed variable (proportion of household infected) changes with respect to the regressors. This will cater for the representativeness of the model by taking into account all observations whether observed or unobserved. Marginal effects are given by partial derivatives of the probability of each outcome of the dependent variable with respect to the particular explanatory variable being observed. Finally, crosstabs are run on the survey data serve as robustness and consistency checks for results observed from the regression output.

4.6.6 Selection of Variables

The dependent and independent variables for this model are chosen in accordance with findings from existing literature earlier reviewed and the objectives of this study.

INCOME

Cholera is basically seen as a disease of poverty and empirical evidence has pointed to the persistence of the disease in areas where poverty is entrenched and provision of basic amenities is deeply lacking. There is an inverse relationship between income and cholera contraction hence, increased income is expected to lessen the incidence of cholera. Households with higher levels of income can afford better sources of drinking water, more improved and less shared toilet facilities and are more likely to avoid the consumption from food vendors operating under insanitary conditions. Income is a categorical variable with persons earning the highest income (above GH¢750 per month) within the sample as the reference base. Other categories are those not earning any income at all, those earning less than GH¢ 100, between GH¢ 100 and GH¢ 350, above GH¢ 350 but less than GH¢ 750.

SEX and AGE

From literature cholera appears to have no discrimination in its infection with regard to sex or age but there exist some evidence supporting claims of gender and age disparities in the rate of infection especially due to particular behavioral and social characteristics. In this model, sex is a dummy variable with males as the reference group. Males are represented as 1 and females 0. A report by Oxfam

on Sierra Leone's 2012 outbreak suggests that "women and young girls appear to be exposed to contamination in the domestic realm, in particular during the role of caring for babies and the sick, whereas in some urban contexts, males appear to be more vulnerable to infection, presumably, due to their hygiene and eating practices on the street" (Oxfam, 2012, p.35). Particularly in Greater Accra Region, Ghana, during the recent outbreak, contraction was higher for males than females and infection seem to be clustered within the age range of 10 to 49 years but the highest infection among those between 20 to 29 years GHS (2014). Based on this, the proportion of infection among males will be expected to higher than their female counterparts.

Age is a continuous variable measured in years describing the last birthday of household members. Age of an individual is considered important in the literature towards the demand for health. Grossman's demand for health care postulates that the elderly make less investment into their health because of decreasing health stock but there exist a counterfactual where the elderly have an increased health expenditure because of depleting stock of health. Age is also an important demographic feature of individual and will demonstrate the risk and exposure of contraction of cholera. As shown by the outbreak in Greater Accra, Ghana, infections have been highest within the youthful age range and least among more dependent populations (those below 9 years and those above 60 years). Just as sex, cholera is age neutral and different studies have suggested different age ranges susceptibility. But for this study, impact is expected for increased ages and specifically for youthful populations.

MARITAL STATUS

Marital status is defined as a dummy variable. It classifies individuals into either married or not married. For the peculiarities of this study, people living together in consenting relationships are also considered under the married category. Unmarried persons have been shown to be at greater risks of contracting cholera due to their likelihood of eating from vending sources which has been identified by the GHS as one of the main factors leading to the incidence of the recent outbreak in Ghana. Also, married persons are presumed to be more careful about their lifestyles because they normally carry an extra responsibility in caring and catering for other household members and hence will be cautious in their out of home eating habits. The Ministry of Health profiling of affected men in Ghana's last outbreak showed higher incidence among unmarried men than the married counterparts.

RELATIONSHIP WITH HOUSEHOLD HEAD

Household composition is an important determinant on the impact of disease. For example the impact on heads and spouses might have greater consequences than other household dependents because there are usually "bread winners". Other dependents within the household are set as the reference base and impacted of cholera Head of the household, spouse and son or daughter regressed in relation to the base.

EDUCATION

Education also plays a key role in the contraction, prevention and cure of diseases. Cholera is no different and literature suggest higher incidence of cholera

among people with lower levels or no education than people with higher levels of education. This is simple due to their ability to assimilate and make better sanitary choices that greatly influence the contraction of cholera. Education is a categorical variable and is categorized into No education, Primary Education, Middle School or Junior High School and Higher. Higher education is set as the reference category for which the impact is accessed. Since education is key in the fight against cholera, infections among lower levels of education is expected to higher than higher levels.

HEALTH INSURANCE

Health insurance is a dummy variable and those with insurance are set as the base. Jehu-Appiah et al. (2010) have observed that poor homes have limited access to health insurance due to the issue of costs. Hence, it is expected that individuals without insurance cover will have a greater impact of cholera to their insured counterparts. But contrary to this evidence, the theory of moral hazard suggests that people with some form of health insurance tend to live riskier lifestyles due to the knowledge that their health care costs will either be totally absorbed or at least partially by a third party. Therefore the impact can be either ways, impacting greater on those insured or those not.

DRINKING WATER SOURCE

Water sources are often classified as ‘improved’ or ‘unimproved’: Sources considered as improved are piped public water into homes, public standpipe, borehole, protected (lined) dug well, protected spring, and rainwater collection; unimproved are unprotected wells and springs, vendors, and tanker-trucks (WHO

and UNICEF, 2000). Source of drinking water is a categorical dummy and inside plumbing is set as the reference base. The other categories are drinking water from water vendors, neighboring house pipe, public stand pipe and other sources. According to the WHO report on the progress of sanitation and drinking water update 2014, the safest source of drinking water is a piped water source on the household premises and most unimproved are surface water sources like ponds, rivers and dams. Hence, other water sources are compared to this reference base to assess the impact of cholera. It is expected that households using unimproved sources will have greater likelihood of cholera infections.

Table 4.1 Variables and their expected signs

Variable	**Variable Defined**	**Expected sign**
1. Income	Categorical dummy; Base Highest Income group (Above GH¢750per month) Category 1: less than GH¢ 100 Category 2: between GH¢ 100 & GH¢ 350 Category 3: above GH¢ 350 but less than GH¢ 750	+/-
2. Sex	Dummy variable; base male	-
3. Age	Continuous variable	+/-
4. Marital status	Dummy variable: base married	-
5. Relationship with HH head	Categorical dummy; base Other dependents Category 1: Head of Household Category 2: Spouse Category 3: Son/Daughter	+/-
6. Education	Categorical dummy; base highest education (above Sec.) Category 1: None Category 2: Basic Category 3: Sec/Tec/Voc.	+/-

7. Health insurance	Dummy variable with not enrolled on health insurance as base	+/-
8. Source of Drinking Water	Categorical dummy; base Inside Plumbing/Inside Standpipe Category 1: Water vendor Category 2: Neighboring house pipe Category 3: Public Standpipe Category 4: Other sources	+/-

4.7 Methodological Limitations

Some critiques have challenged the usefulness of the COI method claiming that the identification of costs does not provide enough information for policy. This argument is flawed to some degree because COI studies is the first line method in assessing economic burden in terms of costs of an ailment and its possible cost saving benefits when the disease is either eradicated or its prevalence reduced. Also, COI has an important feature of placing costs within their various segments and this helps to know which aspects of the costs are most important and attention focused.

CHAPTER FIVE
PRESENTATION AND DISCUSSION OF RESULTS

5.0 Introduction

This chapter presents demographic statistics of households selected for the study. These characteristics include; age, sex, education, income classification and etc. It also presents descriptive statistics of key variables relevant to this study and ends with an econometric estimation of the data. All descriptive statistics were from empirical results obtained from the field and were analyzed using STATA version 13.

5.1 Demographic Characteristics

The survey captured in total 1543 individuals from 418 sampled households in two districts. Out of these, 1052 and 491 individuals were within La-Dadekotopon district; the High Incidence Area (HIA) for this study and Shai-Osudoku district; Low Incidence Area (LIA) for this study respectively. In the HIA females formed 54.0% of the sample selected and in the LIA 48.9%. Within the household headship structure in these districts, 63.4% were males for the HIA and 75.5% for the LIA. In both districts, children and other dependents formed over 40% of the household composition.

Females were dominant at lower levels of education (Primary or None) in both districts but in relation to health insurance, females formed a slightly higher proportion (over 52% in both districts) of those enrolled. The mean 0.46 and 0.51 for sex in the HIA and LIA show an almost near equal proportion of males and

females sampled in the study. The mean age in both districts was 27 years. The largest household size was an 11 member household found in the HIA. The average room occupancy was 0.5 and 0.6 for the HIA and LIA respectively showing relatively more people per room in the HIA than the LIA. There is a maximum of 1 for the proportion of household infected for both districts. This indicate a situation in which either all members of a household were infected or a single member household infection but in this study the latter was the case. Table 5.1 and appendix C provide details of these variables. See appendix C, Section I for tables of demographic statistics.

Table 5.1 Descriptive Statistics of dummy and continuous variables

	La-Dadekotopon					Shai-Osudoku				
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
sex	1052	0.460	0.499	0	1	491	0.511	0.500	0	1
age	1052	**27.136**	17.398	0	85	491	**26.697**	17.991	0	95
NHIS enrolled	1052	0.476	0.500	0	1	491	0.713	0.453	0	1
Cholera infection	1052	0.285	0.452	0	1	491	0.283	0.451	0	1
Marital status	1052	0.326	0.469	0	1	491	0.387	0.488	0	1
Proportion of HH infected	281	0.342	0.164	0.09	1	137	0.354	0.179	0.1	1
Number of rooms	281	1.491	0.975	1	13	137	2.015	1.430	1	10
HH size	281	3.733	1.627	1	11	137	3.577	1.670	1	10

5.1.1 Cholera Infection

The total of 1542 persons were affected by the outbreak of which 439 (28.5%) were infected by cholera of which 300 (19.4%) were from the HIA and 139 (9.0%) from the LIA. Infection among females was slightly higher (52.3%) in the HIA but the inverse persisted in the LIA (51.1%). Infection rates were highest in

the 20 to 29 years age category where as many as 109/438 (24.9%) persons were infected. The youthful age category (between 10years to 49 years) recorded the highest incidence of the disease and together they formed 69.4% of all cases. Adults above 60 years were the least people affected by the disease with not more than 6% of total infections. The mean proportion of household infection was 0.2 and 0.4 for the HIA and LIA respectively showing a higher relative proportion of household infection in the LIA than the HIA. This can be well explained by the slightly higher mean household size of 3.7 in the LIA compared to 3.6 in the LIA. See appendix C, Section II for tables on Cholera Infection.

5.1.2 Infection; Household heads, Sex, Age, Education and Income level

Household heads play an important role in the social and economic setup of the family. In most cases they are “breadwinners” of their home and most often the impact of their incapacitation due to disease is heavy. In all households, 67% of the household heads were males and females 33%. Of the total 439 persons infected, 147 (33.5%) where heads of household and they formed the second highest percentage of those infected with the highest persons being dependents (36.5%) who were children of the head of household. For all those infected, there was an almost 50% split between males and females who contracted cholera but the females slightly edged the males by 2.6%.

A large proportion of those that contracted cholera fell within age categories less than 50 years (over 85% of all infections). Literature shows an inverse relationship between cholera infection and education. With higher levels of education people are more likely to make better sanitary choices and avoid

diseases than those with lower forms of education or no education. Household members with educational levels lower than secondary recorded 75.6% of all infections cases. In terms of infections and income quintiles, persons within households of the poorest income quintiles had 45.6% of total infection which was the highest percent of infection among the income categories. These comprised of children who did not earn any income and adults who were currently unemployed. The highest income category (that is those who earned above GH¢750) had the least percentage of infection (3.9%). Infection rates in the income categories that fall between the highest categories and lowest category showed mixed infection rates. Persons in the middle income category (those earning above GH¢100 but less then GH¢350) had 21.2% of all infection followed by those of the fourth category (17.3%) then followed by those of the second category (12.1%). This implied a mixed infection within income categories. See appendix C, Section III for tables.

5.1.3 Infection; Location, Access to portable water sources and Access to Toilet facility

Inside household plumbing or inside house standpipe is viewed as the safest source of drinking water and surface water the least safe. Majority of households (176) resort to the use of public standpipes (42.1%) followed closely by 111 households having an inside plumbing or inside house standpipe (26.6%). These two sources together account for close to 70% of drinking water sources in households. Hence access to portable water is seemly not to be a major problem in these districts. This raises questions about the handling of drinking water or

hygienic practices which might not be properly observed by households such as washing hands with soap before meals and after visiting the toilet. La-Dadetokopon had 32.4% of its households using inside plumbing whilst in Shai-Osudoku (14.6%). This evidence is counterfactual that cholera is a water related disease and is normally incidence by lack of portable drinking water.

There was greater access to toilet facility within the homes in the LIA than in the HIA. In the LIA, there was 23.6% more access to a toilet facility at home than in the HIA. In total only close to 31% of households in both districts combined have access to toilet facility in their homes. With the type of toilet facility commonly used, both districts showed a high usage of KVIP (59.1%) than any other facility. Of the 29.9% that were infected in the HIA, 23.8% did not have access to toilet facility at home; as much as 17.8% more for homes without toilet facility but this gap was considerable lower in the LIA (5.8%). See appendix C, Section IV for tables.

5.2 Direct and Indirect Costs of Cholera to Household

Direct costs were measured by simple accounting process of identifying the components of the costs and their respective expenditures summed. For example, first aid was calculated by summing all medical expenditures (specifically on drugs) made by households before patient was finally sent to the health facility for treatment. In calculating average costs at the individual level, costs incurred for each component (e.g. First aid) is divided by the number of cholera cases recorded per that district but at the household level the cost is divided by the number of households in a particular district to obtain the average household cost.

For example, the total first aid cost incurred in La-Dadetopon was GH¢ 2,236.60. This amount was obtained by summing all first aid costs incurred by households in that district. This is then divided by 300 which is the total number of cholera cases in the sample to obtain an individual average of GH¢ 7.46 for first aid. At the household level the cost is divided by 282 which was the total household sampled for La-Dadekotopon to obtain GH¢ 7.93.

Indirect costs on the other hand are calculated by transforming all missed time components into days. All time components collected in hours are summed to obtain the total hours mixed and then divided by 8 hours (official working hours) to obtain the number of days mixed. The average income for each district is calculated by summing all household incomes and dividing by the number of households within that particular district. This is then multiplied by the lost days for each component. For example, the total number of days missed by patients in Shai-Osudoku was 655, this is multiplied by GH¢26.90 which is the average income for Shai-Osudoku to obtain GH¢17,619.50, as the Household Daily Total Indirect Cost. This amount is further divided by 136 (the number of households in the district) to obtain the Household Daily Average Indirect Cost (GH¢129.56).

5.2.1 Direct Cost of Cholera within Higher and Lower Incidence Areas

The total direct cost incurred by households in La-Dadekotopon and Shai-Osudoku amounted to GH¢96,444.30 (USD 30,138.84) and GH¢26,991.30 (USD 8,434.78) respectively. In both districts, treatment cost formed the largest component of all direct cost, 49.49% in La-Dadetopon and 47.74% in Shia-Osudoku. This observation is relevant because cholera treatment costs at facilities

during the outbreak were supposed to be free, but hospitals reported shortages of treatment materials and hence patients needed to pay from out-of-pocket. When admission costs are added to treatment costs, household medical expenditure shoots up by 24% in both districts. Besides the medical (treatment and admission) costs, feeding costs represented the highest form of non-medical direct costs (GH¢11,658.00 and GH¢3,684.00 in La-Dedakotopon and Shai-Osudoku respectively). There were six death cases reported in La-Dadetokopon but none in Shai-Osudoku from sampled households. These deaths cost a total of GH¢18,820 (USD 5,881.25) for burial and when included in costs for the HIA it shots up to GH¢115,264.30, a 16.3% increase in the total cost.

Table 5.2 Direct Costs in High and Low Cholera Incidence area

Direct Cost	La-Dadekotopon		Shai-Osudoku		Total	
	GH¢	USD$	GH¢	USD$	GH¢	USD$
First Aid	2,236.60	698.94	283.80	88.69	3,219.34	1,006.04
	(2.32)		*(1.05)*		*(2.10)*	
Treatment at Facility	47,729.00	14,915.31	12,885.00	4,026.56	75,529.31	23,602.91
	(49.49)		*(47.74)*		*(49.18)*	
Feeding	11,658.00	3,643.13	3,684.00	1,151.25	18,985.13	5,932.85
	(12.09)		*(13.65)*		*(12.36)*	
Admission	22,637.00	7,074.06	6,470.00	2,021.88	36,181.06	11,306.58
	(23.47)		*(23.97)*		*(23.56)*	
Transportation (Patient)	5,912.00	1,847.50	1,410.00	440.63	9,169.50	2,865.47
	(6.13)		*(5.22)*		*(5.97)*	
Transportation (Caregiver)	6,271.70	1,959.91	2,258.50	705.78	10,490.11	3,278.16
	(6.50)		*(8.37)*		*(6.83)*	
Total	**96,444.30**	**30,138.84**	**26,991.30**	**8,434.78**	**123,435.60**	**38,573.63**

Source: Survey Data; Author's computation from Excel

**Italic & bracket figures are percentages*

*Exchange rate: 1USD = GH¢3.20 (Exchange rate as at December 31, 2014)

At the individual level, a person incurred a total average cost of GH¢321.48 (USD 100.46) in direct costs per episode of cholera in the HIA. This cost rose to GH¢342.00 (USD 106.88) when the average cost is considered at the household level. In the LIA, the direct average cost to the individual was GH¢194.18 (USD 60.68) and GH¢198.47 (USD 62.02) at the household level but was much higher in the HIA, GH¢321.48 (USD 100.46) at the individual level and GH342.00 (USD 106.88) at the household level. These household costs were significantly higher (more than two folds higher in the LIA and more than three folds higher in the HIA) than the average costs reported by Sarker et al. (2013) in Bangladesh where average cost of cholera to the household amounted to USD 30.40.

The average expenditure by the household on treatment in the HIA was GH¢169.25 (USD 52.89) per episode of cholera. This was markedly lower (GH¢94.74 or USD 29.61) in the LIA.

Table 5.3 Individual and Household Direct Average Costs for HIA

	Individual Average Direct Cost				HH Average Direct Cost			
	La-Dadekotopon		Shai-Osudoku		La-Dadekotopon		Shai-Osudoku	
	GH¢	USD	GH¢	USD	GH¢	USD	GH¢	USD
First Aid	7.46	2.33	2.04	0.64	7.93	2.48	2.09	0.65
Treatment	159.10	49.72	92.70	28.97	**169.25**	**52.89**	94.74	29.61
Feeding	38.86	12.14	26.50	8.28	**41.34**	**12.92**	**27.09**	**8.47**
Admission	75.46	23.58	46.55	14.55	80.27	25.09	47.57	14.87
Transportation (Patient)	19.71	6.16	10.14	3.17	20.96	6.55	10.37	3.24
Transportation (Caregiver)	20.91	6.53	16.25	5.08	22.24	6.95	16.61	5.19
Total	**321.48**	**100.46**	**194.18**	**60.68**	**342.00**	**106.88**	**198.47**	**62.02**

Source: Survey Data; Author's computation from Excel

*Exchange rate: 1USD = GH¢3.20 (Exchange rate as at December 31, 2014)

In all, average direct costs components were higher in the HIA than the LIA. This was due to the private purchases of treatment materials that occurred in the HIA, where because of shortages patients had to purchase some treatment materials from private sources rather than free treatment. First aid cost was relatively small (less than GH¢10.00) for both districts and represented the least amount spent during an episode of cholera. This is in consonance with the suddenness of the onset of cholera with healthy individuals becoming critically ill within few hours and hence need to be rushed quickly to the hospital. In general, average direct cost in the HIA is almost 2 times more than that of the LIA, signaling a proportional increase in costs with higher incidence. Cost compositions from findings of Sarker et al. (2013) study, suggest transportation costs to be the largest component of direct non-medical costs (USD 1.90) followed by caregiver costs (USD 1.50) before feeding costs (0.80). This situation is only somewhat different to that which persists in Ghana. When transportation costs are aggregated for patients and caregivers they cost USD 13.50 which is higher than feeding costs (USD 12.92) but there are no costs attributed to caregiver payments. This is not a normal practice in Ghana, because most often caregivers are relatives of sick patients and are not paid caregivers. Caregivers in turn only incur indirect costs associated with days missed away from normal economic activity.

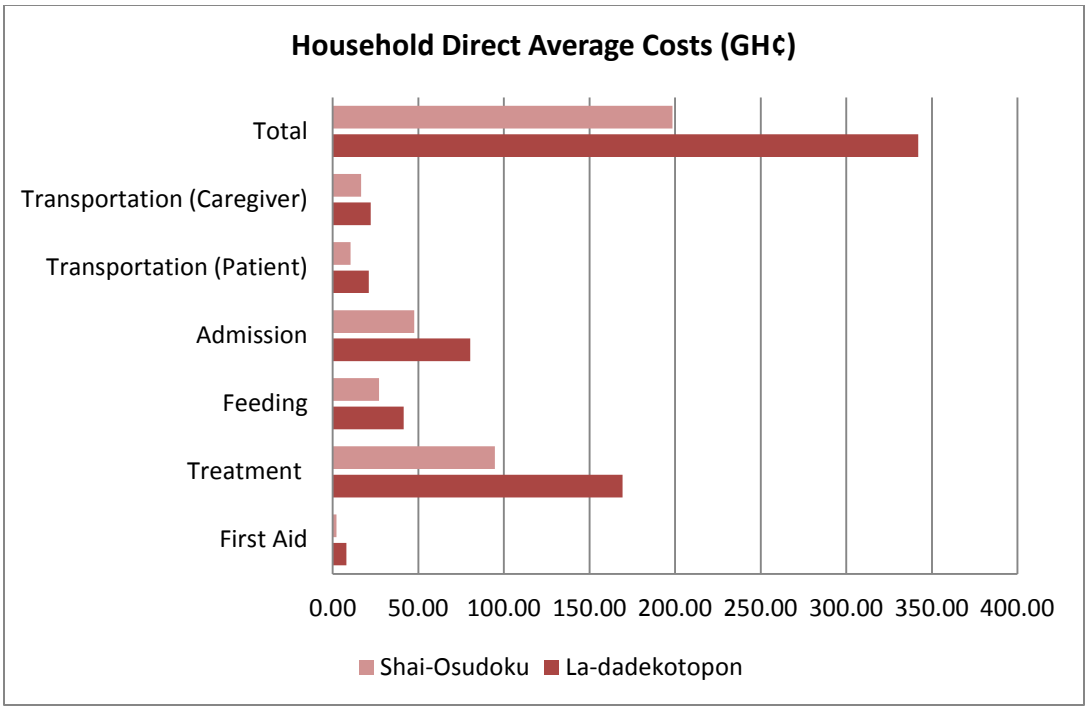


Figure 5.1 Household Direct Average Costs in High and Low Incidence Areas
Source: Survey Data; Author's computation from Excel

5.2.2 Indirect Cost of Cholera within Higher and Lower Incidence Areas

The survey found average daily wage for households in Shai-Osudoku to be higher (GH¢26.90) but the district's average household size (3.6) smaller than that in La-Dadekotopon (GH¢22.80; 3.7). These have bearings on the estimation of costs within these two districts since with higher average incomes the opportunity cost away from work would be much greater compared to that in the LIA. Also, because incomes are averaged by the household size; larger household sizes mean lower per capita income within that household therefore indicating a greater burden of the disease on that household.

In both districts, days missed by patients during recovery formed the largest composition of indirect costs but was 1% higher in La-Dadetokopon. Indirect

costs associated with travel time was not significant in both districts and is explained by existence of fairly easy access to transportation in both districts and even though Shai-Osudoku is rural, its proximity to the capital Accra makes transportation means much better than that which pertains in most typical rural settings. Average admission days was the same for both districts (3 days) but admission days formed a larger composition of total indirect cost in the LIA (25%) than the HIA (19%) but interestingly, patients from LIA spent an average of 5 days away from normal activities, 2 days lesser than in the HIA (7 days). These suggest that complete recovery was much faster and better in the LIA than the HIA.

Total productivity loss by patients was GH¢ 141, 656.40 and GH¢ 56,293.20 in HIA and LIA respectively. That of caregivers was GH¢56,293.20 (HIA) and GH¢28,809.90 (HIA). Together these costs formed more than 70% of indirect cost composition.

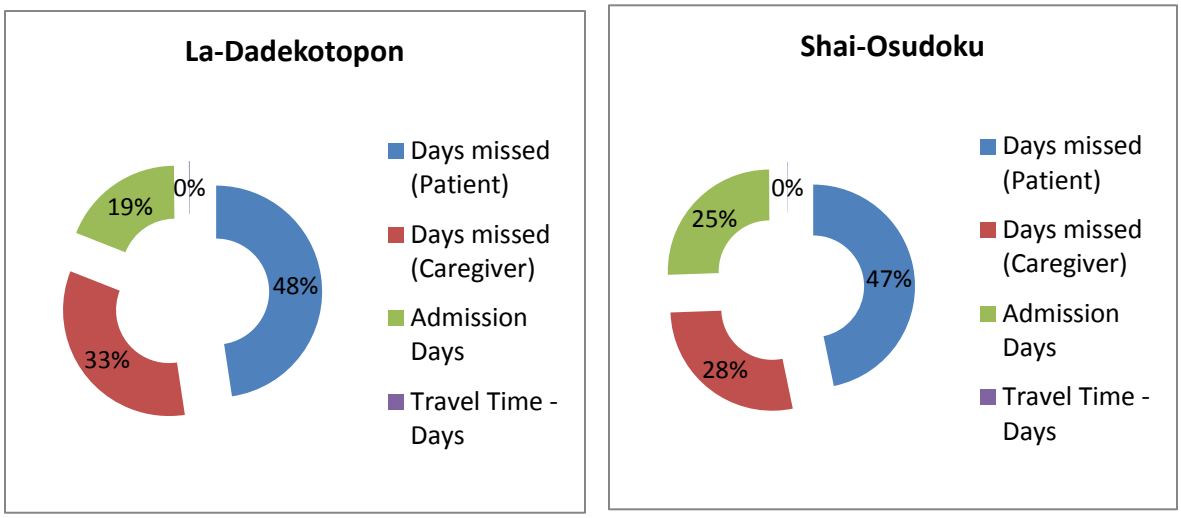


Figure 5. 3 & 5. 4 Graph of the composition of Indirect Cost for high and low incidence areas.
Source: Survey Data; Author's computation from Excel

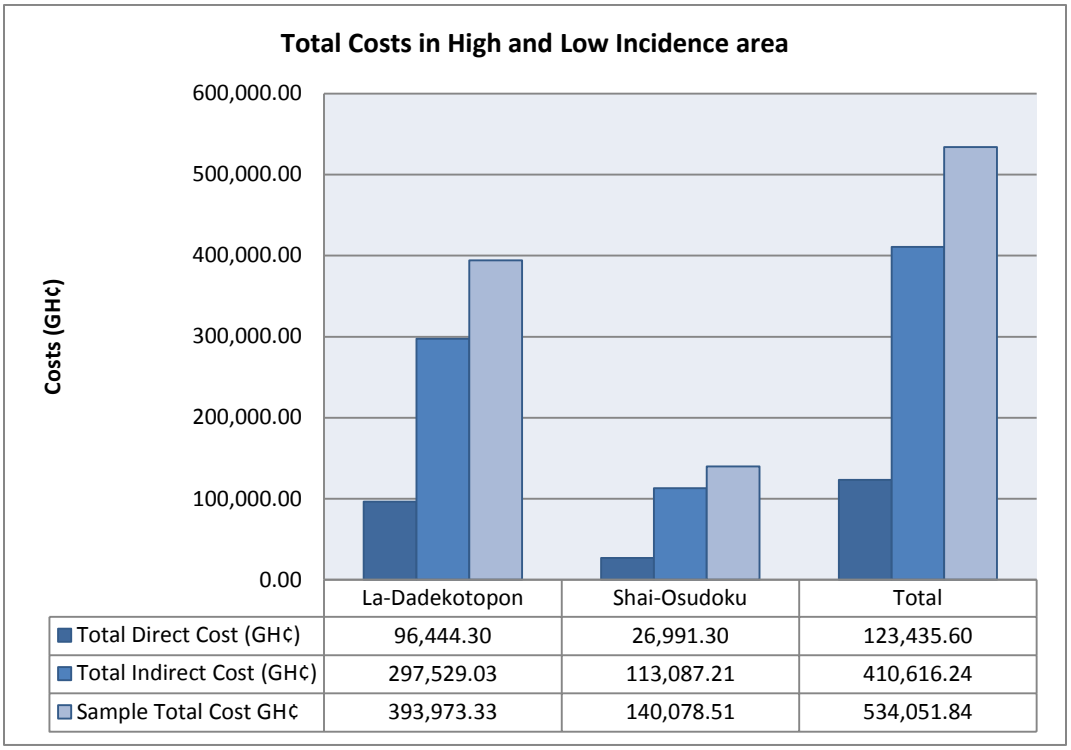
From Table 5.4, an average 25 days were missed in total by patients and caregivers away from their normal economic activity in the LIA but this was almost doubled in the number of days missed in the HIA (48 days). This translated into GH¢11,055.07 and GH¢831.52 average indirect cost for the selected sample in La-Dadekotong and Shai-Osudoku respectively. Indirect costs in La-Dadekotong were greater for all components than in Shai-Osudoku with the exception of costs associated with productive days missed by caregivers.

Table 5.4 Days missed by Patients and Caregivers with Indirect Costs in High and Low incidence areas

		Days missed (Patient)	Days missed (Caregiver)	Admission Days	Travel Time (Days)	Total
La-Dadekopon		**2071**	**1451**	**823**	**5**	**14409**
	Average	*6.90*	*4.84*	*2.74*	*0.02*	*48.03*
Shai-Osudoku		**655**	**388**	**357**	**1**	**6816**
	Average	*4.71*	*1.41*	*2.57*	*0.00*	*24.79*
	Total	**2726**	**1839**	**1180**	**6**	**5751**
		GH¢	GH¢	GH¢	GH¢	GH¢
La-Dadekopon	HH Total Indirect Cost	141,656.40	56,293.20	99,248.40	331.03	297,529.03
Shai-Osudoku	HH Total Indirect Cost	52,858.50	28,809.90	31,311.60	107.21	113,087.21
La-Dadekopon	HH Average Indirect Cost	502.33	199.62	351.94	1.17	1,055.07
Shai-Osudoku	HH Average Indirect Cost	388.67	211.84	230.23	0.79	831.52
	Difference	113.66	-12.22	121.71	0.39	223.54

Source: Survey Data; Author's computation from Excel

In Figure 5.5 all costs are summed and represented by the incidence area. It shows household costs of GH¢393,973.33 and GH¢140,078.51 for sample selected in La-Dadekotopon and Shai-Osudoku districts respectively during the 2014 cholera outbreak in Ghana. In La-Dadekotopon indirect costs was markedly greater (above GH¢200,000 more) but in Shai-Osudoku just slightly above GH¢65,000.



	La-Dadekotopon	Shai-Osudoku	Total
Total Direct Cost (GH¢)	96,444.30	26,991.30	123,435.60
Total Indirect Cost (GH¢)	297,529.03	113,087.21	410,616.24
Sample Total Cost GH¢	393,973.33	140,078.51	534,051.84

Figure 5.5 Total Costs in High and Low cholera incidence areas.
Source: Survey Data; Author's computation from Excel

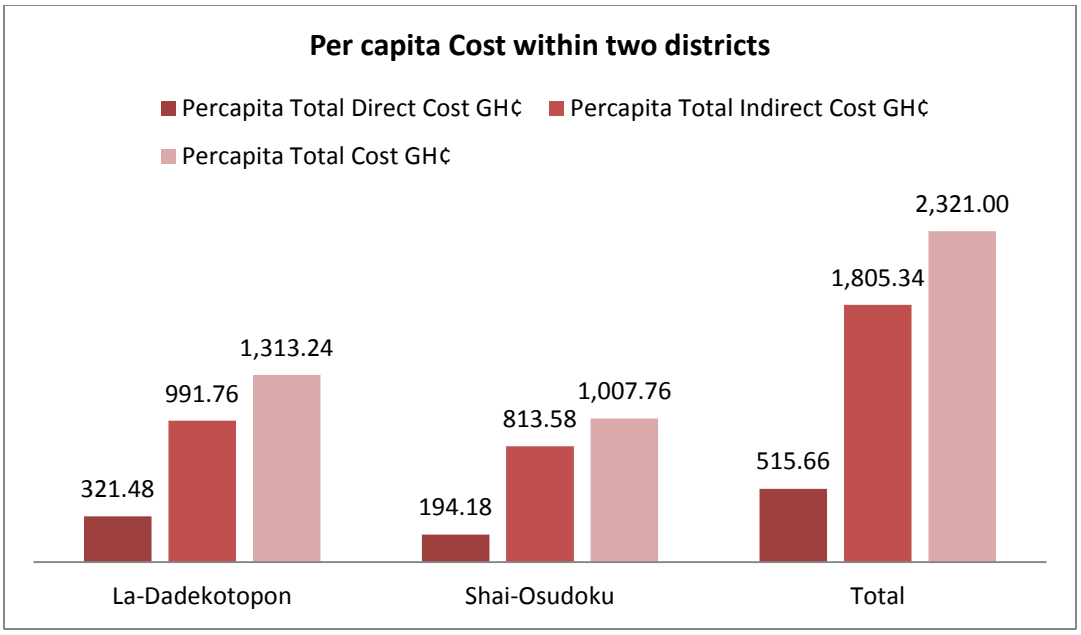


Figure 5.6 Per capita cost in High and Low incidence area.
Source: Survey Data; Author's computation from Excel

In total, 2,222 cholera cases were reported in health facilities; HIA (1907) and LIA (315). These included cases of individuals who were from other districts but sought treatment within the selected districts. When costs are projected for the total number of cases reported for both districts, the total cost of the 2014 cholera outbreak in these areas GH¢2,504,357.12 (USD 782,611.60) and GH¢317,444.10 (USD 99,201.28) for HIA and LIA respectively. Hence, if cases are reduced to levels of the LIA, cost saving will be GH¢2,186,913.02 (USD 683,410.32).

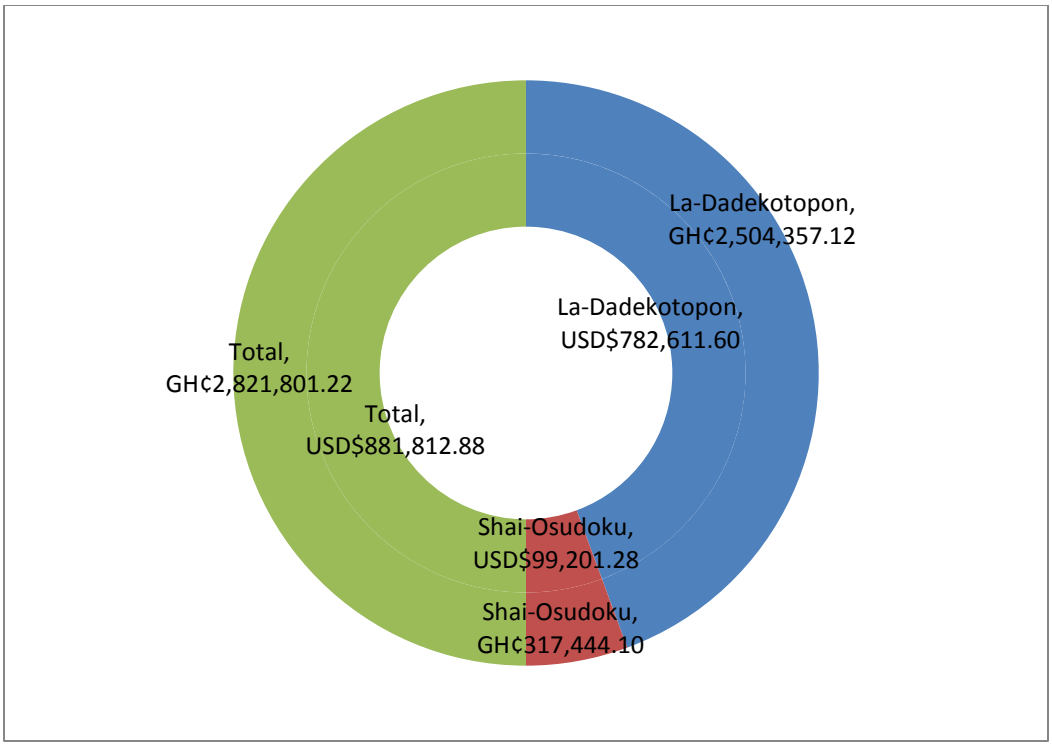


Figure 5.1 Total Cost of 2014's Cholera Outbreak in High and Low Incidence Area.
Source: Survey Data; Author's computation from Excel

5.3 Facility Costs in High and Low Incidence areas

Facility costs in treating one cholera patient included items such as gloves, IV Fluids, given set, cotton wool, surgical gloves, spirit and cannular. Treatment of cholera during the outbreak was covered by the government and facilities were to bear no costs but facilities still bore extra costs in providing these items when there were shortages. The average cost of treatment in La General Hospital amounted to GH¢35 (USD 10.94) and GH¢20 (USD 6.25) in Shai-Osudoku District Hospital, these amounts when multiplied by the total number of cholera cases treated at these facility (regardless of which district patient came from; 1907 in HIA and 315 in LIA) amounted to a total of GH¢66,745 (USD 20,862.58) and

GH¢6,300 (USD 1,968.75) in La General Hospital and Shai-Osudoku District Hospital respectively. Other costs such as physician and nurses time costs and facility physical structure use were not easy to capture due to the shared nature of these costs.

5.4 Correlates of Cholera incidence using Tobit Regression Model

The Tobit model estimates linear relationships between variables when there is either left or right-censoring in the dependent variable and also called censoring from below and above, respectively. Censoring from above takes place when cases with a value at or above some threshold, all take on the value of that threshold, so that the true value might be equal to the threshold, but it might also be higher. In the case of censoring from below, values those that fall at or below some threshold are censored.

In this study, the dependent variable (proportion of household that contracted cholera) is censored from below at 0.09 proportion of household infection. The highest value in the censored range is 1 and represents an entire case of complete household infection and 0.09, the least proportion of household infection. These proportions represent the level of incidence within these households and this is calculated on the number of household members who contracted per the household size. The tobit regression model gives a useful advantage by truncating off the proportion of household that did not contract cholera from the regression in order to access more appropriately the impact incidence. Hence, because all households within the sample experienced at least a case of cholera, the regression captures the observation at the household level. After the estimation,

marginal effects are calculated on the censored sample to adjust for the representativeness in the sample.

A multicollinearity test is run using a correlation matrix to determine if two or more of the explanatory variables are highly correlated. Multicollinearity becomes a problem in a model when the pair-wise correlation coefficient is greater than or equal to 0.8 (Gujarati, 2006 pp.372). When the test was run for the model in this study, none of the variables had a correlation coefficient up to 0.8 with each other and hence the model passes this test. (See Appendix B for correlation matrix).

In addition, a tobit regression estimation from STATA also runs Likelihood Ratio Chi-Square test in determining whether all predictors' regression coefficients in the model are simultaneously zero. Per the model, the probability chi^2 is 0.000 and shows that the overall significance of model at 1 percent. Though the model reports a pseudo R^2 but this is equivalent to the R^2 found in an OLS regression which is the proportion of variance of the response variable explained by the predictors, the pseudo R^2 is usually not attached much importance. Table 5.5 shows the tobit regression output and calculated marginal effects for the censored sample indicating the impact of the recent outbreak of cholera.

Table 5.5 Tobit Regression Output showing coefficients, marginal effects for censored sample, standard errors and p-values.

	Tobit Regression			Censored Sample		
Proportion of HH	Coef.	Std. Err.	P>t	dy/dx	Std. Err.	P>z
Income Grouping (Above GH¢750)						
C1: No Income	0.073**	0.032	0.022	0.019**	0.009	0.036
C2: Less than GH¢100	0.002	0.033	0.960	0.000	0.009	0.960
C3: >GH¢100 <GH¢350	0.059**	0.030	0.050	0.019**	0.009	0.037
C4: >GH¢350 <GH¢750	0.061**	0.030	0.042	0.019**	0.009	0.031
Sex (Male)						
Female	0.004	0.012	0.760	0.001	0.003	0.760
Marital Status (Married)						
Not married	0.137***	0.015	0.000	0.035***	0.004	0.000
Relationship with HH Head (Other Dependents)						
Head of HH	0.002	0.018	0.925	0.001	0.006	0.925
Spouse	-0.043*	0.022	0.054	-0.015*	0.008	0.059
Son/Daughter	0.146***	0.016	0.000	0.038***	0.004	0.000
Age	0.002***	0.000	0.000	0.001***	0.000	0.000
Education (Higher)						
None	0.008	0.036	0.820	0.002	0.009	0.822
Basic	0.017	0.034	0.619	0.005	0.009	0.610
Sec/Tec/Voc.	0.038	0.035	0.283	0.010	0.009	0.260
NHIS Enrolled (Yes)						
No	-0.015	0.011	0.167	-0.004	0.003	0.168
Drinking Water Source (Inside Plumbing/Standpipe)						
Water vendor	0.015	0.021	0.486	0.004	0.006	0.492
Neighbouring hse pipe	0.058***	0.016	0.000	0.016***	0.005	0.000
Public Standpipe	0.019	0.013	0.143	0.005	0.003	0.140
Other sources	0.004	0.027	0.879	0.001	0.007	0.880

Tobit regression	Number of obs	= 1543
	LR chi2(18)	= 315.16
	Prob > chi2	= 0.0000

Log likelihood = -3801.5065 Pseudo R2 = 0.0398

Significance levels = ***p<0.01, **p<0.05, *p<0.1

Source: Author's Survey, 2015.

Socioeconomic and demographic factors have been reported to significantly influence the vulnerability of infection among populations and contribute to epidemic spread (Ali et al., 2002a, 2002b; Borroto and Martinez-Piedra, 2000; Ackers et al., 1998; Sasaki et al., 2008; Sur et al., 2005). Also, a research report by Oxfam on gender and vulnerability to cholera in Sierra Leone states factors such as sex, age and social status are all factors that may contribute to individuals' vulnerability to cholera (Oxfam, 2013).

The regression result supports the fact that the impact of cholera is felt largest by the lower income categories. The Tobit regression output shows that with a unit increase of individuals in households of category 1 (those earning no income) there is 0.07 increase incidence of cholera infection compared to those in the highest income category (above GH¢750). The impact reduces for the categories 3 and 4 where the proportion of infection is 0.06 in both categories. All are statistically significant at 10%. These results corroborate the percentages in the crosstab calculations on the infection rates among these income categories. See results in appendix D. Both Borroto & Martinez-Piedra (2000) Talavera & Pérez (2009) studies support impacts of cholera being heaviest on the least income people and people burdened by poverty. On the other hand, when the marginal effects are calculated for the censored sample, the impact of a unit change in

income in all categories leads to the same proportion of infection (0.019) in relation to the highest income category.

Unmarried folks are more associated with eating outside of home and street food vending was seen as a key risk factor in the incidence of cholera in Accra during the outbreak. Households with unmarried persons had 0.14 greater incidence than their married counterparts. The marginal effects on the censored sample show relatively similar impact. An Oxfam research report on gender and vulnerability to cholera in Sierra Leone (2013) showed that infection rates were higher in males that were unmarried compared those that were married.

Within the household composition, the impact of cholera was greatest among dependents of household heads in the sample. There was 0.15 higher proportion of cholera incidence among this group in relation to the head of household. Spouses however had 0.04 less incidence of the disease during the outbreak.

With the level of incidence in relation to age, despite the results show statistical significance at 1% the level of impact of age is small. With an additional year in age of a household member, there is barely 0.002 greater incidence in proportion of cholera infection. Indicating the impact of age on cholera incidence is very low. But Deen et al. (2008) in a study of three cholera endemic areas (Jakarta, Kolkata and Biera) found that in all three area the impact of the disease was highest among children under five.

The incidence of cholera and sources of water cannot be exaggerated and studies such as Crooks and Hailegiorgis (2014) corroborate this fact. The safest source of

drinking water as stipulated by the WHO is piped water on premises. Nketiah-Amponsah et. al's (2009) study on the socioeconomic determinants of drinking water source in Ghana found that income increases access to piped water in residence by 29 percentage points. Asante (2003) also found a significant statistical relationship between income and access to safe or portable water. Based on these, inside plumbing and inside standpipe was set as the reference base for which other sources were estimated. In the sample for this study close to 70% of the households get their drinking water from a piped source, that is, an inside plumbing or in-house stand pipe (27.5%), tab water in neighbouring house (18.1) or public stand pipe (42.0%). These together formed 87.6% of drinking water sources that qualify as portable sources. The only water source that showed significance in relation to infection of cholera was water from neighbouring house. There was 0.058 incidence in cholera in households that had their water sources from a neighbouring house as compared to household having inside plumbing as source of drinking water.

5.5 Summary of Chapter

This chapter has discussed the findings from the study. Cholera's economic impact in Ghana is not well documented and this study set out to investigate the costs of the country's most recent outbreak at the household and facility level plus impact of that the disease had on households. These costs were assess based on direct and indirect costs resulting from cholera infection and impact on households assessed on the income categories of households plus some demographic characteristics of the households. Results from the study revealed

that costs of the disease were significantly higher in the HIA as expected but contrary to expectation, the impact of treatment costs was large despite government's efforts in making treatment of the disease free during the outbreak. Average treatment cost per household to amounted GH¢47.74 in LIA and GH¢49.49 in HIA which were almost twice the average household income in the LIA (GH¢26.90) but more than twice in the HIA (GH¢22.80). The tobit regression output clearly showed increased proportion of infection within income categories 1 (0.073), 4 (0.061) and 3 (0.059) respectively. Factors such as age, marital status, role in household and drinking water source were significant and characterized various levels of impact of the cholera episode.

CHAPTER SIX
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

6.0 Introduction

This chapter summarizes the study and presents conclusions and recommendations for policy consideration. These findings and recommendations can be the bases for action against the menace that cholera causes. Finally, the limitations of this study are outlined in the last section including areas for which future research can target.

6.1 Main findings of study

This study suggests that preventing one episode of cholera outbreak in a HIA will avert a total cost of GH¢2,504,357.12 (USD 782,611.60) or when reduced to LIA rates will reduce costs to GH¢317,444.10 (USD 99,201.28). Key findings are detailed as follows;

Firstly, total direct cost in HIA amounted to GH¢96,444.30 (USD 30,138.84) about four times lesser in the LIA (26,991.30; USD 8,434.78). Treatment costs were the largest component of direct costs in both districts (49.49% in HIA and 47.74% in LIA). With admission costs included, direct medical costs rose by 24% in both districts.

Secondly, transportation costs in both districts were not important indirect cost factors. Average admission days were the same in both districts (3 days) but

admission days formed higher composition of indirect cost in LIA (33%) compared to that of HIA (28%).

Fourly, facility costs were 10 folds higher in the HIA than in LIA. Total costs for all cases reported in the HIA health facility was GH¢66,745 (USD 20,862.58) and GH¢ 6,300 (USD 1,968.75).

Finally, factors such as income quintile, marital status, age and some drinking water sources were significant correlates with the incidence of cholera.

6.2 Contributions and Policy Recommendations of the Study

The main contribution of the study is the detailing and capturing of costs associated with cholera incidence on Ghana where a gap in literature exited. Based on detailed findings, the following recommendations are made;

One, costs of cholera for Ghana have been clearly defined by this study hence, policy implementers have a firm footing backed with figures from the study to make claims for appropriate interventions like investments into cholera vaccines or investments in appropriate drainage systems seeing the grave financial impact these outbreaks cause.

Two, findings revealed that treatment costs formed the greatest composition of direct cost regardless of the fact that treatment costs for cholera during the outbreak was declared free by the government. The study has shown a gap in policy and its implementation and the need for government and other related non-governmental organizations making investments into cholera related issues to ensure correct implementation of their policies. Additionally, the government needs to do an assessment on whether its policy intervention such as free treatment is faced with challenges and if so, the best strategies in overcoming this.

This information is critical in guiding government and other agencies financial budgeting in curbing the impact of future outbreaks.

Three, in both districts indirect cost were more than twice that of direct costs on households. This prelude that impact of the disease leads to huge indirect income losses to both patients and caregivers. Therefore to lessen such impacts, social intervention packages such as free feeding can be put in place to mitigate the impact of the disease on the household.

Four, the study proved that travel time was not an important factor and that most patients could easily get to facilities. Contrastingly, most deaths were as a result of patients arriving late to health facility. This indicates that most deaths can be prevented if education on treatment and first aid procedures is intensified. Most affected persons will able to make better informed choices and needless deaths will be averted. This education needs to be under by hospitals and government agencies like National Commission for Civic Education and the Information Services Department.

Five, disparities in infections at variously income strata plus other characteristics such as age, education, sex, access to portable drinking water etc. shows that issues of discrimination and equity of resources distribution needs a re-examination by government agencies if the efforts into tackling cholera incidence are to be holistically addressed. This will effectively address the problem of cholera being a disease of poverty.

6.3 Limitations of the study and areas for further research

A nation-wide study would have given a complete picture of the costs associated with the cholera outbreak in Ghana because the 2014 outbreak affected all ten regions but time and financial constraints inhibited widening the scope of the study.

These same constraints; time and finances also limited the study from doing further comparative with other disease conditions or a control group of households where there were no incidence and hence assess the relative impact of the disease and thereby establishing priorities.

Costs borne by the government is important in assessing the total cost of the disease but this information was difficult to ascertain due to the complex distributional channels hospitals receive their supplies.

Moving forward, cholera in mainly a water and waste management problem and there is a need for cost-benefit analysis of interventions such increased access to pipe water on premises, management of drainage system in preventing flooding that leads to contamination of water and costs of investments in public education to increase sanitation knowledge.

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APPENDICES

APPENDIX A: Sample Size Calculation

$S = X^2 NP(1- P) \div d^2(N -1) + X^2P(1- P)$.

S = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level

(3.841).

N = the population size. (In this case the population is the number positive cases from a particular district)

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (0.05).

Sample Size (Shai-Osudoku District); Population Size (N = 211)

$S = X^2 NP(1- P) \div d^2(N -1) + X^2P(1- P)$

$S = (3.841)\ (211)\ (0.5)\ (1\text{-}0.5) \div (0.05)^2\ (211\text{-}1) + (3.841)\ (0.5)\ (1\text{-}0.5)$

$S = 202.61275 \div 1.48525$

$S = 136$

Sample Size (La-Dadekotopon District); Population Size (N = 1063)

$S = X^2 NP(1- P) \div d^2(N -1) + X^2P(1- P)$

$S = (3.841)\ (1063)\ (0.5)\ (1\text{-}0.5) \div (0.05)^2\ (1063\text{-}1) + (3.841)\ (0.5)\ (1\text{-}0.5)$

$S = 1020.74575 \div 3.61525$

$S = 282$

APPENDIX B: Test for Multicolinearity

	incomeq	sex	marita~a	hhhrel	age	edulevel	nhisen~d	DWS
incomeq	1.0000							
sex	0.0633	1.0000						
maritalsta	0.5313	-0.0106	1.0000					
hhhrel	-0.4866	-0.1193	-0.4267	1.0000				
age	0.5559	-0.0643	0.5216	-0.5309	1.0000			
edulevel	0.4143	0.0966	0.2296	-0.2052	0.3467	1.0000		
nhisenrolled	0.0123	-0.0923	-0.0163	0.0500	-0.0255	-0.0214	1.0000	
DWS	-0.0949	0.0357	-0.0466	-0.0226	-0.0662	-0.1266	-0.0601	1.0000

APPENDIX C: Descriptive Statistics

I. DEMOGRAPHIC STATISTICS

Gender distribution within the two districts

	La-Dadekotopon			Shai-Osudoku		
Sex	Freq.	Percent	Cum.	Freq.	Percent	Cum.
0. Female	568	**53.99**	53.99	240	**48.88**	48.88
1. male	484	46.01	100	251	51.12	100
Total	**1,052**	100		**491**	100	

Household Headship and Gender distribution within the two districts

Relationship with HH Head	La-Dadekotopon			Shai-Osudoku		
	Sex			Sex		
	Female	Male	Total	Female	Male	Total
Head of HH	107	185	292	35	108	143
Percent	36.64	**63.36**	100	24.48	**75.52**	100
Total	107	185	292	35	108	143
	36.64	63.36	100	24.48	75.52	100

Household composition distribution within the two districts

Relationship with HH Head	La-Dadekotopon			Shai-Osudoku		
	Freq.	Percent	Cum.	Freq.	Percent	Cum.
Head of HH	292	27.76	27.76	143	29.12	29.12
Spouse	122	11.6	39.35	76	15.48	44.6
Son/Daughter	441	**41.92**	81.27	203	**41.34**	85.95
Other Dependents	197	18.73	100	69	14.05	100
Total	1,052	100		491	100	

Education and Gender distribution within the two districts						
Educational	**La-Dadekotopon**			**Shai-Osudoku**		
level		Sex			Sex	
complete	Female	1. male	Total	Female	1. male	Total
1. None	159	127	286	95	91	186
Percent	**15.11**	12.07	27.19	**19.35**	18.53	37.88
2. Primary	103	78	181	38	17	55
Percent	**9.79**	7.41	17.21	**7.74**	3.46	11.2
3. Middle/JSS	197	125	322	79	84	163
Percent	18.73	11.88	30.61	16.09	17.11	33.2
4. Higher	109	154	263	28	59	87
Percent	10.36	14.64	25	5.7	12.02	17.72
Total	568	484	1,052	240	251	491
Percent	53.99	46.01	100	48.88	51.12	100

Gender and Health Insurance enrolment within the two districts				
	La-Dadekotopon		**Shai-Osudoku**	
	HH members currently enrolled on any health insurance			
B2 Sex	1. Yes	Total	1. Yes	Total
0. Female	296	296	185	185
Percent	**59.08**	59.08	**52.86**	52.86
1. male	205	205	165	165
Percent	40.92	40.92	47.14	47.14
Total	501	501	350	350
	100	100	100	100

II. CHOLERA INFECTION STATISTICS

Cholera Infection per District			
Cholera	District		
Infection	La-Dadekotopon	Shai-Osudoku	Total
Not Infected	752	352	1,104
Percent	48.74	22.81	71.55
Infected	**300**	**139**	**439**
Percent	**19.44**	**9.01**	**28.45**
Total	1,052	491	**1,543**
Percent	68.18	31.82	100

Cholera infection by Gender distribution within the two districts						
	La-Dadekotopon			**Shai-Osudoku**		
		Sex		Sex		
	Female	Male	Total	Female	Male	Total

Infected	157	143	300	68	71	139
Percent	**52.33**	**47.67**	100	**48.92**	**51.08**	100

Infection among Age categories			
Age Category	Total Infected	Percent	Cum
Below 5yrs	43	9.82	9.8
5yrs to 9yrs	32	7.31	17.1
10yrs to 19yrs	71	16.21	33.3
20yrs to 29yrs	**109**	**24.89**	58.2
30yrs to 39yrs	75	17.12	75.4
40yrs to 49yrs	49	11.19	**86.5**
50yrs to 59yrs	35	7.99	94.5
60yrs & above	24	5.48	100.0
Total	438	100	

III. CHOLERA INFECTION STATISTICS, HEAD OF HOUSEHOLD, SEX, AGE, EDUCATIONAL AND INCOME LEVEL

Gender distribution in household headship			
	Sex		
Head of HH	Female	Male	Total
Total	142	293	435
Percent	**32.64**	**67.36**	100

Cholera Infection within HH		
Relationship	Number Infected	
with HH Head	Infected	Percent
Head of HH	**147**	**33.49**
Spouse	51	11.62
Son/Daughter	160	36.45
Other Dependents	81	18.45
Total	439	100

Cholera Infection by gender			
	Female	Male	Total
Infected	225	214	439
Percent	**51.25**	48.75	100

Cholera Infection by Education

Educational Level	Infected	Cum. Percent
None	126	
Percent	28.7	28.7

Basic	206	
Percent	46.92	**75.62**
Sec/Tec/Voc	96	
Percent	21.87	97.49
Higher	11	
Percent	2.51	100
Total	439	
Percent	100	

Cholera Infection and Income Quintiles		
	Infected	Cum. Percent
C1: No Income	200	
Percent	45.56	45.56
C2: Less than GH¢100	53	
Percent	12.07	57.63
C3: >GH¢100 <GH¢350	93	
Percent	21.18	**78.81**
C4: >GH¢350<GH¢750	76	
Percent	17.31	96.12
C5: >GH¢750<GH¢1000	17	
Percent	3.87	100
Total	439	
Percent	100	

IV. INFECTION; LOCATION, PORTABLE WATER SOUREC & ACCESS TO TOILET FACILTY

Drinking water source			
drinking water	Freq.	Percent	Cum.
Indoor Plumbing/Inside Standpipe	**111**	**26.56**	26.56
Water vendor	33	7.89	34.45
Neighbouring house pipe	81	19.38	53.83
Public Standpipe	**176**	**42.11**	95.93
Covered Well	15	3.59	99.52
Uncovered well	1	0.24	99.76
River/Lake/Spring/ Pond	1	0.24	100
Total	418	100	

Proportion of Household having Indoor Plumbing or Inside Standpipe per districts			
	La-Dadekotopon	Shai-Osudoku	Total
Indoor Plumbing/Inside Standpipe	355	70	425
Percent	**83.53**	**16.47**	100

Main Sources of Drinking Water per district						
	La-Dadekotopon			Shai-Osudoku		
Drinking water source	Freq.	Percent	Cum.	Freq.	Percent	Cum.
Indoor Plumbing/Inside Standpipe	91	**32.38**	32.38	20	**14.6**	14.6
2. Water vendor	11	3.91	36.3	22	16.06	30.66
3. Neighbouring house pipe	56	19.93	56.23	25	18.25	48.91
4. Public Standpipe	121	**43.06**	99.29	55	**40.15**	89.05
5. Covered Well	2	0.71	100	13	9.49	98.54
6. Uncovered well	*	*	*	1	0.73	99.27
7. River/Lake/Spring/Pond	*	*	*	1	0.73	100
Total	281	100		137	100	

* Not a source of drinking water in district

Access to Toilet Facility at home per district				
	La-Dadekotopon		**Shai-Osudoku**	
	Freq.	Percent	Freq.	Percent
1. yes	65	**23.13**	64	**46.72**
2. no	216	76.87	73	100
Total	281	100	137	

Access to Toilet Facilty at home			
	Freq.	Percent	Cum.
1. yes	129	**30.86**	30.86
2. no	289	69.14	100
Total	418	100	

Type of Toilet Facility Used by Households			
	Freq.	Percent	Cum.
1. Flush Toilet	73	17.46	17.46
2. Pit Latrine	59	14.11	31.58
3. Pan/Bucket	10	2.39	33.97
4. KVIP	247	**59.09**	93.06
5. Open Defecation	24	5.74	98.8
6. Other	5	1.2	100
Total	418	100	

Cholera Infection and Household access to toilet facility						
	La-Dadekotopon			Shai-Osudoku		
	Yes	No	Total	yes	no	Total
Not Infected	48	149	197	42	43	85
	17.08	53.02	70.11	30.66	31.39	62.04
Infected	17	67	84	22	30	52
	6.05	**23.84**	**29.89**	**16.06**	**21.9**	**37.96**
Total	65	216	281	64	73	137
	23.13	76.87	100	46.72	53.28	100

APPENDIX D: Cholera Infection Cross Tabulations

Infection Within Income Groups		
	Infected	Percent
No Income	200	**45.56**
Less than GH¢100	53	12.07
>GH¢100 <GH¢350	93	21.18
>GH¢350<GH¢750	76	17.31
>GH¢750<GH¢1000	17	3.87
Total	439	100

Infection within Household		
	Infected	Percent
Head of HH	147	33.49
Spouse	51	11.62
Son/Daughter	160	**36.45**
Other Dependents	81	18.45
Total	439	100

Infection and Marital Status		
Status	Infected	Percent
Not married	294	**66.97**
Married	145	33.03
Total	439	100

Infection and Gender		
Sex	Infected	Percent
Female	225	**51.25**
Male	214	48.75
Total	439	100

Infection within Age categories		
Age Category	Infected	Percent
Below 5yrs	43	9.82
5yrs to 9yrs	32	7.31
10yrs to 19yrs	71	16.21
20yrs to 29yrs	109	**24.89**
30yrs to 39yrs	75	17.12
40yrs to 49yrs	49	11.19
50yrs to 59yrs	35	7.99
60yrs & above	24	5.48
Total	438	100

Infection per Educational Level		
Level	Infected	Percent
None	126	28.7
Basic	206	**46.92**
Sec/Tec/Voc	96	21.87
Higher	11	2.51
Total	439	100

Infection and Health Insurance		
Insurance	Infected	Percent
0. No	191	43.51
1. Yes	248	**56.49**
Total	439	100

Infection and Drinking water source		
Drinking water source	Infected	Percent
Indoor Plumbing/Insid	120	27.33
Water vendor	34	7.74
Neighbouring hse pipe	84	19.13
Public Standpipe	185	**42.14**
Other sources	16	3.64
Total	439	100

APPENDIX E: Health Facility Questionnaire

Name of Health Facility: _____

Name of Respondent: _____

Position: _____

1. When was the first Cholera case reported in this district in 2014? ……..…
2. How many cases were reported to this facility in 2014? ……..
3. How many Cholera related deaths were recorded by facility? ……
4. How many Cholera related admissions did the facility record? ..…….
5. How much did it cost the facility to treat a Cholera patient on an average? ……
6. How much was the highest and lowest cost of treating a patient at the facility?……
7. How many Cholera cases were reported in the previous year 2013? .....
8. How many Cholera related deaths were recorded by facility that year?.....
9. How many Cholera related admissions did the facility record? ..…….
10. How much did it cost the facility to treat a Cholera patient on an average? ……
11. How much was the highest and lowest cost of treating a patient at the facility? .....……

---

12. List the items that went into treating an average patient? …….

……

……

……

……

13. How much did each item cost the facility? .....

.....

.....……

……

……

14. Which health workers worked on cholera cases? .....

.....

.....

.....

15. On average how much time did each of these staff spend on caring for cholera patients? ……

16. What is the basic salary for each of these health staff?

……

……

……

……

……..

17. How much did the facility spend directly on Cholera interventions like

    a. Health Education? GH¢……..
    b. Supervision of Burial? GH¢……
    c. Intervention Programmes (Fumigation of Public toilets)? GH¢……
    d. Disinfectants? GH¢……
    e. Fuel? GH¢……
    f. Others (Specify)?

……

……

……

……

18. What other direct expenditures did the facility make on cholera?

……

.....

.....

19. When was the last Cholera case reported in this district in 2014?……

20. Any other comments……

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APPENDIX F: Household Questionnaire

SECTION A: IDENTIFICATION PANEL									
DISTRICT NAME & CODE:	La-Dadekotopon(LD) .....1 Shai-Osudoku(SO).....2		House Number:						
NAME OF INTERVIEWER:									
DATE: / /			START TIME: :						
HH ID: (LD or SO/IntID/HH No.) : / /			**IntID: Interviewer ID**			**HH No.: Household Number**			
					18YRS>				
SECTION B: HOUSEHOLD INFORMATION									
HH ID No.	**B1: NAME** Please give the names of persons who usually live and eat in your household starting with the head of household. **Add *Name(s) of a caregiver(s) who is not a member of this HH at the bottom**	**B2:SEX** M.....1 F.....2	**B3: RELATIONSHIP WITH HH HEAD** Head of HH.....1 Spouse.....2 Son/ Daughter.....3 Son/Dau-in-law.....4 Grandchild.....5 Parent.....6 Parent inlaw.....7 Bro/Sis.....8 Other relative.....9 Not related.....10 Caregiver not part of HH.....11	**B4:AGE** Age at last birthday	**B5:MARITAL STATUS** Married.....1 Divorced.....2 Separated.....3 Widowed.....4 Living togthter.....5 Married but not living together.....6 Never Married.....7 N/A.....99	**B6:RELIGION** Christian.....1 Muslim.....2 Traditional....3 None.....4 Other.....5	**B7:EDUCATIONAL LEVEL COMPLETED** None.....1 Primary.....2 Middle/JSS.....3 Secondary.....4 Tech/Voc.....5 Higher.....6	**B8:** Is HH member currently enrolled on any health Insurance Yes.....1 No.....2 **Check insurance card for current enrolment** **Skip B9 if "2" is chosen for HH member**	**B9:** Type of Health Insurance NHIS.....1 PHIS.....2

SECTION C: SOCIOECONOMIC & EMPLOYMENT STATUS (≥15YEARS HH MEMBERS)							
HH ID No.	**C1: MAIN OCCUPATION** Public Sector.....1 Private Formal.....2 Private Informal...3 Agric.....4 Self Employed.....5 Retired.....6 Student.....7 Unemployed.....8 Other Specify.....9 **Skip to C5 If 6, 7or 8 is chosen**	**C2: APPROXIMATELY HOW MUCH INCOME DOES YOUR MAIN OCCUPATION GENERATE IN A MONTH?** Less than GH¢100.....1 ≥GH¢100 <GH¢350.....2 ≥GH¢350<GH¢750.....3 ≥GH¢750<GH¢1000.....4 ≥GH¢1000<GH¢1500.....5 ≥GH¢1500<GH¢2000.....6 ≥GH¢2000.....7	**C3: SECONDARY OCCUPATION** Public Sector.....1 Private Formal.....2 Private Informal...3 Agric.....4 Self Employed.....5 Student.....6 Retired.....7 Unemployed.....8 Other Specify.....9 NA.....99 **If NA skip to C5**	**C4: APPROXIMATELY HOW MUCH INCOME DOES YOUR SECONDARY OCCUPATION GENERATE IN A MONTH?** Less than GH¢100.....1 ≥GH¢100 <GH¢350.....2 ≥GH¢350<GH¢750.....3 ≥GH¢750<GH¢1000.....4 ≥GH¢1000<GH¢1500.....5 ≥GH¢1500<GH¢2000.....6 ≥GH¢2000.....7	**C5: HOW MUCH DID YOU EARN IN KIND OVER THE LAST MONTH?** Indicate item & amount in GH cedis		**C6: Approximately how much did you receive from other income sources like Pension, Relatives or Friends working & living elsewhere over the past 12 months?** Amount in GH cedis
ID					ITEM	AMOUNT	AMOUNT

SECTION D: HOUSEHOLD FEATURES (RECORD OBSERVATION WHERE APPLICABLE)					
D1: TYPE OF DWELLING	Single Family House.....1 Apartment/Flat.....2 Compound House.....3 Family House.....4 Other Specify.....5		**D9:** What is the main fuel used by household for cooking?	Wood.....1 Charcoal.....2 Gas.....3 Electricity.....4 Kerosene.....5 Other (specify).....6 None.....99	
D2: WHAT IS THE MAIN ROOF MATERIAL OF DWELLING	Thatch/straw.....1 Wood.....2 Corrugated Iron sheets.....3 Iron sheets.....4 Cement.....5 Asbestos.....6 Brick Tiles.....7 Other (specify).....8		**D10:** How does your HH dispose off refuse?	Waste Mgt Com.....1 Burning.....2 Rubbish dump.....3 Burying .....4 Others (specify).....6	
D3: HOW MANY ROOMS DOES HH HAVE?	Number of rooms:		**D11:** Do you have a toilet facility in your house?	Yes.....1 No.....2	
D4: MAIN FLOOR MATERIAL OF ROOMS	Earth/sand.....1 Rudimentary/Wood Planks.....2 Linoleum.....3 Cement.....4 Cement Tiles.....5 Wall-to-wall carpet.....6 Other (specify).....7		**D12:** What kind of toilet facility do most members of your household use?	Flush Toilet.....1 Pit Latrine.....2 Pan/Bucket.....3 K.V.I.P.....4 Open defecation.....5 Other (specify).....6	
D5: MATERIAL OF WALLS OF DWELLING	Earth/Mud.....1 Wood.....2 Cement.....3 Straw.....4 Burnt Bricks.....5 Other (specify).....6		**D13:** Do you normally wash hands with soap under runnning water before meals?	Always.....1 Most of the time.....2 Sometimes.....3 Never.....4	
D6: WHAT IS THE OWNERSHIP STATUS OF DWELLING	Built on squatter land.....1 Given by relative/Rent-free.....2 Provided by government/Rent-free...3 Rented.....4 Owned.....5 Other (specify).....6		**D14:** Do you normally wash hands with soap under runinng water after visiting the toilet?	Always.....1 Most of the time.....2 Sometimes.....3 Never.....4	
D7: What is the main source of drinking water in your household	Indoor Plumbing/Inside Standpipe.....1 Water vendor.....2 Neighbouring house.....3 Public Standpipe.....4 Covered Well.....5 Uncovered well.....6 River/Lake/Spring/Pond.....7 Rain water.....8 Other (Specify).....9		138		
D8: How long does it take to fetch water to & fro?	HOURS..... MINUTES.....				

SECTION E: HEALTHCARE UTILIZATION & COSTS (For HH members that contracted cholera)												
NO.	**E1:** Which member(s) of your Household suffered from Cholera last year? *Suffered.....1 Did not suffer....2 Did not suffer but a caregiver.....3* **If "Did not suffer (2)" END for that HH member**	**E2:** Where did the person "**first**" seek Treatment from? Self-treatment.....1 Hospital.....2 Traditoinal Methods.....3 Other (Specify).....4	**E3:** Did the person receive any first aid or medication before going to the facility? Yes.....1 No.....2 **If No skip to E5**	**E4:** How much did you spend on the first aid? **Amount in GH cedis**	**E5:** Did you pay (out of pocket cash) for consultation, drugs, treatment and laboratory test at facility Yes.....1 No.....2 **If No skip to E7**	**E6:** How much did you pay for these services in total? **Amount in GH cedis If answered skip to E8**	**E7:** Why did you not pay for service? Used Health Insurance.....1 FreeTreatment .....2 Could not afford.....3 Others (Specify).....4	**E8:** Did you make any under-the-table payment to receive treatment ? Yes.....1 No.....2 **If No skip to E10**	**E9:** How much did you pay for under-the-table to receive treatment ? **Amount in GH cedis**	**E10:** How much did you spend on feeding for the sick patient? **Amount in GH cedis**	**E11:** How many nights was HH member on admission ? **Number of nights the patient spent admitted**	**E12:** How many work/school days did sick person(s) miss as a result of cholera?

SECTION E: HEALTHCARE UTILIZATION & COSTS (For HH members that contracted cholera)								Caregivers Only					
NO.	**E13:** How much did the admission cost you? **Amount in GH cedis**	**E14:** By what means did you get to the facility? Taxi.....1 Trotro.....2 Walked.....3 Private Car...4 Ambulance ...5 Other Specify.....6	**E15:** How long did it take you to get to the health facility? **Time in HR:MINS**	**E16:** How much did you pay for transportation? (Indicate separate amounts for multiple patients) **Amount in GH cedis**	**E17:** Did any member of your HH die as a result of Cholera? Yes.....1 No.....2 **If No to E19**	**E18:** How much did you pay for the burial in Total? **Amount in GH cedis**	**E19:** How did your HH pay for the all expenses? Paid cash.....1 Sold Assets.....2 Borrowed money.....3 Took a loan.....4 Others (Specify).....5	**E20:** Did **caregiver(s)** do multiple visits to facility to cater for the patient? **(Either moving between the home and facility more than once within a day or over a number of days)** Yes.....1 No.....2 **If No skip to E22**	**E21:** How many times did you visit patient before he/she was discharged?	**E22**: How many days did you stay away from your normal work/school activities to take care of the patient?	**E23:** How much did caregiver(s) spend in total on transportation for these visits?	**E24:** How much time in total did **caregiver(s)** spend at the facility in multiple visits to the facility? **Time in HR:MINS**	**E25:** What is the main consequence of costs incurred as a result of cholera to the HH and the caregiver? **(Accept Multiple Responses)** Cash Shortage.....1 Less savings.....2 Loss of investment.....3 Less consumption.....4 Couldn't pay school fees.....5 Kids dropped out of sch.....6 HH members had to work more for extra cash.....7 Lost Job.....8 No Effect.....9 Other (Specify).....10
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