Economic Burden of Malaria in Ghana

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INTRODUCTION

1.1 Background

Malaria contributes substantially to the poor health situation in Africa. It is on record that, Sub-Saharan Africa accounts for 90% of the world's 300 – 500 million cases and 1.5 – 2.7 million deaths annually. About 90% of all these deaths in Africa occur in young children. This has serious demographic consequences for the continent. Between 20 and 40 percent of outpatient visits and between 10 and 15 percent of hospital admissions in Africa are attributed to malaria (WHO, 1999). This burdens the health system. In general, it is estimated that malaria accounts for an average of 3% of the total global disease burden as a single disease in 1990. In Sub-Saharan Africa (SSA), 10.8% of all Disability – Adjusted live years (DALYs) were lost to malaria in 1990. Again, among the ten leading causes of DALYS in the world in 1998, malaria ranked eighth with a share of 2.8% of the global disease burden. In SSA however, Malaria is ranked second after HIV/AIDS accounting for 10.6% of the disease burden.

According to the World Bank, Malaria accounted for an estimated 35 million DALYs lost in Africa in 1990 due to ill health and premature deaths (World Bank, 1993). This loss was again estimated at 39 million DALYs in 1998 and 36 million DALYs in 1999 (WHO, 1998, 1999, 2000). Further more, while malaria contributed 2.05% to the total global deaths in 2000, it was responsible for 9.0% of all deaths in Africa (WHO, 2002). The World Health Organisation also estimated that the total cost of malaria to Africa was US$ 1.8 billion in 1995 and US$ 2 billion in 1997 (WHO, 1997). Malaria is therefore a massive problem, which plagues all segments of the society.

The effect of malaria on people of all ages is quite immense. It is however very serious among pregnant women and children because they have less immunity. When malaria infection is not properly treated in pregnant women, it can cause anaemia and also lead to miscarriages, stillbirths, underweight babies and maternal deaths. Also, frequent cerebral malaria can lead to disabling neurological sequelae. Further, malaria in school children is a major cause of absenteeism in endemic countries. It is estimated that about 2% of children who recover from cerebral malaria suffer brain damage including epilepsy (WHO/UNICEF, 2003). Hence, among young children, frequent episodes of severe malaria may negatively impact on their learning abilities and educational attainment. This is a threat to human capital accumulation, which constitutes a key factor in economic development.

The debilitating effects of malaria on adult victims are very much disturbing. In addition to time and money spent on preventing and treating malaria, it causes considerable pain and weakness among its victims. This can reduce peoples working abilities. The adverse impact of the disease on household production and gross domestic product can be substantial. Malaria therefore is not only a public health problem but also a developmental problem. At the national level, apart from the negative effect of lost productivity on the major sectors of the economy, malaria has negative effects on the growth of tourism, investments and trade especially in endemic regions.

Malaria presents a major socio-economic challenge to African countries since it is the region most affected. This challenge cannot be allowed to go unnoticed since good health is not only a basic human need but also a fundamental human right and a prerequisite for economic growth (Streeten, 1981).

1.2 The Problem

The malaria burden is a challenge to human development. It is both a cause and consequence of under-development. In Ghana, malaria is the number one cause of morbidity accounting for 40-60% of out patient. It is also the leading cause of mortality in children under five years, a significant cause of adult morbidity, and the leading cause of workdays lost due to illness.

Despite its devastating effects, the importance of a malaria-free environment in promoting economic development and poverty reduction has not been fully appreciated in Ghana. Perhaps the reason may be that the impact of the burden of malaria has not been demonstrated in quantitative terms to convince politicians, policy makers, programme managers and development partners to devote the needed attention to this dreadful disease. The study is an attempt to provide this needed information.

1.3 Objectives of the Study

The specific objective of the study is to assess the economic burden of malaria in Ghana, that is:

(i) to estimate the impact of the burden of malaria on economic growth;

(ii) to estimate the cost of malaria illness and control; and

(iii) to determine the ability and willingness to pay for malaria control.

1.4 Methodology

Three approaches to the measurement of the economic burden of malaria are used in this study. These are:

(i) A production function for the Gross Domestic Product (GDP) of Ghana is estimated econometrically as a function of gross investment, labour force participation, malaria prevalence, and other exogenous variables.

(ii) Cost of illness is estimated in an accounting sense using direct cost of malaria, indirect cost of malaria, and institutional cost of malaria care. The data required has 2 components: micro data involving cost of illness to individuals or households and macro data involving cost pertaining to disease control programmes and

(iii) Willingness to pay for malaria care is estimated using contingent valuation method through a household survey. The odds that a household or individual will be willing to pay to avoid malaria care at a given cost is estimated by multinominal probit function. The ability to pay for malaria care is assessed through the income and expenditure structure of households that were obtained through a household survey.

1.5 Structure of the Study

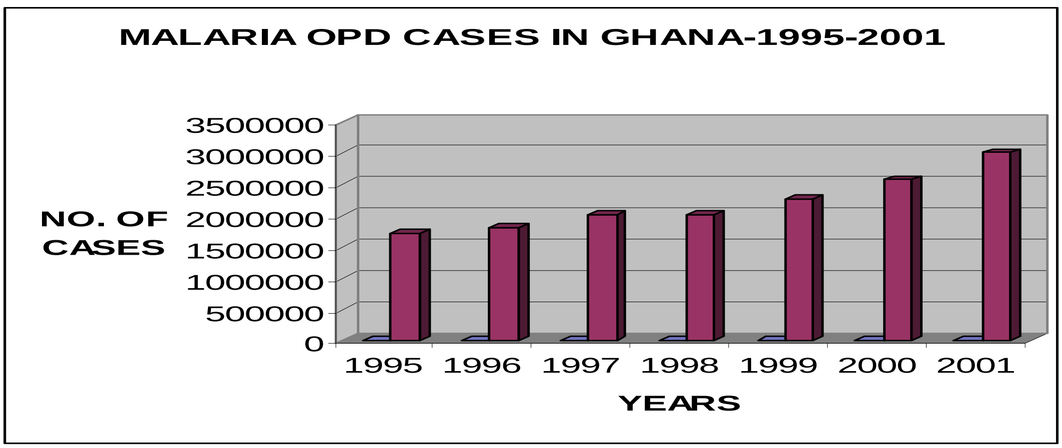
Following the introduction, section 2 presents a review of extent of malaria in Ghana. Section 3 is devoted to the data used in the study and characteristics of the study area. The impact of malaria on economic growth is presented in section 4. Sections 5 and 6 presents the cost of malaria illness and control and the willingness to pay for malaria treatment, respectively. The summary and conclusions including a discussion of the policy implications of the study is presented in section 7.

SECTION 2

EXTENT OF MALARIA IN GHANA

Malaria presents a serious health problem in Ghana. Malaria is hyper endemic in Ghana, with a crude parasite rate ranging from 10 – 70% with Plasmodium falciparum dominating. It is the number one cause of morbidity accounting for over 40 % of out-patient attendance in public health facilities with annual reported cases of about 2.2 million between 1995 and 2001 (Figure 2.1), with over 10 % ending up on admission.

Figure 2.1



Source of Data: Centre for Health Information Management, Ghana Health Service, 2003.

Malaria is a major killer in Ghana and also the leading cause of mortality among children under five years old (UNDP, 2000). The disease accounts for an average of 13.2% of all mortality cases in Ghana and 22% of all mortalities in children under 5 years. In the case of pregnant women, out of the total number reporting at the health institutions, 13.8% suffer from malaria and 9.4% of all deaths in pregnant women (Antwi and Marfo, 1998; Marfo, 2002). It is estimated that malaria prevalence (notified cases) is 15,344 per 100 000 with a malaria death rate for all ages being 70 per 100 000. In the case of the 0 – 4 years, it is 448 per 100 000 reported for the year 2000 (United Nations, 2003).

The disease is also the leading cause of workdays lost due to illness in Ghana and thereby contributing more to potential income lost than any other disease. According to Asenso-Okyere and Dzator (1997), on the average 3 work days is lost per fever episode by the patient and 2 work days by the caretaker. The value of this days lost to the management and treatment of fever per episode is US$ 6.87 and this formed about 79 percent of the cost of seeking treatment in 1994. In another study by WHO (1992) Malaria accounted for 3.6 ill days in a month, 1.3-work days absent and 6.4 percent of potential income loss in Ghana for 1988/89. The disease again is responsible for 10.2 percent of all healthy life lost from diseases, making it the chief cause of lost days of healthy life in Ghana (Ghana Health Assessment Team, 1981).

Ghana can broadly be divided into three agro-ecological zones namely, the Coastal, the Forest and the Savannah. According to the Ministry of Health (MoH), each of these zones exhibits different characteristics in relation to the vector and the parasite. Differences in temperature, rainfall and humidity patterns as well as the ecology account for these variations. Several species of the Anopheles mosquito carry the four species parasites namely, *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale* and *Plasmodium malariae*, which cause malaria in humans. Epidemiological analysis in Ghana has revealed that only three species of the *Plasmodium* are present; *Plasmodium falciparum* (80%-90%), *Plasmodium malariae* (20%-36%) and *Plasmodium* ovale (0.15%). The *Plasmodium falciparum* is thus the predominant parasite species carried by a combination of vectors. The principal vectors are the *Anopheles gambiae complex*, which is most widespread and difficult to control, and *the Anopheles funestus* accounting for 95% of all catches (MOH, 1991).

Malaria transmission is intense and perennial in the rain forest zone with slight fluctuations but the peak transmission occurs shortly after the major rainy season. Malaria is stable and the level of endemicity in the forest zone is high since favourable environment exist throughout the year for disease transmission. The principal vector is the *Anopheles gambiae complex* while the predominant parasite species is the *Plasmodium falciparum,* which is quite fatal.

The Coastal zone falls into two eco-epidemiological areas. Just along the coast is the coastal lagoons and mangrove swamps. The principal vector is the Anopheles melas, which breeds in the lagoons and swamps. The zone also lies in the Coastal Savannah which stretches from the lower Volta Region through the Accra Plains to the lower Central Region. Malaria transmission is intense and perennial but markedly reduced during the dry season especially in the coastal savannah.

The Northern Savannah zone covers the three Northern Regions of Ghana. Unlike the forest zone, the rainfall pattern there could be described as erratic. The principal vector is the *Anopheles arabiensis* while the predominant parasite is the *Plasmodium falciparum*. Though transmission is intense and perennial, it reduces during the long dry season (October to April). It has however been observed that this situation is changing since a favourable micro-climate exist in certain parts of the zone for all year round transmission.

Though malaria can strike several times in a year to an individual, it is a curable disease if promptly diagnosed and adequately treated. This rather poses a serious problem in Ghana like in many other African countries. This is because effective treatment and prevention of the disease is now expensive and at times remote from victims especially to those in the rural areas. The malaria parasite is also becoming resistant to the commonly used first and second line anti-malarial drugs and also takes long to be cured. The Chloroquine-resistant *P. falciparum* was confirmed for the first time in Ghana in 1989. The emergence of resistance might lead to a change to more expensive drugs. Very often, malaria attacks are associated with poor social, economic and environmental conditions. The main victims are the poor who are often forced to live on marginal lands. Malaria endemic communities are therefore caught in a vicious circle of disease and poverty. In a recent study in Northern Ghana, Akazili (2002) finds that while the cost of malaria care was just 1% of the income of the rich households, it was 34% of the income of the poor households.

Self prescription or medication is a widespread phenomenon in Ghana. Majority of the malaria victims only seek medical examination and treatment from health facilities when the initial attempts have failed resulting in late presentation (Agyapong, 1992; Asenso-Okyere and Dzator, 1995). Very often malaria treatments in Ghana occur at home with only a few of such home-based treatments being correct and complete. Accessibility to orthodox medical treatment in Ghana is low with per capita out patient visit of 0.46 in 2000 (MoH, 2002).

SECTION 3

DATA SOURCES AND CHARACTERISTICS OF STUDY AREA

3.1 Data Sources

The location and severity of malaria are mostly determined by climate and ecology (Gallup and Sachs, 2001). The area of potential transmission is controlled by climatic factors such as temperature, humidity and rainfall as well as the socio-economic conditions of the population. These factors influence the development of both the vector and the parasite. Thus, based on the agro-ecological zones in Ghana, three districts were selected for this study. They are (i) Bole District, in the savannah zone, (ii) Sekyere East District in the forest and (iii) Awutu-Efutu-Senya District in the coastal zone (Figure 3.1).

Both primary and secondary data were collected for the study. A field survey of the 3 selected districts was conducted between mid-March and mid-May 2003. Secondary data sources were from the Ghana Health Service, the Ministry of Health, Ghana Statistical Service and published data from the World Bank.

3.1.1 Primary Data – Field Survey

The field study was organised at two levels in order to obtain the relevant data for the cost estimation. At the micro level, a district based cross-sectional survey of households was conducted to collect the data. The population was made up of households with malaria episodes during the last one month of the survey in the selected districts. The household therefore was the unit of analysis. The household in this instance was considered as an important social and economic unit and therefore an attack of malaria on a member was a drain on the resources of the household.

Figure 3.1

A structured questionnaire was the main research instrument for the collection of primary data from the households. The questionnaire sought to gather the following data: demographic and socio-economic characteristics of households, direct cost of a malaria episode to the household (out-of-pocket expenses), indirect cost in the form of productivity lost by malaria patients, caretakers and substitute labour, protection strategies of households against malaria attack and the cost involved as well as households' standard of living. In addition, households' willingness to pay for malaria prevention and control was solicited through contingent valuation (see Appendix 1 for the questionnaire used in the survey).

3.1.2 Sampling procedure for primary Data collection

The household data needed for the study were gathered from 600 households in the three districts (200 from each district), having taken into consideration disease prevalence and accessibility. In each district, communities were randomly selected in a systematic manner with the help of the District Director of Health Service and the District Planning Officer.

In each community, screening interviews were conducted to identify households, which had experienced any illness during the last one month (reference period). The screening was done for two main purposes; (i) to establish that the reported illness was indeed malaria and (ii) to be sure that the illness occurred within the reference period. Where these two conditions were not satisfied the interview was terminated. To confirm the case, the respondent was asked to describe the illness by mentioning the major symptoms experienced especially if the patient was a child. Adult patients had to do this by themselves. Malaria was well identified in the communities, though under different local names. In addition, necessary documentation available in the household including hospital forms, prescription forms, payment receipts among others were verified.

3.1.3 Secondary Data

To obtain the institutional cost of malaria in Ghana, a checklist was used to gather the relevant secondary data (see Appendix 1 for details of the checklist). The checklist broadly sought to find the cost of malaria surveillance, detection, treatment, control and prevention to the Ministry of Health/Ghana Health Service. In the study districts, the District Hospitals were also contacted for data. Apart from data on various costs at the facility level, morbidity and mortality figures were collected. National data were collected from the office of Malaria Control Programme, the Central Medical Stores, Centre for Health Information and Management and the Policy, Planning, Monitoring and Evaluation Unit all of the Ministry of Health. In addition, official documents of the MoH, the Ghana Health Service and the WHO on malaria and related issues were also reviewed.

Other secondary data on the economy like the Gross Domestic Product (GDP), labour force, stock of capital, etc. were obtained from the Ghana Statistical Service, Penn World Tables, World Bank Tables, among others.

3.2 Characteristics of Study Area

3.2.1 Bole District

The Bole district is located in the Northern Region of Ghana. It lies in the savannah zone and occupies the extreme western part of the region. It covers an area of 9201 square kilometres. The total population of the district is 124,147 (Population and Housing Census, 2000), representing 7% of the total population of the Northern region. It has an urban population of 11.9% with Bole as its capital.

The Bole district, like the others in the northern savannah zone, experiences one major rainy season from April to October and often followed by a long dry season. The mean annual rainfall is between 80cm and 105cm. The mean temperature ranges between 27^0c

– 36^0c depending on the season. Relative humidity is also high falling between 70% - 90% in the rainy season and about 20% during the dry season.

There are a number of rivers and streams that traverse through the district but most of them dry up during the dry season. The major river serving as a boundary to the south and La Cote d'Ivoire is the Black Volta which does not dry up in the year. The vegetation of the district is predominantly Guinea savannah to the north while the southern portion is covered with dense grasses interspersed with short trees.

The principal economic activities in the district include crop farming, livestock rearing (e.g. cattle, sheep, goats, pigs, guinea fowls, etc.), commerce and fishing. The prominent crops cultivated include yam, millet, guinea corn, groundnuts and sorghum. Other important economic activities include shea-butter extraction, groundnut oil extraction, 'pito' brewing, and weaving.

The district has a public hospital and two private clinics. In addition, there are about eight public health centres serving eight sub-districts. Malaria is the number one cause of out patient attendances in the district accounting for over 51 percent of all reported cases in 2001 and 2002 (table 3.1). Due to the erratic and unpredictable rainfall pattern in the district, there are a number of small dams and ponds constructed in the district to serve people and livestock as well as for vegetable production. These water collections serve as potential breeding grounds for mosquitoes.

3.2.2 Sekyere East District

The Sekyere East district lies in the forest zone of the Ashanti region. It is located in the north-eastern part of the region. Almost 70% of the land area of the district lies in the Greater Afram Plains to the north. This part is covered with the guinea savannah woodland. The vegetation of the southern portion is moist semi-deciduous forest. The district experiences double rainfall maxima in a year but it is heavier in the southern parts. Like the rest of the forest zone, the mean annual rainfall ranges between 125cm and

200cm. The mean monthly temperature is 26^0c with a mean monthly humidity of between 70 - 80%.

Table 3.1 Major Causes of Out Patient Consultations in the Bole District, 1997-2002 (Cases Reported)

DISEASE	YEAR 1997	1998	1999	2001	2002
MALARIA	8,343(43.2)	8,816(37.4)	11,292(36.4)	22,445(52.0)	22,288 (51.0)
UPPER RESP. TRACT INFECTION	2,304(11.9)	2,496(10.6)	3,151(10)	4,158 (10.0)	4,465 (10.2)
DIARRHOEAL DISEASES	1,199 (6.2)	1,072(4.6)	2,050(7.0)	2,486 (6.0)	3,179 (7.2)
DISEASESOFSKIN /ULCERS	1,160 (6.0	1,307(5.5)	1,889 (6.0)	1,745 (4.0)	1,799(4.1)
PREGNANCY RELATED COMPLICATIONS	472 (3.2)	736(3.1)	836 (3.0)	1,652 (3.8)	1,494 (3.4)
PNEUMONIA	614 (3.2)	600(2.5)	711(2.3)	1,O84 (2.5)	1,233 (2.8)
INTESTINAL WORMS	763 (3.9)	893(3.8)	969 (3.2)	1,O29 (2.4)	1,095 (2.5)
ACCIDENTS/FRACTURE S/BURNS	1,054 (5.5)	1,097(4.7)	852(2.7)	1,125 (2.6)	1,002 (2.3)
ANAEMIA	838 (4.3)	766(3.3)	684 (2.2)	805 (1.8)	988 (2.2)
ACUTE EYE INFECTION	-	404(1.7)	--	753 (1.7)	541 (1.2)
MEASLES	655 (3.4)	-	-	-	-
TYPHOID FEVER	-	-	403 (1.3)	-	-
ALL OTHERS	1,917(9.9)	5,371(30)	8,162 (25.7)	5,186 (13.2)	5,616 (31.1)
TOTAL	19,319 (100)	23,558 (100)	31,009 (100)	43,068 (100)	43,700 (100)

Source: Ghana Health Service, Bole District, 2003.

The district is drained by the Afram, Obosom, Boumfum, Sene and the Ongwam rivers among others. The entire northern part lies in the Volta basin. In the district, there is no bridge on the Afram River, which is a major tributary of the River Volta. This situation introduces a barrier between the northern part and the south almost throughout the year. This makes accessibility to the northern part of the district very difficult especially from the district capital.

Sekyere East district has a total population of 157,396 (Population and Housing Census, 2000). This represents 4.4% of the total population of the Ashanti region. It has an urban population of 33.7%. The population is highly concentrated in the southern portion resulting in a population density of 72.8 persons per kilometre while that of the north is 7.8 persons per kilometre.

The principal economic activities in the district are agriculture and commerce. Major agricultural crops cultivated in the district include cocoa, kola nuts, plantain, cassava, cocoyam, among others. The favourable climatic and soil conditions enhance crop production throughout the year.

The district has one public hospital, one private hospital and one mission hospital. It also has over eight clinics and health posts serving various communities. Malaria is the leading cause of morbidity in the district accounting for over 60% of the out-patient consultations (table 3.2). It is also the first among the top major causes of inpatient admissions in the district with an annual average of 1666 cases (58%) between 2000 and 2003. Cerebral malaria and malaria with severe anaemia are the second cause of recorded deaths during the same period.

Table 3.2 Major Causes of Out Patient Consultations in the Sekyere East District, 1998 -2002 (Cases Reported)

DISEASE	YEAR				
	1998	1999	2000	2001	2002
MALARIA	14,057(59.6%)	15,071(63.6%)	13,760(60%)	14,929(58.7%	17,986(63.5%
HYPERTENSION	1,421 (6.0%)	1,846 (7.8%)	1,688 (7.4%)	2,524 (9.9%)	1,960 (6.9%)
ANAEMIA	474 (2.0%)	502 (2.1%)	944 (4.1%)	1,687 (6.6%)	1,460 (5.2%)
DIARRHOEA	897 (3.8%)	868 (3.7%)	1,196 (5.2%)	1,829 (7.2%)	1,320 (4.7%)
RHEUMATISM	662 (2.8%)	--	1,272 (5.5%)	1,618 (6.4%)	1,030 (3.6%)
ACCIDENTS	1,935 (8.3%)	1,210 (5.1%)	1,832 (8.0%)	1,021 (4.0%)	734 (2.6%)
GYNAECOLOGICAL DISSORDERS	546 (2.3%)	211 (0.9%)	220 (1.0%)	972 (3.8%)	848 (3.0%)
INTESTINAL WORM	691 (2.9%)	906 (3.8%)	924 (4.0%)	806 (3.2%)	688 (2.45%)
SKIN DISEASES	1,282 (5.4%)	1,302 (5.5%)	--	--	
EYE INFECTIONS	--	93 (0.4%)	--	--	1,627 (5.6%)
URTI	1,614 (6.8%)	1,702 (7.2%)	1,096 (4.8%)	29 (0.1%)	658 (2.3%)
TOTAL	32,579 (100%)	23,711 (100%)	22,932(100%)	25,415 (100%)	28,311 (100%)

Source: Ghana Health Service, Sekyere East District, 2003

3.2.3 Awutu-Efutu-Senya District

The Awutu-Efutu-Senya district is in the Central Region of Ghana and falls in the coastal agro-ecological zone. It covers an area of 417.3 square kilometres with 168 settlements. According to the 2000 Population and Housing Census, the district has a total population of 169,972 representing 10.7% of the total population of the Central region. It has an urban population of 65.5% with Winneba as its capital.

The topography of the district is characterised by isolated highlands around the Awutu sub-district, which is to the north while the south is characterised by the Senya - Winneba coastal lowlands lying in the Coastal plains. There are a number of lagoons and swamps along the coast. There are also a number of rivers and streams draining the district with the major ones being Ayensu and Gyahadze.

About 70% of the district is covered by semi-deciduous forest vegetation to the north while the southern portion is covered by the coastal savannah grassland. The district enjoys two rainfall regimes with the major rainy season occurring between April and July and recording a mean annual rainfall of over 100cm in the hinterlands. The minor rainy season is between September and November. The Coastal Plains records a mean annual rainfall of between 40cm and 50cm. The mean annual temperature is between 22^{o}C and 28^{o}C.

The leading economic activities in the district are agriculture and commerce. The coastal area is noted for fishing. Livestock rearing is predominant in the Coastal Plains. Major agricultural crops cultivated in the district include cassava, maize, cowpeas, pineapples, papaya and citrus. Food processing activities especially "gari" and cassava dough processing among women are quite popular in the district.

The district has a number of public and private health care facilities. There are three hospitals of which one is public and two private. Others include the Awutu, Kasoa, Senya and Bawjiase Health Posts serving various zones of the district. Malaria is the most dominant disease and accounts for on an average over 50% of the out-patient cases reported in the district since 2000 (table 3.3). Malaria accounted for 21.82% of the 141 recorded deaths in 2002.

Table 3.3 Major Causes of Out Patient Consultation in the Awutu-Efutu-Senya District, 2000 – 2003 (Cases Reported)

DISEASE	YEAR			
	2000	2001	2002	JAN - MAR. 2003
MALARIA	12,990 (54.2%)	19,380 (55.1%)	19,734 (48.5%)	6,710 (49.7%)
UPPER RESP. INF.	2,078 (8.7%)	4,238 (12.0%)	5,763 (14.2%)	1,313 (9.8%)
RTA	1,729 (7.2%)	1,643 (4.7%)	2,047 (5.0%)	--
DIARRHOEA	1,502 (6.3%)	1,679 (4.8%)	2,435 (6.0%)	717 (5.3%)
BITES&MINOR TRAUMA	1,488 (6.2%)	1,517 (4.3%)	2,388 (5.9%)	--
SKIN DISEASES	1,407 (5.9%)	2,480 (7.0%)	2,950 (7.3%)	1,318 (9.8%)
GASTRO. INTERSTINAL DISORDERS	1,013 (4.2%)	2,002 (5.7%)	1,501 (3.7%)	--
GYNECOLOGICAL DISORDERS	741 (3.1%)	1,092 (3.1%)	1,324 (3.3%)	648 (4.85%)
ACCIDENTS/FRACTURE/ BURNS	--	--	--	523 (3.9%)
ACUTE EYE INFECTION	--	--	--	285 (2.1%)
PREGNANCY RELATED COMPLICATIONS	423 (1.8%)	412 (1.2%)	1,228 (3.0%)	--
INTERSTINAL WORMS	--	--	1,313 (3.2%)	--
OTHER URINARY TRACT INF.	--	745 (2.1%)	--	--
DISEASES OF ORAL CAVITY	--	--	--	581 (4.3%)
HYPERTENSION/OTHER HEART DISEASES	--	--	--	702 (5.2%)
EAR INFECTIONS	612 (2.6%)	--	--	--
TYPHOID	--	--	--	693 (5.1%)
TOTAL	23,983 (100%)	35,188 (100%)	40,683 (100%)	13,490 (100%)

Source: Ghana Health Service, Awutu-Efutu-Senya District, 2003.

SECTION 4

IMPACT OF MALARIA ON ECONOMIC GROWTH

4.1 Introduction

From a macroeconomic perspective, malaria mortality and morbidity have been observed to slow economic growth by reducing capacity and efficiency of the labour force. Basic economic theory postulates that the quantity of a given output that is produced is a function of several factors including the capital stock, labour force and the quality of labour available. Based on this, it could be argued that the effects of malaria on labour diminishes total output and for that matter national income. Gallup and Sachs (2001) in a cross-country econometric estimation of the effects of malaria on national income concluded that countries with substantial level of malaria grew 1.3% less per person per year for the period 1965 - 1990. The study also confirmed that a 10% reduction in malaria was associated with 0.3% higher growth in the economy.

In a similar study to explore the impact of macro policy variables on malaria morbidity across countries and the importance of indirect effects of malaria on total factor productivity, McCarthy and Wolf (2000) found a negative association between higher malaria morbidity and GDP per capita growth rate. Most of the Sub-Saharan African countries used in the study incurred an average annual growth reduction of 0.55%. Sachs and Malaney (2002) have also observed that where malaria prospers most, human society have prospered least.

4.2 Conceptual Framework

The economic burden of malaria is the total loss or reduction in output (Gross Domestic Product), that is associated with malaria morbidity and mortality. Labour is a key input determining the quantity of output that can be produced with a given technology. Other things being equal, the greater the quantity of labour, the larger the volume of output produced. Premature mortality due to malaria reduces the quantity of labour available for production, not just in the period that it occurs, but in all subsequent periods. Malaria morbidity in contrast reduces output by increasing absenteeism from work, and by reducing work capacity or effort. According to McDonald (1950) and Wernsdofer et al. (1998), malaria attacks are a major cause of school absenteeism and this have a negative impact on long term learning capacity over time.

The relationship between aggregate output and malaria can be expressed in a production function as

$$Q = f(K, L, X, M)$$

Where,

Q is the annual volume of goods and services (GDP).
K is the capital stock or investment expenditure as a ratio of GDP.
L is labour input or workers aged 15-65 years.
M is an index of malaria for example, malaria morbidity, malaria advisory index, intensity of malaria transmission, among others.
X is a vector of other factors affecting production such as trade openness, quality of public investment, political stability, etc.

4.3 Model Specification

The study uses a recently applied approach, an application of the production function method, in which malaria is used as an explanatory variable in economic growth models in the style of Barro (1991). This method also used by Gallup and Sachs (2001) relates the growth in GDP to initial income levels (INC), intial human capital stock (HCAP), policy variables (POLICY), labour input (LAB) and a malaria index (MALARIA).

Mathematically, this is expressed as

GDP = f (INC, HCAP, POLICY, LAB, MALARIA)

Description of Variables and Sources of Data

The study uses time series data from 1984 to 2000. This period was used due to the lack of malaria morbidity data for earlier periods.

GDP, Growth in real Gross Domestic Product (GDP). Data was obtained from various issues of the State of the Ghanaian Economy Report, published by the Institute of Statistical, Social and Economic Research of the University of Ghana.

INC, initial income level, was defined as GDP per capita. Data was obtained from the Penn World Tables.

YRSEDC, a measure of the stock of human capital. This is defined as the average number of years of schooling in the total population over 15 years of age (secondary schooling). This was obtained directly, interpolated or extrapolated from Baro and Lee (1996).

EXP, Life expectancy at birth, also a measure of the stock of human capital, was obtained from various sources of United Nations publications.

LAB, the labour input (workers aged 15-65 years) is proxied by the stock of agricultural labour force in Ghana. This was obtained from the Food and Agriculture Organisation (FAO) production yearbooks.

MALARIA, malaria index, was calculated by dividing the annual malaria outpatient morbidity data obtained from the Center for Health Information Management of the

Ministry of Health by the projected population over the same period. The ratio was then divided by 1,000 to get the malaria morbidity per 1,000 and this was used as a malaria index for Ghana.

Due to data limitation from the Ministry of Health, the malaria outpatient morbidity data was from 1984 to 2000. This was obtained by summing all malaria cases reported at the out patient department in all public health facilities in the 10 regions of Ghana.

OPEN, openness of the economy or trade intensity index, a policy variable was measured as foreign trade share of GDP. That is, OPEN = (EXPORTS + IMPORTS) / GDP. EXPORTS are exports of all goods and non-factor services (free on board). IMPORTS are imports of all goods and non-factor services (cost insurance and freight). Data for the computation were obtained from World Bank (1995).

TOT, terms of trade, a policy variable was measured as the export price index divided by the import price index. Data were obtained from World Bank (1995).

4.4 Empirical Results

The model specified above was estimated as a double-log function. A Pearson Correlation between growth in GDP (GDP) and the malaria index, proxied by the malaria morbidity rate had a negative correlation of 0.367 and statistically significant at the 10 percent level using a one-tail. Table 4.1 shows the estimated results of the impact of malaria on economic growth. The coefficient of the initial income, Log (INC) on the growth in GDP is negative in models 1 and 3 and positive in models 2 and 4. In all 4 models they were not statistically significant. The stock of human capital, proxied by secondary schooling, Log (YRSEDU) is positive in models 1, 2 and 4 and statistically significant at the 5% level. Thus, a percentage increase in the years of secondary schooling will result in a 1.6% increase in the growth of real GDP. Similarly, life expectancy, Log (EXP) which is also a measure of the stock of human capital has a negative coefficient which is statistically significant at the 10% level. This implies that, a percentage increase in the life expectancy decreases the growth in real GDP by over 3.0%.

The coefficient of the malaria index, Log (MALARIA) had the expected negative sign and statistically significant at the 10% level. A percentage increase in malaria morbidity rate results in a decrease in growth in real GDP by 0.41%.

Trade openness of the economy, Log (OPEN) has a positive coefficient in models 1, 2 and 4. The coefficient for models 2 and 4 are statistically significant at the 10% and 5% levels, respectively. A percentage increase in the trade openness of the economy will lead to a 0.59% increase in the growth of real GDP. The stock of labour, Log (LAB) has a positive coefficient but not statistically significant.

Since Log (Exp) had a negative sign (which was not expected) but statistically significant, dropping it in model 3 results in all the other variables, including the malaria index, being not statistically significant. From Table 4.1, apart from model 3, the coefficient of malaria index, Log (Malaria) does not change much when variables are added or removed.

Table 4.1 Estimation of the Impact of Malaria on Economic Growth

Dependent Variable: Log. Growth in Annual Real GDP, Log (GDP)

Variable	Regression Results			
	Model 1	Model 2	Model 3	Model 4
CONSTANT	-1.437	4.892	1.456	5.987
	(-0.143)	(2.019) **	(0.723)	(1.651)
LOG(INC)	-0.720	0.086	-0.558	0.017
	(-0.524)	(0.148)	(-0.996)	(0.018)
LOG(YRSEDU)	1.614	1.601	1.101	1.691
	(2.349) *	(2.396) *	(1.560)	(2.325) *
LOG(EXP)	-3.286	-3.280	-	-3.628
	(-2.037) **	(-2.089) **		(-1.981) **
LOG(MALARIA)	-0.435	-0.412	-0.354	-0.455
	(-1.961) **	(-1.933) **	(-1.480)	(-1.865) *
LOG(OPEN)	0.426	0.593	0.388	0.689
	(1.110)	(2.140) **	(1.323)	(1.878) *
LOG(TOT)	-	-	-	-0.167
				(-0.420)
LOG(LAB)	1.313	-	-	-
	(0.651)			
R-Square	0.57	0.55	0.38	0.56
Durbin Watson (DW)	2.83	2.77	2.28	2.82

( ) t-statistics in parenthesis
* Significant at 5% level
** Significant at 10 % level

4.5 Conclusions

The study reveals that the impact of malaria on the growth in real GDP is negative and decreases (-0.41%) for every increase in the malaria morbidity rate. The significant negative association between malaria and economic growth confirms earlier studies by Gallup and Sachs (2001) and McCarthy et al. (2000). The study also shows that the impact was smaller than that found by Gallup and Sachs (2001) of 1.3% but closer to the average of 0.55% for sub-Saharan Africa in McCarthy et al. (2000). McCarthy et al. further stated hypothetically that the growth effect of eliminating Malaria Morbidity could be 0.61% for Ghana in 1988. This figure is 32.8% higher than the 0.41% result obtained by our model.

SECTION 5

COST OF MALARIA ILLNESS AND CONTROL

5.1 Conceptual Framework for the Cost-of -illness Approach

Malaria attack results in morbidity, disability and in some cases mortality. The effects of these conditions constitute the cost of illness. Andreano and Helminiak (1988) put the effects of tropical disease into perspective by providing a typology of disease effects. They classified the economic and social impacts of tropical diseases into four as;

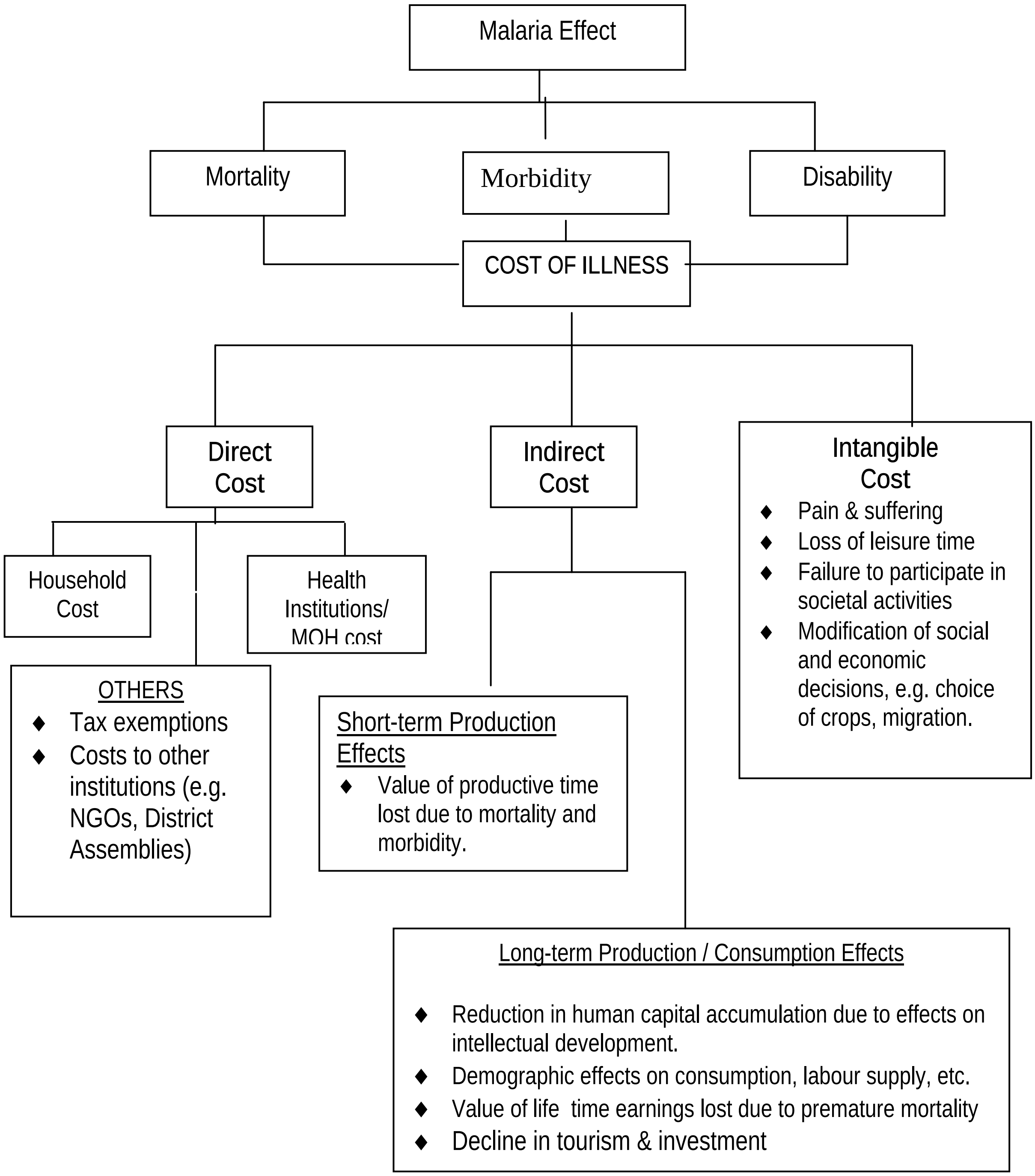
- Health consumption effects
- Social interaction and leisure effects
- Short - term production effects
- Long - term production and consumption effects

These effects result in various cost components, which can be categorised into direct costs, indirect costs and intangible costs (Shepard *et al.* 1991). These costs may be borne by an individual, the household, the health care provider and/or the economy in various forms. Malaney (2003), comprehensively expressed the cost-of-illness (COI) as:

COI = Private Medical Cost + Non Private Medical Cost + Labour Loss + Risk Related Behaviour Modification + Investment Lost + Non Economic Personal burden.

Schematically, the COI approach is conceptualised in figure 5.1.

Figure 5.1 Conceptual Framework of Cost of Illness



Source: Culled from Shepard et al. (1991) with modifications by Authors

5.1.1 Direct cost

The exposure of people to the bites of the Anopheles mosquito results in sickness and if not promptly and efficiently addressed may result in the death of the victim. The process of seeking treatment involves cost to the individual and his household. The fear of contracting malaria also urges people to protect themselves. The theory of averting behaviour predicts that a person will continue to take protective actions as long as the perceived benefits exceed the costs of doing so. Since these processes involve the expense of tangible resources, the resource cost is termed direct cost to the individual and his household in the form of treatment and preventive costs.

In addition, it is the duty of every government to promote and sustain a healthy lifestyle for its people. The government ensures that resources are provided to maintain and operate a good health system. This resource cost constitutes the non-private medical cost (social cost) to the institution and the society in general if the services are subsidised for consumers.

The direct cost of illness to the household (private cost) could be obtained with less controversy since it is an *ex-post* exercise which could be obtained through recalls. This is however not simple when it comes to the direct costs of a particular disease to the health system. Due to the nature of the health system, certain costs are shared by several activities which make the estimation of the institutional cost of a particular disease difficult. The health system provides general treatment and therefore malaria-related expenditures are often not separated from other health service costs in budgeting and accounting systems.

The best approach to the estimation of the institutional cost is to document precisely the inputs required to treat or prevent the disease but this is not only sophisticated but also laborious. According to Drummond *et al*. (1987), the shared costs could be prorated among various services by observing the total costs and apportioning them using hospital morbidity data. For personnel costs, Creese and Parker (1994) suggest that, the proportion of time spent by staff devoted to the case (disease) of interest could be observed and measured for the proportional calculation of the cost to the disease. For this study, the approach by Drummond et al (1987) was adopted.

The cost of illness to the economy also includes tax exemptions on imported anti-malarial products. The direct costs may also include the resources that are spent directly or indirectly by various institutions like local governments, Non-Governmental Organisations (NGOs) and communities.

5.1.2 Indirect cost

During the period of the sickness, the individual may stop work completely or may work partially due to the debility associated with the disease on temporary bases. Situations like these may affect household production adversely. In certain cases, a household member will have to cut down his/her own duty to cater for the sick or perform the duties of the sick person. The subsequent decline in output in this case is termed indirect cost. These indirect costs mainly represent loss of potential productivity. This is not an out - of - pocket payment but the opportunity cost of both market and non-market (unpaid domestic) productive time lost to the household.

The indirect cost of illness is often estimated through the human capital approach. The human capital approach considers the value of lost productivity as a result of illness and premature mortality. This perspective is based on the application of "neo-classical" market oriented economic principles. The human capital approach is therefore applied within the opportunity cost framework, which is a central concept in market economics (Harwood, 1994).

The value of time lost is assumed to be equal to the earnings people could have earned but for the illness. The human capital approach applies forgone wages to estimate lost productivity. The opportunity cost of time could be evaluated as the marginal cost of labour. Brandt (1980) suggested that in subsistence agriculture with easily available land, labour is by far the most important input variable to production. Because of this, the marginal cost of labour (MCL) could be approximated by the marginal product of labour (MPL).

In a perfect market economy, the marginal product of labour is equal to the worker's earnings per day on the particular job at which he/she is working. This is however not likely to be so due to the imperfections in the market especially in the economies of developing countries. For this reason, various proxies are often used to value the marginal product of labour. According to Mills (1989) the methods that have been used to appraise the lost productive time are varied and include average agricultural wage, salaries, marginal productivity calculated from a Cobb-Douglas production function, income per capita, legislated minimum wage among others. However, Prescott (1999) is of the view that some of these methods may poorly represent the actual marginal product of labour and therefore must be used with caution. The average daily agricultural wage was employed for the cost estimation since agriculture is the dominant economic activity in the study areas.

It is possible that mosquito-infested areas could experience reduced land utilisation since people would not want to invest in such malarious areas. This could have a negative effect on the development of that area as a result a decline in tourism, agricultural and industrial activities among other things. This constitutes indirect costs to the local economy and the nation as a whole. This cost component was however not addressed by this study since no evidence existed in the study areas.

Travel time to seek treatment or buy drugs are important indirect cost components in the rural areas where people travel long distances to health facilities and drug stores. Another important indirect cost is waiting time at the health facility.

5.1.2.1 Mortality Cost

Another important indirect cost of malaria is attributed to the permanent loss of labour days due to mortality. Thus, the death of the victim denies society of the benefits that would have been gained from the victim’s productivity presently or in the future. The premise for the estimation of this cost is that mortality destroys potential output. This potential loss of productivity is usually valued using market wage rate and the earnings in the future are discounted at a constant rate.

According to Hodgson and Meiners (1992) premature death represents a 'loss of economic product, equal to the discounted stream of earnings that otherwise would have been earned over the remaining expected life. The problem with this approach however is that, the life of non-income producing older people, children and the unemployed is valued as negligible or zero. In situations like this, a disease like malaria, which has higher child mortality rate, will seem to present a lower disease burden on the society.

The idea of placing a monetary value on life has received its fair share of criticisms in the literature since it has been challenged on several grounds including ethical and methodological. For instance, people's earnings may not always accurately reflect their ability to produce due to market imperfections. Another concern also is how to value the death of those who are outside the labour force (e.g. children and the unemployed). Though it is methodologically possible to value life in monetary terms by age groups and sex by assigning different weights, it is not clear if the life of all the people in a particular age cohort or sex group should be treated equally.

Notwithstanding these concerns, it has been argued that it is still necessary to place some value (not necessarily in monetary terms) on human life in economic cost estimation since failure to do so will set the value of life at zero. The number of years of life lost due to premature mortality could be enumerated without placing a monetary value on those years. This could be expressed as years of potential life lost (YPLL) (Single, 2001). The

YPLL gives more emphasis to deaths among young members of the population as the death at a young age makes a high contribution to YPLL than a death at an older age.

The mortality cost of malaria could not be captured in the study due to the lack of adequate data on age and sex-specific causes of death.

5.1.2.2 Intangible cost

The final cost component is the intangible cost, which is explained by the health consumption and social interaction as well as the leisure effects of the disease. Malaria infection diminishes and/or shortened the enjoyment (in economic terms) of good health. This is in the form of pain, suffering, anxiety and grief associated with the death of a family member. It also includes the loss of leisure time due to illness and the cost of not participating in societal activities.

Though the intangible cost associated with a disease could be very substantial, the human capital approach fails to capture the costs of pain, suffering and the psychosocial consequence of illness and premature mortality (Mills, 1992). This has been a major limitation of the approach but Glenn *et al.* (1996) argues that this argument is flawed because intangibles such as pain, suffering and anxiety are strictly not costs in economic sense. This is because, economic costs are resources forgone in alternative uses but since psychosocial effects do not have resource consequences *per se*, they should be treated as negative benefits.

In addition, there is cost to households, which modify their social and economic decisions in response to risks of contracting malaria. For instance, high malaria prevalence in an area may compel households to cultivate crops that require less labour or may migrate to less malarious regions which may result in net output losses. This is what is termed as the risk-related behaviour modification.

Since the intangible cost constitute long-term production and consumption effects of the disease, they could be best be measured in a longitudinal study and therefore not addressed by this study.

5.2 Method of Analysis

The cost of illness due to malaria constitutes the resources that are spent on treatment, control and prevention of malaria by households, health institutions, the government and her development partners. It also includes the monetary value of output and services that are not performed as a result of the illness. These costs can be categorised into direct, indirect and intangible. The cost of illness can be expressed as; **C = X + Y + Z,** where: **C** = cost of illness of malaria, **X** = Direct costs associated with malaria, **Y** = Indirect costs, Z = Intangible costs.

The direct cost of illness (**X**) is the combination of personal, household, institutional and government expenditures on both prevention and treatment of malaria. The direct cost is expressed as **X = H + I+ G,** where; **H** = the household cost of malaria treatment and control, **I** = the institutional cost of malaria not borne by patients, **G** = the cost incurred by the government not captured in the institutional cost.

The household direct cost is expressed as **H = h1 + h2+ h3 + h4 + … + hn**. These represent the households cost of drugs, fees pay for registration, consultation, laboratory test, transportation cost for patient and caretaker, where applicable, cost of malaria prevention to the household, and any other direct costs borne by households due to the illness and its control.

The institutional cost of malaria is also expressed as **I= b1+ b2+ b3+ b4+…+ bn**. This cost component include: malaria treatment cost for children under 5 years, pregnant women and the aged over 70 years exempted by government. Others include cost of malaria surveillance, prevention, research, health education, salaries of health personnel and the cost of running the health institutions borne by the Ministry of Health, the Ghana Health Service and other health care providers.

Where these costs are not malaria specific, (i.e. shared costs), incidence based costing approach is used to calculate the proportion for malaria. In terms of the salary of health staff, a percentage of their working time devoted to malaria care, multiplied by the total salary gives the estimate for malaria. In addition to this, the cost to the government (**G**), in the form of subsidies and tax exemptions on imported malarial products not covered by the above will be included. This cost based on the data collected for 2002 represents the institutional cost of malaria for the year 2002. This procedure is also employed to obtain the estimate of the cost to the health facilities in each district.

The indirect cost of illness (**Y**) due to malaria is the value of the output that is lost because people could not work either permanently or partially due to malaria related morbidity and premature mortality. The indirect cost due to malaria morbidity is expressed as: $\mathbf{Y = \mu\ (y1 + y2 + y3 + \ldots + yn)}$,

where;

y1 = time spent travelling to obtain health care,

y2 = waiting time for treatment at the facility,

y3 = time spent caring for the sick,

y4 = time lost due to incapacitation (i.e. duration of illness and convalescence).

y5 to yn = other indirect cost due to malaria.

μ = daily agricultural wage rate.

The sum of y1 to yn gives the value of productive time lost by the patient, the caretaker and the substitute labour attributed to malaria morbidity. Since there is the possibility of intrahousehold labour substitution, the net productive time lost is calculated for the estimation.

To do this estimation, the number of days or hours lost from work is multiplied by the value of output lost during that period. This can best be done by valuing all the time lost according to the daily average productivity of the individuals involved. Due to the complexity of the informal market arrangement and data constraint, the daily agricultural labour wage ('by-day') obtained through the field survey is used for this valuation and differentiated by age and sex.

It is however assumed that children below the age of 10 are economically not productive while those between 10 and 17 are assumed to earn half of the adult wage rate. The daily minimum wage (as a proxy for the value of labour output per day) is divided by 8 hours (i.e. the official working hours for a day in Ghana), to obtain the wage per hour.

The indirect cost also includes the productivity lost due to premature mortality attributed to malaria. This is defined as any death occurring before the age of 58 years, which is the average life expectancy at birth for Ghana. Since malaria related mortality is very significant for children under 5 years, the impact of malaria mortality on short-run production will be negligible. To obtain the mortality cost of malaria, the Years of Potential Life Lost (YPLL) method could be used to estimate the value of life lost. The focus of this approach is not to consider the value of individuals only as a production factor by equating value of output to human life but to estimate the potential years of life lost. This will however not be captured by this study.

The final cost component is the intangible cost (**I**) attributed to pain, suffering, the loss of leisure time, the cost of coping strategies of households due to malaria and grief due to the death of a household member. Though this constitutes a major cost, it is difficult to measure. However, since people will always want to enjoy good health, good health is considered a consumption good which people will be willing to pay for. This however, is not captured in this study.

All the cost components will be summed to obtain the total cost-of-illness of malaria. The total cost to the households is divided by the total number of cases registered by the survey to get the average cost per case. On the other hand, the total direct prevention cost to the households is divided by the total household size to obtain the prevention cost per household. These average costs are then used to calculate the national estimate for the country for the year 2003 based on the field survey and the recorded clinical morbidity figures for 2002.

5.3 Discussion of Results

5.3.1 Direct Cost of Malaria to the Household

5.3.1.1 Households' Cost of Seeking Orthodox Health Care

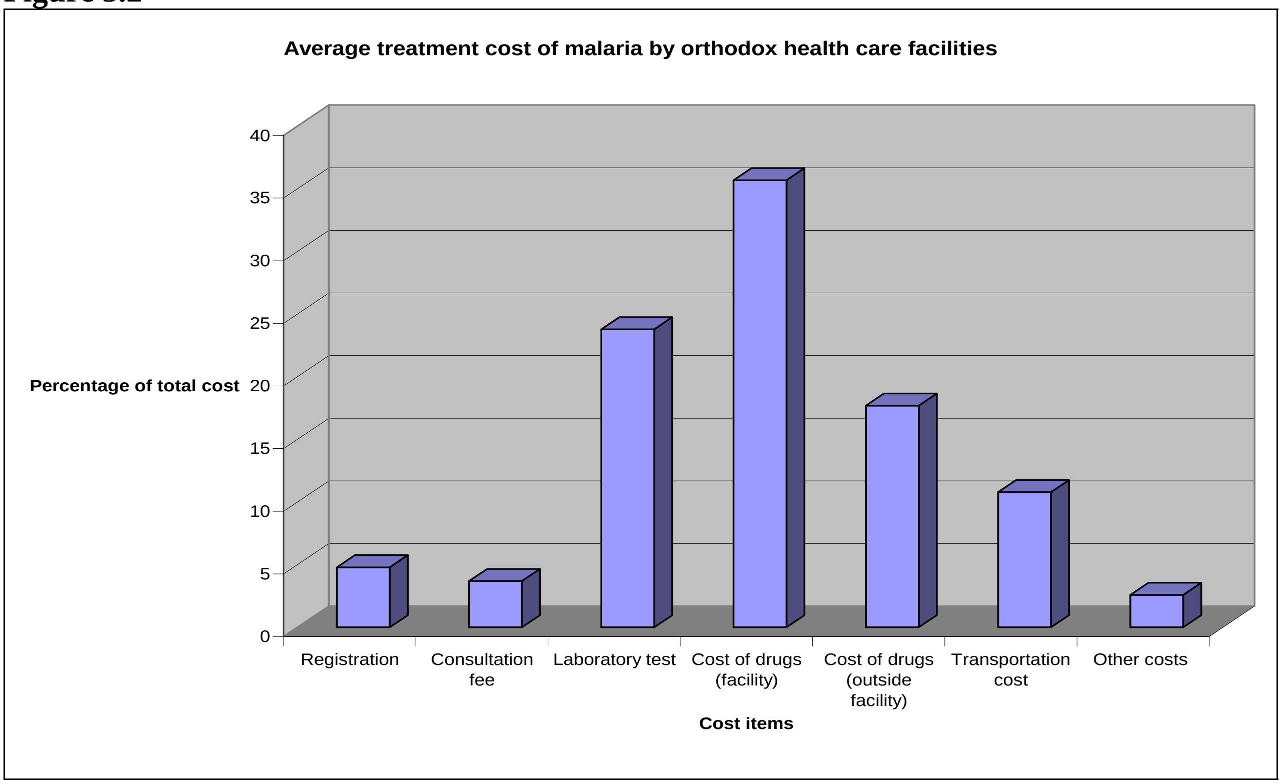
The total direct expenditure incurred on the 687 malaria cases recorded in the household survey amounted to ¢33,399,814.00 ($3,935.07). This amount translates to ¢48,616.91 ($5.73) per case on the average. About 17% of the total direct expenditure is attributed to the cost of treatment through self-medication while 81.56% was incurred by those who sought treatment from the orthodox health care facilities. The average treatment cost per case however varies depending on the type of treatment sought.

The average cost of treatment from the orthodox health care providers was ¢58,317.98 (US$6.87) per malaria episode (Table 5.1 and Figure 5.1). Patients paid ¢62,748.98 (US$7.39) in the Awutu-Efutu-Senya district, ¢60,986.67 (US$7.19) in the Sekyere East district and ¢51,378.10 (US$6.05) in the Bole district. The cost of drugs formed a significant proportion of the total treatment cost. The drugs were either supplied by the health facility or had to be purchased from outside. Approximately 36% of the total cost of treatment from the orthodox health facilities was due to the cost of drugs supplied amounting to ¢20,828.99 on the average. This was however 45.45% in the Awutu-Efutu-Senya district where households paid ¢28,518.87 for their drugs. The cost of prescribed drugs bought from outside the health facility ranged from 11.51% of the total treatment cost in the Bole District to 23.42% in the Sekyere East district.

Transportation cost to the facility averaged ¢6,294.20, which represented 10.79% of the total treatment cost with the average round trip distance of 9.6 kilometres. Almost 44% of the patients and/or their caretakers walked to the facilities. Households in the Bole district however had to pay ¢8,396.82 on the average to get to the health facility and travel the longest round trip distance of 12.3 kilometres compared with the 5.8 kilometres in the Awutu-Efutu-Senya district. Costs of registration and consultation were relatively low in all the districts but were relatively higher in the Awutu-Efutu-Senya district where apparently more private facilities were consulted. The cost of laboratory test in the districts represented between 16.91% and 20.65% of the total treatment cost (figure 5.2 and table 5.1).

Few patients incurred several other costs in the process of seeking further treatment after the first one. These costs related to costs incurred during referrals, reviews, extra medication and food among others (figure 5.2). Out of the total number of patients who visited the clinic/hospital as the first choice of treatment, 24.3% reported not cured and therefore sought further medical care.

Figure 5.2



Source: Survey Data, 2003

Table 5.1 Average Treatment Cost of Malaria Case by Orthodox Health Facilities (in cedis) [a]

Cost item	District			Combined sample
	Bole	Sekyere East	Awutu-Efutu-Senya	
Registration	1,676.99 (3.26)	3,039.47 (4.98)	3,673.68 (5.85)	2,779.17 (4.77)
Consultation fee	1,852.27 (3.61)	2,000.00 (3.28)	3,000.00 (4.78)	2,170.59 (3.72)
Laboratory test cost	10,608.00 (20.65)	10,885.71 (17.84)	10,608.70 (16.91)	13,876.54 (23.79)
Cost of drugs (Facility)	16,127.59 (31.39)	20,850.00 (34.17)	28,518.87 (45.45)	20,828.99 (35.72)
Cost of drugs (outside facility)	5,914.73 (11.51)	14,321.00 (23.42)	9,737.73 (15.52)	10,305.30 (17.67)
Transportation cost to the facility	8,396.82 (16.34)	6,197.48 (10.16)	4,104.00 (6.54)	6,294.20 (10.79)
Transportation cost to buy prescribed drugs	761.90 (1.48)	479.02 (0.79)	368.42 (0.59)	536.32 (0.92)
Other costs	6,039.80 (11.76)	3,213.99 (5.27)	2,737.58 (4.36)	1,526.87 (2.62)
Total treatment cost (¢)	**51,378.10** (100.00)	**60,986.67** (100.00)	**62,748.98** (100.00)	**58,317.98** (100.00)
Total treatment cost (US$) [b]	**6.05**	**7.19**	**7.39**	**6.87**

Source: Survey data, 2003.

[a] Treatment cost does not include extra cost incurred during reviews.
[b] Exchange rate: US$1= ¢8487.73 (March 2003 inter-bank rate).
*Figures in parenthesis are percentages of the column totals.

5.3.1.2 Cost of malaria prevention to households.

The household survey revealed that prevention cost is relatively significant for households. The total monetary expenses incurred on prevention per month is estimated at ¢4,422,511.10 (US$ 521.05) which translated to a per capita cost of prevention of ¢1,405.76. Households on the average spend ¢10,750.03 (US$ 1.3) a month on products such as aerosol sprays, mosquito coils and bednets to protect themselves against mosquito bites. Seventy percent of the households' total expenditure per month is on preventive measures, mosquito coils.

Households in the Awutu-Efutu-Senya district accounted for almost 50% of the total expenditure on prevention. The average cost per household per month is estimated at ¢13,500.98. About 82% of the total monthly expenditure on preventive measures was on mosquito coils. The Bole district reported the lowest average cost of ¢7,680.13 per household on prevention where aerosol sprays contributed about 46% to the cost. The households in the Sekyere district on average spent ¢10,277.61 per month on preventive measures with 76.1% of it being spent on mosquito coils. This forms 27.8% of the total monthly preventive cost.

With regards to bednets, the household survey revealed that 18% had at least one bednet with majority of the net users coming from the Bole districts (48.1%). While almost 43% of the users preferred the bednets as a protective measure because it was effective, the availability of the nets was confirmed by only 14% of the respondents. It was also observed that only 17.9% of the bednet users had Insecticide Treated Nets (ITNs) which cost on the average ₵42,286 (US$4.98) per net. Majority of the bednet users (82.1%) had ordinary bednets which also on the average cost ₵35,032 (US$ 4.132) per net.

5.3.2 Indirect Cost of Malaria to the Household

The indirect cost is estimated by quantifying in monetary terms, the opportunity cost of the time that was spent by households in seeking treatment from the various treatment resorts. In addition, during the days of complete incapacitation and the period of convalescence, any productive time that was lost by the malaria patients, their caretakers as well as substitute labourers were valued. The local gender-specific average agricultural daily labour wage obtained through the household survey in each district was used for the time valuation.

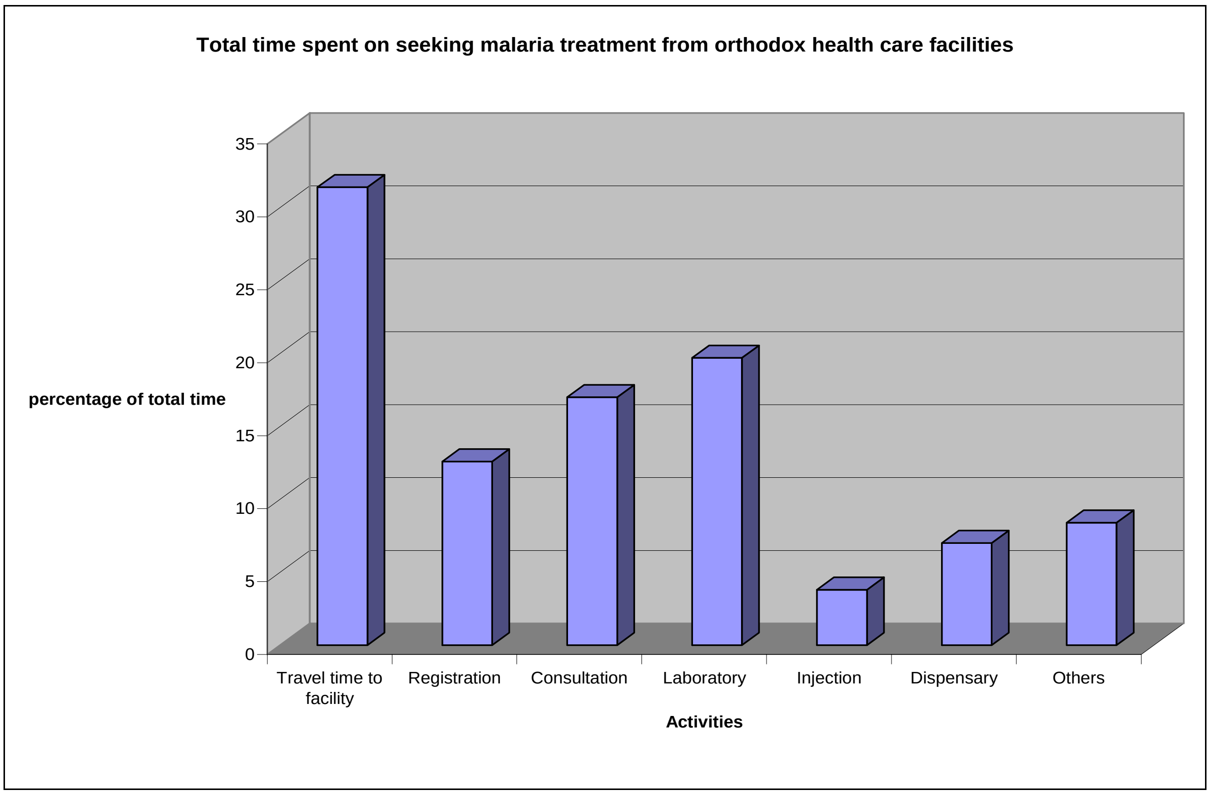
The average daily agricultural wage, popularly known as 'by-day' computed for the Bole district was ¢10,000.00 for males and ¢7,500.00 for females. In the Sekyere East and the Awutu-Efutu-Senya districts, males earned ¢11,000.00 while females earned ¢8,500.00. For the combined sample, an average of ¢10,666.67 and ¢8,166.67 were computed for males and females respectively. Since a farm labourer is typically hired to work for six hours a day on the average under local arrangements, the average hourly wage is computed as: ¢1,666.67 for males and ¢1,250.00 for females in the Bole district; ¢1,833.33 for males and ¢1,416.67 for females in the Sekyere East and Awutu-Efutu-Senya districts; and ¢1,777.78 for males and ¢1,361.11 for females in the combined sample. The value of the opportunity cost of the productive time lost is obtained by multiplying the age-gender specific wage rates by the total number of productive days and hours lost due to the illness.

5.3.2.1 Value of Time Lost in Seeking Orthodox Health Care

The distribution of the travel and waiting times spent by households seeking treatment for malaria from orthodox health care facilities is presented in figure 5.3 and table 5.2. A total of 172.93 minutes was spent on the average to seek treatment for a malaria episode. The highest travel and waiting time of 184.75 minutes was spent by patients in the Sekyere East district. Patients on the average spent 162.57 minutes and 154.79 minutes in the Awutu-Efutu-Senya and Bole districts respectively in seeking treatment from orthodox health care facilities. About 69% of the total treatment time was spent on waiting at the facility while travel time accounted for 31.43%. On the average, patients in all the districts spent almost one hour to travel to the health facilities.

Patients spent almost 22 minutes going through registration formalities at the health facilities. About 30 minutes on the average, representing 24.85% of the total waiting time, was spent on consultation. Comparatively, more time was spent at the laboratory. The average time spent at the laboratory ranged between 25.44 minutes in the Sekyere East district and 29.86 in the Bole district. On the average, 34 minutes was spent by the combined sample at the laboratory. Less than 20% of the total waiting time was spent for injections and drugs at the dispensary. The rest of the time was spent in-between activities at the facility.

Figure 5.3



Source: Survey data, 2003

Table 5.2 Average Travel and Waiting Time to Seek Treatment for Malaria at Health Facilities (minutes)

Item	District			Combined Sample
	Bole	Sekyere East	Awutu-Efutu Senya	
Waiting time at the facility				
Registration	20.12 (19.79)	20.60 (16.18)	20.73 (18.64)	21.74 (18.33)
Consultation	23.28 (22.90)	32.49 (25.51)	29.27 (26.32)	29.46 (24.84)
Laboratory	30.36 (29.86)	32.40 (25.44)	31.47 (28.30)	34.00 (28.68)
Injection	13.20 (12.98)	6.65 (5.22)	5.76 (5.18)	6.65 (5.61)
Dispensary	8.37 (8.23)	11.84 (9.30)	11.86 (10.67)	12.16 (10.26)
Other	6.34 (6.24)	23.37 (18.35)	12.10 (10.88)	14.56 (12.28)
Total time spent at facility	101.67 (100.00)	127.35 (100.00)	111.19 (100.00)	118.57 (100.00)
Travel time to facility	53.12	57.40	51.38	54.36
Total time spent on treatment at the orthodox health care facilities	154.79	184.75	162.57	172.93
Cost of treatment time (¢)	3762.25	5003.65	4402.94	4523.42
Cost of treatment time (US$) [a]	0.44	0.59	0.52	0.53

Source: Survey data, 2003

[a] Exchange rate: US$1= ¢8487.73 (End of March 2003 inter-bank rate).

*Figures in parenthesis are percentages of the total time spent at orthodox health care facilities.

The indirect cost of the average total time of 172.93 minutes spent by households in seeking treatment from the orthodox health facilities was valued at ¢ 4,523.42 (US$0.53) per malaria case. The indirect cost per case amounted to ¢3,762.25 (US$0.44) in the Bole district, ¢5,003.65 (US$0.59) in the Sekyere East district and ¢4,402.94 (US$0.52) in the Awutu-Efutu-Senya district. From these estimations, the surveyed households incurred a total of ¢1.84 million indirect cost as a result of seeking orthodox malaria treatment. While the households in the Sekyere East district lost ¢815,594.95 in indirect cost, the Awutu-Efutu-Senya and the Bole districts lost ¢506,338.10 and ¢485,331.54 respectively.

5.3.2.2 Value of Workdays Lost to Households due to Malaria Attack

A total of 7,328 sick days were reported by households for the 679 reported malaria episodes with an average of 10.79 sick days per case. The Sekyere East district recorded 37.9% of the total sick days while 34.4% and 27.7% were recorded in the Awutu-Efutu-Senya and the Bole districts respectively. The highest number of 11.48 sick days per case on the average was recorded in the Sekyere East district. The Awutu-Efutu-Senya district recorded 11.31 sick days per case and 9.48 sick days per case in the Bole district.

To ascertain the productive days lost due to the malaria attack, respondents were asked to indicate whether they were able to perform their normal activities during the sick days. The question was not applicable to 50.7% of the patients who were either children, unemployed or unoccupied as at time of the illness. It was assumed that the opportunity cost of the labour of these categories of patients was zero. About 36% of the patients who work under normal conditions stated that they could not perform their normal economic activities due to the illness. Almost 14% of the patients responded that they did not stop work during the sick days. A total of 2844 sick days (38.8% of the total sick days) were lost by all the economically active patients. On the average, 9.03 workdays were lost by economically active patients. Patients lost 10.85 productive days in the Sekyere East district, 9.37 days in the Awutu-Efutu-Senya district and 7.03 days the Bole districts.

The economically active male patients who could not perform their normal activities lost 9.35 workdays during the period of illness, while 8.87 workdays were lost by the female patients. In the Sekyere East district, it was 12.11 lost workdays for males and 11.66 for females. Male patients in the Awutu-Efutu-Senya district lost 10.70 workdays on the average while 9.80 workdays were lost by the female patients. In the Bole district, male patients absented themselves from work for 6.58 days. The female patients on the other hand lost 7.33 workdays (table 5.3).

About 23% of the economically active patients responded that they had substitute labourers to work for them while sick. Fifty-eight (82.9%) of the substitute labourers were adults while 12 (17.1%) were teenagers. Thirty-two percent of the substitute labourers were paid for their work. By deductions, the affected households gained a total of 198 days through intrahousehold work adjustments, which must be subtracted from the days lost by the patients to get the net lost workdays.

Table 5.3 Average Workdays Lost by Households by Sex

Workdays Lost	District			
	Bole	Sekyere East	Awutu-Efutu Senya	Combined sample
Total				
Male	6.58	12.11	10.70	9.35
Female	7.33	11.66	9.80	8.87
Caretaker				
Male	5.87	4.15	3.20	5.02
Female	5.99	5.61	5.76	5.94
Part-time (Partial)				
Male	3.98	5.30	3.71	5.84
Female	3.62	3.89	5.06	5.82
Cost of workdays lost	63,597.48	72,049.60	80,614.41	71,157.79
Cost of workdays lost (US$) [a]	7.5	8.5	9.5	8.4

Source: Survey data, 2003.

[a] Exchange rate: US$1= ¢8487.73 (End of March 2003 inter-bank rate).

During the period of illness, healthy household members sacrificed their productive activities to take care of the sick individuals. In 52% of the cases, people had to sacrifice their productive activity to take care of the sick. Adults constituted 96% of the caretakers. Almost 83% of the caretakers were females. More than five workdays on the average were sacrificed by caretakers to take care of the sick who were mostly children. Male caretakers lost between 3.20 and 5.87 workdays in the districts. On the average, approximately six workdays were lost by female caretakers. The days lost by caretakers were greatly affected by 80 patients (19.7%) who were admitted for 4.76 days on the average.

In addition to the above, out of the 14% of the economically active patients who did not absent themselves from work, 53.8% stated that they worked partially by cutting down their normal working hours in a day for the period of the illness while the remaining 46.2% indicated that they did not cut down their normal schedule of work. Among those who worked below their normal capacity, the lost period ranged between 3.71 workdays in the Awutu-Efutu-Senya district and 5.30 workdays in the Sekyere East district for male patients. The female patients lost between 3.62 workdays in the Bole district and 5.06 workdays in the Awutu-Efutu-Senya district.

A total of 48.9 million cedis was lost by households in indirect costs attributed to the lost workdays. Females accounted for 68.62% of this indirect cost in the household. The estimated cost of the workdays lost to households amounted to 13.9 million cedis in the Bole district, 17.8 million cedis in the Sekyere East district and 17.9 million cedis in the Awutu-Efutu-Senya districts. While females in the Bole district accounted for about 63% of this indirect cost, females in the Sekyere East and the Awutu-Efutu-Senya districts borne a little over 70% of the total cost in each district.

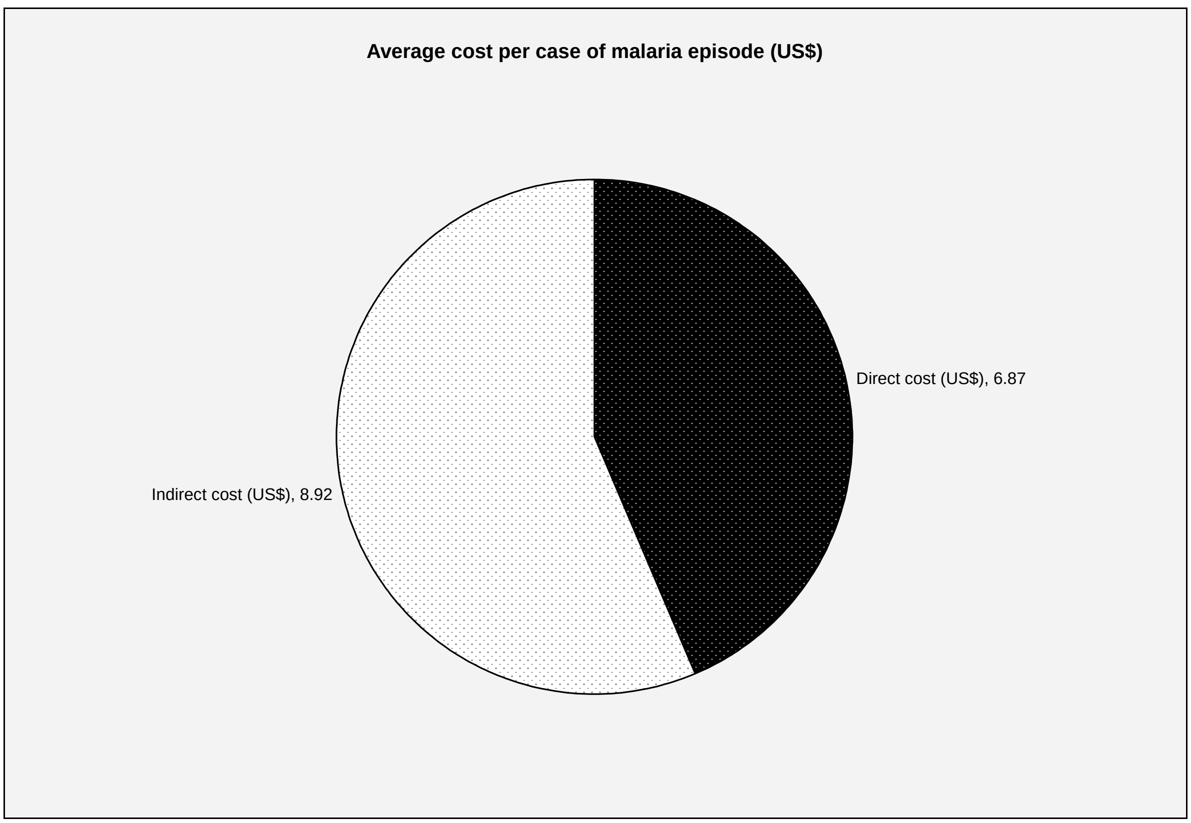
5.3.3 Summary of the Cost-of-Illness of Malaria to the Household

The average cost of a malaria episode to the household was estimated at ¢133,999.19 (US$15.79) (Figure 5.4 and Table 5.4). The direct cost of illness amounted to ¢58,317.98

(US$ 6.87) per case which represented 43.52% of the total cost of a malaria episode to the household. The indirect cost of illness is estimated at ¢75,681.21 (US$ 8.92) per case. This represented 56.48% of the total cost of illness per malaria case.

The average cost of a malaria episode to the household is estimated at ¢118,737.83 (US$13.99) in the Bole district and ¢138,039.92 (US$ 16.26) in the Sekyere East district with the Awutu-Efutu-Senya district recording the highest cost of ¢147,766.33 (US$17.41) per case. The direct prevention cost to the household per month amounted to a per capita cost of ¢1,405.76. The estimated cost of illness of a case of malaria to the household is equivalent to the value of output of 14 farm workdays on the average.

Figure 5.4



Source: Survey data, 2003

Table 5.4 Summary of Average Cost per Case of Malaria Episode (Household)

Cost of illness	District			Combined sample
	Bole	Sekyere East	Awutu-Efutu-Senya	
<u>Direct cost</u>				
Treatment (¢)	51,378.10 (43.27)	60,986.67 (44.18)	62,748.98 (42.47)	58,317.98 (43.52)
Treatment (US$)[a]	6.05	7.19	7.39	6.87
<u>Indirect cost</u>				
Workdays/time Lost (¢)	67,359.73 (56.73)	77,053.25 (55.82)	85,017.35 (57.53)	75,681.21 (56.48)
Workdays/time Lost (US$)	7.94	9.07	10.02	8.92
Total cost (¢)	118,737.83	138,039.92	147,766.33	133,999.19
Total cost (US$)	13.99	16.26	17.41	15.79
Per capita cost of prevention/month [b]	904.00	1,231.74	2,392.40	1,405.76

Source: Survey data, 2003

[a] Exchange rate: $US1.00 = 8487.73 (End of March 2003 inter-bank rate)

[b] Total cost of prevention in a month is divided by the surveyed household size.

*Figures in parenthesis are percentages of the total cost.

5.3.4 Institutional Cost of Malaria in Ghana[1]

Malaria imposes a heavy burden on health institutions in Ghana especially those at the Primary Health Care level. Though the treatment of malaria is not free in Ghana except in cases of exemptions, health sector resources are stretched in the course of providing preventive and treatment services. The cost imposed on health institutions by malaria is assumed to contribute substantially to their annual recurrent expenditures. It is however not possible to quantify precisely the amount of resources that go into malaria prevention

[1] Estimated institutional cost of malaria does not include capital cost.

and treatment due to the number of institutions involved directly or indirectly in the fight against the disease in various ways. The costs incurred by the facilities include expenditures on personnel, supplies, administration, maintenance, accommodation, allowances and general services such as sanitation and utility among others. Apart from the direct resource cost, the congestion at the facilities could adversely affect the efficiency of service delivery.

The institutional cost of malaria in Ghana was estimated from two sources - first by estimating the disease burden on public health facilities at the district level where most malaria cases are handled and secondly on the entire health system from the MoH/GHS level. For the national estimates, the average unit cost obtained from the two sources was multiplied by the number of cases from the national morbidity statistics.

Since malaria-specific cost data was not available in the health facilities in the districts, the total annual recurrent expenditures of public health facilities in the districts for the 2002 fiscal year were obtained for the facility cost estimation. Using the 'shared cost' approach, the district mortality data for the same period was used to apportion the total annual recurrent expenditures for the various diseases. For 2002, malaria contributed 51% to the total mortality cases in the Bole districts, 63.5% in the Sekyere East district and 48.5% in the Awutu-Efutu-Senya district. Thus, Malaria accounted for ₵342,326,992.30 (51%) of the total annual recurrent costs in the in Bole district, ₵104,189,200.00 (63.5%) in the Sekyere East district and ₵521,115,861.20 (48.5%) in the Awutu – Efutu – Senya district (see Figure 5.5 for cost breakdown and Table 5.5).

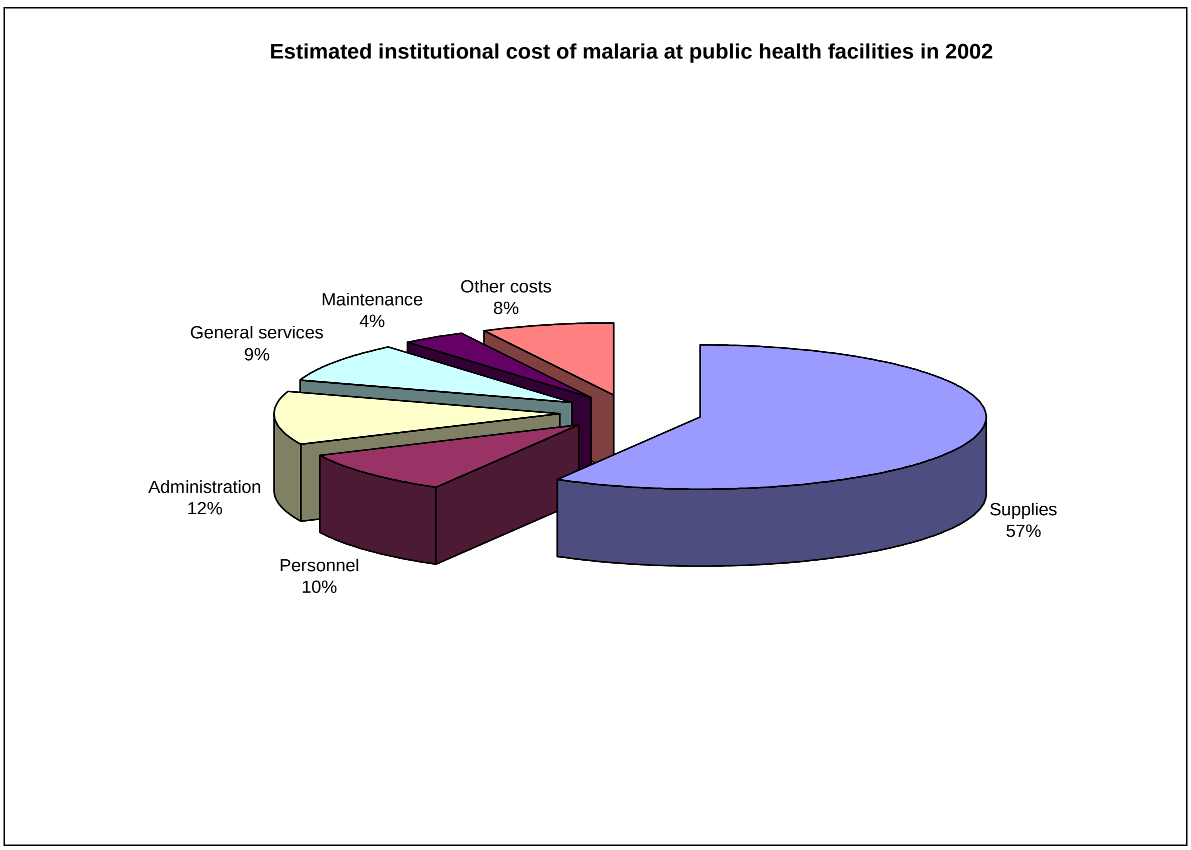
On the average, malaria cost to the public health facilities in the three districts amounted to 967.67 million cedis in 2002 financed mainly from their internally generated funds (IGF). This amount represented 48.5% of the total recurrent expenditure from the IGF with the average cost per case being estimated at ¢16,125.75 (Table 5.5).

The estimated average total annual recurrent expenditure for malaria obtained from the three District Directorate of the Ghana Health Service multiplied by the 110 districts in

Ghana with the assumption that the districts incurred comparatively similar facility costs from their own resources (This excludes the three teaching hospitals). By this procedure, it is estimated that the public health care facilities spent about ¢35.48 billion cedis of their internally generated funds (IGF) on malaria in 2002.

In 2002, the Ministry of Health's budget estimate for the ten regional secretariats of the Ghana Health Service for the running of the health care delivery system in Ghana amounted to 133.0 billion cedis. The allocations to the three Teaching Hospitals in the country were excluded from this estimate. Out of the total amount disbursed, 23.8 billion cedis was meant for personal emoluments. Malaria is estimated to have accounted for about 10.6 billion cedis for the cost of time health workers devoted to the treatment and prevention of malaria at the district levels. This was obtained using the weight of malaria in out patient department (OPD) cases.

Figure 5.5



Source of data: Table 5.5

Table 5.5 Estimated Institutional Cost of Malaria at Public Health Facilities in 2002

Cost item	District			Combined
	Bole	Sekyere East	Awutu-Efutu Senya	
Supplies	278,751,936.20	13,849,540	272,693,996.10	565,295,472.30
Personnel	24,738,566.43	22,870,800	44,759,749.84	92,369,116.27
Administration	10,452,065.97	9,529,500	95,857,113.51	115,838,679.50
General services	3,690,536.46	38,118,000	44,676,878.86	86,485,415.32
Maintenance	12,210,490.38	13,976,600	8,379,478.86	34,566,569.24
Other costs	12,483,397.50	5,844,760	54,790,644.00	73,118,801.50
Total direct cost (¢)	**342,326,992.90**	**104,189,200**	**521,157,861.20**	**967,674,054.10**
Average cost per case(¢)	15,359.25	5,792.79	26,125.75	16,125.75
Average cost per case (US$)[a]	1.84	0.69	3.13	1.9

Source: Survey data, 2003.

[a] Exchange rate: $US1.00 = 8351.80 (End of December, 2002 inter-bank rate)

The Ministry of Health's exemption policy provides free selective treatment for children under-5 years old, pregnant women and the elderly who are above 70 years. This exemption policy is supposed to operate in public facilities and cover the cost of basic drugs. It is anticipated that a significant portion of the exemption budget would be spent on malaria due to the fact that malaria is common among the potential beneficiaries. During the year under review, the Ministry of Health released about 18 billion cedis to the ten regional secretariats of the Ghana Health Service to cover the cost of exemptions (MoH, 2002).

In 2002, malaria morbidity among children under-5 and pregnant women reported by the Ghana Health Service was 35% of the clinically reported malaria cases (2,636,871). Malaria morbidity among the two sub-groups represented 15% of the total outpatient morbidity cases in 2002. The exempted treatment to the two sub-groups was estimated at 2.7 billion cedis, to cover the cost of basic anti-malaria drugs.

Malaria specific expenditure in Ghana is basically driven by the Roll Back Malaria (RBM) Strategic Plan for Ghana for the period 2001 – 2010. The Budget estimate for the 2002 fiscal year amounted to approximately 16.0 billion cedis (US$1.92 million) from the Government of Ghana and development partners. This amount was meant to finance activities including malaria case management, multiple prevention activities, focused research, monitoring and evaluation of malaria specific programmes. The amount however excluded the cost of anti-malarial drugs and Insecticides Treated Nets (ITNs).

The distribution of the institutional cost of malaria for Ghana in 2002 is presented in table 5.6. The total cost of malaria has been estimated at 64.79 billion cedis (US$7.76 million). This cost is considered as a direct cost to the Ministry of Health/Ghana Health Service. This amount translates to 24,571.35 cedis per malaria case. Almost 55% of the total cost was facility cost while malaria specific cost represented about 25%.

Table 5.6 Estimated Cost of Malaria to the Ministry of Health/Ghana Health Service, 2002

Cost components	¢ (billion)	**US$** [d] (million)
Facility [a]	35.48 (54.76)	4.25
Personnel	10.61 (16.38)	1.27
Treatment (Exemptions) [b]	2.70 (4.17)	0.32
Malaria specific expenditures [c]	16.0 (24.69)	1.92
TOTAL	**64.79** (100.00)	**7.76**
Average cost per case	**24,571.35**	**2.94**

Source: Survey data, 2003.

[a] Based on the averages from the three districts, excluding the three Teaching Hospitals

[b] Share of malaria among the under-5 and pregnant women was 15% of the total outpatient cases.

[c] Excludes cost of drugs and ITNs.

[d] Exchange rate: $US1.00 = 8351.80 (End of December, 2002 inter-bank rate

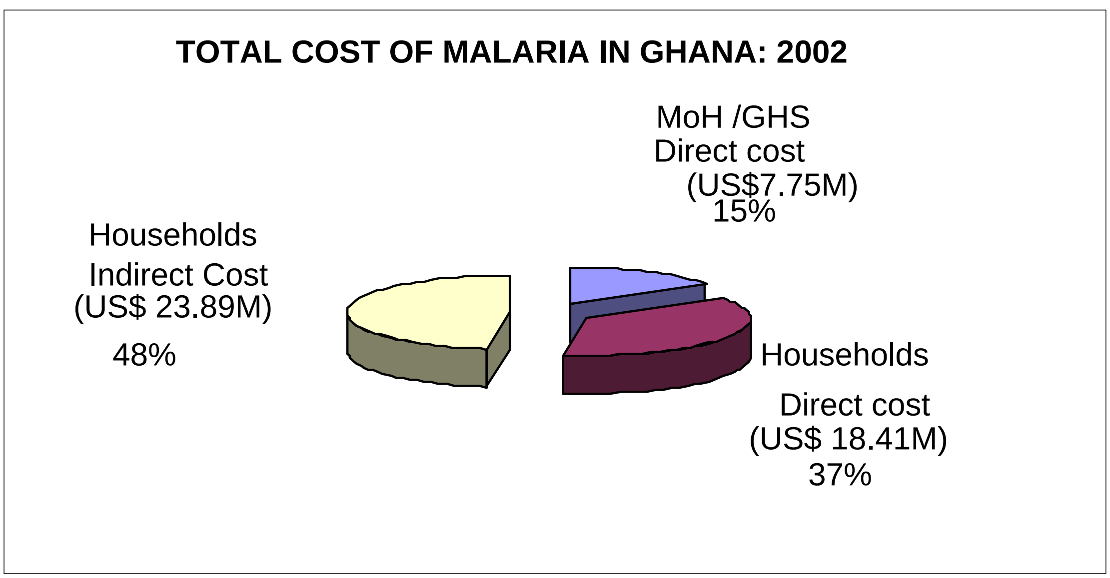
*Figures in parenthesis are percentages of the total cost.

5.3.5 Total Cost of malaria in Ghana

The total cost of controlling malaria in Ghana for 2002 has been estimated at 418.01 billion cedis (US$ 50.05 million) in direct and indirect costs by applying the various average costs per case obtained from the survey results to the total malaria cases recorded in 2002. The direct cost of treatment and prevention amounted to 218.49 billion cedis (US$26.16) which represented 52% of the total cost. The prevention cost to the households however stood at about 28 million cedis, assuming that 50% of the households in Ghana spend an average of ¢10,750.03 a month to protect themselves.

The indirect cost of illness in the form of workdays lost to the illness is estimated at 199.52 billion cedis (US$ 23.89 million). This represented 48% of the total cost of illness. While households accounted for 85% of the total cost of malaria, 15% was incurred by the MoH/GHS (Figure 5.6).

Figure 5.6



Source: Survey Data, 2003

Exchange rate: $US1.00 = 8351.80 (End of December, 2002 inter-bank rate

The total cost of illness due to malaria in 2002 translated to an average cost per capita of US$2.63 or US$13.51 per household. Ghana's per capita government expenditure on health in 2002 stood at US$27 compared with the WHO recommended standard of between US$30 and US$45 (WHO, 2003)[2]. The estimated average per capita cost of malaria is equivalent to 9.74% of the per capita government expenditure on health.

The average cost per capita compares favourably with earlier results from other parts of Africa. For instance, the average cost per capita for Sub-Saharan Africa in 1987 was estimated at US$2.34 and was projected to increase to about 2.92 per capita in 1995. In 1989, the average per capita cost was estimated at US$2.88 in 1987 dollars (Shepard *et al*., 1991). The average cost of US$15.79 per episode of malaria obtained through the household survey was within the range of US$7 – US$24 from a household survey in Ethiopia in 1999 (Cropper et al. 1999).

5.3.6 Cost of Malaria Illness on Household Income

The average household cost of ₵133,999.20 per malaria episode and an average monthly prevention cost of ₵10,705.03 is equivalent to 13.7% and 1.1% of the total household monthly expenditure (actual and imputed), respectively. These expenditures on malaria prevention and treatment may not only stretch the already tight expenditure budgets of households but also contribute to a lower standard of living.

Both the direct and indirect costs associated with a malaria episode represent a substantial burden on poorer households, this is because the poor households will tend to spend a substantial proportion of their income on malaria prevention and treatment. The situation is worsened when a household experiences multiple bouts of malaria infections at a point in time or repeated bouts in a year. If such a situation continues, poor households may be forced to sacrifice their productive capital for health care thereby pushing them into a poverty trap.

[2] The estimated average per capita cost of malaria is equivalent to 5.2% of the per capita total expenditure on health of US$ 51.

SECTION 6

WILLINGNESS TO PAY FOR MALARIA TREATMENT

6.1 Introduction

The Cost-of-Illness (COI) approach employing the Human capital augment is questioned on the grounds of whether production is an adequate or ethical measure of human value and whether earnings is an adequate measure of production. This is because people's earnings do not always accurately reflect their ability to produce. The willingness-to-pay (WTP) approach has therefore been advanced as an alternative to address some of these limitations. This approach considers the amount people are willing to pay to avoid or decrease their risk of injury, disease or death so as to keep alive and healthy. The WTP approach has the advantage of quantifying all costs of illness to society, including the intangibles (WHO/AFRO, 2001). An important issue that is addressed by the WTP approach is that it accounts for consumer behaviour in purchasing goods and services.

The fundamental framework underpinning the WTP concept is the 'value theory'. An important assumption of the value theory is that consumers value their own consumption, (in this case, good health), and that they rationally seek to maximise the value of their consumption as best they can, subject to various constraints such as their income and price (Single *et al*., 2001). It is expected that, rational people will be willing to pay a price that reflects the value they place on their health and life. The WTP therefore reflects individual preferences over health risks. It is known that individual preferences are unique and individual demands for risk reduction vary. This variation may depend on several factors including the level of risk, the type of risk and the socio-economic characteristics of the population including income differences. This means that income and circumstances could play a role in determining the size of willingness-to-pay estimates.

In making such a decision, people assess the pains and suffering associated with the particular condition, the values of lost productive and leisure time, among others and weigh them against the expected benefits. This means that if the approach is well implemented, it makes it possible to capture the direct and the indirect costs associated with a particular issue.

6.2 Method of Analysis – Contingent Valuation

Due to data constraint, the contingent valuation technique is often employed to estimate the WTP. The contingent valuation is the stated preference method in a survey to elicit individuals' or households' WTP for hypothetical commodities or cases. This method is favoured over the human capital based COI, as it potentially captures the full set of effects of illness on individual well-being (US-EPA, 2003).

The approach was was developed in the environmental field to assess the value of 'intangible' items such as clean air and improved water quality (NOAA, 1993). In so doing the technique can also be used to provide a guideline for setting a price for an intangible good or service which is the case in this study – malaria control. In contingent valuation studies, respondents are presented with well described but hypothetical situations. Each individual or household is asked to choose whether or not they would purchase a non-market, 'intangible' good at a specified price. In making this decision, they trade off perceived cost and benefits just as they do when purchasing consumer goods (Lee et al., 1997). Their choices allow insight into the willingness to pay for the 'good' being valued.

The contingent valuation method measures WTP and is consistent with the economic theory of health valuation. If respondents understand the commodity to be valued and answer valuation questions truthfully, the method yields estimates of individual WTP. Valuation questions can ask for household WTP or even for the WTP an individual may have for others outside of the household (i.e., altruism). Contingent valuation appears to be the only method capable of measuring these altruistic benefits. It potentially captures the full set of effects of illness on individual well-being. In situations involving risks, the method can elicit *ex ante* WTP values, though many contingent valuation studies have estimated *ex post* WTP instead.

6.2.1 Methodological Problems

Although the contingent valuation method sets out to find the theoretically correct measure of economic benefit, many economists doubt that the measures obtained actually correspond to individuals' true WTP (see Diamond and Hausman, 1994). The main objections to contingent valuation center on the hypothetical nature of the transaction: because a respondent does not have to pay the amount he states, he may have little incentive to provide accurate answers. He may not think carefully enough about the question to give answers reflecting his preferences or opportunities, or may respond strategically in an effort to influence the outcome of the survey.

A second criticism of contingent valuation involves the unfamiliarity of the valuation task. Respondents may not understand the commodity or the valuation task the way researchers intend, and respondents almost certainly lack experience paying for a commodity not normally traded in markets.

Proponents of contingent valuation argue that poorly designed studies may suffer from any number of problems, but well designed and executed studies provide reliable information about individual WTP. These economists believe that contingent valuation responses reflect stable preferences, in accordance with economic theory, and often correspond closely to value measures inferred from actual behavior (Hanemann, 1994). Practitioners generally try to eliminate, minimize, or test for known sources of bias or imprecision through careful survey design and data analysis.

6.3 Model Specification

The willingness to pay for malaria control/eradication was estimated via an ordered probit model with the dependent variable being the qualitative choice of amount an individual is willing to pay and the explanatory variables being a selected set of variables denoting demand for malaria control/eradication and other socio-economic factors. Thus, the WTP for malaria control (WTPMC) is given by:

WTPMC = f (M, S, I)

Where, M is the malaria prevalence, S is the socio-economic background/characteristics of the household and I is the household income. Various factors were considered as explanatory variables for the ordered probit analysis to study the demand for malaria control/eradication and these are presented in table 6.1.

To solicit for the WTPMC, a detailed explanation and description of the advantages and potential disadvantages together with their associated costs in effective treatment and control of malaria were provided to the respondents (see part 2 of Appendix 1 for details). The bidding next followed and was designed to determine the maximum price that a respondent will be prepared to pay for an effective treatment and control of malaria. Guided by responses during the pre-testing of the questionnaire, the household head was asked whether he or she was willing to pay ¢400,000 (US$ 47.13) to treat and control malaria in the household. If the respondent declined the offer the subscription was lowered and the respondent was asked to reconsider the new offer. The offer was lowered until a bid or acceptance was obtained or the lowest offer of ¢5,000 (US$ 0.59) was reached.

It is hypothesized that the willingness to pay to control malaria will be affected by the sex with females and pregnant women being more willing to pay higher amounts to control malaria. It is expected that married couples would be more willing to pay higher amounts to control malaria than single persons because of the responsibility the former have for each others health. As the years of schooling increase it is expected that people will understand the advantages of malaria control better than others.

People who travel long distances to attend clinic or to treat themselves of malaria and therefore spend more on health care would be willing to pay more to control malaria so as to cut down cost.

Table 6.1 Description of Explanatory Variables for Ordered Probit Model

Variable	Description of Variable	Mean
SEX	Sex (Male=1; female=0)	0.34
MARITAL	Marital status (Married=1; otherwise=0)	0.51
YRSCH	Number of years in school (in logarithms)	0.83
OCC	Primary occupation (Farming & fishing=1; otherwise=0)	0.16
NDEP	Dependency status of household members (Non-dependent=1; otherwise=0)	0.97
DIST	Distance traveled to attend clinic (in logarithms)	0.32
FACILITY	Health care facility usually attended (Government facility=1; otherwise=0)	0.67
INCOME	Monthly income. Proxied by total monthly household Expenditure (in logarithms)	5.97
MALPRE	Malaria prevalence, proxied by malaria morbidity rate	0.13

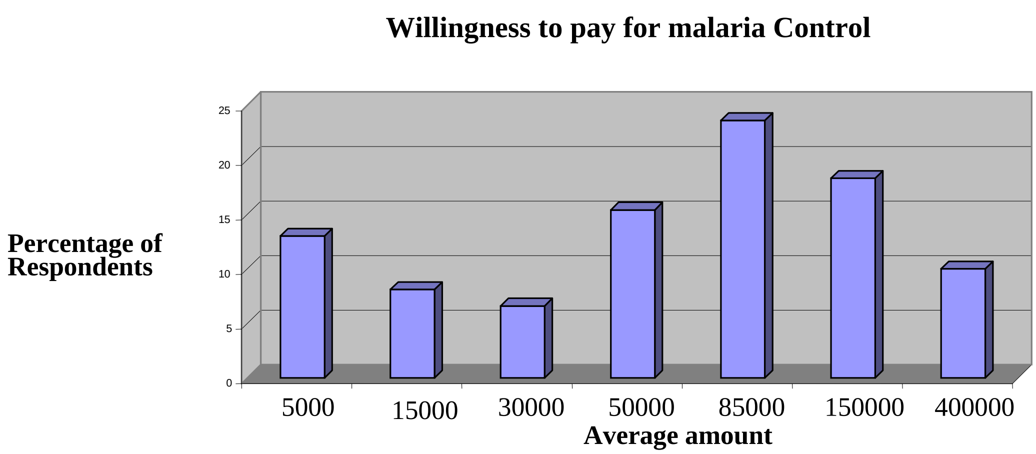
By offering bids, the response of an individual is restricted to one of the bids which represents an ordinal valve. Since multinomial logit or probit models fail to account for the ordinal nature of the response variable and ordinary regression analysis would give the wrong signals, and would therefore not be appropriate, an ordered probit or logit was used to analyse the data (Whittington et al., 1990 and Kahneman and Knetsch, 1990). Since the choice are hypothetical rather than real, it is important to interpret the results of contingent valuation studies with some caution.

6.4 Results and Discussion

6.4.1 Descriptive

The average amounts that respondents were willing to pay for malaria control are shown in figure 6.1. The average amounts they were willing to pay ranged from a low of ¢5,000.00 (US0.59) to ¢400,000.00(US$47.13). While 13% of the respondents were willing to pay ¢5,000.00, 10% of the respondents were willing to pay ¢400,000.00. Majority of the respondents (23.6%) indicated their willingness to pay ¢85,000.00. This was followed by an amount of ¢150,000.00 which 18.3% of the respondents were willing to pay for malaria control. On the average, households are willing to pay ¢119,511.26 (US$14.1) to avoid malaria.

Figure 6.1



Source: Survey data, 2003.

6.4.2 Empirical Results

The estimated results from the ordered probit model are presented in table 6.2. The log-likelihood function and a log-likelihood computed assuming all slopes are zero (restricted log-likelihood) are 320.1954 and 331.0952, respectively. The chi-square statistic, 21.80 given is a valid test statistic for the hypothesis that all slopes on the non constant regressors are zero is statistically significant at the 1% level. It is also used to determine if the overall model is statistically significant.

The variables that significantly discriminate among the amount households would be willing to pay are to control/eradicate malaria are dependency status of the household members, type of health facility usually attended and household income. The results confirm that, in general as people's income increase they are willing to pay more for the control/eradicate of malaria in their household. At a subscription rate of ¢85,000, there is a 0.04% chance that households are willing to pay to control/eradicate malaria. As the offer increase to ¢150,000, the chances increase to 0.17% that households will be willing to pay to control/eradicate malaria. If the household income rises by 1%, there is a 0.23% chance that households are willing to pay on the average ¢400,000 the highest offer to control/eradicate malaria in their household (table 6.3).

Table 6.2 Results of Multivariate Ordered Probit Model

```
+---------------------------------------------+
| Ordered Probit Model                        |
| Maximum Likelihood Estimates                |
| Dependent variable                 WPGG     |
| Weighting variable                  ONE     |
| Number of observations              178     |
| Iterations completed                 21     |
| Log likelihood function       -320.1954     |
| Restricted log likelihood     -331.0952     |
| Chi-squared                    21.79954     |
| Degrees of freedom                    9     |
| Significance level          .9536478E-02 |
|    Cell frequencies for outcomes            |
|  Y Count Freq  Y Count Freq  Y Count Freq   |
|  0    23 .129  1    11 .061  2    12 .067   |
|  3    35 .196  4    37 .207  5    35 .196   |
|  6    25 .140                               |
+---------------------------------------------+
```

```
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
         Index function for probability
 Constant -4.730941942      2.6843053      -1.762   .0780
 DSEX      .1938377575      .17946721       1.080   .2801  .34269663
 MARITAL   .2905629830      .18958152       1.533   .1254  .50561798
 LGYRSCH  -.7405489318E-01  .32591187       -.227   .8202  .82583263
 OCC      -.2699777685      .25341574      -1.065   .2867  .16292135
 NDEP     -.7059818308      .44125235      -1.600   .1096  .96629213
 FACILITY -.3872001267      .18155370      -2.133   .0329  .66853933
 LGDIST   -.1266543273      .12357400      -1.025   .3054  .31906415
 LGINCOME  1.124969663      .42990005       2.617   .0089  5.9685963
 MALPRE    .7816168424      3.5919519        .218   .8277  .12632584
         Threshold parameters for index
 Mu( 1)    .2774264165      .82924693E-01   3.346   .0008
 Mu( 2)    .5212870232      .10546430       4.943   .0000
 Mu( 3)    1.095428550      .13118413       8.350   .0000
 Mu( 4)    1.657322953      .15018178      11.035   .0000
 Mu( 5)    2.352694302      .18335459      12.831   .0000
```

Table 6.3 Estimated marginal Effects of Significant Continuous Variable(s)

Variable	P(5000)	P(15000)	P(30000)	P(50000)	P(85000)	P(150000)	P(400000)
INCOME	-0.2161	-0.0747	-0.0635	-0.0916	0.0400	0.1725	0.2334

SECTION 7

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

7.1 Summary and Conclusions

Malaria is not only a health problem but also a developmental problem in Ghana. It places significant financial hardships on both households and the economy. The burden of malaria therefore is a challenge to human development manifesting itself as a cause and consequence of under-development. Malaria's impact on households and society can be assessed from at least three important dimensions namely; health, social and economic. The impacts of malaria in all the dimensions to a large extent are less appreciated especially with the emergence of the HIV/AIDS pandemic.

In an effort to estimate the economic burden of malaria in Ghana, three approaches were employed by this study. The approaches were;

- A production function approach that estimates the impact of malaria on economic growth econometrically from the macro level. The estimation through this approach relied mainly on secondary data gathered from various official sources.

- Cost of illness approach that estimates the burden of malaria in an accounting sense. The data for the estimation of the burden on households was obtained through a cross – sectional survey of households from three different agro-ecological zones in Ghana. The selection of the study areas from the different agro-ecological zones was not only to ensure national representation but also to account for the climatic and ecological effects on malaria transmission. The approach was also to assess the impact of malaria on the Ministry of Health and the Ghana Health Service. The data was mainly secondary in nature.

- The Willingness to pay approach was used to estimate the burden of malaria on households through the contingent valuation method based on a cross-sectional household survey.

From the macroeconomic perspective, an estimated econometric model found malaria to have negative effect on real GDP growth. It was estimated that, one percentage increase in the malaria morbidity rate will slow down the rate of real GDP growth by 0.41%. This figure however is 32.8% lower than the 0.61% estimated in a hypothetical case by McCarthy *et al.* for Ghana in 1998.

The Cost of illness approach revealed that a single episode of malaria episode in the household resulted in an estimated average cost of ¢133,999.21(US$ 15.79). Almost 44% of this cost was direct expenditure incurred on treatment from orthodox health care providers. The treatment cost amounted to ¢58,319.98 per case. The major cost item was the cost of drugs. Patients paid ¢20,828.99 for drugs supplied by the facility.

The illness also contributed to the loss of productive time not only to the economically active patients but also the caretakers of sick children. The value of productive time lost to the households amounted to ¢75,681.21 (US$ 8.92) per case of malaria. The indirect cost represented 56.48% of the total cost of illness to the household. About 9 workdays were lost by economically active patients while more than 5 workdays were lost by their caretakers. School children also lost about four school days on the average due to the malaria illness.

The burden of malaria in Ghana in 2002 obtained through the cost of illness approach is estimated at US$2.63 per capita or US$13.51 per household. This estimated average per capita cost of malaria was equivalent to 9.74% of the per capita health expenditure in 2002. The study further revealed that about 70% of the households on the average spend ¢10,750.03 per month on anti-malarial products, mostly mosquito coils.

The study reveals that dependency status of the household member, type of health facility usually attended and household income discriminate significantly on the amount households are willing to pay to control/eradicate malaria. Generally, as people's incomes increase they are willing to pay more for control/eradicate of malaria in their household. As the subscription rate increases from ₵85,000 to ₵150,000 there is a chance of 0.04% and 0.17% respectively that households will be willing to pay to control/eradicate malaria. An increase in the household income by 1% results in a 0.23% chance that households will be willing to pay the highest offer, on the average ₵400,000.00 (US$47.13) to control/eradicate malaria in the household.

7.2 Recommendations

Malaria presents significant costs to the affected households since it is possible to experience multiple and repeated attacks in a year. The aggregated effects on the economy could be substantial. According to the World Health Report, malaria flourishes in situations of social and environmental crisis, weak health care systems and disadvantaged communities (WHO, 1999). It is therefore important that policies that seek to reduce the burden of malaria take such issues into consideration. Against this background, some policy recommendations that can de deducted from this study include:

(i) In the face of increasing cost of illness there is the need for a strong collaboration among major stakeholders including the Government, the District Assemblies, Non-Governmental Organisations and more importantly the communities. Every effort must be made by all the stakeholders to look for effective and cost saving methods of prevention and treatment. Generally, incomes levels of households have to be improved and especially that of agricultural households. This can be achieved by offering access to markets and good prices for their produce. There is also the need to increase opportunities for off-farm employment.

(ii) Though the use of mosquito coils was identified as the major method of protection due its availability and affordability to many households, the efficacy of some of the numerous brands on the market is questionable. In the short-term, the efficacy of these products needs to be assessed by the concerned authorities so as to afford resistance and waste of resources.

It is important that preventive behaviour of households are understood for effective planning. Though it has been established that the use of ITNs is an effective method of preventing malaria, the availability and the affordability of the net in Ghana is still low (Binka et al 1996; MoH, 2000). While sustaining the education on the use of the ITNs, it is recommended that efforts are seriously made by the major players in the health sector to make the nets readily available in the market. Households are already spending on other anti-material products especially mosquito coils and therefore a well package and sustained education on the ITNs is likely to make a positive impact. ITNs are more cost effective than the other products being used, they confer proven benefits and last longer than those products which last for one or two weeks.

(iii) On treatment cost of malaria, efforts should aim at facilitating early detection as well as rapid and effective treatment not only to cut down the cost of treatment but also to reduce the number of workdays lost. Policy should improve upon the treatment seeking behaviour of households towards malaria. Very often patients resort to self medication as a first line of treatment, with the intention of saving cost. However, they end up spending more when they have to visit a health facility as a follow up to the treatment of an episode of malaria. Since self medication could not be avoided in the short term, Home-Based care could be improved upon by first of all educating mothers on how to recognize and treat malaria early enough. In addition, School Health Education programmes especially at the Basic Education level need to be promoted to offer 'first aid' in schools. This process could be made less complicated if certified drugs are conveniently and ‘friendly’ packaged to reduce the ‘dislike’ for bitter drugs such as chloroquine.

(iv) The decision to seek medical care from a provider is influenced by several factors but the perceived quality of the provider and the proximity to the health care provider are major determinants. The proximity to the orthodox health facility affects the cost of transportation and more importantly the cost of time. In order to improve timeliness of treatment, the service consequently would have to be brought closer to patients especially those in the remote areas regularly. Programmes such as the mobile outreach programme of the Ghana Health Service must be well equipped so that difficult areas could be serviced regularly and also bring service closer to the client.

(v) Finally, while the effort at promoting effective case management through prompt and accurate recognition of cases by patients and caretakers at home and the implementation of appropriate malaria treatment and preventive policies which take issues of efficacy, accessibility, affordability and acceptability into account, the issue of malaria as a development problem must receive considerable attention. Malaria control strategies must be imbedded consciously into Ghana’s poverty reduction strategy. It is anticipated that with a considerable reduction in poverty and improvement in income levels, households would become increasingly responsible for the improvement of their health status and quality of life.

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APPENDIX 1

Household Questionnaire

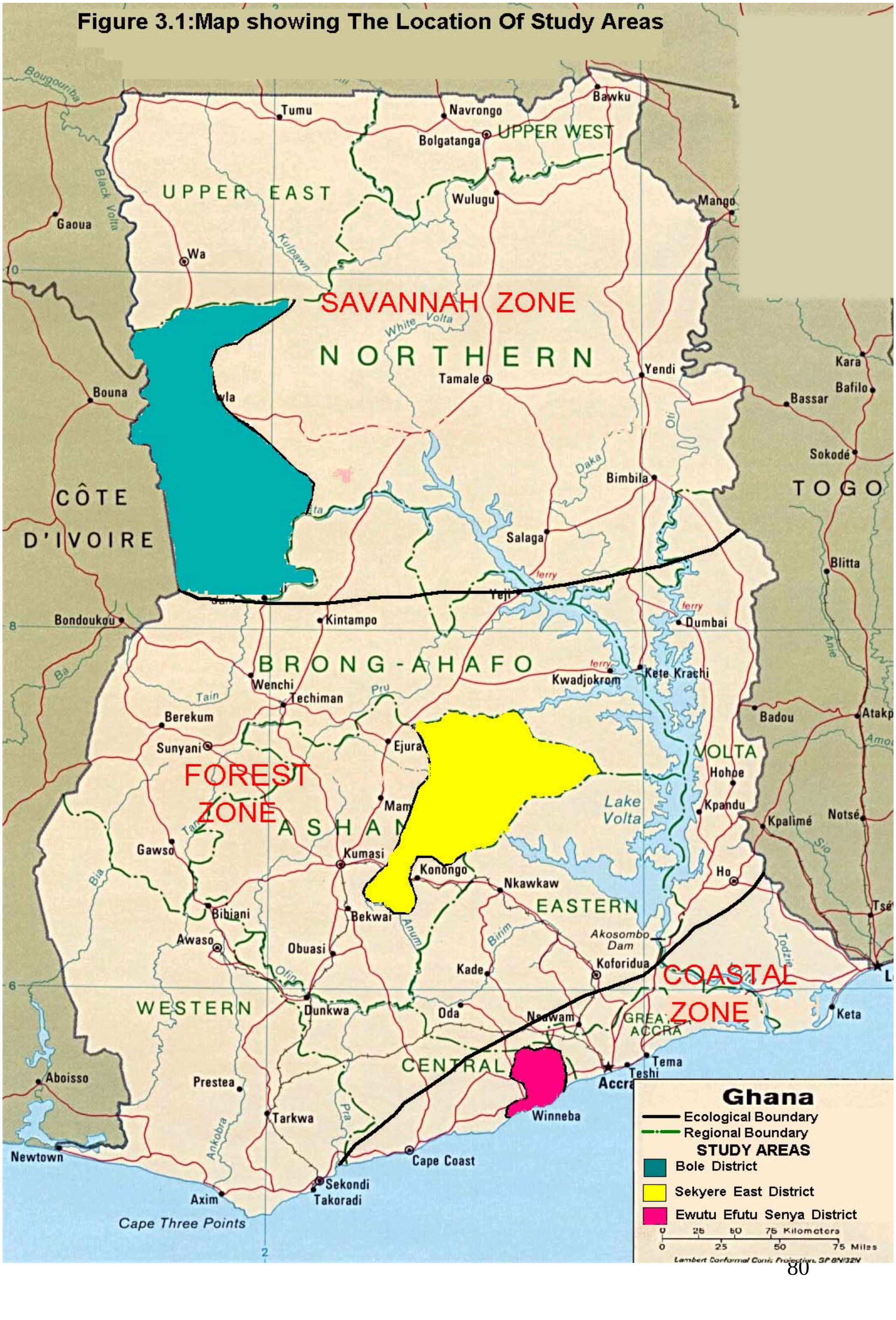
Figure 3.1:Map showing The Location Of Study Areas
SAVANNAH ZONE
NORTHERN
UPPER EAST
UPPER WEST
FOREST ZONE
COASTAL ZONE
BRONG-AHAFO
ASHANTI
EASTERN
VOLTA
WESTERN
CENTRAL
GREATER ACCRA
CÔTE D'IVOIRE
TOGO
Ghana
Ecological Boundary
Regional Boundary
STUDY AREAS
Bole District
Sekyere East District
Ewutu Efutu Senya District