ECONOMIC APPRAISAL OF MALARIA CONTROL IN OBUASI MUNICIPALITY – A FINANCIAL ASSESSMENT OF THE DIRECT TREATMENT COST OF MALARIA EPISODES FROM 2005 – 2008

By

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DECLARATION

I declare that this dissertation is my original work and has not been presented, either whole or part, for any purpose anywhere. To the best of my ability I have duly acknowledged information from other sources. I am solely responsible for any errors in the work.

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I declare that I have supervised the student in undertaking the study herein submitted and confirm that the student has my permission for assessment.

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DEDICATION

I dedicate this work to my two lovely boys, Lloyd Livingston Stiles-Ocran and Don Daemyn Stiles-Ocran and my loving and supporting husband, Joseph Blankson Stiles-Ocran.

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"To God Be the Glory, great things he has done"!

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ABSTRACT

Although malaria is the most significant cause of morbidity and mortality in Ghana, the cost of treating the disease in the country has not been well documented. Knowledge about the cost of treating malaria can affect the health care seeking behaviour of people and justify increased expenditure for malaria control measures. The present study explored the direct treatment cost of malaria episodes in Obuasi from 2005 to 2008. The study also looked into the public perception on malaria control efforts in Obuasi and the personal protective measures individuals have adopted against malaria infection and the cost involved.

A structured questionnaire was administered at the government and private hospitals and pharmaceutical shops to obtain information on the direct cost of malaria treatment. The direct medical costs were divided into five categories and their estimates were based on specific disease charges documented by the National Health Insurance Scheme or as per the charges by the individual hospitals and clinics. Areas in which direct charges were estimated for malaria include the costs of consultation, cost of diagnosis and drugs.

About 700 people were also interviewed to gather data on: demographic and socio-economic characteristics of the general public and cost of personal malaria prevention measures to them. About 99.7% (698/700) of the questionnaires were successfully administered and analysed. It was found that the proportion of the female respondents was significantly higher than the male respondents but the choice of malaria prevention method did not vary with gender. All the respondents were found to have at least one preventive measure in some way against malaria attack with the highest proportion being happy with the Obuasi Malaria Control Programme (which started in 2006). Approximately 31.7% of the respondents did

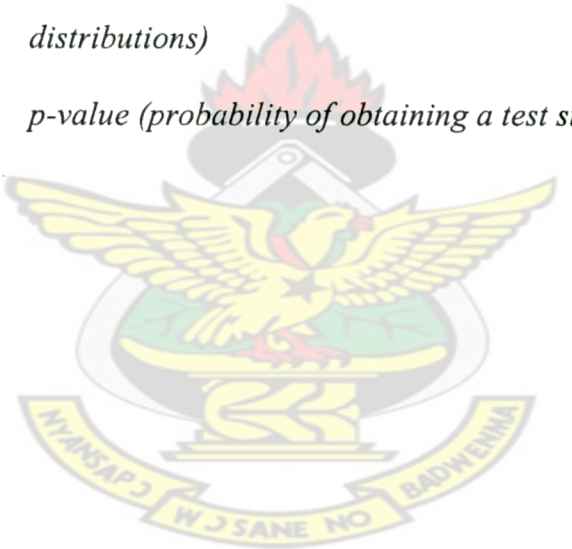
not spend any money on malaria as they depended exclusively on the IRS (by AngloGold Ashanti) and sanitation and/or a combination of these strategies. However, about 68.19% of the respondent spent out-of-pocket money for malaria prevention. The amount spent ranged from GH¢2.16 ($1.54) to GH¢3.94 ($2.8) a month or an average of GH¢3.66 (US$2.61) a month. It was also found out that, in between some of the years under consideration, there was an increase in the costs of treating malaria even though the large-scale control intervention was ongoing. For example, the amount of money spent in treating malaria in 2007 increased by 9% compared to the 2005(year before intensive malaria control activities started in Obuasi) baseline value. Again, using the malaria treatment cost in 2005 as baseline expenditure, we observed that there was about 14% and 2% reduction on expenses due to malaria infections in 2006 and 2008 respectively.

The high acceptance of the obuasi malaria control programme is essential to achieving the goals of the National Malaria Control Programme whose aim is to reduce malaria cases by 75% by 2015. The fact that each respondent is using at least one malaria control intervention is also an indication that the behavioural change communications being implemented has been of some benefit to the residents. The observation of reduction in the cost of treating malaria by the end of the four year period may be attributed to the success of the malaria control intervention, which possibly led to the decline in malaria cases and accordingly the overall costs of treatment.

LIST OF ABBREVIATIONS AND ACRONYMS

AFRO	WHO's Regional Office for Africa
AGA	AngloGold Ashanti Ltd
AIDS	Acquired Immune Deficiency Syndrome
CE	Clean environment
CEO	Chief Executive Officer
DALYs	Disease Adjusted Life Years
GES	Ghana Education Service
GDP	Gross Domestic Product
GHS	Ghana Health Service
GH¢	Ghanaian Cedis
HIV	Human Immunodeficiency Virus
IRS	Indoor Residual Spraying
ITNs	Insecticide treated Nets
MoH	Ministry of Health
NMCP	National Malaria Control Programme
OMA	Obuasi Municipal Assembly
OMCC	Obuasi Malaria Control Centre
OMCP	Obuasi Malaria Control Programme
PPPs	Public Private Partnerships
PR	Public relation
PW	Pregnant women
PSPs	Private Sector Providers

RBCs	Red Blood Cells
RBM	Roll Back Malaria
SPSS	Statistical Package for Social Science
TB	Tuberculosis
UK	United Kingdom
USD/ US$	United States Dollars
WHO	World Health Organisation
YPLL	Years of Potential Life Lost
z	*z-score (compare the relative standings of items from distributions)*
p	*p-value (probability of obtaining a test statistic)*



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CHAPTER ONE

GENERAL INTRODUCTION

1.0. Introduction

This section talks about the nature of the study conducted, the reasons behind this study, the knowledge this study intends to put across and why it is important to conduct such research. Discussions are also made on the extent this study targets, what prevented this study from attaining its perfection and how it is organized.

1.1. Background of Study

Malaria affects the health and wealth of nations and individuals alike. In Africa today, malaria is understood to be both a disease of poverty and a cause of poverty. Malaria has significant measurable direct and indirect costs and has recently been demonstrated to be a most important constraint to economic development. For developing economies the gap in prosperity between countries with malaria and countries without malaria widens every year (WHO, 1998).

Macro-level studies estimate that the per capita GDP in highly malaria endemic regions is on average one-fifth (1/5) that of non-endemic countries and the annual growth rates in endemic countries are 1.3% points lower than those of non-endemic countries, even after controlling other factors known to influence economic growth, such as human capital and initial income (Gallup & Sachs, 2001; Sachs & Malaney, 2002; McCarthy *et al*, 1999). Malaria is thought to contribute towards national poverty through its impact on foreign direct investment, tourism, labour productivity and trade. At the micro-level, malaria may cause poverty via spending on health care, income losses and premature deaths. Poor people are considered to be at particular risk of being infected in view of the fact that they are less likely to buy effectual preventive measures and to seek prompt effective treatment (Sachs & Malaney, 2002; World Bank, 1999, 2001; Worrall *et al*, 2005).

Conscious of the drain on their economies, governments in Africa are now increasing resources for malaria control, which is in line with the resolutions made at the Abuja Summit in 2000. Malaria is also becoming an important topic within the discussions of poverty reduction and debt relief and its control is now seen by many to be an important element of national poverty reduction strategies for malaria-endemic countries. Countries are also taking steps to ensure that insecticide treated nets (ITNs) for malaria prevention become more affordable by reducing or abolishing taxes and tariffs on insecticides, mosquito nets and the materials used in their manufacture (WHO, 2002).

Local and international businesses organisations operating in malaria endemic areas have also appreciated the fact that, support for malaria control programmes does not only reduce levels of absenteeism and therefore the lost of productivity, but it also boosts labour, community and government relations. In the long term, increased productivity will encourage market expansion, boost household spending and change consumption patterns. Accordingly, increased and effective malaria control interventions will work to the benefit of many companies, especially those producing consumer goods or developing local tourist industries (WHO, 2002).

The two most important strategies for malaria control are treatment using drugs and vector control. Malaria control in Ghana involves early recognition, diagnosis and prompt treatment to reduce severe morbidity and prevent death (GHS/MOH, 2008). Nevertheless, malaria diagnosis and treatment are primarily based on symptoms without laboratory confirmation. Drugs are usually given at home in wrong doses with the last resort, after the sickness has failed to respond to home treatment, being the formal health sector (Ahorlu *et al.*, 1997) leading to delays in effective treatment. Formally, there has been a progress in improving access to prompt and effective treatment. Treatment of uncomplicated malaria is now done with artesunate-amodiaquine and artemether-

lumefantrine combination therapies (RBM, 2005; GHS/MOH, 2008; Adjei *et al.*, 2008). These are effective for treatment of children with uncomplicated malaria with virtually no drug-related adverse effects but the widespread potential amodiaquine resistant parasites threatens the utility of amodiaquine as a partner for artemisinin combination therapy (Adjei *et al.*, 2008). Also, there is an effective intermittent preventive treatment using sulfadoxine-pyrimethamine for pregnant women (RBM, 2005; Osei-Tutu, 2009). Malaria vector control on the other hand, supplements the impact of early diagnosis and prompt treatment of malaria cases (WHO, 2003). The most advocated malaria control and/or prevention method appears to be the use of insect-treated bed nets (Binka *et al.*, 1996; GHS/MOH, 2008). These nets have been effective at reducing clinical disease and deaths in some large controlled trials (Alonso *et al.*, 1991, 1993; Binka *et al.*, 1996; Navill *et al.*, 1996). However, in some other trials treated nets did not have major impact in reducing malaria in a setting where the vectors rest outdoors (Banerjee & Nayak, 2002). Notwithstanding, the Roll Back Malaria campaign emphasises the use of treated bed nets due to their value in reducing human contact with vectors (RBM, 2005).

Although malaria or fever (as it is commonly referred to) is a major cause of morbidity and mortality in Ghana, the cost of treating the disease in the country has not been well documented. Knowledge about the cost of treating malaria can affect the health care seeking behaviour of people and justify increased expenditure for malaria control. The study therefore sought to appraise the cost of treating malaria and for that matter the cost-effectiveness of malaria control in Obuasi. The study took into consideration malaria cases in Obuasi estimating the amount of money spent on malaria infection and control, that is, the cost of treating malaria (before and after intensified Malaria Control exercise) to assess how worthwhile control measures have been in order to substantiate the need for increased expenditure on malaria control measures. The study also looked into the public perception of the Obuasi community malaria control programme as well as the

personal protective measures individuals have adopted to protect them from malaria infection and the cost involved.

1.2. Problem Statement

Individuals working and/or living in the gold mining areas could suffer profound and varying levels of exposure to malaria infection and consequently different risk of malaria prevalence (Barbieri & Sawyer, 2007). Malaria was the most significant public health threat to the Obuasi community and also threatened the operations of AngloGold Ashanti (AGA) mine. In 2005, an average of 12,000 cases of malaria was recorded monthly within the Obuasi Municipality. On the average, 48% of all out patient attendance was due to malaria and the disease headed the top ten killers, being responsible for 22% of all deaths (GHS-District Annual Report, 2005). To deal with this, the AGA together with the Obuasi Municipal Assembly (OMA) in 2006, intensified malaria control efforts within the municipality by implementing an integrated malaria control programme with indoor residual spraying (IRS) as the major intervention and complemented by larviciding of mosquito breeding grounds within beneficiary communities (total number of dwellings in the intervention area was 35000). An initial estimated capital of US$3 million was committed by AGA into the Obuasi Malaria Control Programme (OMCP) in 2006 and thereafter, and annual expenditure of US$1.3 million. The OMA is the first municipality/district in Ghana to implement a malaria control programme of such magnitude. Since the commencement of this programme, there has not been any published study that sought to appraise the cost-effectiveness of this malaria control efforts. Also, as the Ghana National Malaria Control Programme (NMCP) is preparing to scale-up the malaria control programmes to cover other districts in the country, there is the need for a diagnostic study, which seeks to explore the economic appraisal of malaria

control in the Obuasi Municipality to guide decision making and to possibly enhance stakeholder participation.

1.3. Research Questions

The research sought to tackle several issues including the amount of money spent on malaria control, taking into consideration malaria cases in Obuasi over four year period to assess how worthwhile the control measures have been in order to substantiate the need for increased expenditure on malaria control efforts.

1. What have been the malaria cases in Obuasi since malaria control was intensified?
2. Are people in the community happy about the malaria control programme and how have they benefited from this exercise in monetary terms?
3. What was the direct monthly and annual treatment cost of malaria incidents from 2005 - 2008?

1.4. Research Objectives

This study aimed at determining the direct treatment cost of malaria episodes recorded in Obuasi from 2005 – 2008.

The specific objectives were to determine the:

1. Perception of the beneficiary communities concerning malaria control.
2. Protective measures that the beneficiary communities have adopted against malaria and how much money they spent in the process.
3. Financial cost of treating malaria in Obuasi including the;
    a) Cost of malaria treatment among children below 5years.
    b) Cost of malaria treatment among adults.
    c) Cost of malaria treatment on pregnant women.

1.5. Research Justification

It has long been suggested that malaria is a major hindrance to the economic development of countries that are most severely affected by the disease. Several studies have documented the economic consequences of malaria at the household level, primarily in communities engaged in subsistence farming. A missing element is the appraisal of the economic impact of malaria control on the individual, community, public health and the government, which will probably inform policy makers in the affected economies (WHO, 2005).

Malaria posed a huge socio-economic burden on the poor people in Obuasi and a major health treat on health systems (Action Aid, 2006). In 2005, the monthly malaria episodes within the municipality were on average 12,000 of which the AGA hospital sees an average of 6,800 malaria patients monthly (2500 are mine employees). Medication for the treatment of malaria was in excess of USD $55,500.00 per month (AGA Report to Society, 2006). Estimating the economic impact of malaria control efforts is however critical and highly needed for evidence-based decision making and to attract donor funding for disease control programmes.

In Ghana, malaria has been the subject of many epidemiological, entomological and biomedical researches. The NMCP in collaboration with the OMCP intends to scale-up IRS to cover 40 districts in Ghana based on the Obuasi model, with the Global Fund as the principal donor. It is therefore necessary to design studies aimed at exploring the financial cost of managing malaria situation at local levels to inform policy decisions, especially on the choice of economically feasible control strategies. The current study focuses on the direct treatment costs of malaria episodes as a measure of programmatic impact of the malaria control on the economic burden of the disease.

1.6. Scope of Research

This research looks at malaria control in Obuasi and Ghana as a whole. We also looked at the financial component associated with the direct treatment of malaria incidence among the populace to enable us appraise the financial burden of the menace on the municipality. The study primarily utilized secondary data from all health institutions within the OMA which was obtained from the municipal directorate of the Ghana Health service (GHS), as well as tariffs from the National Health Insurance Scheme (NHIS) where the different prizes and charges used at the health facility level and pharmacy/chemical shops were obtained for calculating the treatment cost per patient within each of the three population categories.

1.7. Limitations of Research

One major limitation was getting all the pharmacy shops and hospitals to get us cost of malaria treatment. It was quite difficult getting a full statistics on malaria cases in Obuasi from the offices of the Municipal Health Directorate since some hospitals have not submitted their results yet. Time for submission and cost limited this work since it was difficult administering questionnaire to all citizens of Obuasi and so only a sample of the population was explored. This however did not duly affect the quantum of data needed for the study.

1.8. Organization of Study

This study is organized into five chapters. The first chapter provided a general introduction to the study and background information on the topic. It defined the core problem and the objectives of the study. It also talked about the research problem, research questions and objectives. This was then followed by justification of the study, scope of the research and the practical limitations encountered during the study. Chapter

two was devoted to the review of literature on the burden of malaria, economic costs and impact of malaria. Chapter three, which is the methodology and study area, talked about how the research was carried out: the sources of data, collection, organization and integration of collected data to attain the end result. It also talked about the background information on the study area, the Obuasi Municipality. Analysis of data continued in chapter four together with discussion on the findings of the survey. Chapter five wrapped up with summary of findings, conclusions, limitation based on the final outcome of the surveillance and recommendations for further studies.

CHAPTER TWO

LITERATURE REVIEW

2. 0. Introduction

Literature review attempts to summarize or comment on what is already known about a particular topic. By collecting different sources together, synthesizing and analyzing critically, it essentially creates new knowledge or perspectives (*www.nyu.edu, 2008).* This chapter seeks to review related literature that helps to explain the subject matter of this study, what others have done in connection with this topic, how they achieved their goal and what their conclusion on their study was.

2.1.0 Malaria Awareness

The word *malaria* comes from 18th century Italian word *mala* meaning bad and *aria* meaning air (Nordqvist, 2009). Most likely, the term was first used by Dr. Francisco Torti, Italy, when people thought the disease was caused by foul air in marshy areas. It was not until 1880 that scientists discovered that malaria was a parasitic disease which is transmitted by the *anopheles* mosquito (Nordqvist, 2009).

2.1.1 Malaria Transmission

Malaria is transmitted through the bites of female *Anopheles* mosquitoes infected with *Plasmodium* parasites. When a mosquito bites an infected person, it ingests microscopic malaria parasites found in the person's blood. The malaria parasite must grow in the mosquito for a minimum of 10 days before infection can be passed to another person. When the mosquito bites another person, the parasites go from the mosquito's salivary gland into the person's blood. The parasites then travel to the person's liver, enter the liver's cells, grow and multiply. During this time when the parasites are in the liver, the person has not yet felt sick. The parasites leave the liver and enter red blood cells

(RBCs); this may take as little as 8 days or as many as several months. Once inside the RBCs, the parasites grow and multiply. The RBCs burst, freeing the parasites to attack other RBCs. Toxins from the parasite are also released into the blood, making the person feel sick. If a mosquito bites this person while the parasites are in the blood, it will ingest the parasites. After completing its life stage in the mosquito, this mosquito can infect another person (WHO, 2003, 2009).

2.1.2 Symptoms, Diagnosis, Treatment and Prevention

Malaria is diagnosed by the clinical symptoms and microscopic examination of the blood. It can normally be cured by antimalarial drugs. The symptoms of malaria include fever, shivering, pain in the joints and headache, which quickly disappear once the parasite is killed. In certain regions, however, the parasites have developed resistance to certain antimalarial drugs, particularly chloroquine. Patients in these areas require treatment with other more expensive drugs. Cases of severe disease including cerebral malaria require hospital care (WHO, 2009).

2.2.0 The Burden of Malaria

About 300 million people worldwide are affected by malaria and between 1 and 1.5 million people die from it every year. Previously extremely widespread, malaria is now mainly confined to Africa, Asia and Latin America. The problems of controlling malaria in these countries are aggravated by inadequate health structures and poor socioeconomic conditions. The situation has become even more complex over the last few years with the increase in parasite resistance to commonly used drugs (WHO, 2009).

2.2.1 The Burden of Malaria in Africa

Malaria contributes substantially to the poor health situation in Africa. Sub-Saharan Africa accounts for 90% of the world's annual malaria cases and deaths. Of this, about 90% of all those who die due to malaria are young children. About 20 to 40% of out-patient visits and 10% and 15% of hospital admissions in Africa are attributed to malaria (WHO, 1999). According to the World Bank, malaria accounted for an estimated 35 million Disease Adjusted Life Years (DALYs) lost in Africa in 1990 due to ill health and premature deaths it caused. This accounted for 10.8% of all DALYs in Africa and 3% of the total global disease burden (World Bank, 1993). This loss was again estimated at 39 million DALYs in 1998 (2.8% of the global disease burden) and 36 million DALYs in 1999 (WHO, 1998, 1999, 2000). Furthermore, whereas malaria contributed 2.05% to the total global deaths in 2000, it was responsible for 9.0% of all mortalities in Africa (WHO, 2002). The burden of malaria is still enormous in that in 2006 there were an estimated 247 million malaria cases among 3.3 billion people at risk of the disease, leading to virtually a million mortalities, largely of children under 5 years old. One hundred and nine (109) countries were endemic for malaria in the year 2008 with 45 of these countries occurring within the WHO African region (World Health Report, 2008). The observed ill health and mortalities associated with malaria in Africa has a serious demographic effect on the continent.

With regard to financial burden, the World Health Organisation estimated that the total cost of malaria to Africa was US$ 1.8 billion in 1995 and US$ 2 billion in 1997 (WHO, 1997). According to a publication of the roll back malaria (RBM), malaria has been estimated to cost Africa over US$ 12 billion every year in lost of the gross domestic product (GDP) [*www.rollbackmalaria,2009*]. The implication of these assertions is that malaria is a massive problem, which possibly plagues all segments of the society and is

ranked second after HIV/AIDS accounting for 10.6% of the disease burden in sub-Saharan Africa (Asante &.Asenso-Okyere, 2003).

2.2.2 The Burden of Malaria in Ghana

Being hyper-endemic in Ghana, malaria presents a serious public health problem in the country. The crude parasite rate ranges from 10 – 70% with *Plasmodium falciparum* being the dominant parasite species. Everyone is at risk of being infested with malaria in Ghana with children under five years, pregnant women and non-immune visitors being at the greatest risk. Presumptively diagnosed, malaria cases form 33.75% of all outpatient diseases, 36% of all admissions and 33.4% of all mortalities in children under five years of age in Ghana. The disease also accounts for 13.8% of all out-patient attendances, 10.6% of admissions and 9.4% of mortalities among pregnant women. Most morbidities and mortalities resulting from malaria occur at home and are not reported (WHO, 2008).

The disease is also the leading cause of workdays lost due to illness in Ghana and thereby contributing more potential income lost than any other disease. According to the WHO, (1992) malaria accounted for 3.6 ill-days in a month, 1.3 work-days lost and 6.4% of potential income loss in Ghana for 1988/89. The disease again is responsible for 10.2% 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). Another study has showed that on the average three work days is lost per fever episode by the patient and two work days by the caretaker in Bole, Sekyere East and Awutu-Effutu-Senya districts in Ghana. The value of these days lost to the management and treatment of fever per episode is US$ 6.87 and this formed about 79% of the cost of seeking treatment in 1994 in these three districts (Asenso- Okyere & Dzator, 1997)

2.2.3 Malaria in Pregnancy and children in Malaria-Endemic Areas

The burden of malaria in pregnancy in malaria-endemic areas of the world is enormous and has been extensively studied. For example, Steketee, *et al*, (2001) reviewed studies reported between 1985 and 2000 on malaria infection in pregnancy and other associated conditions such as anaemia and HIV infection. Some of the health related anomalies found to be associated with malaria in pregnancy include low birth weight, prematurity and infant mortality. It was established that maternal malaria infection and the often accompanying anaemia and HIV contributes significantly to the global burden of infant mortality. Although effective interventions against malaria have been identified, the failure to provide these efforts continues to contribute substantially to infant deaths around the world (Steketee, *et al*, 2001).

2.3 Malaria and Poverty

Poverty and malaria are inter-linked. *Poverty affects malaria.* Communities with low incomes, limited education and poor access to health care are least able to engage in malaria control activities. Prevention of malaria may not be affordable or properly understood. Equally, treatment-seeking behaviour may be influenced by lack of education and inability to pay transport, consultation and treatment fees at health facilities. At the same time, *malaria affects poverty*. In poor households, a greater proportion of income is likely to be spent on malaria treatment than in richer households. Malaria illness can cause absenteeism from work and school, poor scholastic performance, lack of labour for cultivation, and a decline in child care; malaria deaths can lead to funeral costs, loss of an income-earner and a rise in orphan hood. Hence, a negative spiral can develop with malaria causing and deepening poverty which, in turn, *exacerbates inequalities* in society (WHO /AFRO, 2001).

2.4 Impact of Malaria on Economic Growth

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. Other studies also confirmed that a 10% reduction in malaria was associated with 0.3% higher growth in the economy (Asante &.Asenso-Okyere, 2003). 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 & 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 & Malaney, (2002) have also observed that where malaria prospers most, human society have prospered least. The study by Jimoh *et al*, (2007) also quantified the economic burden of malaria in Nigeria using the willingness to pay approach. Their results indicated that households would be prepared to pay an average of about Naira 1,112 (USD 9.3) per month for the treatment of malaria. This is about Naira 427 (USD 3.6) in excess of the average expenditure they currently make on malaria treatment per month. Similarly, households are willing to pay on the average a sum of Naira 7,324 (USD 61) per month for the control of malaria. Again, this is an excess of about Naira 2,715 (USD 22.6) over the cost they currently bear (protection, treatment and indirect costs), and it represents households' average valuation of their intangible costs of malaria

illness. This amount represents about Naira 611.7 (USD 5.1) per head per month and Naira 7,340 (USD 61.2) per year. For a country with a population of about 120 million this translates to about Naira 880,801 million per annum representing about 12.0% of GDP. Hence, the malaria burden in Nigeria is enormous and has a devastating impact on economic growth. The findings of the literature reviewed imply that malaria and poverty are closely linked and that reducing the burden of malaria will contribute to the economic well-being of communities; poverty-reduction will be an essential input into improving health. The recognition of these links would help identify mechanisms for ensuring that the poorest have access to essential health interventions.

2.5 Cost of malaria to households in Ghana

A study by Asante & Asenso-Okyere (2003) on Cost-of-Illness of Malaria to Household in three districts (Bole, Sekyere East and Awutu-Efutu-Senya district) in Ghana revealed that the average cost of a malaria episode to the household was estimated at GH¢13.40 (US$15.79). The direct cost of illness amounted to GH¢5.83 (US$ 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 GH¢7.57 (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 GH¢11.87 (US$13.99) in the Bole district and GH¢13.80 (US$ 16.26) in the Sekyere East district with the Awutu-Efutu-Senya district recording the highest cost of GH¢14.78 (US$17.41) per case. The direct prevention cost to the household per month amounted to a per capita cost of GH¢0.14. 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.

The average household cost of GH¢13.40 per malaria episode and an average monthly prevention cost of GH¢1.07 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 (Cropper *et al.*, 1999). Both the direct and indirect costs associated with a malaria episode represent a considerable burden on poorer households since the poor households will tend to spend a substantial part 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. This may compel poor households to sacrifice their productive capital for health care thereby affecting significantly their standard of living. 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 Ministry Of Health/ Ghana Health Service [MoH/GHS] (Cropper *et al.*, 1999). Akazili *et al.*, (2002) also studied the economic impact of malaria on households, particularly the treatment cost at the household level using data collected from a random sample of 423 households in Kassena-Nankana District (KND) of northern Ghana. Malaria was ascertained through self-reporting of symptoms using a one-month recall period. Cost analysis of seeking malaria care to households comprising direct and indirect costs to households were estimated and examined in terms of location, severity, and wealth. It was found that indirect cost accounts for 71% of total cost of a malaria episode. The cost of malaria care was estimated at 1% of the income of the rich and 34% of the poor households' income, suggesting that the burden of malaria is higher for poorer households. Whereas these findings may inform the choice of malaria control and/or prevention strategies, there is the need for more studies designed to explore the socio-

economic costs of malaria at household levels in communities where such data is lacking. This is due to the fact that the cost of malaria management at the household level could be influence by the culture of a given community and that culture may vary between communities short distance apart.

According to the WHO, (2003) the total cost of controlling malaria in Ghana for 2002 was 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 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. The estimated average per capita cost of malaria is equivalent to 9.74% of the per capita government expenditure on health. The high average cost per capita compares favourably with earlier results from other parts of Africa (WHO, 2003). 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).

The recent estimated annual economic cost of reported malaria cases alone in Ghana is GH¢77.24 million (MOH, 2008). According to the latest study conducted by the Ministry of Health, the figure is hovering around GH¢30.04 or $32.65 per person. With the budget for Ministry of Health at about GH¢20,000,000.00 a year, the total economic cost of malaria, comprising the cost of treatment and the productive time lost under the spell of the disease, is several times greater than the ministry's annual budget (MoH, 2008).

2.6 The Role of Private Sector in Malaria Control

Some of the ways in which private companies can contribute vital resources and expertise to malaria control include: contributing much-needed capital to scale-up current programmes or create new ones; assisting in the research and development of new interventions and treatments for malaria; providing management and business expertise to stimulate the market for insecticide-treated mosquito nets and antimalarial drugs; using their network of distribution channels to carry life-saving medicines and prevention measures to remote communities and using their marketing and public relation (PR) expertise to assist public education campaigns (RBM, 2001-2010).

There are powerful economic arguments to support public action to increase the uptake of effective malaria control efforts. Market failures are likely to arise from monopoly power of pharmaceutical firms, positive externalities associated with insecticide-treatment of nets, residual spraying, environmental control, and, potentially, ACT and information problems. In addition, commercial markets are unlikely to guarantee adequate uptake of interventions in contexts of widespread poverty (Hanson, 2004).

The challenge is to prioritise areas for public action (Hanson, 2004). Existing funding for malaria control is inadequate to fund the full menu of effective interventions with market failures, and even if considerable additional funds are made available through global

initiatives such as the Global Fund for AIDS, Malaria and TB, priorities will still need to be set. In the face of information failures and externalities, public funding should be focused on those interventions that are most cost-effective. Existing evidence shows that most existing malaria control interventions are very cost-effective, costing less than $100/DALY averted. There are important information gaps, however, relating to the costs and consequences of alternative delivery strategies, and the costs of reaching the poor (Hanson, 2004).

Private delivery of interventions such as ITNs and drugs offers the potential to extend coverage and focus public sector resources on those most in need. At the same time, the many deficiencies of the private sector in terms of quality and reach of distribution networks must be recognised. These factors will differ across contexts, requiring careful assessment of local conditions and provider characteristics. What is clear, however, is that public action will influence the private sector, and the likely impact needs to be assessed in making public choices (Hanson, 2004).

Future technological developments may simplify or make more complex the relationship between optimal public and private roles. For instance, it is currently relatively inexpensive and feasible to publicly subsidize insecticide for net treatment, but the binding of public and private benefits that will come about through long-lasting nets will require new funding mechanisms, such as licensing agreements for manufacturers.

Finally, it is important to recognize that financing and provision can often be separated in delivering interventions. Even if there is a strong case for public subsidy due to market failures, it is not necessarily the case that this must be delivered through public sector channels. Other options exist, such as vouchers which can be redeemed at private providers (Mushi *et al*, 2003), or contracting of private providers. The choice of how to

intervene will require a careful assessment of the options available, and their suitability to specific contexts.

In developing countries, informal and formal Private Sector Providers (PSPs) play a critical role in malaria control. Ambitious new benchmarks for malaria control have been set through the Millennium Development Goals and the Abuja targets. In many countries, policy makers and managers are beginning to work with, and not against, existing health seeking and provider behaviours. Public Private Partnerships (PPPs) enable countries to pool knowledge and resources, and to combine the different strengths of public and private organizations. The key objective of PPPs for health is to increase coverage of essential health interventions, improve the quality of care provided, and control excessive health care costs to users. PPPs represent a wide spectrum of possible relationships between public and private actors, and civil society, for the provision of public health and health care services. For effective malaria control at country and sub-regional level, strategic frameworks for implementation through PPPs need to be created.

2.7 Malaria control and/or prevention strategies

The major strategies employed at present for malaria control are treatment using chemotherapy and vector control. Treatment using drugs may vary with population and/or may be targeted. For example, pregnant women are provided with intermittent treatment using fancider but the general population is offered Artemisinin-based combination therapies. The effort of early and effective diagnosis of malaria is supplemented by vector control. Thus malaria control in Ghana is basically designed to be an integrated one (MoH, 2008).

2.8 Malaria control in Obuasi

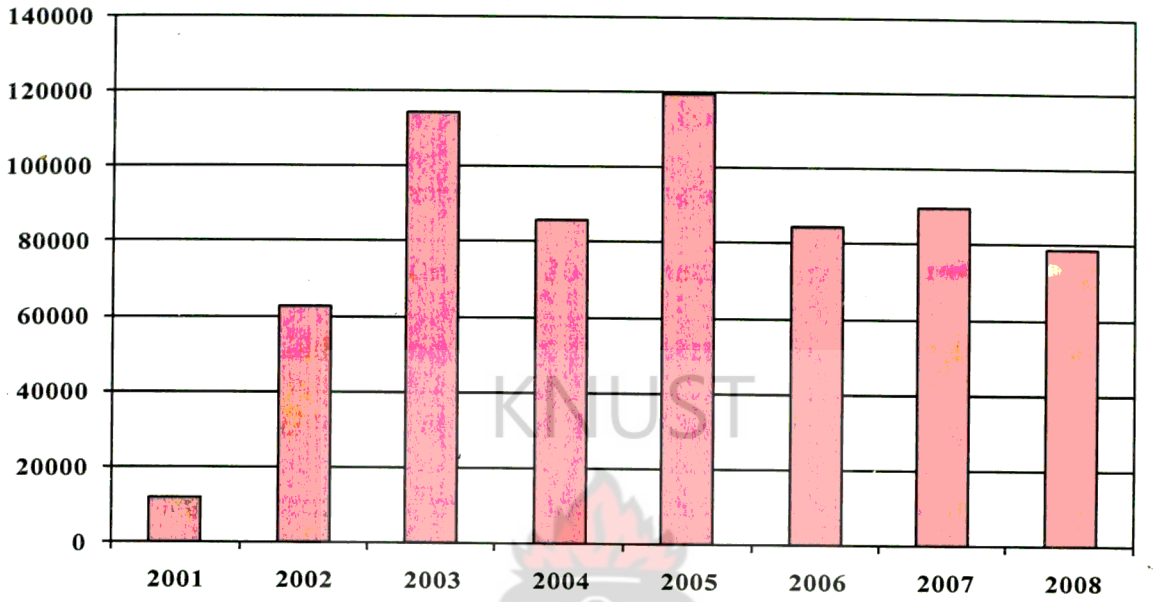
The stakeholders in malaria control within the Obuasi municipality include: Municipal Assembly; Ghana Health Service (Municipal Health Directorate); AngloGold Ashanti Ltd; National Malaria Control Programme (NMCP); Ghana Education Service (GES); Chiefs and Opinion leaders; and local populace.

The malaria control in Obuasi is an integrated programme with an initial aim of halving malaria incidence over two years. It has adopted multiple intervention methods to prevent the transmission of malaria and to effectively treat those already infected. One of the key elements of the integrated malaria control programme for Obuasi is vector control involving indoor residual spraying coupled with the distribution of long lasting insecticide-treated bed nets to the most venerable in society such as orphanages, maternity and children's wards. Also, temporary and permanent breeding habitats are treated with larvicides. Another key strategy against malaria is effective disease management employing the standard treatment protocols for rapid and early detection and diagnosis of malaria adopted by the Ghana Health Service. Malaria treatment in Obuasi includes the mandatory use of the new Artesunate drugs or artiminisin combination therapies.

Besides the large-scale programmed malaria control efforts, more people are accessing prevention and treatment services for malaria due to the intensified malaria health education being organised lately in the Obuasi municipality as part of the malaria control programmes. This is sparking some hope that the number of people who suffer morbidities and mortalities due to malaria will begin to decline. However, at present it is not known how much funds go into malaria control. Meanwhile, knowledge on the indirect costs and the direct costs of treating malaria may influence the healthcare seeking behaviour of people and provide the needed impetus for malaria control in the

country. Thus, it is essential to establish these costs to help individuals make a choice about alternative providers of malaria treatment and also for decision makers to use the cost structures as inputs in formulating effective health care policy (Lennox 1991).

8 YEAR TREND OF MALARIA CASES 2001-2008



CATEGORY OF MALARIA CASES

CATEGORY	**2005**	**2006**	**2007**	**2008**
Clinical malaria < 5yrs	13395	15,552	15,602	14,489
Clinical malaria≥ 5yrs	77023	67980	68,769	59,320
Confirmed Malaria cases < 5yrs	1598	3,666	624	772
Confirmed malaria cases ≥ 5yrs	13726	1,752	1,506	3,913
Malaria with severe anaemia < 5yrs	1516	1,220	433	0
Malaria with severe anaemia ≥ 5yrs	8952	2,516	1,057	0
Malaria in pregnancy	3397	2,826	1,490	830
Malaria in Pregnancy Confirmed	0	0	0	114
TOTAL	**119,607**	**84,671**	**89,518**	**79,438**

CHAPTER THREE

METHODOLOGY AND STUDY SITE

3.0. Introduction

A research methodology is a section of a research proposal in which the methods to be used are described. The research design, the population to be studied, and the research instruments or tools to be used are discussed. Research methodology can also be defined as what the activity of research is, how to proceed, how to measure progress, and what constitutes success. Research method is a systematic way to solve the problem by logically adopting various steps (Sridhar, 2008). Methodology helps to understand not only the products of scientific inquiry but the process itself. It aims to describe and analyze method, throw light on their limitations and resources, clarify their presupposition and consequences, relating their potentialities to the twilight zone at the frontier of knowledge (Sridhar, 2008). This section discusses the research design, population to be studied, types of research methods used, techniques, collections and ways of analyzing data as well as discussing the quality of research.

3.1 Research Design

Research design provides the glue that holds the research project together (Sridhar, 2008). A design is used to structure the research, to show all of the major parts of the research project. Different research designs have different attributes. The design is the structure of any scientific work. It gives direction and systematizes the research (Experiment-resources.com, 2009). What design you choose depends on different factors. What information do you want? How reliable should the information be? Is it ethical to conduct the study? And what is the cost of the design? This study however uses both qualitative and quantitative designs. This is because; applying both quantitative and qualitative methods in this intercultural research gives you a number of advantages. A

quantitative method ensures high levels of reliability of gathered data. Qualitative research allows for obtaining more in-depth information about the implementation of the Malaria Control Exercise (Saunders *et al*, 2007).

3.2 Sources of Data

The material source can be primary or secondary in nature. Primary data is collected to satisfy the specific purpose of the study. Secondary data is published findings from earlier research studies, often collected at the beginning of research to provide a background and basic information about the topic being researched (Anderson & Nylander 1999). The primary data for this study were collected from 15 hospitals, 20 pharmacies and 700 individuals of the Obuasi Municipality from June to September 2009. Secondary data on malaria episodes in the Obuasi Municipality and expenditure was also obtained from the Municipal Health directorate, AngloGold Ashanti hospital and Obuasi Malaria Control Centre. We also had the cost of treating malaria per age category by different health facilities from NHIS.

3.3. Population

Population is about people, and the dwellings, locations and environments that people live in. Population can be defined in many ways, for example by age, ethnicity, and type of housing, birthplace or location. Population sampling refers to the process through which a group of representative individuals is selected from a population for the purpose of statistical analysis (population.govt.nz, 2009). Performing population sampling correctly is extremely important, as errors can lead to invalid or misleading data. There are a number of methods used in population sampling to ensure that the individuals can be used to generate data which can in turn be used to make generalizations about a larger population. Obuasi currently has population of about 190,907 people with 5 sub-districts.

3.4 Sampling

Sampling refers to the process used to select a portion of the population for study. Sampling decisions are made for the explicit purpose of obtaining the richest possible source of information to answer the research questions (Saunders *et al*, 2007). The major reasons why we sample are; it is usually too costly to test the entire population of obuasi. The second reason to sample is that it may be impossible to test the entire population. The third reason to sample is that testing the entire population often produces error. Thus, sampling may be more accurate. The final reason to sample is that testing may be destructive (Saunders *et al*, 2007).

There are three primary kinds of samples: the convenience, the judgment sample, and the random sample. They differ in the manner in which the elementary units are chosen. The 700 populace for the study were selected at random. Fifteen (15) hospitals and twenty (20) pharmacy shops were selected by convenience sampling since these were the main hospitals well known in town and the others were at remote villages in Obuasi.

3.5 Data Collection Instruments

A structured questionnaire was administered to heads, doctors, nurses and record keepers consulted at the hospitals as well as the owners and the caretakers of the pharmaceutical shops to obtain information on the cost of malaria treatment. The basic components used to derive total cost estimates were the direct costs of health care utilization. The direct medical costs were divided into five categories and their estimates were based on specific disease charges documented by the National Health Insurance Scheme or as per the charges by the individual hospitals and clinics. Areas in which direct charges were estimated for malaria include the costs of consultation, cost of diagnosis (laboratory fees) and drugs. A structured questionnaire was the main research instrument for the collection of primary data from the general populace. The questionnaire was administered to 700

people selected at random from selected communities in the municipality to gather data on: demographic and socio-economic characteristics of the general public, direct cost of malaria prevention to them (out-of-pocket expenses), that is, monthly expenses on personal protection measures from malaria and perception about malaria control in the Obuasi. The Municipal Health Director, AngloGold Ashanti Hospital Manager and the Entomologist for The Malaria Control Centre were all interviewed using semi-structured interview method in order to get in depth knowledge on malaria control in Obuasi.

3.6 Data Analysis

Data analysis was carried out in relation to the research problem. Quantitative analysis was largely used for this research but in some cases qualitative analysis was also employed. Statistical Package for Social Science (SPSS) was used in analyzing the data. Finally all data was retested to check for the reliability of the results. Data analysis was presented in the form of frequency distribution tables, graphs and pie charts. In preparing the data obtained for analyses, the data was first edited to check for consistency, comprehensibility, legibility, completeness of answers, accuracy, uniformity and appropriateness. Questions that were not expressed in numbers were coded by assigning numbers to variable categories. The categories were answers to the questions that simplify data analysis. Edited and coded data were cleaned to make sure the right data was fed into the computer before the final analysis was run.

3.7 Study Site

Obuasi is a city in southern Ghana, lying south of Kumasi. It's made up 5 sub districts and had a population of 115,564 (2000 census) and can be found on the railway line from Kumasi to Sekondi. The Obuasi Municipality is one of the 26 districts of the Ashanti Region. It is located in the south-western part of Ghana between latitude 5.35N and

5.65N and longitude 6.35N and 6.90N, and covering a land area of 162.4 square kilometer. The municipality is bounded to the east by Adansi South, west by Amansie Central, to the north by Adansi North and to the south by Upper Denkyira District in the Eastern Region. The climate is of the semi-equatorial type with double rainfall maxima and average/mean annual rainfall ranging between 125mm and 175mm. Mean annual temperature is 25.5°C and relative humidity is 75% - 80% in the wet season. The vegetation is predominantly a degraded and semi-deciduous forest. The forest consists of limited species of hard wood which are harvested as lumber.

Obuasi Municipality is made up of 34 communities with a population of 184,630 as at 2007(GHS, 2007). There are 21 communities distributed towards the boarders of the municipality with about 60% being rural settlements. The town has about 16 health centres and about 25 pharmacy and chemical shops formally registered by the Municipal Health directorate. Obuasi is also noted for the great healthcare facilities such as AGA Hospital owned by AGA and also private health facilities such as, St. Jude Hospital, owned by Dr. George Owusu-Asiedu, etc. These facilities are noted for many successful surgeries and numerous successful births at the maternity wing of the hospital run by the former president of the Ghana Midwives Association, Mrs. Priscilla Owusu-Asiedu. As of September 13, 2008, Obuasi was signed in as another Sister City of Riverside, California, USA *(http://en.wikipedia.org/wiki/Obuasi, 2009).* The people are largely dependent economically on the AngloGold Ashanti mining operations and other illegal mining activities called *"Galamsey"*. Although mining is the principal industry within the municipality, there are other small scale business sectors. Cocoa, oil palm and citrus farming are the most important economic activities in the villages. Food crops such as cassava, plantain, maize, cocoyam and vegetables are grown for subsistence.

Obuasi is well known for its gold mine which is now one of the ten largest in the world with gold having been mined on the site since at least the seventeenth century. Tourists can visit the mine by arranging with the Public Relations Directorate of AGA. Operated by the Anglo Gold Ashanti (AGA), formerly the Ashanti Gold Company, it was the company's largest mine until the company's merger with the South African company AngloGold. Notable people from the city include the footballer John Mensah and Sam E. Jonah, the former CEO of Ashanti Goldfields Company. Ashanti Gold Sporting Club, a football club, and Adullam orphanage are also located within the city.

The AngloGold Ashanti mining operation covers about 70% of the land area within the municipality with pockets of *"Galamsey"* operators located within some communities. The housing includes the full spectrum - from large western style executive houses, bungalow type western houses, mine housing estates, shanty style basic housing and rural village housing. Houses made of clay/mud form less than 10% of the total number of houses and are found mostly in the rural areas. The mine workers are mostly housed in accommodation provided by the mine in "estates" scattered within the Obuasi Municipality. Drainage in the municipality to remove liquid waste is via surface drains on the side of the roads. Some of the better maintained sections have well constructed concrete drains, in some cases covered with concrete slabs. In many areas, the drains are damaged, creating swamps and supporting mosquito breeding. Mining activities within the municipality especially the illegal ones, result in the creation of deep trenches and open pits. As a result of this, swamps are created especially in the rainy season, which in time become the breeding sites for mosquitoes. It is therefore not surprising that malaria is the major public health problem in the Obuasi municipality (GHS-District Annual Report, 2005).

The malaria control strategies adopted by the AngloGold Ashanti together with the Municipal Assembly and the municipal directorate of the GHS include treatment using artemisinin-based combination therapies, indoor residual spraying; larval control through larviciding and environmental management; ITN distribution to vulnerable groups such as pregnant women, children under one, orphanages, hospitals and maternity homes; and community advocacy via information, education and communication towards environmental sanitation, screening of homes, adherence to the use of ITNs and cooperation with IRS implementation programme.

Sub district population distribution over four year period

SUB MUNICIPALITY	%	2005	2006	2007	2008
NEW NSUTA	29.2	50425	52139	53912	55745
GAUSU	23.2	40063	41426	42834	44290
BRAHABEBOME	19.5	33674	34819	36003	37227
TUTUKA	18.5	31947	33033	34157	35318
KWABRAFOSO	9.6	16578	17142	17724	18327
DISTRICT	100	**172,687**	**178,559**	**184,630**	**190,907**

CHAPTER FOUR

FINDINGS, ANALYSIS AND DISCUSSION

4.0 Introduction

The purpose of this chapter is to outline and analyze data collected from the field on the perception of the general public on the ongoing malaria control programme, the personal protective measures employed, amounts spent on personal protective measures at the household level ,as well as the expenditure on treating malaria using institutional records from the Municipal Health Directorate. Tables, figures, statistical and econometric techniques were employed to aid analysis. SPSS 16.0 (SPSS Inc., Chicago – USA) WINKS SDA 6.0 (TexaSoft, USA) statistical data analysis packages were prominent in this analysis.

4.1 Survey responses

Seven hundred (700) questionnaires were sent out to the general populace of the Obuasi Municipality. Fifteen (15) questionnaires were also sent out to health facilities comprising one government hospital, one mission hospital, two health centres and eleven private hospitals/clinics. Twenty (20) pharmacy and chemical shops were also surveyed [refer to Table 4.1(a) shows the profile of the respondents]. Table 4.1(b) and Figure 4.1(a) also show the demography and gender ratios of general public who responded to the questions. Of the 700 questionnaires given out to the general public, 698 were received representing 99.71% response rate. All health facilities and pharmacy/chemical shops responded to questionnaire. All the questionnaires were administered by trained personnel and hence included in the analysis. The proportion of the female respondents was significantly higher than the male respondents ($z = -5.781$, $p = 0.001$)

Table 4.1(a): Profile of Respondents

Class of respondents	N	n	RR (%)
General public	700	698	99.71
Health facilities	15	15	100
Pharmacy and chemical shops	20	20	100

N is the number of questionnaires sent

n is the number of questionnaires received

RR is the response rates

Table 4.1(b): Gender of the general public respondents

Gender	Frequency	Percentage (%)	Cumulative percentage (%)
Male	295	42.26	42.26
Female	403	57.74	100.00
Total	698	100	

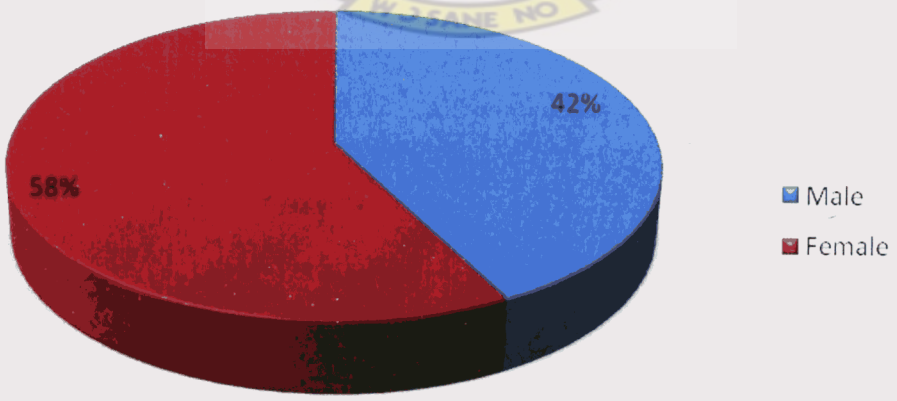


Figure 4.1: Questionnaire response by gender

4.2 Personal protective measures used by respondent

Table 4.2 and Figure 4.2 shows the responses obtained from this survey indicating the specific personal protective measures adopted by the respondents. These include those who depend exclusively on the indoor residual spraying (IRS), aerosols, insecticide-treated nets (ITNs) and clean environment to prevent mosquito bites. Those who use two or more of these measures were also indicated. None of the respondents claimed to depend on all the four named protective measures but all of them have adopted at least one of the above measures against malaria infection.

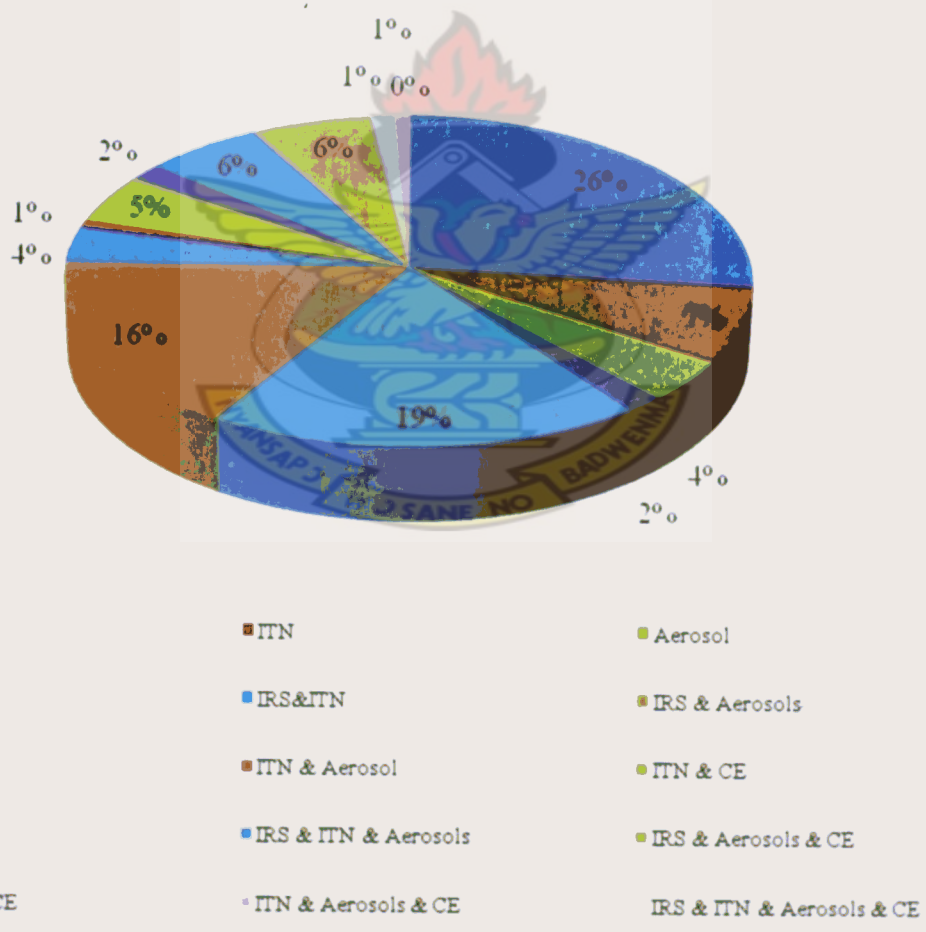


Figure 4.2 Respondents personal protective measures

Approximately 39.68% (277/698) of the respondents were protected by one malaria control intervention. Similarly, 46.13% (322/698) of the respondents relied on a combination of any two of the above malaria control interventions. Finally, 14.18% (99/698) of the general public interviewed were protected by a combination of any three control interventions named above against malaria transmission. Respondents who depend solely on IRS and environmental sanitation claimed to have no monthly expenses on preventive measures. Intra-domiciliary IRS campaign by AGA is basically done free of charge for the community as part of the strategies adopted for the malaria control exercise. This explains why the highest number of correspondents depends solely on this intervention.

About 41.02% (121/295) and 38.71% (156/403) of the male and female respondents employed one of the four named protective measures against malaria. There were no significant differences between these patterns of personal preventive measures between genders. About 45.42% (134/295) and 46.65% (188/403) of the male and females use two of the four protective measures in preventing malaria infection. Similarly, there were no significant gender variations in these observations ($z = -0.321$, $p = 0.748$). Finally, 13.56% (40/295) and 14.64% (59/403) of the male and female respondent use three of the four personal protective measures for protection against malaria transmission and this pattern did not vary with gender ($z = 0.404$, $p = 0.686$).

Approximately 27.11% and 26.05% of the male and female respondents respectively depended solely on the IRS to protect them against malaria infection with no significant variations in the proportions of male and female respondents who relied exclusively on this intervention ($z = 0.315$, $p = 0.753$). Also, 7.94% and 6.78% of the male and female respondents respectively depended only on ITNs for protection against the disease. The dependence on ITNs for protection against malaria infection did not also vary

significantly between the sexes ($z = -0.577$, $p = 0.564$). Whereas 5.3% and 3% of the male and female respondents respectively use only aerosols as personal protective measures, 1.69% and 1.74% of the males and females rely on environmental sanitation. Again, there were no significant variations in the choice of either aerosols ($z = 1.627$, $p = 0.104$) or environmental sanitation ($z = -0.042$, 0.966) as exclusive measure against malaria transmission between genders. On the whole, there were no significant differences in the proportions of both the male ($p > 0.05$) and female (($p > 0.05$) respondents who have adopted either the IRS, ITNs, aerosols or clean environment as their exclusive protective measures against malaria transmission.

Among the 277 respondents who claimed to depend on only one protective measure to combat malaria transmission, significantly high proportion 66.80% (185/277) relied exclusively on the IRS. The remaining 33.21% (92/277) of the respondents were distributes as follows: ITNs 18.77% (52/277), aerosols 10.1% (28/277) and clean environment 4.3% (12/277). Accordingly, there were significant differences between the proportions of the respondents who relied exclusively on one protective approach against malaria transmission ($p > 0.05$). There was a significant variation in the proportions of the respondents who employed a particular combination of intervention against malaria infection. Finally, 99 of the respondents were protected from malaria through a combination of three interventions namely: 42.4% (42/99) for IRS, ITNs and aerosol; 43.4% (43/99) for IRS, aerosol and CE 8% (8/99) for IRS, ITNs and CE; and 6% (6/99) for ITNs, aerosol and CE. Significant variations occurred between proportions of public being protected by the various combinations of the malaria control strategies ($p < 0.05$).

None of the respondents who claimed exclusive dependence on the IRS strategies against malaria spend money on malaria control. Similarly, none of those who protect themselves from malaria infection through environmental management or a combination

of this and IRS strategies incur any direct personal financial cost on malaria transmission prevention. In other words, 31.80% (222/698) of the respondents did not spend any money on malaria principally as a result of the IRS and environmental sanitation exercise champion by the municipal assembly. The rest of the respondents constituting about 68.19% (476/698) incur some direct monthly costs on personal protection measures, which range from an average of GH¢2.16 a month for those who purchase aerosols and embark on environmental management to GH¢3.94 a month for those who use ITNs alongside the IRS. This was due to the fact that most of the respondents in this category spent more on nets and also forms the majority of those who use combined measures. On the average, 68.19% of the study respondents spend about GH¢3.66 a month in protecting themselves against the malaria infection.

Others who use ITNs and Aerosols gave out different cost spent on these measures and a sum of their expenses was recorded. Some ITNs usage also claim they had their nets for free from the Municipal Health Directorate as part of their malaria control effort amongst pregnant women, children <1years and mothers of under ones.

4.3 Respondents perception on malaria control activities

Table 4.2 shows the perception of the respondents concerning the malaria control interventions in Obuasi. The majority (64.9%) of the respondents were happy with the malaria control activities, especially the AGA IRS programme and would wish it continues to help them save more cost in future. About 22.4% of the respondent do not agree with malaria control activities and would wish indoor residual spraying is stopped because they think the programme has not benefited them in any. Finally, about 12.8% of the general public interviewed were indifferent because they were not directly involved in the exercise.

Table 4.2: Respondents' perception of the malaria control activities

Perceptions	Frequency	Percentage (%)	Cumulative (%)
Malaria control activities has been beneficial and has help me save some cost **(a)**	453	64.90	64.90
Malaria activities have not been beneficial and I think they should stop IRS **(b)**	156	22.35	87.25
I can't tell because I'm not involved **(c)**	89	12.75	100
Total	698	100	

4.4 The direct treatment cost of malaria from institutional records.

4.4.1 Monthly trends of the costs of treating malaria episodes among children less than five years of age from 2005-2008.

The monthly trends of the direct costs of treating malaria episodes among children less than five years of age from 2005-2008 in the present study communities were as illustrated in Figure 4.3. In 2006, the highest monthly expenses GH¢27,013.84 made on the treatment of malaria cases in general occurred in January with the second highest expenditure GH¢20,090.85 occurring in March, all in the main dry period of the year. The lowest monthly cost of GH¢9,872.19 for treating malaria cases during the dry weather and throughout the year occurred in February. During the major rainy period from May to July, an amount of GH¢11,385.47 which was the lowest cost observed due to malaria infection in May. Afterwards, the monthly costs of managing malaria episodes increased until the month of October in the minor rainy season to approximately

GH¢19,565.93. The second lowest monthly cost of treating malaria cases in general in the dry season and throughout the year was GH¢10,503.88.

In both year 2005 and 2007, the direct monthly treatment costs malaria cases were comparatively constant from January to April after which the cost increased sharply until June when the highest expenditure of about GH¢22,943.40 in each year in question occurred. After this period, the cost of treating malaria cases reduced month by month until after August, when the cost began to increase again till October. From October the monthly cost incurred remained somewhat constant for the year 2007 but decreased steadily for the year 2005 until December. The lowest amount of money spent on malaria treatment in 2005 and 2007 occurred in March GH¢11,556.93 and April GH¢13,234.69 respectively.

In 2008, the direct treatment costs of monthly malaria episodes generally increased from January GH¢17,454.03 until April GH¢21,386.54 shortly before the major rainy period. Afterwards, the cost of managing malaria decreased generally until shortly after the rains in August GH¢14,002.07 when the monthly cost per treatment of malaria began to increase again until November GH¢19,853.97. The lowest amount of money GH¢5,262.68 spent in a month on malaria episode treatment in the year 2008 among children who were less than five years of age occurred in December.

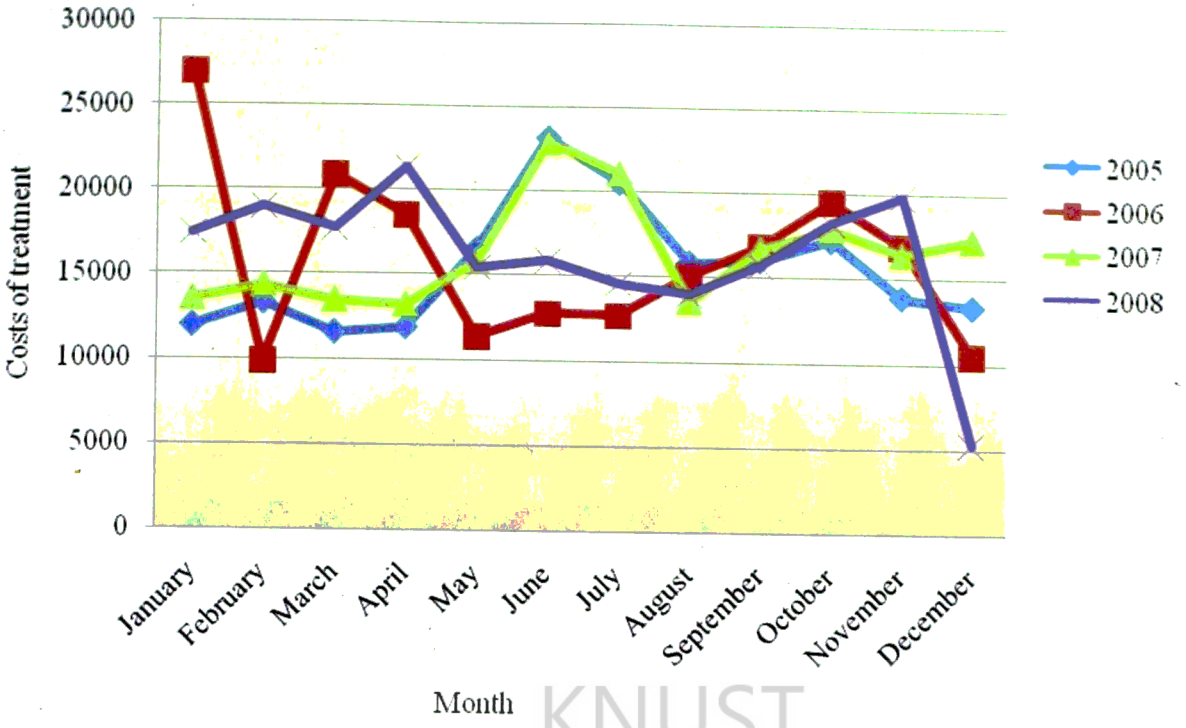


Figure 4.3: Monthly cost (GH¢) of malaria treatment among children under five years old over four year period

Figure 4.4 illustrate the direct monthly treatment costs (GH¢) of in-patients malaria episodes (i.e. admissions due to severe malaria) among children less than five years old over four year period (2005-2008) in the present study areas. On the whole, there were low in-patient (admissions) malaria cases among children under five years of age compared to the out-patient episodes. Accordingly, the amount of money spent for the treatment of malaria episodes was comparatively low. The highest treatment costs observed in the years 2005, 2006, 2007 and 2008 were GH¢6,631.94(in October), GH¢2,987.00 (in April), GH¢18,475.68 (in October) and GH¢2031.84 (in November) respectively. On the other hand, the least cost observed in the years 2005, 2006, 2007 and 2008 were respectively, GH¢300.74 (in April), GH¢62.74 (in June), GH¢253.17 (in July) and GH¢0.00 (in November).

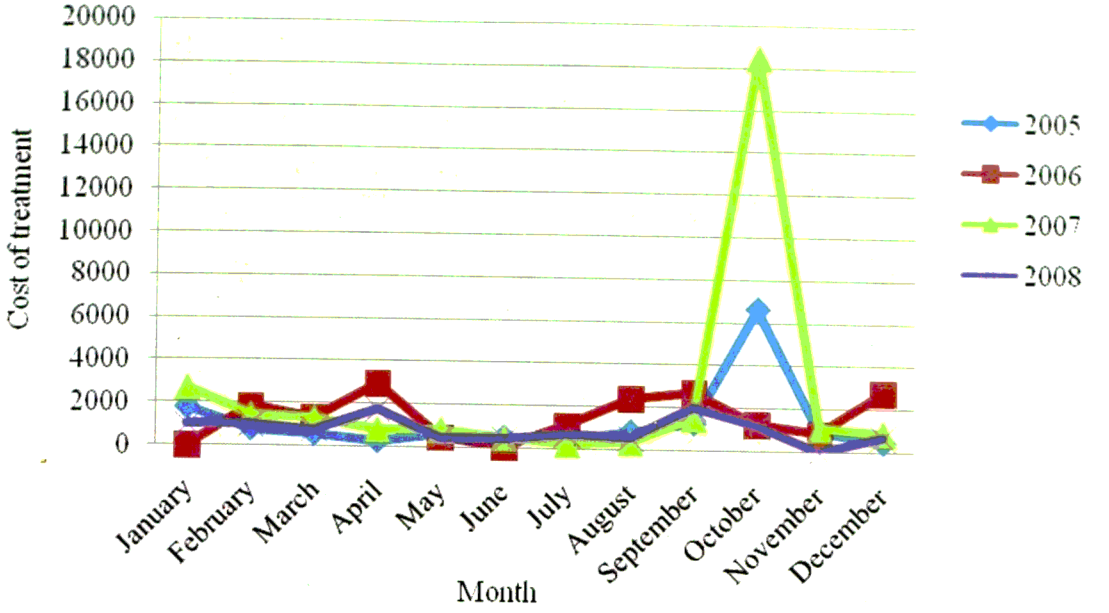


Figure 4.4: Monthly costs (GH¢) of in patients malaria treatment among children under five years old over four year period

4.4.2 Monthly trends of the treatment costs of malaria episodes among the age category 5yrs & above over four year period.

The monthly direct treatment costs of malaria episodes among this population category were as illustrated in Figure 4.5. In the year 2005, the monthly treatment cost increased from GH¢47,529.27 in January in the early, dry period of the year to a highest of GH¢110,884.69 in August shortly after the major rainfall season. From August 2005, monthly expenditure on malaria treatment declined steadily to GH¢78,816.88 in December. In 2006, the highest monthly treatment cost of GH¢107,866.86, was observed in January and the lowest in June, amounting to GH¢42,368.99. On the whole, the total sum of money used in managing malaria episodes in 2006 was lower than any other year being considered. The monthly costs of managing malaria attacks in 2007 generally increased from January GH¢59,446.74 until December GH¢96,540.82 with the highest amount of GH¢105,482 occurring in August. Lastly, in 2008 the highest cost of treatment occurred April GH¢99,130.98 and the lowest in December GH¢32,573.18.

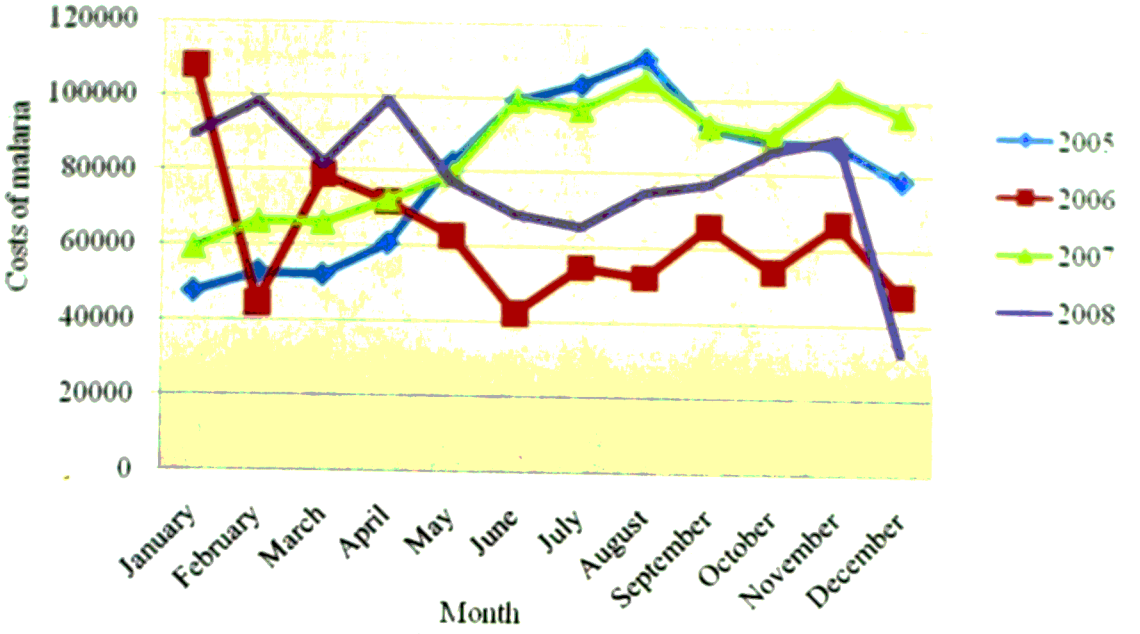


Figure 4.5: Monthly costs (GH¢) of malaria treatment among children above five years old and general adults population over four year period

The monthly treatment costs (GH¢) of in-patient malaria episodes for the population in question from 2005-2008 are indicated in Figure 4.6. Generally, there was less severe malaria cases requiring detention at all health facilities and hence the cost of treatment among this population. The treatment costs generally decreased from January to December for the years 2005 and 2007 with the highest being GH¢8,855.49 and GH¢6,163.80 respectively in January for both years. The least malaria related financial costs in the year 2005 and 2007 were GH¢415.05 and GH¢0.00 respectively in the month of July for both years. In 2006, there was no spending on severe malaria episodes in January after which the treatment cost increased until December with the highest occurring in September GH¢8,295.24. Lastly, the monthly expenditure on treatment of in-patient cases in the year 2008 ranged from GH¢3,243.15 in February to GH¢0.00 in November.

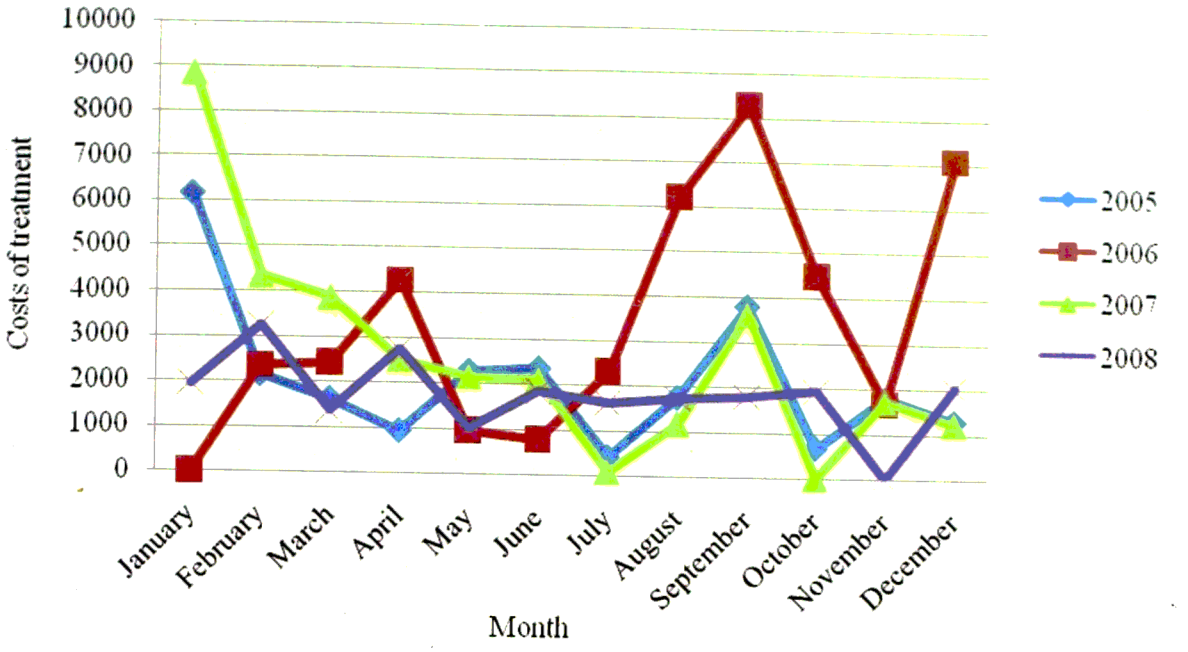


Figure 4.6: Monthly costs (GH¢) of in patient malaria treatment among children above 5 years old and general adults population over four year period

4.4.3 Monthly trends of the costs of managing malaria episodes among pregnant women from 2005-2008.

The monthly trends of the treatment costs (GH¢) of malaria incidence at the out-patient department (OPD attendants) among pregnant women over four year period were as given in Figure 4.7. Similar patterns of malaria treatment expenses were observed during 2005 and 2007. The monthly costs of treatment were high in January for the years 2005 (GH¢3,591.94) and 2007 (GH¢3,402.13) as well as in July 2005 (GH¢2,989.29) and June 2007 (GH¢2,790.28). Relatively lower expenses were made in April 2005 (GH¢1,347.38) and April 2007 (GH¢1,183.22) and from August to December in each year (refer to Table V in Appendix 2). During the year 2008, the highest treatment costs were incurred in January and from March to October with comparatively lower costs occurring in the months of February, November and December (refer to Table V in Appendix 2). The cost of treating malaria in pregnancy was comparatively lower in the year 2008 than the other three years in question. The highest treatment cost occurred in November GH¢2,126.16 and the lowest in December GH¢362.40.

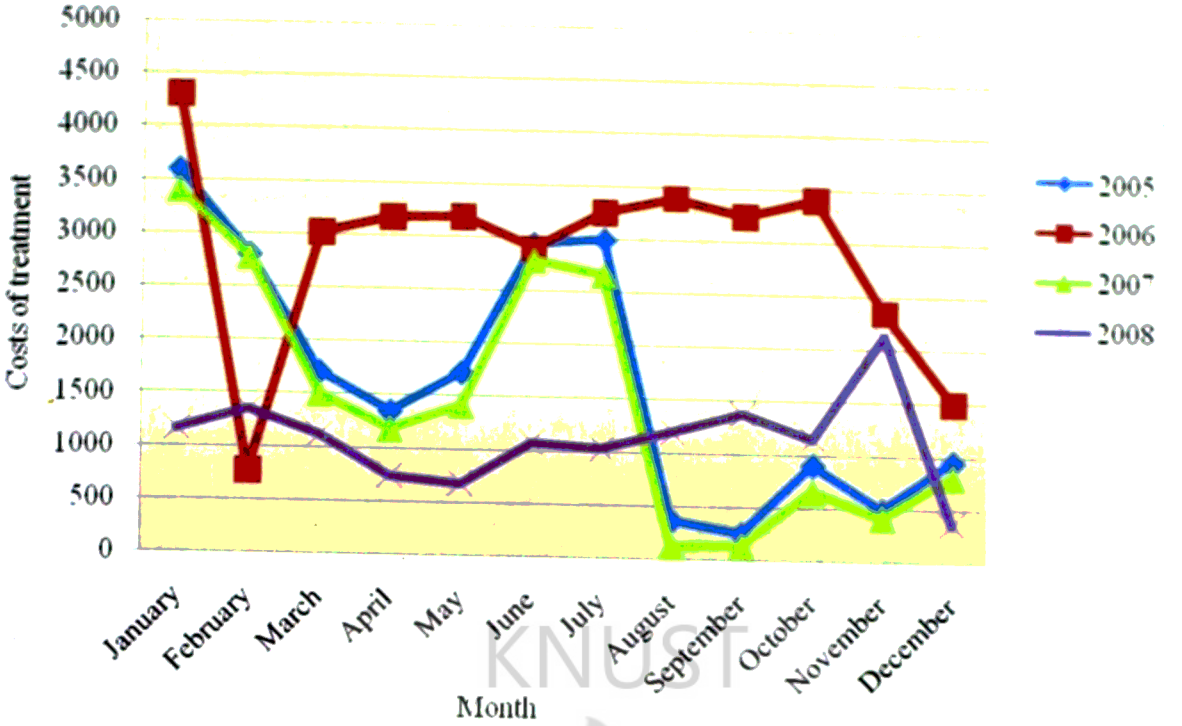


Figure 4.7: Monthly costs (GH¢) of malaria treatment among pregnant women over four year period

Figure 4.8 also illustrates the monthly treatment costs of malaria admissions among pregnant women over the four years period. In comparison with the out-patient treatment costs estimated for pregnant women, there were low financial costs for in-patient malaria episodes with the highest values occurring in August (GH¢899.30), October (GH¢954.70) and December (GH¢610.04) 2006.

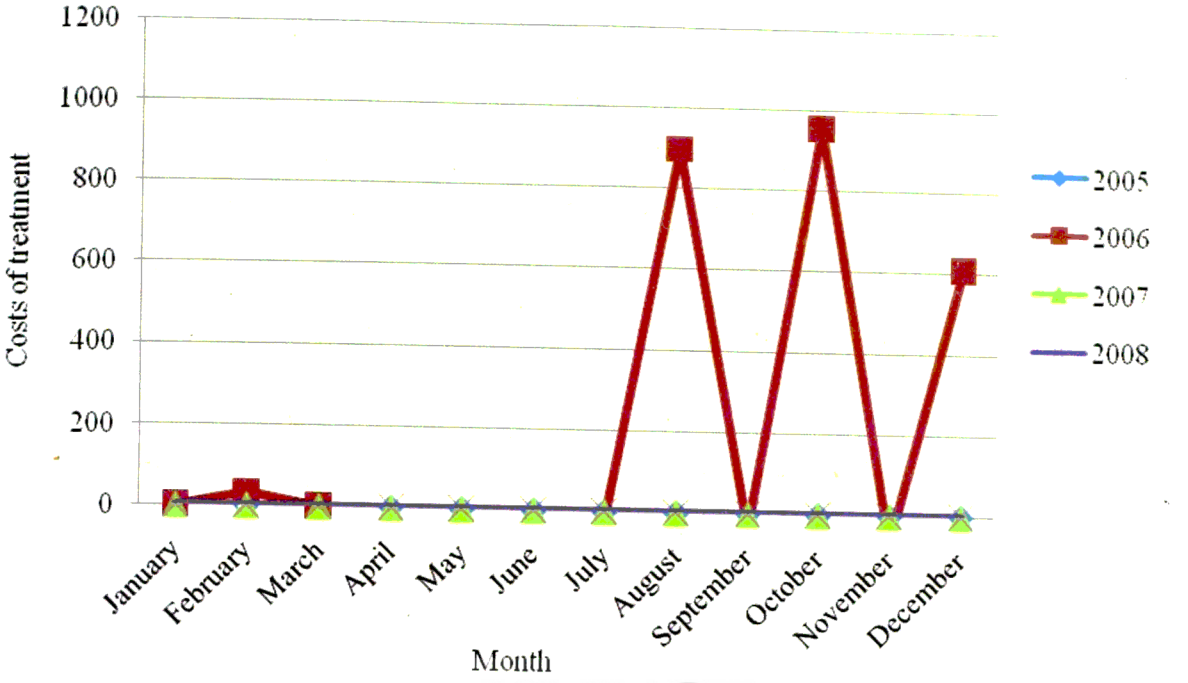


Figure 4.8: Monthly costs (GH¢) of in patient malaria treatment among pregnant women over four year period

4.4.4 Overall monthly trends of the treatment costs of malaria OPD episodes over four year period (2005-2008).

The overall treatment costs (GH¢) of the out-patient malaria episodes among the general populace within the Obuasi Municipality over the four years period were as indicated in Figure 4.9. This graph was obtained from a compilation of all treatment costs from malaria episodes recorded from children <5yrs, ≥5yrs population category and pregnant women. There were similar pattern in the distribution of costs in 2005 and 2007 with the lowest occurring in January and the highest occurring from June to August (refer to Table VI in Appendix 2). During the year 2006, the costs of treating general malaria attacks primarily decreased from January in the dry season to June in the major rainy season. Subsequently, treatment costs increased gradually till the end of the year with the peak during the second half of the year occurring in November. In the year 2008, the highest treatment costs occurred in February, April and November with the lowest occurring in December (refer to Table 5 in Appendix).

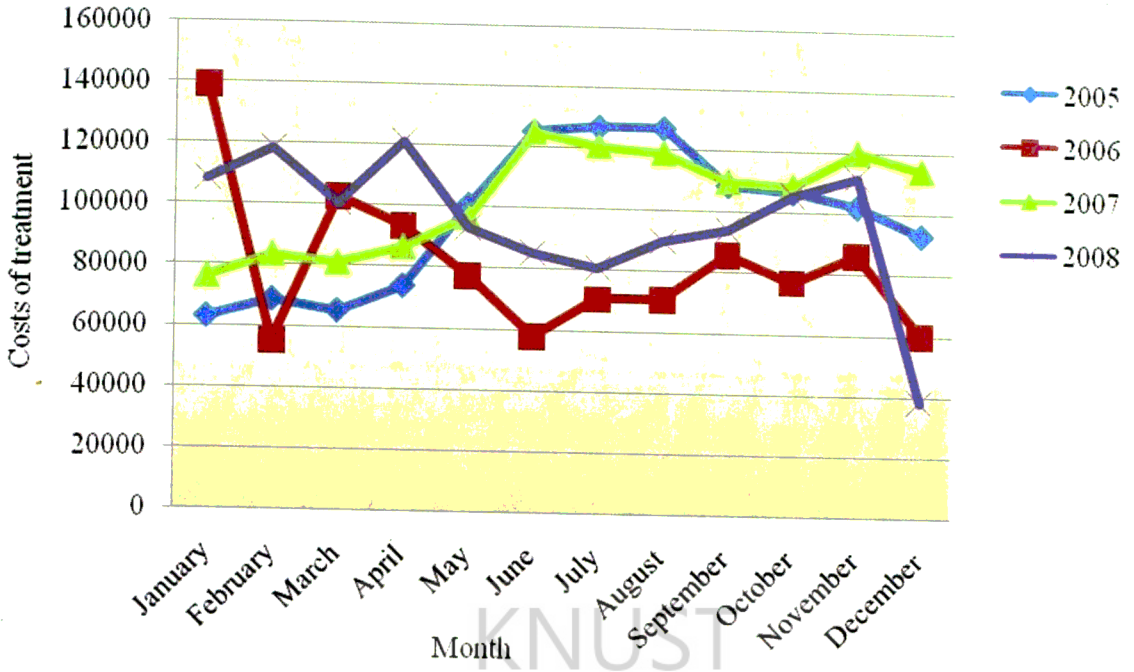


Figure 4.9: Overall monthly treatment costs (GH¢)of OPD malaria episodes for 2005-2008

The overall monthly trends of the treatment costs (GH¢) of in-patient malaria episodes recorded among the OMA populace over the four years period were as demonstrated in Figure 4.10. The highest treatment costs in 2005 were recorded in January (GH¢7,957.34) during the dry season and the lowest in July (GH¢931.53) at the end of the rainy season. In the year 2007, the highest annual cost of treating general in-patient malaria episode occurred in October (GH¢18,475.60) and the lowest in July (GH¢344.61). In July 2006, no malaria episode was recorded in January (GH¢0.00) in the dry season but treatment cost due to the disease was highest in September (GH¢10,973.29) during the minor rainy season.

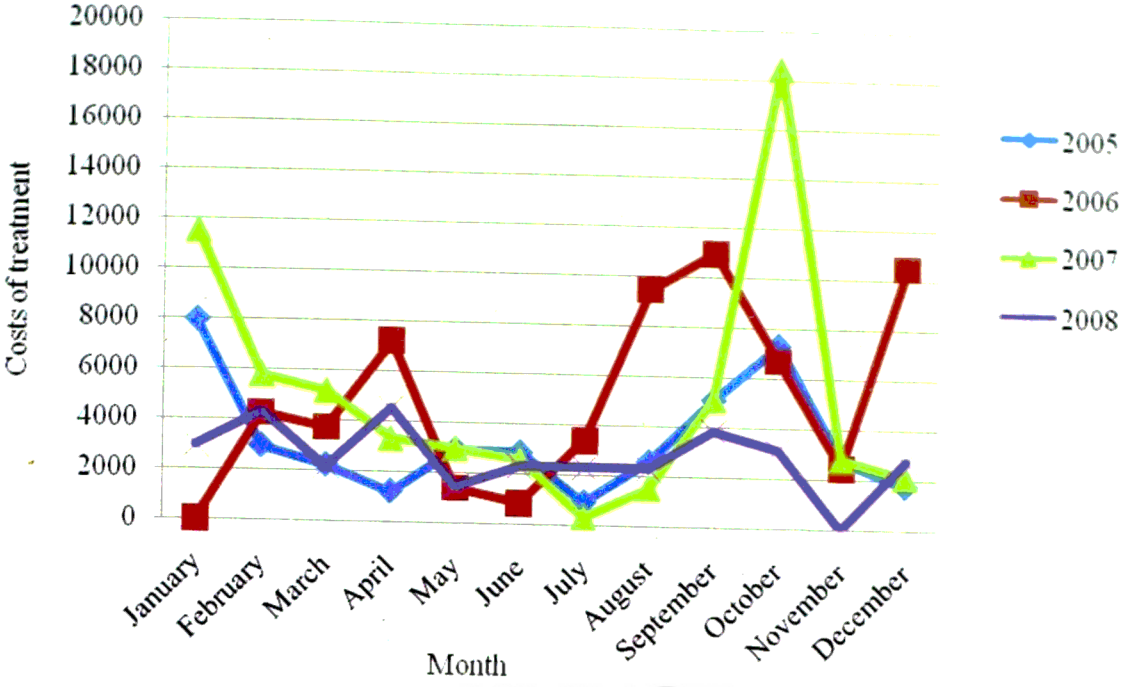


Figure 4.10: Overall monthly treatment costs (GH¢) of malaria admissions (in-patinet episodes) from 2005-2008

4.4.5 Annual treatment cost of malaria for children under five years old

Estimated annual costs (in Ghana Cedis) of out-patient department (OPD) and in-patient malaria cases among children less than five years old for 2005-2008 observed were as indicated in Table 4.3. There was an increase in the costs of treating OPD malaria cases from 2005, which was a year before the introduction of the large-scale IRS exercise within the Obuasi Municipality in April 2006. There was a significant variations in the annual expenditure on the OPD malaria cases over the four year period with the lowest occurring in 2005 and the highest in 2007 ($\chi^2 = 383.82$, d.f. = 3, $p < 0.001$). Similarly, the treatment costs for malaria admissions varied significantly on annual basis during the four year period under consideration ($\chi^2 = 11299.69$, d.f. = 3, $p = 0.001$). However, the expenditure on these in-patient malaria episodes similarly increased significantly from baseline cost of GH¢15,465.66 in 2005 to GH¢30,324.00 in 2007, and subsequently to least treatment cost of GH¢10,702.00 in 2008 ($\chi^2 = 10032.75$ DF = 2, $p < 0.001$).

Table 4.3: Annual treatment costs (GH¢) of malaria cases among children under five years old over the four year period.

Cases	2005	2006	2007	2008
OPD	185,220.28	192,163.24	196,553.00	194,668.00
In patients	15,465.66	17,900.24	30,324.00	10,702.00

4.4.6 Annual treatment costs of malaria for the population category above five years old and above.

Table 4.4 illustrates the annual financial burden associated with the treatment of both the out-patient and in-patient malaria cases among adults including children above five years. There was a decline in the direct expenditure on treatment of OPD malaria cases from the year 2005 to 2006 but malaria treatment cost in 2007 (a year after the introduction of the IRS) was significantly higher ($p < 0.001$). The amount of money spent on malaria treatment in the year 2008 was similarly, significantly higher than at the early years of the IRS campaign. There was a significant increase in annual treatment expenditure on malaria episodes with the highest being recorded in 2007 ($\chi^2 = 46170.55$, d.f. = 3, $p < 0.001$). On the other hand, yearly treatment cost of disease episodes increased from 2005 to 2006 after which the expenditure on hospital admission due to malaria morbidity decreased significantly until 2008. Significant differences in annual expenditure on hospital admissions due to malaria-related morbidity with the highest cost being incurred in the year 2006 ($\chi^2 = 7388.54$, d.f. = 3, $p < 0.001$). There was a significant Reduction in treatment cost on in-patient cases due to malaria infection from the year 2006 to 2008 with the least cost occurring in 2008 ($\chi^2 = 7940259.0$, d.f. = 2, $p < 0.001$).

Table 4.4: Annual treatment costs (GH¢) of malaria cases among the adult category (≥5yrs) within the Obuasi Municipality from 2005-2008

Cases	2005	2006	2007	2008
OPD	956,628.25	750,732.31	1,029,768.00	940,118.00
In patients	25,112.14	40,742.93	31,664.00	21,189.00

4.4.7 Annual treatment cost of malaria episodes among pregnant women.

Annual treatment costs of malaria episodes among pregnant women are indicated in Table 4.5. With the exception of 2006 when GH¢2,292.74 was spent on malaria incidence, no cost was incurred due to hospital admission in any other year under consideration. However, GH¢13, 376.00 to GH¢34,490.53 was spent on out-patient episodes during the study period. Expenditure on the disease morbidity among pregnant women increased from the GH¢20,057.69 in 2005 to GH¢34,490.53 in 2006 after which treatment cost reduced to GH¢ 13, 376.00 in the year 2008. Approximately 39% reduction in treatment cost was observed for pregnant women from the year 2006 to 2008.

Table 4.5: Annual treatment costs (GH¢) of malaria episodes among pregnant women over four year period

Cases	2005	2006	2007	2008
OPD	20,057.69	34,490.53	17,881.00	13,376.00
In patients	-	22,92.74	-	-

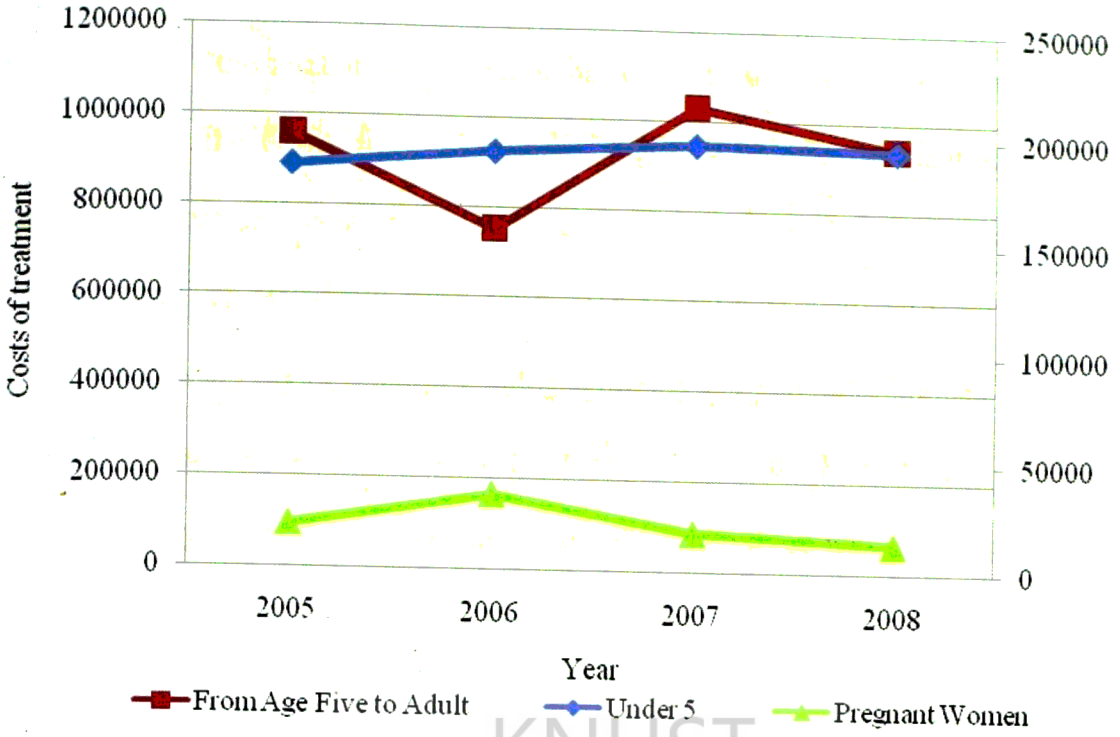


Figure 4.11: Annual treatment cost of managing the out-patient malaria cases among the different age-groups and pregnant women

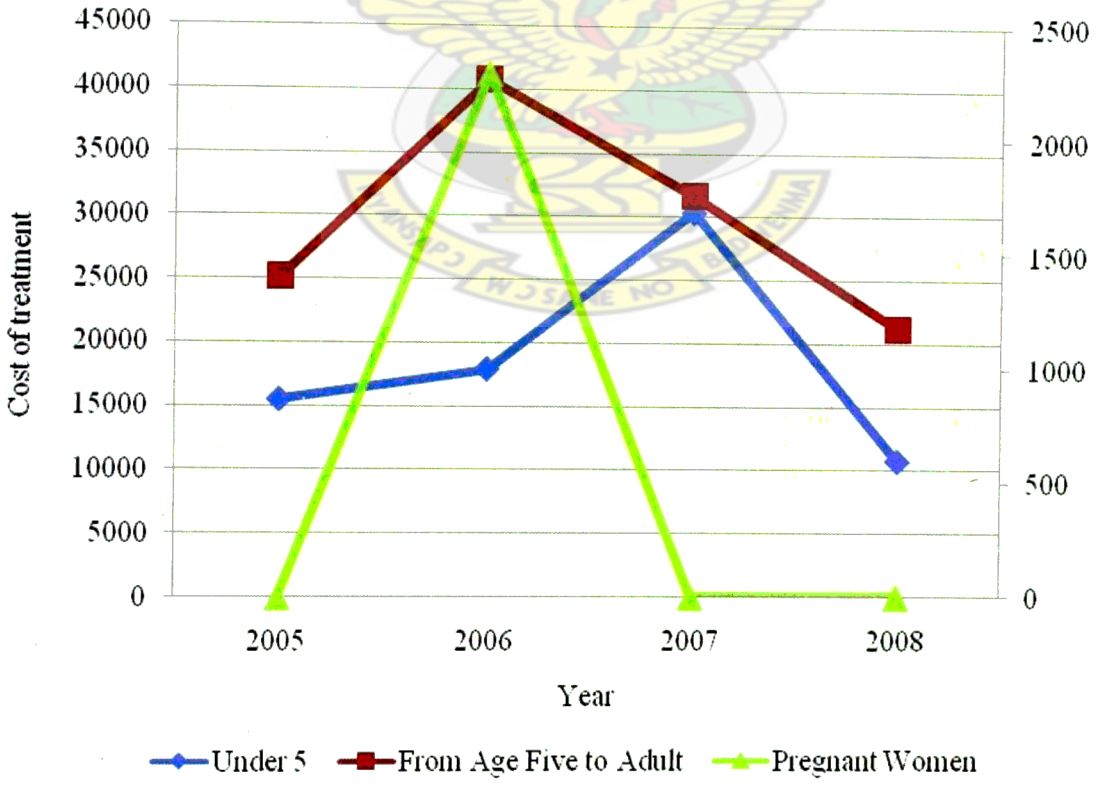


Figure 4.12: Annual treatment cost of managing the in-patient malaria cases among the different age-groups and pregnant women

4.4.8 Overall annual treatment costs of malaria cases over the study period.

Table 4.6 shows the annual direct treatment costs of out-patient and in-patient malaria episodes within the OMA from 2005-2008. Figure 4.13 also demonstrates the overall annual direct treatment costs over four year period, by representing the treatment costs incurred among children below 5yrs, the older population above 5yrs, and pregnant women. Treatment cost of malaria incidence among the general populace declined from 2005 to 2006, but increased considerably afterwards in 2007. However, in 2008, the cost was significantly lower than that incurred in 2005 when there was no large-scale malaria control programme within the municipality ($\chi^2 = 211.16$, d.f. = 1, $p < 0.001$).

With a baseline treatment cost of GH¢1,202,484.02 incurred in 2005, , approximately 14% (GH¢164,162.03) and 2% (GH¢22,429.00) (2%) reduction in expenses were observed in 2006 and 2008 respectively. However, treatment cost of malaria cases in 2007 was in excess of GH¢103, 706.00 (9%) compared to the 2005 baseline expenditure.

Table 4.6: Annual treatment costs (GH¢) of malaria cases over four year period

Cases	2005	2006	2007	2008
Overall	1,161,906.22	977,386.08	1,244,202.00	1,148,163.00
In patients	40,577.80	609,35.91	61,988.00	31,892.00
Overall	**1,202,484.02**	**977,386.08**	**1,306,190.00**	**1,180,055.00**

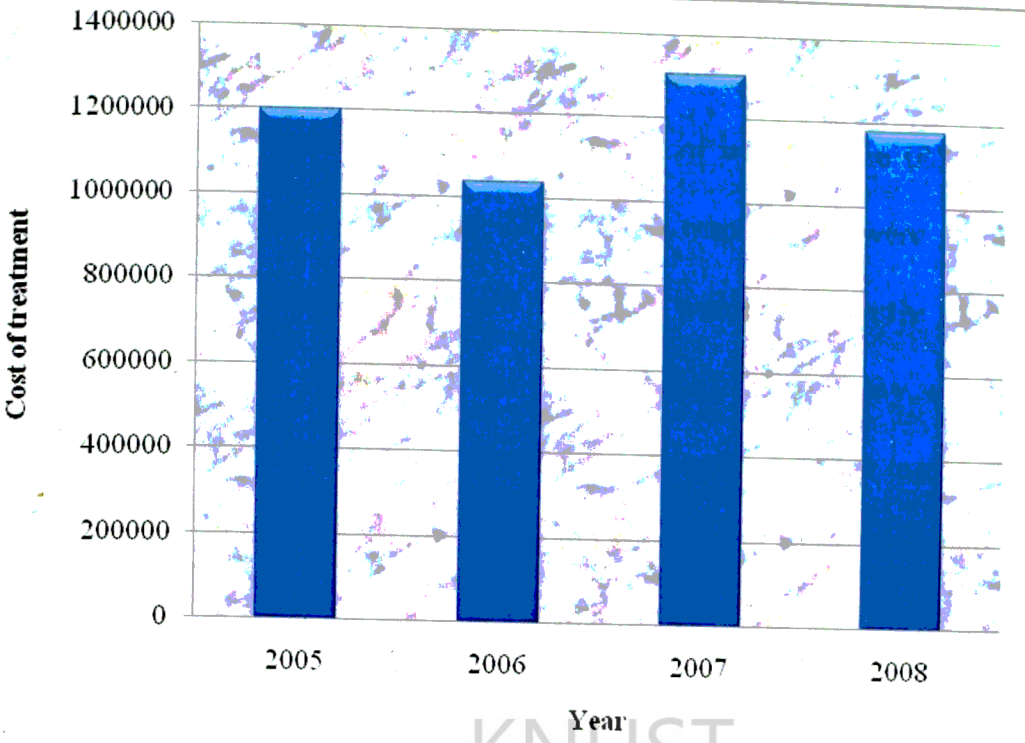


Figure 4.13: Overall annual treatment costs of managing malaria cases over the four years period.

4.5 Discussion

Malaria remains a major public health problem in the Obuasi Municipality in the Ashanti Region of Ghana. The implementation of the Obuasi Malaria Control Programme (OMCP) is still ongoing seeking to sustain the previous success made and/or improve on it. The success of any health intervention in malaria control may require the knowledge of the general public's or community's perception of the disease control programme and possibly their health-seeking behaviour. One of the objectives of the present study was to investigate the general public's perception on the ongoing malaria control and the personal protective measures adopted at the household level to prevent mosquito bites and hence malaria transmission.

The results of the present study show that the proportion of the female respondent who responded to the questionnaires was significantly higher than the males but preference or

choice of personal protective measure against malaria infection did not vary among the sexes. The present study also shows that all respondents were protected to an extent by at least one malaria control intervention, the common of which is the IRS exercise being sponsored by AGA. About 13% and 22% of the respondents were respectively not interested in the IRS campaign due to fact that were not directly involved in the programme or think the programme has not benefited them in any way. However, a significant proportion (65%) of the respondents was happy with the introduction and the sustenance of the control programme. The high acceptance rate is essential to achieving the goals of the roll back malaria and especially that of the Ghana National Malaria Control Programme (NMCP). One of the aims of the NMCP is to reduce malaria cases by 75% by 2015 (GHS/MOH, 2008). The current malaria control strategies depend largely on individuals and/or members of the communities to take action that will protect them against malaria infection and to ensure that they get treated when they are infected. Such tactics will only be successful if there is proper communication and real understanding around the causes, symptoms and ways of preventing and treating malaria to protect the most vulnerable people in society. This kind of communication has to go beyond message delivery and social marketing to a real exchange of understanding between agencies such as disease control agencies and local people as to what will work best in the local context (www.healthlink.org.uk/PDFs/findings_malaria.pdf). The malaria control division of the Municipal Health Directorate together with the community liaison section of the IRS campaign has embarked on behavioural change communications (BCC) over the past four years with the ultimate objective of keeping the general public of the Obuasi Municipality informed about the current malaria control strategies. Although direct assessment of individual knowledge on the general malaria control measures was not captured in the present study, the fact that each respondent is

utilizing at least one malaria control intervention is an indication that the BCC programme has been of some benefit to the residents of the municipality.

The results of the present study also showed that a significant proportion of the public rely on more than one preventive approach to control malaria. According to the AGA reports to society, the integrated malaria control in Obuasi involves; indoor residual spraying, larviciding, environmental management and an occasional distribution of ITNs to the most venerable in society, particularly to maternity homes and children wards within the municipality (AGA Report to Society, 2006). The use of interventions such as ITNs and other chemicals including aerosols have also been promoted by the NMCP, hence an ongoing campaign by the health administration within the municipality to educate the populace on the effectiveness of ITN usage in control malaria morbidity and transmission. This forms part of the strategies of the NMCP for malaria control (GHS/MOH, 2008). According to the Obuasi Municipal Health Director, ITNs are distributed free of charge at antenatal/post-natal care centres within the municipality on regular basis to pregnant women and mothers of children under one (Dr. Samuel O. Somuah, *personal communication*). This might be the reason why ITNs has featured as one of the personal protective measures which has been adopted by a considerable number of the respondents.

Advertisement has been defined as the activity of attracting public attention to a product or business, as by paid announcements in the print, broadcast, or electronic media (http://www.answers.com/topic/advertising). One of the most advertised product on the electronic media especially television in Ghana has been aerosols. This might also possibly explain why aerosols are used as a protective measure in most of the surveyed communities in Ghana. For example, Adasi *et al.*, (2008) have reported a considerably widespread use of aerosols in the Greater Accra region in the southern belt of Ghana.

Considerable use of aerosols has also been reported in some communities in the Ashanti region of the middle belt of Ghana (Stiles-Ocran *et al.*, 2007).

The results of the present study demonstrated that 31.7% of the respondents did not spend any money on malaria as they depended exclusively on the OMCP interventions. This might be a section of the community to whom the information, education and communication regarding the intervention has gone down well with and possibly accept the programme to a significant extent. The rest of the respondents 68.19% (476/698) spent some amount of money on monthly basis to purchase some items for protection against malaria infection. The amount spent ranged from GH¢2.16 ($1.54) for those who purchased aerosols and embark on environmental management to GH¢3.94 ($2.8) for those who use ITNs alongside the IRS. On the whole, an average of GH¢3.66 (US$2.61) was spent by an individual for protection against malaria attack per month. Similar study undertaken by Akazili, (2007) in the northern parts of Ghana estimated found an average direct cost which is out-of-pocket expenditure of US$1.87 per a malaria episode. This was described as being quite substantial given that more than 80% of people in the region are below the poverty levels of US$1.00 per day (Government of Ghana, Ghana Poverty Reduction Strategy 2003–2005). According to Sachs & Malaney, (2002) the cost of malaria infection in economic terms is high: treatment cost ranges between US$ 0.80 and US$ 5.30 depending on local antimalarial drug and the total cost to Africa is estimated at US$1.8 trillion per year. The implications of these findings are that some people may have to even borrow money or sell some personal assets to meet the out-of pocket expenditure on malaria.

Current malaria control programme cost analysis seeks to explore only institutional services cost (Conly, 1972; Creese & Henderson, 1980; WHO, 1991) whilst ignoring control costs which fall outside the institutional service costs. This is due to the fact that

data for such investigations are more readily obtainable than the cost incurred by individuals, households or other community costs. For similar reasons, the present study sought to identify and quantify the costs of malaria control from both public and private health institutions including mission hospitals, by estimating the actual direct financial costs of managing malaria episodes within the Obuasi Municipality. The study also looked at the both the monthly and annual trends in the costs of managing the out-patient and in-patient as well as the overall malaria cases among children <5 years, the older population ≥5 years and pregnant women in the Obuasi Municipality. The study also sought to establish possible changes in expenses associated with malaria infection following the introduction of the Obuasi Malaria Control Programme.

Analysis of secondary data obtained from the MHD/GHS on malaria morbidity from all health facilities within the OMA (a total of 17) and the NHIS on tariffs for malaria treatment including; consultation, general OPD, drugs and detention, were used for the direct treatment costs determinations. It was found that generally, there was a decrease in the costs of treating malaria episodes from the year 2005 when the large-scale Obuasi community malaria control intervention had not been instituted to the year 2006, when the intervention was introduced. This decline in malaria episodes and associated costs was expected as the OMCP interventions were implemented in April 2006. However, the treatment costs due to malaria increased in 2007 before subsequently reducing in 2008. The 2007 upsurge might be due to several factors including management decisions and programme failure due to resistance in the local mosquito vector population as there were some level of resistance to the pyrethroid used for the said year and might have impacted on programme success. There might be other underlying scientific explanations to the observed increase.

The current study also shows significant variations in the costs of treating both the in-patient and out-patient malaria cases among the children under five years on one hand and the children above five years together with the general adult population on the other over the four year period with the lowest occurring in 2005 and the highest in 2007. There was no steady decrease or increase in the costs of managing the out-patient malaria episodes from year to year over the four year periods but the costs of managing the in-patient malaria cases decreased sturdily from 2006 to 2008. Similar trends were observed for the costs of managing out-patient cases for pregnant women. However, with regard to detention, it was only in 2006 that some costs were incurred in treating malaria cases. Using the GH¢1,202,484.02 ($858917.16) spent in 2005 in managing all the categories of malaria cases has a baseline figure, approximately GH¢164,162.03 ($117258.59) representing 14% reduction and GH¢22,429.00 ($16020.71) constitution 2% reduction in expenses were observed for the year 2006 and 2008 respectively. This observation may be attributed to the introduction of the large-scale malaria control intervention, which possibly led to the decline in malaria cases and accordingly the overall costs of treatment. This is notwithstanding, the amount of money spent in treating general malaria cases in the year 2007 was in excess of GH¢103, 706.00 ($74075.71) constituting 9% compared to the 2005 baseline expenditure, probably due to the same reasons stated above.

CHAPTER FIVE

SUMMARY OF RESULTS, CONCLUSION, LIMITATIONS OF STUDY AND RECOMMENDATIONS FOR FURTHER STUDIES

5.0 Introduction

This chapter summarises the results from the empirical analysis and makes appropriate recommendation for more intense financial assessment on cost of malaria treatment. Limitations to of this study were also detailed.

5.1 Summary of Results and Conclusion

The resent study showed that the proportion of the female respondents was significantly higher than the males but the choice of malaria prevention method did not vary with gender. All the respondents were being protected in some way against malaria attack with the highest proportion being happy with the Obuasi malaria control programme. This high acceptance of the programme is essential to achieving the goals of the NMCP whose aim is to reduce malaria cases by 75% by 2015. The fact that each respondent is using at least one malaria control intervention is also an indication that the behavioural change communications programme being implemented by the Municipal Health Services in conjunction with the Obuasi Malaria Control Programme has been of some benefit to the residents of the municipality.

The study revealed that 31.7% of the respondents did not spend any money on malaria since depending exclusively on the IRS and sanitation and/or a combination of these strategies. This might be a section of the community to whom the information, education and communication regarding the intervention has gone down well with and possibly accept the programme to a significant extent. These may also include those who over the past years have observed some benefit of malaria control such as reduction in mosquito bites. Other respondents (68.19%) spent out-of-pocket money for malaria prevention.

The amount spent ranged from GH¢2.16 ($1.54) to GH¢3.94 ($2.8) or an average of GH¢3.66 (US$2.61). These costs fall in the range of the cost of malaria infection which has been described in economic terms has being high. These costs range is also higher than the current minimum wage. The implications of these findings are that those who do not depend exclusively on the ongoing malaria control efforts as well as those who do not depend on it at all may have to borrow money or sell some personal assets to meet the out-of pocket expenditure on malaria attack seeing that malaria transmission in the Obuasi Municipality occur all year round.

The present study also explored the costs of managing malaria attacks using secondary data from institutional records. It was found that in between some of the years under consideration, there was an increase in the costs of treating malaria even when the large-scale control intervention was ongoing. For example, the amount of money spent in treating general malaria cases in the year 2007 increased by 9% compared to the 2005 baseline expenditure. There might be some scientific explanation to these observations that might be beyond the scope of the present study. However, it suffices to say that the presence of the malaria control in the Obuasi Municipality might not always translate directly to reduction in financial expenditure in managing malaria episodes.

Using the amount spent in 2005 in treating malaria as baseline expenditure in managing malaria episodes in the Obuasi Municipality, approximately 14% and 2% reduction in expenses due to malaria infections were observed in 2006 and 2008 respectively. This observation may be attributed to the success of the malaria control intervention, which possibly led to the decline in malaria cases and accordingly the overall costs of treatment.

5.2 Limitations and recommendation for further studies

This study did not explore the economic appraisal of all malaria control interventions in the Obuasi Municipality. In Ghana, the major malaria control measures are chemotherapy including treatment (using antimalarial drugs) and prevention in pregnancy (using sulfadoxine-pyrimethamine, Fancidar); and vector control (IRS, ITN use, larviciding, use of aerosols and coils, and environmental management). Malaria treatment is done either by medical and herbal practitioners or through self-medication. This study captured the costs of malaria treatment using secondary data from institutional records. The present study did not also look into the cost of treating malaria using drugs prescribed by the either herbal practitioners or self medication. It is therefore recommended that future studies should go further to investigate self medication and herbal practitioners' contribution to obtain an all inclusive data on the financial expenditure associated with treating malaria in the Obuasi Municipality and other parts of Ghana. Studies would also be required to explore the amount of money that goes into vector control programmes and IPT in the present study area and the country on the whole. Such a comprehensive data on the financial expenditure on malaria control programmes will help in the quantification of the economic benefit of controlling the disease to enhance decision making at both local and national levels.

The present study assumed that there has not been any significant change in the costs of treating malaria cases in the study areas from the year 2005 to 2008. In view of this, the present national health insurance scheme (NHIS) tariffs for treating malaria among the different age groups and pregnant women were used in the financial assessment of the direct treatment cost of malaria episodes from 2005-2008. Therefore, it is recommended that future studies should look out for and utilise the actual cost of treating malaria in each year to establish the exact economic burden of malaria infection.

The questionnaire sent to the general public could not target everybody in Obuasi. Thus, the findings and conclusions in this work were based on the response of a sample of the public and may not necessarily be a representation of the area. Collecting information on the public finances from persons at random assuming that they would have knowledge, perception or may incur costs that represent the community may be invalid. Individuals within a community are often responsible for varying expenditures and might sometimes compromise on a malaria control requirements based on how they prioritise the disease. Notwithstanding these methodological issues, the results of the study may be robust and indicative of the financial difficulties that a significant proportion of the members of community are likely to actually face in the prevention of malaria infection.

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APPENDICES

APPENDIX 1

ECONOMIC APPRAISAL OF MALARIA CONTROL IN OBUASI

A: HOSPITALS AND CLINICS

1. Name of Hospital:

_____

2. Location of Hospital: _____

3. Average number of OPD malaria cases recorded daily

   i) Children (< 5 years): _____

   ii) Adults (≥5 years): _____

4. Cost of consultation for each patient: _____

5. Cost of diagnosis (laboratory diagnosis): _____

6. Cost of treatment:

DRUGS	COST (GHC)	
	Children (< 5 years)	Adults (≥5 years)
Antimalarial drugs		
Vitamin complex		
Blood tonic		
Painkillers		

ECONOMIC APPRAISAL OF MALARIA CONTROL IN OBUASI

B: PHARMACIES AND LICENCED CHEMICAL SELLERS

1. Name of pharmacy:

2. Location of pharmacy:

3. a) Average number of walk in patients to the pharmacy complaining of malaria (self medication patients) daily

(i) Children (< 5 years): _____ (ii) Adults (≥5 years): _____

b) Cost of treatment

DRUGS	COST (GHC)	
	Children (< 5 years)	Adults (≥5 years)
Antimalarial drugs		
Vitamin complex		
Blood tonic		
Painkillers		

5.a) Average number of patients with prescription form for malaria drugs (prescribed medication) daily

(i) Children (< 5 years) = (ii) Adults (≥5 years) =

b) Cost of prescribed medication

DRUGS	COST (GHC)	
	Children (< 5 years)	Adults (≥5 years)
Antimalarial drugs		
Vitamin complex		
Blood tonic		
Painkillers		

ECONOMIC APPRAISAL OF MALARIA CONTROL IN OBUASI

C: LABORATORIES

1. Name of laboratory: _____

2. Location of laboratory: _____

3. Cost of diagnosis for malaria

Diagnosis Type	Cost (GHC)
Microscopy	
Rapid Test	
Hb	
Others (specify)	

4. Average number of cases diagnosed daily: _____

ECONOMIC APPRAISAL OF MALARIA CONTROL IN OBUASI

D: GENERAL POPULACE

This exercise is to help in a research topic above

Date: .....

Demographic profile of customer

1. Gender

   (a) Male [ ] (b) Female [ ]

2. Residence.....

3. Personal protection measures against malaria. *Please tick*

   (a) Rely solely on Malaria Control Centre in-door residual spraying (IRS) [ ]

   (b) Rely solely on aerosols [ ]

   (c) Rely solely on ITNs [ ]

   (d) Rely solely on Clean environment (CE) [ ]

   (e) Rely on IRS&ITNs [ ]

   (f) Rely on IRS & Aerosols [ ]

   (g) Rely on IRS& CE [ ]

   (h) Rely on ITNs & Aerosol [ ]

   (i) Rely on ITNs & CE [ ]

   (j) Rely on Aerosol & CE [ ]

   (k) Rely on IRS & ITNs & aerosols [ ]

   (l) Rely on IRS & ITNs & CE [ ]

   (m) Rely on ITNs &Aerosols& CE [ ]

   (n) Rely on IRS & ITNs & aerosols &CE [ ]

   (o) Other specify.....

4. How much do you spend on these personal protection measures monthly?

.....

5. What is your perception on the Malaria Control Exercise in Obuasi?

   a) Malaria control activities have been beneficial and has helped me save some cost [ ]

   b) Malaria activities have not been beneficial and I think they should stop IRS programme [ ]

   c) I can't tell because I'm not involved [ ]

APPENDIX 2

Table I: Personal protective measures used by respondents

Protective measures	Male	Female	Total
IRS	80	105	185
ITN	20	32	52
Aerosol	16	12	28
Clean environment (CE)	5	7	12
IRS&ITNs	21	111	132
IRS & Aerosols	82	33	115
IRS & CE	12	13	25
ITNs & Aerosol	2	3	5
ITNs & CE	13	20	33
Aerosol & CE	4	8	12
IRS & ITNs & aerosols	17	25	42
IRS & Aerosols & CE	16	27	43
IRS & ITNs & CE	3	5	8
ITNs & Aerosols & CE	4	2	6
IRS & ITNs & Aerosols & CE	0	0	0
Total	**295**	**403**	**698**

Table National Health Insurance Scheme (NHIS) tariffs (GH¢) for malaria episodes treatm among the different for the different population categories as well as for the variou ervices rendered at the different health facilities.

Diagn s-Related Grouping	Age Category	Charges per case per health facility(GH¢)			
		Public Hosp	Mission Hosp	Private Clinics	Health Centres
Gener OPD	Children	4.90	6.63	6.26	1.95
	Adults	5.05	6.80	7.20	1.95
Consu tion only	Children	2.13	2.09	4.01	0.84
	Adults	2.33	2.29	4.16	0.84
Admi on	Children	17.00	17.00	17.00	2.68
	Adults	18.00	18.00	18.00	3.00
Treat nt	Children	4.10	4.10	4.10	4.10
	Adults	5.10	5.10	5.10	5.10
	PW	6.30	6.30	6.30	6.30
Total st OPD	Children	11.13	12.82	14.37	6.89
	Adults	12.48	14.19	16.46	7.89
	PW	13.68	15.39	17.66	9.09
Total st	Children	28.13	29.82	31.37	9.57
IP/Ad ission	Adults	30.48	32.19	34.46	10.89
	PW	31.68	33.39	35.66	12.09

Table II: National Health Insurance Scheme (NHIS) tariffs (GH¢) for malaria episodes treatment among the different for the different population categories as well as for the various services rendered at the different health facilities.

Diagnosis-Related Grouping	Age Category	Charges per case per health facility(GH¢)			
		Public Hosp	Mission Hosp	Private Clinics	Health Centres
General OPD	Children	4.90	6.63	6.26	1.95
	Adults	5.05	6.80	7.20	1.95
Consultation only	Children	2.13	2.09	4.01	0.84
	Adults	2.33	2.29	4.16	0.84
Admission	Children	17.00	17.00	17.00	2.68
	Adults	18.00	18.00	18.00	3.00
Treatment	Children	4.10	4.10	4.10	4.10
	Adults	5.10	5.10	5.10	5.10
	PW	6.30	6.30	6.30	6.30
Total Cost OPD	Children	11.13	12.82	14.37	6.89
	Adults	12.48	14.19	16.46	7.89
	PW	13.68	15.39	17.66	9.09
Total Cost	Children	28.13	29.82	31.37	9.57
IP/Admission	Adults	30.48	32.19	34.46	10.89
	PW	31.68	33.39	35.66	12.09

Table III: Monthly costs (GH¢) of malaria treatment among children under 5 years old over four year period in the Obuasi Municipality

	2005			2006			2007			2008		
Months	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients
Jan	11943.39	2845.26	1793.54	27013.84	6396.06	0.00	13552.43	2878.65	2709.51	17454.03	1291.47	992.06
Feb	13290.36	2385.42	817.83	9872.19	876.57	1882.20	14371.21	2385.42	1467.11	18981.31	1066.20	1030.93
Mar	11556.93	2112.39	614.44	20908.35	10691.28	1317.54	13490.17	2112.39	1328.43	17734.28	697.23	793.6
Apr	11857.02	1868.10	300.74	18528.46	4641.51	2987.00	13234.69	1868.10	834.12	21386.54	861.36	1783.08
May	16533.60	2112.39	670.84	11385.47	4486.41	484.69	15851.67	2112.39	836.24	15468.94	718.50	434.53
Jun	23181.58	3118.29	520.61	12784.38	5013.02	62.74	22943.37	3118.29	513.85	15878.11	847.24	453.50
Jul	20540.42	790.35	516.48	12703.11	5569.93	1114.30	21087.32	790.35	253.17	14586.83	847.24	690.51
Aug	15847.96	617.91	840.04	15119.43	10038.01	2388.91	13575.19	617.91	376.44	14002.07	884.30	569.68
Sep	16014.88	1020.27	1296.69	16851.06	5583.45	2713.87	16737.63	1020.27	1516.66	15753.38	1063.38	2031.84
Oct	17220.97	847.83	6631.94	19565.93	3776.07	1275.42	17919.13	847.83	18475.6	18306.28	1333.31	1209.59
Nov	13887.71	747.24	971.72	16927.14	4599.81	867.61	16460.56	758.37	1105.61	19853.97	862.20	0
Dec	13345.46	704.13	490.79	10503.88	2051.67	2805.96	17329.13	737.52	907.67	5262.68	316.14	712.97
Annual	185220.28	19169.58	15465.66	192163.24	63723.79	17900.24	196552.50	19247.49	30324.41	194668.40	10788.57	10702.29

Total = Confirmed and clinically treated

Table IV: Monthly costs (GH¢) of malaria treatment among children of age 5 years and above to the general adult population over four year period

	2005			2006			2007			2008		
Months	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients
Jan	47529.27	6485.24	6163.80	107866.86	35786.20	0.00	59446.74	6610.04	8855.49	89575.10	6845.00	1946.94
Feb	52693.64	5497.64	2132.54	44688.90	7011.96	2343.28	66489.89	5688.14	4343.09	98388.60	5125.20	3243.15
Mar	52072.34	6435.86	1619.62	78794.02	32590.80	2412.20	66145.64	6464.24	3866.08	81892.67	4072.77	1361.12
Apr	60573.06	5020.30	926.44	71733.35	25134.42	4254.60	72376.08	5020.30	2505.46	99130.98	4340.72	2728.84
May	82399.65	7275.32	2270.79	62908.92	38747.77	951.58	79412.10	7275.32	2153.70	77149.59	4711.47	999.34
Jun	99220.63	10320.42	2341.98	42368.99	31384.96	784.62	99551.47	10320.42	2104.68	68390.02	5248.7	1836.28
Jul	103588.61	3110.94	415.05	54728.85	35146.31	2288.92	97293.92	3110.94	91.44	65235.30	5265.84	1609.09
Aug	110884.69	2946.34	1742.51	52257.33	33190.61	6197.83	105482.0	2946.34	1171.64	74781.43	5885.61	1728.77
Sep	92411.36	4493.58	3788.71	65933.55	18601.42	8295.24	93263.54	4493.58	3620.92	77020.55	6123.12	1789.10
Oct	88605.10	4049.16	665.73	54305.02	11900.47	4470.48	90454.18	4049.16	0.00	86116.14	7676.75	1920.24
Nov	87833.02	4181.38	1771.28	67020.02	15091.35	1659.32	103311.8	4156.42	1720.28	89864.74	5118.38	0.00
Dec	78816.88	4683.68	1273.69	48126.50	9951.96	7084.86	96540.82	4746.08	1231.24	32573.18	2469.00	2026.44
Annual	956628.25	64499.86	25112.14	750732.31	294538.23	40742.93	1029768	64880.98	31664.02	940118.3	62882.56	21189.31

Total = Confirmed and clinically treated

Table V: Monthly costs (GH¢) of malaria treatment among pregnant women over four year period

	2005			2006			2007			2008		
Months	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients
Jan	3591.94	2490.06	0.00	4304.15	2341.97	0.00	3402.13	2490.06	0.00	1161.40	494.48	0.00
Feb	2799.48	1077.26	0.00	777.04	141.28	35.66	2779.44	1077.26	0.00	1350.29	604.48	0.00
Mar	1706.30	759.38	0.00	3019.86	2189.84	0.00	1501.10	759.38	0.00	1121.28	558.31	0.00
Apr	1347.38	865.34	0.00	3173.76	1677.70	-31.84	1183.22	865.34	0.00	747.01	165.84	0.00
May	1720.60	883.00	0.00	3186.32	5520.77	-47.76	1412.8	883.00	0.00	678.91	35.32	0.00
Jun	2937.34	1216.27	0.00	2898.01	1783.16	-7.96	2790.28	1200.88	0.00	1075.94	24.18	0.00
Jul	2989.29	472.28	0.00	3244.90	1966.57	-19.90	2662.68	441.50	0.00	1030.80	30.78	0.00
Aug	366.44	156.17	0.00	3393.67	2425.73	899.30	123.62	17.66	0.00	1193.84	15.39	0.00
Sep	251.90	83.76	0.00	3235.09	2046.29	-35.82	139.04	52.98	0.00	1378.34	17.66	0.00
Oct	905.38	46.17	0.00	3402.13	2505.45	954.70	660.85	76.95	0.00	1150.00	0.00	0.00
Nov	489.53	114.54	0.00	2348.78	847.68	-63.68	419.42	52.98	0.00	2126.16	0.00	0.00
Dec	952.11	140.78	0.00	1506.82	724.06	610.04	806.76	63.83	0.00	362.40	0.00	0.00
Annual	20057.69	8305.01	0.00	34490.53	24170.50	2292.74	17881.34	7981.82	0.00	13376.37	1946.44	0.00

Total = Confirmed and clinically treated

Table VI: Overall monthly treatment costs (GH¢) of malaria cases over four year period in the Obuasi Municipality

	2005			2006			2007			2008		
Months	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients	Total	Confirmed	In patients
Jan	63064.60	11820.56	7957.34	139184.85	44524.23	0.00	76401.30	11978.75	11565.00	108190.5	8630.95	2939.00
Feb	68783.48	8960.32	2950.37	55338.13	8029.81	4261.14	83640.54	9150.82	5810.20	118720.2	6795.88	4274.08
Mar	65335.57	9307.63	2234.06	102722.23	45471.92	3729.74	81136.91	9336.01	5194.51	100748.2	5328.31	2154.72
Apr	73777.46	7753.74	1227.18	93435.57	31453.63	7209.76	86793.99	7753.74	3339.58	121264.5	5367.92	4511.92
May	100653.85	10270.71	2941.63	77480.71	48754.95	1388.51	96676.57	10270.71	2989.94	93297.44	5465.29	1433.87
Jun	125339.55	14654.98	2862.59	58051.38	38181.14	839.40	125285.1	14639.59	2618.53	85344.07	6120.12	2289.78
Jul	127118.32	4373.57	931.53	70676.86	42682.81	3383.32	121043.9	4342.79	344.61	80852.93	6143.86	2299.60
Aug	127099.09	3720.42	2582.55	70770.43	45654.35	9486.04	119180.8	3581.91	1548.08	89977.34	6785.30	2298.45
Sep	108678.14	5597.61	5085.4	86019.70	26231.16	10973.29	110140.2	5566.83	5137.58	94152.27	7204.16	3820.94
Oct	106731.45	4943.16	7297.67	77273.08	18181.99	6700.60	109034.2	4973.94	18475.6	105572.4	9010.06	3129.83
Nov	102210.26	5043.16	2743.00	86295.94	20538.84	2463.25	120191.8	4967.77	2825.89	111844.9	5980.58	0.00
Dec	93114.45	5528.59	1764.48	60137.20	12727.69	10500.86	114676.7	5547.43	2138.91	38198.26	2785.14	2739.41
Annual	1161906.2	91974.45	40577.80	977386.08	382432.52	60935.91	1244202	92110.29	61988.43	1148163.0	75617.57	31891.60

Total = Confirmed and clinically treated

Table VII: Monthly costs of malaria cases over four year period in the Obuasi Municipality

Months	2005	2006	2007	2008
Jan	71,022.00	139,185.00	87,966 .00	111,130 .00
Feb	71,734 .00	59,599.00	89,451 .00	122,994.00
Mar	67,570 .00	106,452.00	86,331 .00	102,903 .00
Apr	75,005 .00	100,645 .00	90,134 .00	125,776 .00
May	103,595.00	78,869 .00	99,667 .00	94,731 .00
Jun	128,202.00	58,891 .00	127,904 .00	87,634 .00
Jul	128,050.00	74,060 .00	121,389 .00	83,153 .00
Aug	129,682.00	80,256 .00	120,729 .00	92,276 .00
Sep	113,764.00	96,993 .00	115,278 .00	97,973 .00
Oct	114,029.00	83,974 .00	127,510 .00	108,702 .00
Nov	104,953.00	88,759 .00	123,018 .00	111,845 .00
Dec	94,879.00	70,638 .00	116,816 .00	40,938 .00
Annual	1,202,484.00	1,038,322.00	1,306,190.00	1,180,055 .00