ปัจจัยที่เกี่ยวกับอุบัติการณ์โรคมาเลเรียในเทศมณฑลมอนต์เซอราโดประเทศไลบีเรีย

นายจัสติน เอมอส คอร์วายอน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
สาขาวิชาเศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ
คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2552

FACTORS ASSOCIATED WITH MALARIA INCIDENCE IN MONTSERRAADO COUNTY, LIBERIA

Mr. Justine Amos Korvayan

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Masters of Science Program in Health Economics and Health Care Management
Faculty of Economics
Chulalongkorn University
Academic Year 2009

Thesis Title	FACTORS ASSOCIATED WITH MALARIA INCIDENCE IN MONTSERRAADO COUNTY, LIBERIA
By	Mr. Justine Amos Korvayan
Field of Study	Health Economics and Health Care Management
Thesis Advisor	Associate Professor Siripen Supakankunti, Ph.D.

Accepted by the Faculty of Economics, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Faculty of Economics
(Professor Teerana Bhongmakapat, Ph.D.)

THESIS COMMITTEE

.....Chairman
(Associate Professor Pongsa Pornchaiwiseskul, Ph.D.)

.....Thesis Advisor
(Associate Professor Siripen Supakankunti, Ph.D.)

.....Examiner
(Associate Professor Sothitorn Mallikamas, Ph.D.)

.....External Examiner
(Assistant Professor Chanetwallop Khumthong)

จัสติน เอมอส คอร์วายอน: ปัจจัยที่เกี่ยวกับอุบัติการณ์โรคมาลาเรียในเทศมณฑลมอนต์เซอราโด ประเทศไลบีเรีย. (FACTORS ASSOCIATED WITH MALARIA INCIDENCE IN MONTSERRAADO COUNTY, LIBERIA) อ.ที่ปรึกษาวิทยานิพนธ์หลัก : รศ. ดร. ศิริเพ็ญ ศุภกาญจนกันติ, 122 หน้า.

วัตถุประสงค์ของการศึกษาคือวิเคราะห์ปัจจัยกำหนดอุบัติการณ์ของโรคมาลาเรียในเทศมณฑลมอนต์เซอราโด ประเทศไลบีเรีย การศึกษาครั้งนี้วิเคราะห์ปัจจัยทางเศรษฐกิจและสังคมของครัวเรือนที่เคยเป็นโรคมาลาเรียและให้ข้อมูลเพิ่มเติมสำหรับการวางนโยบายเกี่ยวกับการควบคุมและป้องกันการระบาดของโรคมาลาเรียในประเทศไลบีเรีย ตัวอย่างจำนวน 400 ตัวอย่าง เป็นการสุ่มอย่างง่ายจากเขตเทศมณฑลมอนต์เซอราโด ประเทศไลบีเรีย และใช้แบบจำลองโลจิสติกในการประมาณการโดยกำหนดตัวแปรตามคืออัตราการเกิดโรคมาลาเรียต่อตัวแปรอิสระคือ ฟังก์ชันโลจิสติกของอัตราการเกิดโรคมาลาเรียต่อรายได้ อายุ การเข้าถึงการให้บริการสุขภาพ ขนาดของครอบครัว เพศ เขตที่อยู่อาศัย ระดับการศึกษา ภาวการณ์ทำงาน ความรู้ ทัศนคติ และพฤติกรรม การใช้มุ้งที่ผ่านการฆ่าเชื้อ การควบคุมโรคโดยยา การใช้ยาฆ่าแมลง สถานะของครอบครัว การควบคุมแมลงและยุง การใช้ที่ดักยุง การใช้ยาฆ่าแมลงแบบพ่น และการรักษาความสะอาด

ผลการศึกษาพบว่า ร้อยละ 67 ของผู้ตอบแบบสอบถามมีมุ้งที่ผ่านการฆ่าเชื้อ ร้อยละ 75 มีอาการอย่างน้อยสามอาการของโรคมาลาเรีย ร้อยละ 80 แสดงให้เห็นถึงสาเหตุที่เกี่ยวข้องกับการเกิดโรคมาลาเรีย ปัจจัยที่มีอิทธิพลในการกำหนดอัตราการเกิดโรคมาลาเรียในระดับนัยสำคัญ 0.01 คือ รายได้ อายุ ระดับนัยสำคัญ 0.10 คือ การเข้าถึงบริการสุขภาพ ระดับนัยสำคัญ 0.05 คือ เพศ การใช้มุ้งกันยุงเป็นวิธีที่ได้ผลที่สุดในการป้องกันการระบาดของโรคมาลาเรีย การศึกษาครั้งนี้มีข้อเสนอแนะต่อรัฐบาลประเทศไลบีเรียในการพัฒนาการเข้าถึงบริการทางสุขภาพด้วยการปรับปรุงสาธารณสุขและการจัดการการควบคุมการระบาดของโรคมาลาเรียอย่างมีมาตรฐาน รายได้เป็นสิ่งจำเป็นที่รัฐบาลจำเป็นต้องสนับสนุนให้เกิดการควบคุมความสะอาดและการปรับปรุงสาธารณูปโภค ตลอดจนส่งเสริมความรู้ต่อประชากรเพศหญิงที่อยู่ในบ้านเกี่ยวกับสภาพแวดล้อมที่เหมาะสมในการควบคุมการระบาดของโรค และการใช้มุ้งในการควบคุมยุงไม่เป็นเพียงวิธีเดียวในการควบคุมโรค เนื่องจากประชากรวัยเด็กร้อยละ 71 ตายจากการเป็นโรคมาลาเรียและจำเป็นต้องมีการพัฒนามาตรการที่เหมาะสมทั้งมาตรการการใช้มุ้งซึ่งต้องมีการควบคุมสิ่งแวดล้อมและมาตรการอื่น ๆ ร่วมด้วย

สาขาวิชา เศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต .....

ปีการศึกษา 2552 ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์หลัก .....

##5285579729: MAJOR HEALTH ECONOMICS AND HEALTH CARE MANAGEMENT

KEYWORDS: MALARIA INCIDENCE/ MONTSERRAADO COUNTY, LIBERIA

JUSTINE AMOS KORVAYAN: FACTORS ASSOCIATED WITH MALARIA INCIDENCE IN MONTSERRAADO COUNTY, LIBERIA. THESIS ADVISOR: ASSOC.PROF. SIRIPEN SUPAKANKUNTI, Ph.D., 122 pp.

The main objective of this study is to identify those factors that are associated with the incidence of malaria in Montserrado County, Liberia. This study analyze the socio-economic factors associated with the households getting infected by malaria and then provide additional information that will be used by the policy makers in the process of preventing and controlling malaria in Liberia. A total of 400 households were sampled during the survey conducted in the Greater Monrovia District of Montserrado County, Liberia. The logistic model was employed to estimate the malaria incidence as the dependent variable against the independent variables as follows: Income, Age, Access to health care, Family size, Sex, Residence, Educational status, Occupation, Knowledge,attitude,and practices, Insecticide treated nets, Intermittent preventive treatment, Indoor residual spraying, Position, Mosquito/insect repellent, Use of mosquito coils, Use insecticide spraying, Keeping surrounding clean.

The study results showed that 67 % of the respondents were in possession of insecticide treated nets (ITN), while 75 % of them mentioned at least three symptoms of malaria. 80 % of the respondents also mention at least three causes of malaria. The following variables were significant and associated with malaria incidence: At significant level $\alpha = 0.01$, were Income of the respondents and Age of the respondents. At significant at level $\alpha = 0.05$, was Sex of the respondents. And at significant level $\alpha = 0.10$, was Access to health care. The used of mosquito coils correlated with malaria incidence at $\alpha=0.10$, and was said to have been the practice of the relative poor respondents against the malaria incidence. The study identified some aspects that the government of Liberia needs to improve; Access to health care by improving the health facilities and ensuring that malaria treatment is standardized. Income, government needs to provide more funds to keep the environment clean and sanitations up to date, the government should ensure that more knowledge is given to the female residence to keep the home and environment from mosquitoes. Finally, the mosquito nets was not the only solution for prevention and control of malaria, as the children accounted for 71% of malaria deaths and there is a need for government to visit the current strategy, by blending the nets option with environmental control and other needed interventions.

Field of Study: Health Economics and Health Care Management Student's Signature .....

Academic Year: 2009 Advisor's Signature.....

ACKNOWLEDGEMENT

My special thanks and appreciation would go to the scholarship committee of the Ministry of Health and Social Welfare of Liberia for selecting and affording me the opportunity to attain the much anticipated knowledge in health economics and health care management. I am also humbled to state my indebtedness to the United States Agency for International Development (USAID/FORECAST Team) for their support to academic excellence, and sponsorship of the training program.

I would also like to thank Assoc. Prof. Dr. Siripen Supakankunti for her stewardship as the Program Director at the Center for Health Economics (CHE) and my thesis advisor, Assoc. prof. Dr. Pongsa Pornchaiwiseskul chairman of the thesis committee, Assoc. Prof. Dr. Sothitorn Mallikamas as examiner on the committee and Assist. Prof. Chanetwallop N. Khumthong as the external examiner and the instructional role he examined.

I would like to extend special thanks to Mr. C. Sanford Wesseh Assist. Minister of Vital Statistics at the Ministry of Health and Social Welfare, Liberia for his support to my thesis writing; I am also grateful to the National Malaria Control Programme of Liberia (NMCP/L) for its support in making resources available for the structuring and completion of the survey for my thesis work.

My heartfelt thanks go to former colleagues of mine from the University of Liberia who made their services available and worked mates at Ministry of Health and Social Welfare for not only the conduct of the household survey on my behalf, but the entry of the data as well. Their collective team work was crucial to the successful completion of my study at the Chulalongkorn University in Bangkok, Thailand.

Finally, I would like to thank my parents and family members who give me every needed encouragement and constant prayers for my success and achievement during the course of study at the Center for Health Economics (CHE) of the Chulalongkorn University in Bangkok, Thailand.

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LIST OF ABBREVIATIONS

ACT	:	Artesunate plus Amodiaquine
ACC	:	Access to health care
CWIQ	:	Core Welfare Questionnaire Indicator Survey
EDU	:	Educational level of household members
FAC	:	Health facilities to attend to community dwellers
FAM	:	Family size of household members
GDP/PPP	:	Gross Domestic Product at Purchasing Power Parity
INC	:	Income level of household members
IPT	:	Intermittent preventive treatment for pregnant women
IRS	:	Indoor residual spraying of household dwellings
ITN	:	Insecticide-treated nets used by household members
KAP	:	Knowledge, Attitude and Practices of household members
LDHS	:	Liberia Demography and Health Survey of 2007
LISGIS	:	Liberia Institute of Statistics and Geo-Information Servicer
MI	:	Malaria incidence of subjects in the survey area
MIS	:	Malaria Indicator Survey (2007 & 2009) in Liberia
MOHSW	:	Ministry of Health and Social Welfare of Liberia
NGO	:	Non-Governmental Organizations in the country
NMCP	:	National Malaria Control Program of Liberia
OCC	:	Occupation of household members in the area of survey
PHY	:	Physicians at health facilities to attend to the patients
POV	:	Poverty level of community members in the survey area
RES	:	Residence of the community members (Urban/Rural)

CHAPTER I

INTRODUCTION

1.1 Rationale

Malaria is a primary killer of between 1 and 3 million people each year the world over; and an estimated 350-500 million people fall sick from it annually. Over a million of these deaths occur in South-Sahara Africa. It can be said to be associated with poverty, and a prime cause of poverty. Major economic development is also hinder by this disease (Breman, 2004; WHO, 2005), also over 107 countries and territories with approximately 50 percent of the world's population can be said to be at most risks of transmission from the disease. Most of said morbidity and mortality are children with in Sub-Sahara Africa (Breman, Alilio, and Mills, 2004; Snow and others, 2005).

Even though in many parts of the world health authorities' are continuously fighting the disease like in Liberia, it can be stated that malaria being preventable and curable, remains a major public health problem, which will take its greatest toll on young children and pregnant women. Malaria is the leading cause of attendance at out-patient departments about 38 percent and is also the number one cause of inpatient deaths. It can be determined that hospital records will be at least 42 percent of inpatient deaths and be attributable to malaria (NMCP, 2006). This health problem was exacerbated by 15 years of civil conflict which was resulted in large population displacements as well as damage to the health systems. In an effort to reduce the malaria burden in Liberia, the Ministry of Health and Social Welfare (MOHSW) introduced a policy and strategic plan for malaria control and prevention.

Because of the negative impacts that malaria contributes on the African population, leaders met in the republic of Nigeria and pledge their commitment to the Roll Back Malaria, by signing of the Abuja Declaration, in April 2000 AD. It is in this light the Government of Liberia and her international health partners which are working to meet the April 2000 Declaration objectives. The measures laid out in the National Strategic plan are attempts to fulfill WHO's Roll Back Malaria objective for reducing malaria morbidity and mortality by 50 percent by until the year 2010.

As parts of this plan, the MOHSW has endorsed the use of more effective drugs for treatment in Liberia—Artesunate plus Amodiaquine (ACT) replacing chloroquine—as well as multiple preventive measures such as intermittent preventive treatment (IPT) for pregnant women, the use of insecticide-treated nets (ITNs), and indoor residual spraying (IRS), especially in camps for Liberians who were internally displaced due to the civil conflict. Data from the 2007 Liberia Demographic and Health Survey (LDHS) can be used to assess the extent of implementation of several of these malaria control strategies.

In 2005, the National Malaria Control Program at the MOHSW implemented a nationally representative, household-based Malaria Indicators Survey (MIS) (NMCP, 2006). The overall objective of this survey was to update the core baseline indicators of malaria in Liberia. Data collection in 8,226 households was conducted by the Liberia Institute for Statistics and Geo-information Services (LISGIS), with funding from several international donors, including the United Nations Development Program; the Global Fund to Fight AIDS, Tuberculosis, and Malaria; and the World Health Organization (WHO). Among the more important findings of the survey was the fact that 66 percent of children under five was infected with the malaria parasite (Plasmodium falciparum) at the time of the survey and that 87 percent of children under five had anemia (NMCP, 2006).

Improving the access to, the high quality and affordable health care is a key priority in a post-conflict and poor country such as Liberia. According to a recent presentation by Liberia's Ministry of Health and Social Welfare (2007), the conflict has led to the destruction or poor maintenance of a number of health facilities. Out of 521 facilities, only 389 are functional, and among these, 300 are currently being supported by NGOs, some of which may reduce their support in a year or two. Many health facilities, even when they are operational, lack potable water supply, lighting, equipment, refrigeration, and emergency facilities. Public spending for health is very low, at $3.4 per person per year. The country currently has a total of 4,000 health workers, as compared to 13,000 recommended by the World Health Organization. There is a lack of capacity at the central and county levels to implement health policies and programs. Health indicators used for monitoring the Millennium development Goals such as infant and child malnutrition, infant and child mortality, and maternal mortality are low (see UNDP,

2006, and Humphreys and Richards, 2005, for a broader discussion related to the Millennium Development Goals in Liberia).

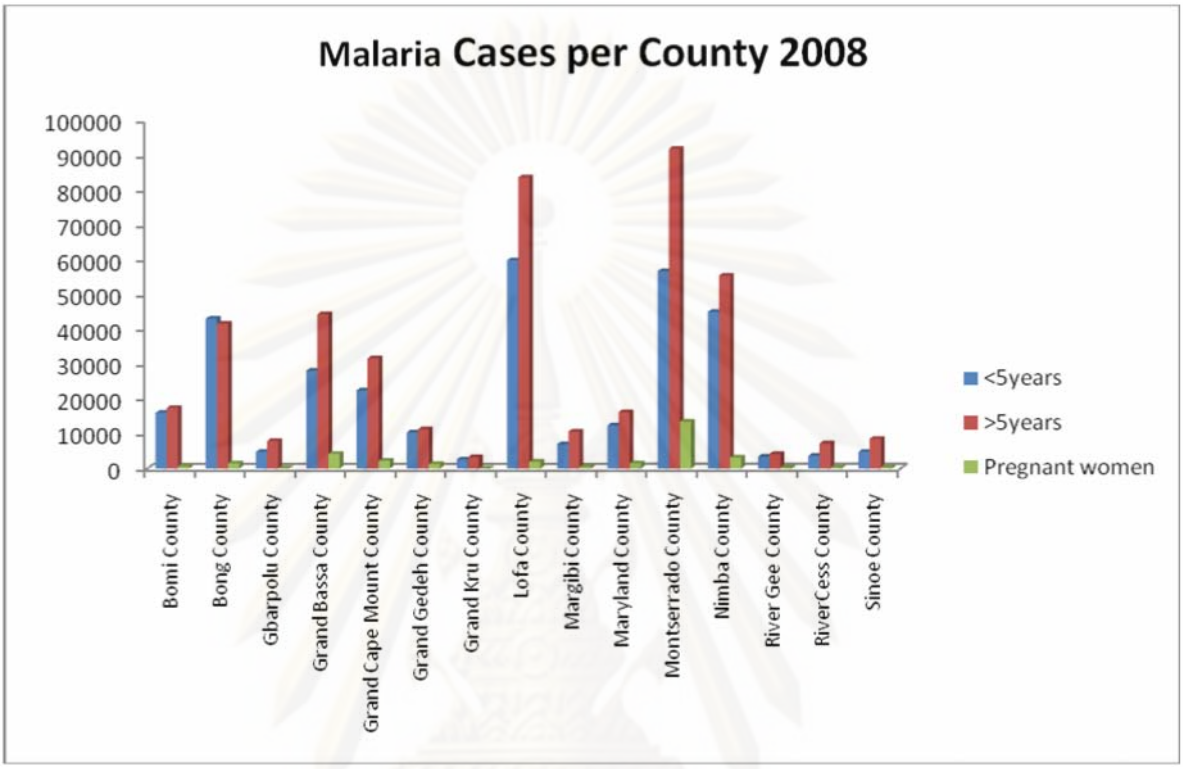
In order to monitor the progress in the delivery of health services, it is important to have good data, among others for establishing a baseline. Although the recent completion of a Demographic and Health Survey can be helpful to fill many gaps, there is still a lack of good information on many aspects of the health system and health outcomes in Liberia in parts because of the limited available data. In order to help inform the preparation of Liberia's full Poverty Reduction Strategy, the objective of this paper is to provide a basic diagnostic of health services as seen from the point of view of users. The diagnostic is based on the newly available nationally representative CWIQ (Core Welfare Questionnaire Indicator) survey she implemented in 2007 by the Liberia Institute of Statistics. The survey includes detailed data on the incidence of illnesses and sickness, the use of various types of health care facilities by households, as well as the reasons for not seeking care while being sick and the degree of satisfaction of households with the services received. Data are also available on private spending for health, as well as on distances to health facilities.

The CWIQ survey also has an interesting question on measures taken by households to prevent malaria. The answers are provided in table 1. Some 41.7 percent of the population does not take any measures, and the proportion is above 50 percent among the bottom two quintiles. Bed nets are the most common preventive measure, for a third of the sample, but the likelihood that they will be used by the poor is lower. Anti-malaria drugs are used by 11.1 percent of the population, with some differences across quintiles. Measures to maintain good sanitation are taken by a tenth of the population as well, again with even more limited differences between quintiles. The use of insecticides is of a similar order of magnitude at the national level, but only three percent of the population in the bottom two quintiles uses them, as this is a strategy mostly used in the urban areas. Therefore, it is clear from the data that the additional efforts could be made to help the population protect itself from malaria, which is the first cause of illness in the country which can be seen from table 1.1 in Appendix A.1.

Table 2 and 3 shows the 8 leading causes of morbidity and mortality for the year 2007 and 2008. Five of the diseases had been decreased during 2007 to 2008, but malaria increased by nearly 15 percent. This shows the level and magnitude at which the disease is taking its toll on the population. Malaria is accounting for approximately 38% of all hospitalizations and outpatients attendances. The national incidence of malaria has been fluctuating during the period of 2006 to 2008 with all of the counties reporting malaria as the leading cause on hospital attendance. The incidence of malaria in 2007 was 104 per 1000 population as compared to 2008 119 per 1000 population. Furthermore, data in table 2 is inclusive of information for all age groups and shows malaria as the major cause of visitation to MOH facilities in the country with an incidence rate of 104 per 1000 population. The data in table 3 is inclusive of information for all age groups. And table shows Malaria as the major cause of visitation to MOH facilities in the country with an incidence rate of 119 per 1000 population. Those can be seen on the table 1.2 and 1.3 in Appendix A.2 and A.3.

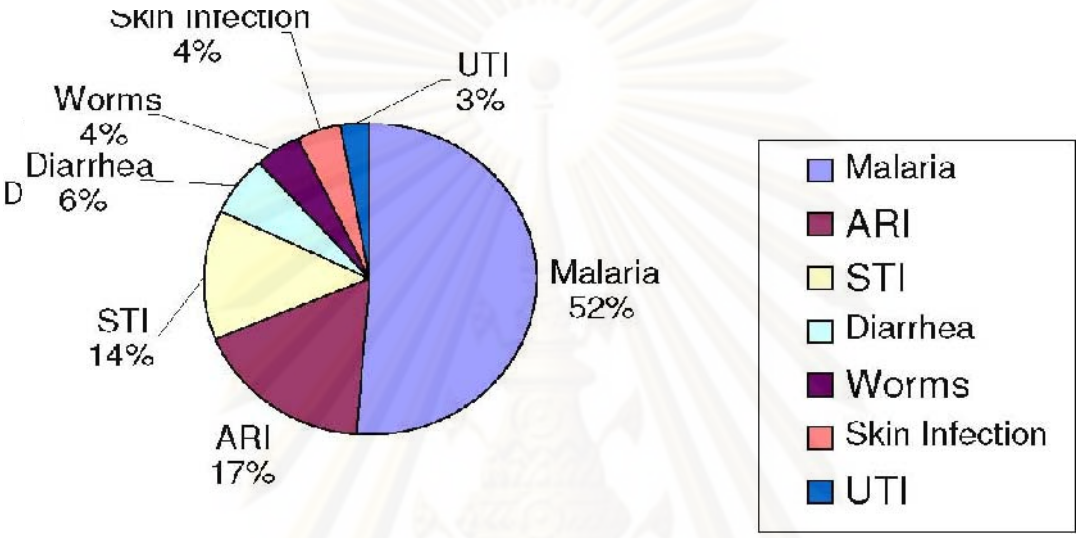
The figure 1.1 and 1.2 can be shown the true picture of the most affected counties, with Montserrado the most populous being the most affected. Figure 1 shows the trend of malaria cases per county in 2008. The diagram reveals that region 3 which represents Bong Lofa & Nimba counties reported the highest number of malaria cases; this could most likely be due to the large population in that region. It also depicts why malaria is a public health problem in Liberia, as in most tropical African countries with seasonal outbreaks. Malaria is endangering not only the health of the population of Liberia, but also Socio-economic development as well.

Figure 1.1 Trends of Malaria Cases per County in 2008.



Source: Epidemiology Unit, MOH&SW2008

Figure 1.2 Major Causes of Hospital Visitation, 2008



Source: Epidemiology Unit, MOH&SW 2008.

The figure above depicts the seven major causes of hospital visitation for the year 2008, with malaria being the leading cause of morbidity in the country. Because malaria is associated with poverty and causes poverty, it has compounded the level of indigence of majority of the post war population.

1.2 Background

The Republic of Liberia

Liberia is located on the west coast of Africa, with a land area of 110,080 $Km^2$and the coastline of 560 Km along the Atlantic Ocean. It is bordered by Sierra Leone to the west, Guinea to the northwest, and Cote d'Ivoire to the northeast and east (See map).Most of the country lies below 500meters in altitude; rain forest and swampy areas are common features. The climate is suitable for malaria transmission throughout the year

in almost all parts of the country. Because during the main rainy season---July to September---temperature average 24.5C and rise to 26.5C in December and January when it predominantly dry. Rainfall in the coastal areas where the capital, Monrovia, lies, is over 5,000 mm per annum; however, this decreases as one moves inland to as little as 2,000 mm and the country average humidity is about 72 (Ministry of health,2001).

The country is divided in to 15 counties which are further subdivided in to districts, chiefdoms and clans. The total population is estimated 3, 5000,000 with an annual growth rate of 2.1 percent (LISGIS, 2008).The table 4 shows some selected indicators of development for Liberia.

Table 1.4 Selected Human Development Indicators for Liberia 2008

Population	3.5 million
Annual population growth rate	2.1 percent
Under five mortality rate (per 1,000 births)	110 deaths
Maternal mortality ratio (per 100,000 births)	994 deaths
Literacy rate (age 15—49)	41 percent (women); 70 percent (men)
Net attendance ratio at primary schools (as percentage	
Primary school—age—population)	41 percent (boys); 39 percent (girls)
Net attendance ratio at primary schools (as percentage	
Secondary school—age –population)	21 percent (boys); 18 percent (girls)

Source: LISGIS, 2008; LISGIS et al., 2008

Figure 1.3 The Map of Liberia Showing Counties and Regions.

Source: Liberia Institute of Statistics Geo- Information Services (LISGIS-2008)

1.3 Research Questions

Primary Question:

- What are the factors associated with malaria incidence in Montserrado County, Liberia?

Secondary Questions:

- What are the socio-economic factors associated with households getting infected by malaria within the population under study?
- Is there a need to provide additional information to enable the formulation of policies in the prevention and control of malaria in Liberia?

1.4 RESEARCH OBJECTIVES

General Objective:

- To identify the factors associated with malaria incidence in Montserrado County, Liberia.

Specific Objectives:

- To analyze the socio-economic factors associated with households getting infected by malaria within the population study.
- To provide additional information that will enable the formulation of policies towards the prevention and control of malaria in Liberia.

1.5 Scope of the Study

The study is an analysis of the factors associated with the incidence of malaria in Montserrado County of Liberia and focuses on those households at risk of malaria morbidity and mortality, their socio-economic conditions, and their knowledge, attitudes and practices,(KAP) with respect to malaria control and prevention (Household-Members

18-60 years) and falls in the selected community to be interviewed. The data to be used during the study will be a primary data from a household survey to be conducted in February-March 2010 and will be information from 2009 malaria incidences or deaths.

1.6 Hypothesis

Access to health care,(Acc) Household income (Inc), Family size(Fam), Knowledge Attitude, Practice(KAP) Educational level(Edu) ,Age, Occupation(Occ), Residence (Res), Sex, Position in the family(Pos), Insecticide treated nets(ITNs),Intermittent preventive treatment(IPT), Indoor residual spraying(IRS), Mosquito/insect repellent(MIR), Use mosquito coils(UMC), Use insecticide spray(UIS), Keep surrounding clean(KSC), contribute to malaria incidence in Montserrado County of Liberia.

1.7 Expected Benefits:

The potential beneficiaries of this study will be beneficial from the Ministry of Health and Social Welfare on behalf of the government of Liberia and also would be researchers in the health economics sector. The findings from the study are expected to inform the policy and decision makers as follows:

1.7.1 To provides evidence as to whether interventions are positive in reducing the burden of malaria on the population.

1.7.2 To provides information on the need to increased budgetary allocations for the fight against malaria.

1.7.3 To get a glimpse of what will be of the economy as a result of the high incidence rate of malaria.

CHAPTER II

LITERATURE REVIEW

Four species of the genus plasmodium cause malaria infection in humans which are *Plasmodium Falciparum, Plasmodium Vivax, Plasmodium Ovale,* and *Plasmodium Malaria*e.The human infection begins when the Malaria Vector, A female anopheline mosquito, inoculates plasmodial sporozoites from its salivary gland into humans during a blood meal. *Plasmodium* Falciparum is the specie in the Sub-Saharan Africa and is the leading cause of morbidity and mortality.(Breman, 2004; WHO, 2005).The malaria disease continue to take its toll on the world's population and especially in Sub-Saharan Africa, where the younger children are the most infected.

2.1 Income & Poverty

"Where malaria prospers most, human societies have prospered least. The global distribution of per capita gross domestic product shows a striking correlation between malaria and poverty, and malaria-endemic countries also have lower rates of economic growth. There are multiple channels by which malaria impedes development, including effects on fertility, population growth, savings and investment, worker productivity, absenteeism, premature mortality and medical costs"(Sachs & Malaney,2002).

According to Steven Russell (2004), ill-health is a serious contributory factor to impoverishment and could be define as the means or processes of household asset depletion and the loss of income that subsequently leads to consumption level falling below minimum needs, processes which are brought into sharper focus by the social and economic impact of the malaria epidemic. The Mounting concerns about the possible link between ill-health and poverty, placed health at the center of development agencies' poverty reduction targets and strategies to improved access for the poorest people of the world, to combat poverty and reduce the burden of disease. This can be further manifested through the household interactions with health services and the costs of

seeking treatment and medications at the health centers, with many health services being ineffective. Health services generate less benefit for the poor than the rich, and can impose regressive costs burdens, with the poor households spending a higher proportion of their income on health care than better-off households. Sachs and Malaney (2004) investigated that the direct costs of preventing and treatment of the malaria disease eat into the disposable income of poor families, and also lead to the lost in costs of productivity.

2.1.1 Income and Consumption Dimensions of Poverty: Measuring Rural and Urban poverty Lines in Liberia

The CWIQ (Core Welfare Questionnaire Indicator) survey was implemented in 2007 by the Liberia Institute of Statistics. The survey includes detailed data on the incidence of illnesses and sickness, the use of various types of health care facilities by households, as well as the reasons for not seeking care when sick and the degree of satisfaction of households with the services received. Data are also available on private spending for health, as well as on distances to health facilities.

The survey also focused on the consumption pattern of the population (per equivalent adult) rather than income, for two reasons: Firstly, consumption is better measured in household surveys than income does, especially since net income is difficult to measure where most of the population works as part of the informal sector. Secondly, consumption is a better indicator than income of welfare and a household's standard of living. The survey calculated rural and urban poverty lines based on the cost of basic needs in two parts. First of all, it estimated urban and rural food poverty lines derived from the cost of a food basket providing 2,400 Kcal per day per adult equivalent. Furthermore, it also computed non-food poverty lines by estimating the non-food spending of households whose food were within five percent of the food poverty line.

The total poverty line is the sum of the two, while the food poverty line is the basis for measuring "extreme" poverty. Estimates of the extent of consumption poverty

were part of findings as follows: It can be found from the CWIQ that 63.8 percent of Liberians live below the poverty line. This implies that 1.7 million Liberians are living in poverty, and out of that amount, 1.3 million people are living in extreme poverty, equivalent to 48 percent of the population. Poverty is said to be higher in rural areas (66.7 percent) than in urban areas (55 percent). Since 70 percent of the population lives in rural areas, about three- quarters (73 percent) of the poor live in rural areas (IMF, The poverty lines estimated are shown in Table 2.1 below (IMF, 2008).

Table 2.1 Liberia, 2007 Poverty Lines (annual, per equivalent adult)

	Food poverty (Extreme Poverty)		Non-Food poverty line		Total poverty line	
	LD	USD	LD	USD	LD	USD
Rural	14,514	242	6,910	115	21,424	357
Urban	14,431	241	15,793	263	30,224	504

Source: (IMF, CWIQ Survey 2007) *Based on an exchange rate of LD/USD=60/1

Sachs and Malaney (2004) maintained that the global distribution of per-capita Gross Domestic Product (GDP) in 1995, adjusted for purchasing power, can be a striking and unmistakable correlation between malaria burden and poverty. Poverty was concentrated within the tropical and subtropical zones, the geographical boundaries that most closely frame the transmission of malaria. The extents of the correlation suggest that malaria and poverty are intimately related. Their comparison of income in malarious and non-malarious countries indicated that average GDP (adjusted to give parity of purchasing power) in malarious countries in 1995 was US$1,526; compare to US$8,268 in countries without intensive malaria—more than fivefold difference. They further asserted that between 1965 and 1990, countries in which large proportion of the population lived in regions with Plasmodium falciparum malaria experienced a growth in

average of per capita GDP of 0.4% per year, whereas average growth in other countries was 2.3% percent per year.

2.2 Access to Health Care

According to Martin Gulliford et al (2002) access is a complex concept and could at least be evaluated from four perspectives. If services are available and there is an adequate supply of services, the opportunity to obtain health care exists, the population may have accessed to the health care services. The extent to which a population may gain such access to the health care depends on financial, organizational and social or cultural barriers that limit the utilization of services. These suggest that access measured in terms of utilization and is dependent upon the affordability, physical accessibility and acceptability of services and not merely adequacy of supply. In this vain, available services must be relevant and effective so as to allow access to the population for satisfactory health outcomes. The availability of services, and barriers to access, have to be considered in the context of different perspectives, health needs and material and cultural settings of diverse groups in society; therefore equity of access may be measured in terms of the availability, utilization or outcomes of services. The horizontal and vertical dimensions of equity should be considered in the process.

2.3 Family Size and Sex of Households

There is a high degree of disparity in the way and manner in which boys and girls are raised in many parts of Africa. Girls with in most families encounter discriminatory practices as they grow up-many in childrearing practices. The girls are rank lower than the boys in the family hierarchies; they received less food, less medical care, and are overburdened by household chores. They are the eventual care takers of the younger children and elderly in the family, and they are subjected to marriage at an earlier age due to cultural and religious practices (UNICEF, 1990; Lane, 1991), smaller family' size may however leads to an equitable childrearing practices, because when families have small number of children, they tend to be well attentive to the survival and well-being of their

children. This situation will therefore see girls being highly valued and subject to less discrimination. The average number and manageable family size is between 3 and 5 members family. As the number grows bigger say between 6 to 10 or more family members of a household, things gets bad and grow worse for survival and the meeting of ends means (Ragheb and Guirgis, 1998).

In Liberia, the family size of majority of households is between 7 and 9 members, with some cases being more than 12 members. The high level of cultural and religious practices leads to an increase the increased in many instances, with more than 60 percent of the population living below the poverty line (Less than US$1 per day). This has resulted into most of the boys getting into the streets and an increase in the crime rates; while many of the girls have resulted to prostitution to meeting daily needs. The situation was even worse when the 14 years of civil conflict forced many of the rural inhabitants to the capital city of Monrovia for refuge.

2.4 Residence and Occupation of Households

Residency in many parts of the world is a serious problem which many governments are strategizing to cope with. The massive rural/urban migration of population in pursuit of better living conditions through seeking of academic enrollments, better jobs and living standards, has lead to the over crowdedness of many capital cities around the world.

Many of such rural dwellers live in abject poverty and are basically subsistent farmers and may not have accessed to the basic social services for survival. Educational, health, housing and other economic needs eludes rural dwellers; it can be found difficult to cope with the standard of living. In Liberia, an average 60 to 70 percent of the educational and health facilities are in the urban cities, especially the capital city of Monrovia. Many health workers and teaching staff are not willing to take up assignments in the rural settings.

Majority of the population (70 %) live in the rural areas, and are also the poorest, and do not have employment opportunities and basic social services to meet the basic needs of life. By residing in the urban cities, it will be more beneficial for the opportunity to have a better occupation for the source of livelihood as a family or household. By being gainfully employed leads to the way of improving the living standards, educational levels and seeking required medications as individuals and family. Very few farmers take part in the business as the war destroy and depleted most of those potential farmers and their sources of income, economic activities are non active in most of the regions and transportation systems are down and smooth travels are seasonal. The dependency ratio thus has been increased to an explosive proportion with in the country, with very few people being employed. The few working groups are thus overburden with payment of taxes, catering to large households, and have even made their marginal propensity to consume and save(MPC & MPS) very slim or impossible to reach.

2.5 Number of Health Facilities

Montserrado County is the host of the capital city of Monrovia and has a population of 1.2 million people, with 25 health facilities to attend to the huge demand of health care and medical services. Of the 25 health facilities, there are 2 hospitals, 4 health centers and 19 clinics for such high population with an average of 44,720 persons to these facilities. Health care services the world over are a human right issue for individual countries and global community, and a very key intervention for the sick population in every country. The explanation and the table give a clear picture of what is obtaining in the malaria endemic country of Liberia. With malaria being the leading cause of morbidity and mortality in the country, and such a high population and few health facilities to attend to, is critical to the public health system of the country in the table 2.2 can be found in appendix A.

2.6 Number of Physicians

The number of professional medical practioners and technicians within the employed of the Ministry of Health and Social Welfare can be shown in table 2.3**.** It is very serious the level and shortage of trained health professionals and technicians to served the estimated 3.5 million population of Liberia. If 290 trained and technically efficient medical practioners are to serve more than 3.5 million people, it remains to be seen the level effectiveness and productivity, that is a dilemma for the public health authorities of the country.

Table 2.2 List of Medical Professionals in MOH Facilities 2009

1. Medical Doctors	12
2. Physician Assistants	41
3. Registered Nurses	93
4. Certified Midwifes	53
5. Laboratory Technicians	21
6. Dispensers	70
Total:	290

Source: Human Resource Department Ministry of Health

2.7 Age of Households

Where malaria is highly endemic, adults tend to generally develop partial immunity to symptoms of the disease. The younger children however, bear a considerable burden in terms of malaria morbidity and mortality. Although the morbidity is most concentrated among the pre-school children, school-age children also suffer the effects, which results into absenteeism, for example, it was found in Kenya that the primary school students missed 11% of school days per year due to malaria, and secondary school

students missed 4.3% of school days. A further study attributed between 13-50% of medically related school absence due to malaria, (Sachs and Malaney 2004).

2.8 Insecticide-treated nets (ITN), Intermittent preventive treatment (IPT) & Indoor residual spraying (IRS)

The WHO (2005) recommended three-pronged approached to the prevention and control of malaria during pregnancy in areas of stable transmission. The package of interventions consisted of intermittent preventive treatment (IPT) of asymptomatic pregnant women, use of insecticide-treated bednets (ITNs) and prompt and effective case management of malaria illness and anemia. Intermittent preventive treatment (IPT) is thus the administration of full treatment doses of an effective, preferably one-dose, and antimalaria for the prevention of malaria at predefined intervals. The WHO recommends that all pregnant women in areas of stable transmission be given at least two doses of intermittent preventive treatment (IPT) after quickening (first noted movement of the fetus) during regularly/ routinely scheduled antenatal clinic visits. It is further recommended that four visits be made with respect to the antenatal clinic and three visits especially after quickening. The most effective drug for intermittent preventive treatment (IPT) currently is Sulfadoxine-Pyrimethamine (SP) due to its safety during pregnancy, effectiveness in reproductive-age women and feasibility for program used.

According to (RBM 2005) the effective used of insecticide-treated bednets (ITNs) to provide personal protection by killing or repelling mosquitoes is one of the major strategies of malaria control. Pyrethroids are recommended for the periodic treatment or retreatment of protective materials. The effectiveness of the ITNs depends on their acceptability by the population at risk and their affordability. It is contingent on the habits, biology, and susceptibility of the mosquito vector, the compliance of the human population, and the concentration of insecticide on or in the fiber, which has to be maintained by regular re-treatment or by incorporating the insecticide in the fiber for long duration.

Lengeler (2004) examined that there were over 20 studies in Africa and Asia which have proven or demonstrated that more than 50 percent of protective efficacy for individual users of ITNs in reducing malaria episodes, 29 percent protection against severe malaria burden, and substantial protection against anemia. More than that, the use of ITNs reduced child mortality by 18 percent in five sites in Sub-Saharan Africa. Lengeler and Sharp (2003) studied and found that indoor residual spraying (IRS) is the application of long-lasting insecticides (up to six months) on the walls of dwellings. It can be said from this study that insecticides repel mosquitoes from entering or impart a lethal dose of the insecticide on the female mosquito when it is rested on a sprayed surface, thereby preventing subsequent transmission to its targets. IRS has been said to be most effective against indoor-biting (endophilic) mosquito vectors. Vector susceptibility and post-feeding behavior are the main criteria to be considered when choosing an insecticide: organophosphates, carbamates, and pyrethroids are the main compounds used although some countries still rely on organochlorines (dichlorodiphenyltrichloroethane, or DDT).

2.9 Education

According to (Gilles 2002) health education is the provision of information via newspapers, radio, or television, and health counseling is individual, and involves the transfer of skills. The provision of basic information to households in respect to prevention of malaria is needed in all endemic communities. It should include the importance of early treatment and where to access it, the use of referral services, and the significance of full compliance with treatment and other interventions. The necessary information can be provided by community and voluntary health workers. These persons are an extension of the health system and work under the direct supervision of some health facility staff or nongovernmental organizations and in conformity with standards and norms established by the national or central government. The information can help to increase the standard of patient care and prevention programs through the promotion of citizens and community advocacy and demand for control.

2.10 Knowledge, Attitude & Practices

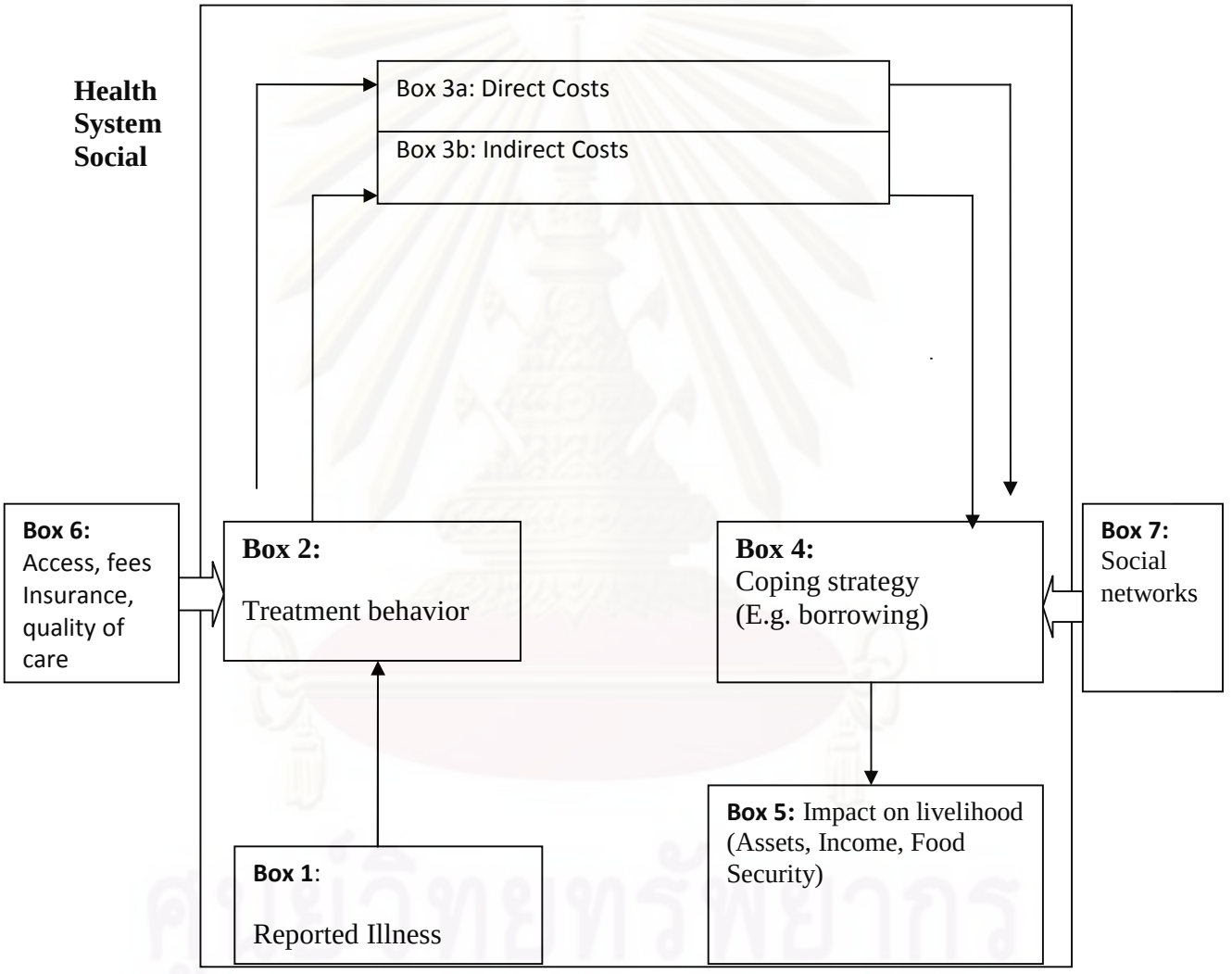
Tyagi and Others (2005) studied and found that ignorance and the level of impoverishment of the population in the malaria endemic areas, contributed in creating source and spread of the disease, as well as hindered its control strategy. The prevention of the malaria burden through better knowledge and awareness is the appropriate way to keep disease away and remain healthy as illness confusion and health-seeking behavior may enhance or interfere with the effectiveness of control measures. It was found that studies pertaining to knowledge, attitude and practices (KAP) showed the direct interaction with the community which played an important role in circumventing malaria problems. The involvement and inclusion of various social groupings, particularly the school teachers in such studies is very important as it can impart correct knowledge about the disease to the school children and can also create awareness in the community. According to Hung et al, (2002), there was a peak in malaria incidence, with an estimated 5,000 deaths, accompanied by a widespread multi-drug resistance which led Vietnam's National Malaria control Program to launch a new approach at fighting the disease. This was comprise of national distribution of free antimalarials—especially artemisinin—and bed-nets, twice-yearly home insecticide spraying, local microscopic diagnosis, treatment and community education.

2.11 The Effects of Malaria on the Household and Economy

In the process of taking a glimpse of the economy due to the high incidence of malaria, we will take the cursory look from two perspectives: Households perspective (Micro) and the national or Gross Domestic product (GDP/Macro) perspective. The brief overview will assessed the impact that ill-health in general has on the population and the economy of a country. Malaria is endemic in the tropical and sub-tropical regions of the World and has mostly affected the African territory by impoverishing a greater percent of the population and killing a large number of people. Figure 2.1 depicts an economic analysis of the burden of illness (malaria) for individuals and household members who were in the sampled. The diagram consists of key components such as individual and

household costs of illness; the strategies implored to cope with the situation, and their economic consequences at the individual and household levels.

Figure 2.1 Economic Analysis of the Burden of Illness for Individual and Household



Source: Steven Russell Am. J. Trop. Med Hyg. 71(Suppl 2), 2004 Page 148. The Economic Burden of Illness for Households in Developing Countries: A Review of Studies Focusing on Malaria, Tuberculosis, and Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome.

The household is the preferred unit of analysis for the assessments of illness related costs because key decisions with respect to treatment and coping from household are based on negotiations (but not necessarily from an equal bargaining position). Illness costs are incurred by the caregivers as well as the sick, and costs fall on the individual and household budgets. The diagram is divided in to seven boxes or segments and gives the following illustrations:

There is an initial effort to respond to perceived illnesses by the individual or households (Box 1), decisions are made about whether to seek treatment and from which source (Income/Budget -Box 2). The health system is shown at the immediate left as a resource outside the household on which members can draw or seek treatment as their income permits (Box 6). Illness costs are broken down in to direct (Box 3a) and indirect costs (Box 3b). The direct costs refer to individual and household expenditures linked with seeking treatment, including non-medical expenses such as transportation and foods. Indirect costs refer to the loss of individual and household productive labor time for patients and caregivers. Cost burden is a term which refers to direct or indirect costs express as a percentage of the household income.

Some analysts assume that a cost burden greater than ten percent (10 %) is likely to be catastrophic for the household economy, suggesting that it is likely to force household members to cut their consumption of other minimum needs, trigger productive asset sales or high levels of debt, and lead to impoverishment. This 10 % however can be an arbitrary figure because; it may not be catastrophic for high income households that can cut back on luxuries or for resilient households that can mobilize assets to pay for treatment. Direct and indirect costs can be influenced by the type and severity of the illness (Box 1) and health services characteristics (Box 6) which in turn influence access and choice of provider. Illness costs going beyond the individual or household's daily or monthly budget may trigger coping strategies such as borrowing or asset sales (Box 4).

In the situation where there is poverty, households struggle to meet daily food and fuel needs, the loss of a daily wage due to illness or a relatively small treatment expense

is likely to trigger such strategies, including claims on resources outside the household such as social networks or local organizations that offer credit (Box 7). The costs of illness and coping strategies then have implications for household asset portfolios and processes of impoverishment (Box 5). Household interactions with health services, and the costs people incur due to illness, are also central to the performance of health care interventions, particularly their coverage and equity implications. Existing costs barriers and quality weaknesses deter the use of health services, particularly by the poor, so services are often ineffective in reaching the poor and generate the less benefit for the poor than the rich. Health services can also impose regressive cost burdens, with poor households spending a higher proportion of their income on health care than better-off households.

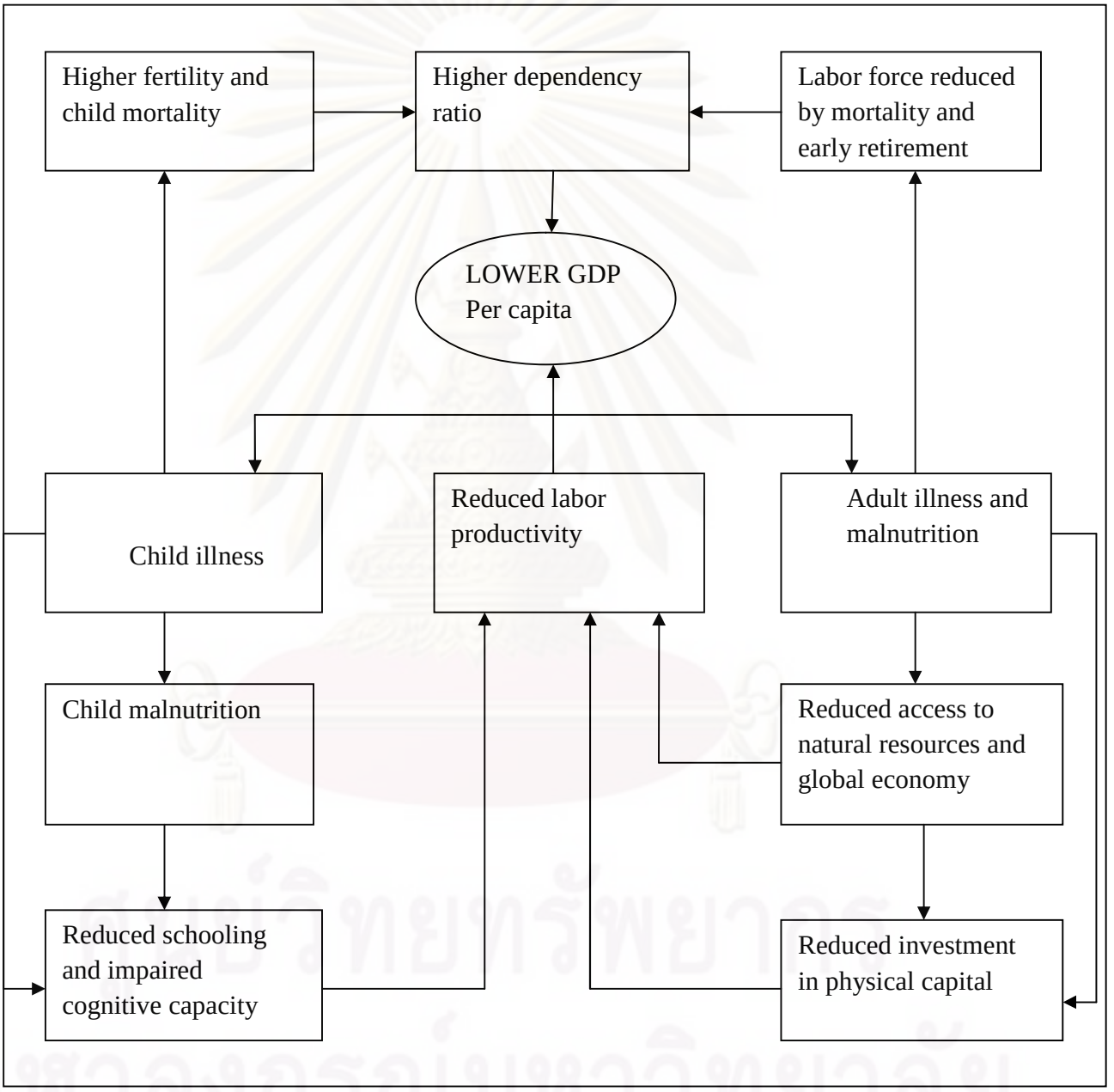
Figure 2.2 below shows the impact of disease (malaria) on lowering gross domestic product (GDP) per capita, of a country. There are multiple channels by which malaria may impede development, such as effects on fertility, population growth; saving and investment, worker productivity, absenteeism, premature mortality, economic growth and medical costs. This may lead to the evocation of the general rule of thumb, that where malaria prosperous most, human societies have prospered least. There is a strong correlation between malaria and poverty, which can be explained in several possible ways. Poverty may promote malaria transmission, malaria may cause poverty by impeding economic growth; or causality may run in both directions. In regions where malaria is highly endemic, it is said that adults tend to generally develop partial immunity to the symptoms of the disease.

The younger children, however, bear a considerable burden in terms of malaria morbidity and mortality in the endemic areas. Although this morbidity is most concentrated among pre-school children, school age children also suffer the effects, which results in to high absenteeism. The adverse effects on schooling are likely to go far beyond just number of days lost per year, as absenteeism increases failure rates, repetition of school years, and drop-out rates. There could be even more severe

consequence arising from the impact of malaria on cognitive development and learning ability, which may also have long-term cognitive effects of severe cases of malaria.

For example children with malaria are found to have poorer nutritional status than non-malaria children, an outcome that impairs brain development. To give a vivid description of the chart above, we will start from the middle at the immediate left, where malaria is major childhood illness and many times lead to malnutrition, with the reduction of schooling days, impaired cognitive capacities and comprehensive learning abilities. This may lead to the reduction in labor productivity, higher fertility rates, increased child mortality and subsequently increased the dependency ratio; thereby lowering the gross domestic product (GDP) per capita of the country.

Figure 2.2 Poor Health Reduces GDP per capita by Reducing Both Labor Productivity and the Relative Size of the Labor Force.



Source: Ruger, Jennifer Prah, Dean T. Jamison and David E. Bloom, 2001, "Health and the Economy," page 619 in International Public Health edited by Michael H. Merson, Robert E. Black, and Anne J. Mills (Sudbury Massachusetts Jonet and Barlott).

CHAPTER III

RESEARCH METHODOLOGY

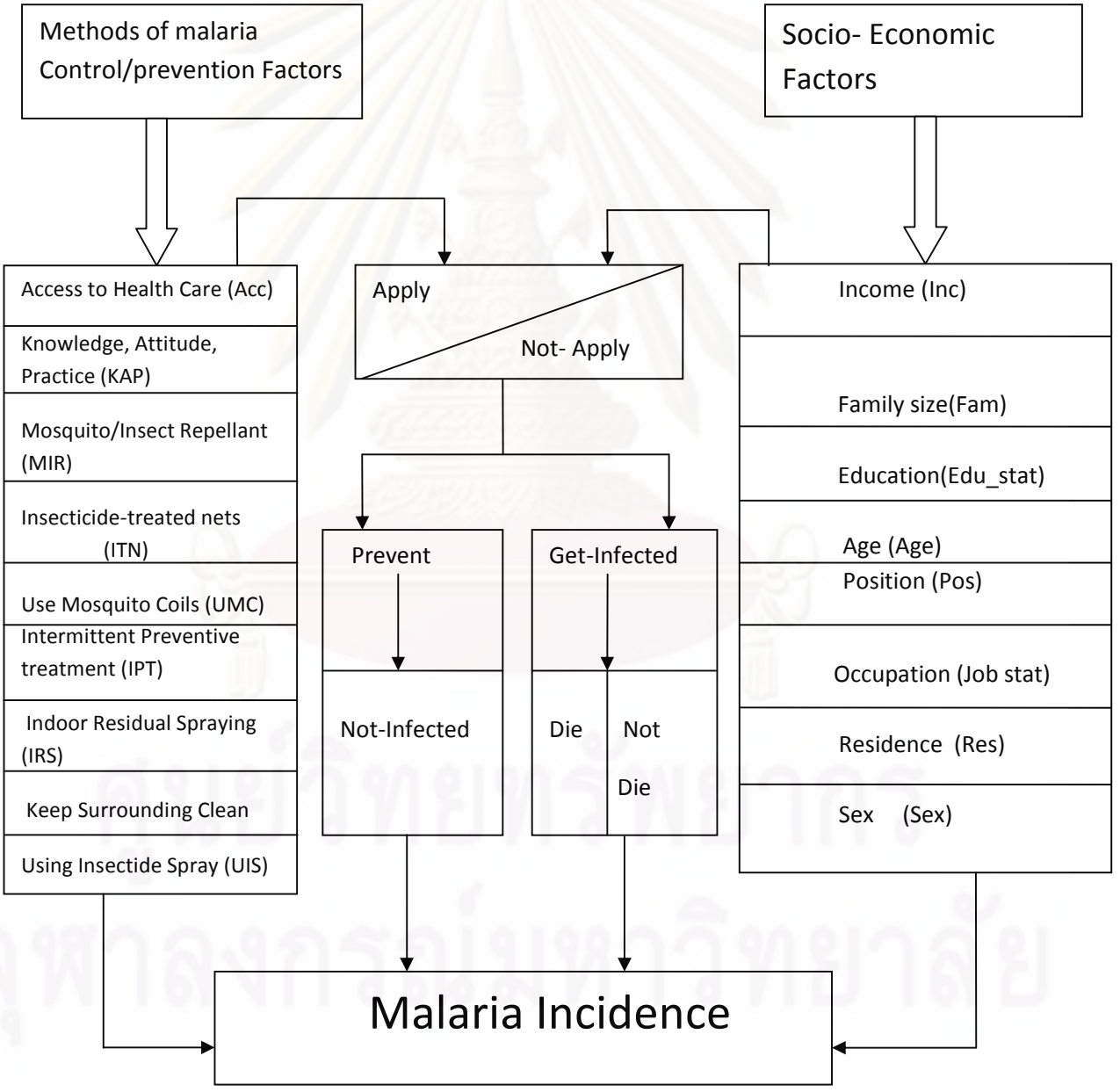
3.1 Conceptual Framework

The conceptual framework figure 3.1 can be categorized in to two sections; first of all, the left hand side is the portion relating to those variables from the intervention (supply side) or the preventive and control measures taken by health authorities in providing those basic health services. The variables include: Accessed to health care, and basic preventive measures such as the knowledge, attitude and practices(KAP) insecticide-treated nets (ITNs), intermittent preventive treatment (IPT),mosquito/insect repellent (MIR),keeping surrounding clean(KSC),using insecticide spray (UIS),use of mosquito coils (UMC) and indoor residual spraying (IRS).Secondly the right-hand side is the socio-economic (demand side) and consists of basic variables such as income level, family size of households, educational status of household members, age of household members, occupation of household members, residency (statement of urban and rural), sex (male/female),and position in the family of the community members. The center of the framework shows a probability from the two perspectives explained above, and the wellbeing or ill health status of the household members about the malaria incidence (MI) in the time of intervention or absence of interventions is measured.

The basic assumptions can be summarized the supply side (holding other factors constant) is implemented on a positive note, the community members will be prevented from malaria and eventual deaths. In the same manner if those basic socio-economic factors are well and positive with the household members, they will equally be prevented from malaria burden and eventual deaths. And the reverse is true that if we hold other factors constant, and they are not implemented, there will be malaria outbreaks and deaths due to the non-intervention and the vulnerable situation with community members. There is a third situation which is a probability that even in the process of an intervention or no intervention; subjects could still be infected and not infected by the malaria disease.

However, after the household survey has been conducted and the data had been processed and analyzed, the true and clear picture of the assumptions and probabilities should be seen and categorized.

Figure 3.1 Conceptual Framework



3.2 Research Design

The study is a cross-sectional descriptive analysis in which the objectives are to identify the factors associated with the incidence of malaria in Montserrado County, Liberia, and to provide additional information that will enable formulation of policies towards the prevention and control of malaria in Liberia.

The effect of malaria on households from the socio-economic (demand side) will be analyzed, and the conduct of a survey will also depict a picture of the household's knowledge, attitude and practices through the prevention and control of malaria (supply side). The process is to be actualized through the conduct of a household survey within the Greater Monrovia District.

3.2.1 Development of Structured Questionnaires

The household member's interviews will be done through a structured questionnaire which consists of two parts including general information, knowledge, attitudes, and practices (KAP) and control of malaria. The questionnaire will be pre-tested before to the conduct of the household survey or interviews. The study area of the survey is the Greater Monrovia District of Montserrado County, and will be divided into four Townships to be as follows: Paynesville Township, Gardnersville Township, Johnsonville Township and Caldwell- Township.

3.2.2 Sampled Population

Those households in which there exist the high prevalence of malaria morbidity and mortality and their socio-economic conditions, and their knowledge, attitudes and practices, in regard to malaria control and prevention (household-members between the ages of18-60 years) and falls in the selected community to be studied.

Inclusion Criteria:

Those households in the communities to be sampled and meet the followings:

1. Must have the ability to answer the interview questionnaire.
2. Fall between the age group 18 to 60 years old, both and female (Head of said household).
3. Must have lived in the community and household for the last 12 months.

Exclusion Criteria:

Those households in the communities to be sampled and with the following criteria:

1. Household heads that are less than 18 years and more than 60 years of age.
2. Households that might be selected for interview and are not willing to be interview.
3. Households that might be selected and have no respondents to the interview.

3.2.3 Sample Size Calculation

The required sample size for household to be interviewed is calculated through the use of the **formula below.**

$$\mathbf{n} = \frac{\mathbf{N}}{1 + N(e)^2} = \frac{300{,}000}{1 + 300{,}000\,(0.05)^2} = 399.5 = 400$$

Where

N= Population size

n= Sample size

e= Level of significant = 0.05

3.3 Sampling Technique

The study will be conducted in the Greater Monrovia District with stratification of said district in to four major Townships. It will use a simple random sampling to select the communities to be interviewed, and also use a systematic random sampling in selecting the households to be interviewed. There are a total of 400 households to be interview during the period of study. The data is expected to be collected in February of 2010 and will meet all the criteria set for the study as stated below.

The selection of households for the interview will be done through a multistage sampling as outline below:

1. Stratified sampling of the Greater Monrovia District. The district will be divided into four sections to incorporate the survey as follows:

   A. Paynesville Township----------Northeast

   B. Gardnersville Township---------- Northeast

   C. Johnsonville Township---------- Northeast

   D. Caldwell Township ---------- Northeast

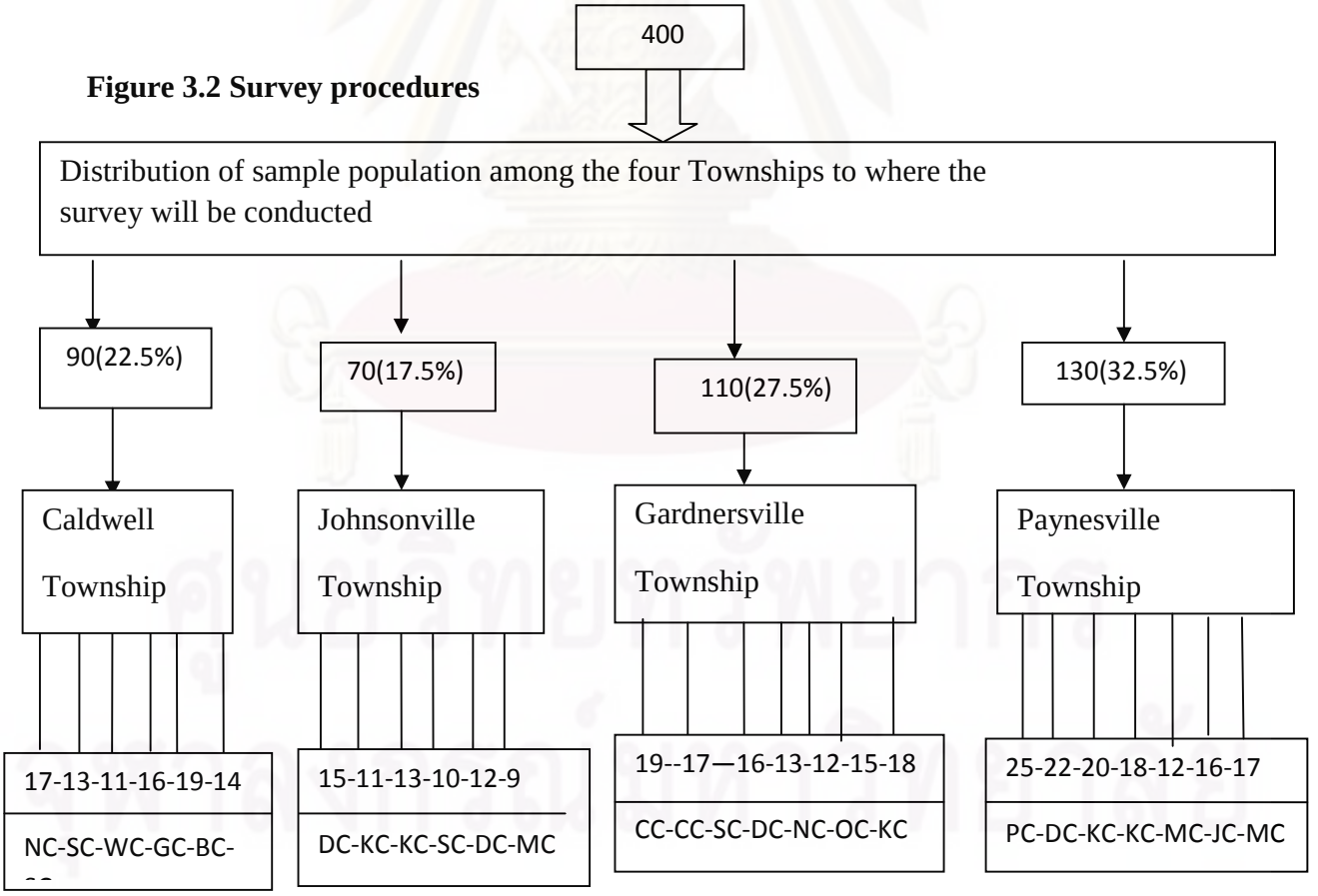
2. Simple random sampling for the selection of communities to be sampled from each stratified Township.

3. A systematic random sampling will be used for the selection of household to be interviewed at the selected sites.

Survey procedures to be used in the selection and allocation of numbers to Townships and communities for the household's interview are as follows figure 3.2.

The below sampling procedure is to be followed for the implementation of the malaria household survey as follows: Greater Monrovia District of Montserrado County will be divided into four Townships which are Caldwell Township, Johnsonville Township, Gardnersville Township and Paynesville Township. The four townships will be stepped down into communities and the household members will also be selected systematically for the conduct of the interviews. The distribution or allocations to the Townships is based on the population density or spares nature. The communities in which the surveys are to be held will in similar manner be allocated to as the Townships.

Figure 3.2 Survey procedures



Where

Caldwell Township	**Johnsonville Township**	**Gardnersville-Township**	**Paynesville-Township**
New Georgia Co .=NC	DryRice-Mkt. Co .=DC	Chicken Soup Fac. Co=CC	Pipeline Commun.=PC
Samuka Town Comm.=SC	Kadoma Co .=KC	Chocolate City Comm. =SC	DuPort Road Comm.=DC
White Plane Comm.=WC	Kebba Town Co .=KC	Steven Tolbert Comm .=SC	Kpelleh Town Comm.KC
Gbandi Town Comm.=GC	Struggle Co. =SC	Dwan Town Comm. =DC	King Gray Commun.=KC
Bassa Town Comm.=BC	Dagwbe Twn Co .=DC	Nyanfor Town Comm. =NC	Mangbeh Town Com=MC
Stockton Creek Comm.=SC	MenmehTwn Co. =MC	Oxygen Fact. Comm. =OC	Jacob Town Comm.=JC
_____ __	_____ _	Kessely Bvd. Comm. =K C	M.V.T.C. Commun.=MC

The table below presents a vivid description of the break down and allocation of the 400 households for which the survey will be carried out. As stated earlier the Greater Monrovia District of Montserrado County is sub-divided in to four Townships to include:

Paynesville, Gardnersville, Johnsonville and Caldwell. The 2008 National population and Housing Census of Liberia only give figures at the County and district levels, and do not cover the Township and Community levels. In view of the above mention, the geographical locations to where the survey will be conducted are estimated based on the area population (Densely/Sparsely).

For example the Paynesville Township is the most populated of the four and was allotted the highest number, and within the Township, Pipeline, Duport Road and Kpellen Town communities are the most populated and were given the highest number in descending order. The same goes for the Township of Gardnersville being the second most populated and has the Chicken Soup Factory, Kessely Boulevard and Chocolate city communities to be the populated communities of the Township. The third Township in the order is the Caldwell Township and has Bassa Town, Gbandi Town and New Georgia communities to have the higher populations within the Township. The Township of Johnsonville is the least populated of the four being survey and in there the Dry Rice Market, Kebba Town, and Dagwbe Town communities are the most populated. The Johnsonville and Caldwell Townships are the least populated and the difficult areas in terms of hard to reach destinations. They are mainly rural related within the outskirts of the District to be survey. Please see below the table with the estimated population of households and percentages at the Township and community levels.

Caldwell Township 90/22.5% Households	**Appropriation**	**Percentage**	**Johnsonville Township 70/17.5% Households**	**Appropriation**	**Percentage**
New Georgia Community	17	18.9	Dry Rice-Market Community	15	21.4
Samuka Town Community	13	14.4	Kadoma Community	11	15.7
White Plane Community	11	12.2	Kebba Town Community	13	18.6
Gbandi Town Community	16	17.8	Struggle Community	10	14.3
Bassa Town Community	19	21.1	Dagwbe Town Community	12	17.1
Stockton Creek Community	14	15.6	MenmehTown Community	9	12.9
Total:	90	100	Total:	70	100
Gardnersville Towns. 110/27.5% Households	**Appropriation**	**Percentage**	**Paynesville Township 130/32.5% Households**	**Appropriation**	**Percentage**
Chicken Soup Factory Comm	19	17.3	Pipeline Community	25	19.2
Chocolate City Community	17	15.5	DuPort Road Community	22	16.9
Steven Tolbert Community	16	14.5	Kpelleh Town Community	20	15.4
Dwan Town Community	13	11.8	King Gray Community	18	13.9
Nyanfor Town Community	12	10.9	Mangbeh Town Community	12	9.2
Oxygen Fact. Community	15	13.6	Jacob Town Comm.=JC	16	12.3
Kessely Bvd. Community	18	16.4	M.V.T.C. Community	17	31.1
Total:	110	100	Total:	130	100

3.4 Data Collection

The study will be a collection of primary data through the administering of questionnaire to household members. The target population is those households at risk of malaria morbidity and mortality and their socio-economic conditions, and their knowledge, attitudes and practices, in regard to malaria control and prevention (Household-Members 18-60 years) and falls in the selected community to be study.

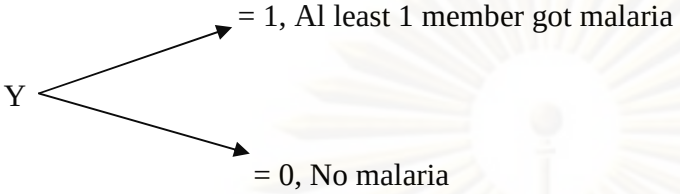
The population to be sampled is those households at risk of malaria morbidity and mortality, their socio-economic conditions, and their knowledge, attitudes and practices, in regards to malaria control and prevention (Household-Members 18-60 years).

The study will be done by a conduct of interviews through a survey of 400 households, by administering questionnaires on the factors associated with the incidence of malaria in Montserrado County, Liberia. The questionnaire consists of 33 questions and is divided in to two sections, socio-economic factors and control measures of malaria.

3.5 Data Analysis

Cox's (1972) developed the logistic regression model that can be used not only to identify risk factors but also to predict the probability of success. The Logistic Regression analysis will use the program Eviews to analyze correlations between dependent and the independent variables. Logistic distribution function is extremely flexible, easy to use and lends itself to a biological meaningful interpretation. This is especially true for the analysis of a dichotomous outcome variable like malaria (affected or non-affected). Logistic regression models allow estimation of the probability of an event occurring for a particular group of independent variables, and can be used to calculate the relative risk of experiencing a particular event. The study will use Logistic Regression Model to analyze correlations between the incidence of malaria on households, their socio-economic conditions and the level of control and preventive measures.

Model:



Logit (Malaria incidence) = f (Inc, Age, Acc, FAM, Sex, Res, Edu, Occ, KAP, ITN, IPT, IRS, Pos, MIR, UMC, UIS, KSC)

Ordinary Least Square (OLS) = (Income) = g (MI, Age, Acc, Occ, FAM, Edu, Sex, Res, Pos, KAP, ITN, IPT, IRS, MIR, UMC, UIS, KSC)

The sample size for model 1 is 400 households and is a logistic regression and has malaria incidence as the dependent variable. The sample size for model 2 is the same as model 1 and is an ordinary least square (OLS) simple regression and has income as the dependent variable. Model 3 is a logistic regression and has practice as the dependent variable. The two categories of regression models are intended to take a cursory look from the perspectives as follows: Firstly, it tends to view from the point of those factors that are associated with the incidence of malaria on household members.

The socio-economic factors and the control and prevention methods are to be analyzed in the processed. Model two will strictly look from the economic point of view of households as it relates to their sustenance and well being during the time of illness and sicknesses. Economic factor is a prime determinant of society growth, its wellbeing or decline. If we consider representative household at each Township/Community as i, the model can be written as follows:

Model 1 (Sample 400 Households)

MI□ = f (Inc□, Age□, Acc□, FAM□, Sex□, Res□, Edu□, Occ□, KAP□, ITN□, IRS□, IPT□, Pos□, MIR□, UMC□, UIS□, KSC□)

Or in the form:

$MI□ = \beta_0 + \beta_1 Inc□ + \beta_2 Age□ + \beta_3 Acc□ + \beta_4 FAM□ + \beta_5 Sex□ + \beta_6 Res□ + \beta_7 Edu□ + \beta_8 Occ□ + \beta_9 KAP□ + \beta_{10} ITN□ + \beta_{11} IRS□ + \beta_{12} IPT□ + \beta_{13} Pos□ + \beta_{14} MIR□ + \beta_{15} UMC□ + \beta_{16} UIS□ + \beta_{17} KSC□$

Model 2 (Sample 400 Households)

Inc□ = f (MI□, Age□, Acc□, Occ□, FAM□, Edu□, Sex□, Res□, Pos□, KAP□, ITN□, IPT□, IRS□, MIR□, UMC□, UIS□, KSC□,)

Or in the form:

$Inc□ = \beta_0 + \beta_1 MI□ + \beta_2 Age□ + \beta_3 Acc□ + \beta_4 Occ□ + \beta_5 FAM□ + \beta_6 Edu□ + \beta_7 Sex□ + \beta_8 Res□ + \beta_9 Pos□ + \beta 10 KAP□ + \beta_{11} ITN□ + \beta_{12} IPT□ + \beta_{13} IRS□ + \beta_{14} MIR□ + \beta_{15} UMC□ + \beta_{16} UIS□ + \beta_{17} KSC□$

With $\beta 1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta 7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}, , \beta_{16}, , \beta_{17} > 0$

Where:

- Inc---------- Income
- Age---------- Age
- Acc---------- Access
- Occ---------- Occupation
- Fam---------- Family size
- Edu---------- Education
- MIR---------- Mosquito/insect repellant
- Sex---------- Sex
- Res---------- Residence
- UMC---------- Use mosquito coils
- UIS---------- Using insecticide spray
- KAP---------- Knowledge, Attitude. Practices
- KSC---------- Keep surroundings clean
- ITN---------- Insecticide-treated nets
- IPT---------- Intermittent preventive treatment
- IRS ---------- Indoor residual spraying
- POS---------- Position in the family

Then our estimation equation can be written as follows:

Estimation equation 1

$\ln MI = \ln\beta_0 + \beta_1 \ln Inc + \beta_2 \ln Age + \beta_3 \ln Acc + \beta_4 \ln FAM + \beta_5 \ln Sex + \beta_6 \ln Res + \beta_7 \ln Edu + \beta_8 \ln Occ + \beta_9 \ln KAP + \beta_{10} \ln ITN + \beta_{11} \ln IRS + \beta_{12} \ln IPT + \beta_{13} \ln Pos + \beta_{14} MIR + \beta_{15} UMC + \beta_{16} UIS + \beta_{17} KSC + \mu$

Estimation equation 2

$Inc = \beta_0 + \beta_1 MI + \beta_2 Age + \beta_3 Acc + \beta_4 Occ + \beta_5 FAM + \beta_6 Edu + \beta_7 Sex + \beta_8 Res + \beta_9 Pos + \beta_{10} ITN + \beta_{11} IPT + \beta_{12} IRS + \beta_{13} MIR + \beta_{14} UMC + \beta_{15} UIS + \beta_{16} KSC + \mu$

Table 3.1 Independent / Explanatory Variables and their Expected Signs

Variables	Description of Variables	Expected sign
Acc.	**Distance of health facilities from households**	**+**
Inc.	**Income of households members**	**_**
Fam.	**Average family size of the household**	**+**
Edu.	**Educational level of the household**	**_**
Age	**Age of the household members**	**+/_**
MIR	**Households who apply mosquito/insect repellant**	**+/_**
Occ.	**Occupation of the household members**	**+/_**
Res.	**Res=1: Urban / Res=2: Rural**	**+/_**
Sex	**Sex=1: Male / Sex=2: Female**	**+/_**
KAP	**Knowledge, Attitude & Practices of malaria**	**+/_**
UMC	**Households who use mosquito coils**	**_**
UIS	**Households who use insecticide spray**	**_**
ITN.	**Insecticide-treated nets for households members**	**_**
IPT.	**Intermittent preventive treatment for pregnant women**	**_**
IRS.	**Indoor residual spraying to protect the household Members from mosquito bites**	**_**
KSC	**Households who kept their surroundings clean**	**_**

Pos	**Position in the family as the head of the household**	_

Table 3.2 Operational Definition of variables and sources.

Variables	Definition	Source
Dependent variable		-
MI=Malaria incidence	Average households infected with malaria at a point in time (New cases).	Primary
Independent variables		-
Inc=Income	Average households with income that is sustainable.	Primary
Age	Percent of households between the ages of 1-60 years at risk of contacting malaria.	Primary
Educ=Education	Percent of household members with education of primary and above.	Primary
Pos=Position	Position of the respondent In the family	Primary
ITN= Insecticide- treated nets	Percent of households with mosquito nests for prevention and control of infection by malaria.	Primary
IPT= Intermittent Preventive treatment	Percent of household members who gets the IPT treatment (Females).	Primary
IRS= Indoor residual spraying	Percent of households who carry on spraying of house and environment.	Primary

Family Size	Average family size that is above 5 members of the household	Primary
Occupation	The occupation of the household that can be sustainable to the family	Primary
Residence	The location of households have A serious bearing on their survival (Urban/Rural)	Primary
Access	The accessibility to health care By household members is good for For their well being (Distance).	Primary
MIR=Mosquito/insect repellant	The actions or decisions of household Members in repelling mosquitoes.	Primary
UIS= Use insecticide spray	The actions of household members in Spraying their environment against Mosquitoes.	Primary
Sex	Has to do with the gender of the Household members,(Male/Female)	Primary
KAP=Knowledge, Attitude and Practices	The level of feedback from households after interventions by health authorities	Primary
UMC=Use of mosquito coils	The usage of mosquito coils by household members.	Primary
KSC=Keeping the surrounding clean	Households who keep their surroundings clean	Primary

Table 3.3 Independent / Explanatory Variables and their Expected Signs

Variables	Description of Variables	Expected Sign
Acc.	Distance of health facilities from households	_
MI	Malaria affected people in the households	_
Fam.	Average family size of the household	_
Edu.	Educational level of the household	+
Age	Age of the household members	+/_
MIR	Households who apply mosquito/insect repellant	+
Occ.	Occupation of the household members	+
Res.	Res=1: Urban / Res=2: Rural	+/_
Sex	Sex=1: Male / Sex=2: Female	+/_
KAP	Knowledge, Attitude & Practices of malaria	+/_
UMC	Households who use mosquito coils	_
UIS	Households who use insecticide spray	_
ITN.	Insecticide-treated nets for households members	+
IPT.	Intermittent preventive treatment for pregnant women	+
IRS.	Indoor residual spraying to protect the household Members from mosquito bites	+
KSC	Households who kept their surroundings clean	+
Pos	Position in the family as the head of the household	_

CHAPTER IV

ANALYSIS AND RESULTS

This chapter provides the results as well as discussion; the result is in consonant with the conceptual framework and consists of two parts:

1. Qualitative / Descriptive Analysis of Households Factors Related to Malaria Incidence.

2. Quantitative or Results of estimation (Correlation and regression analysis).

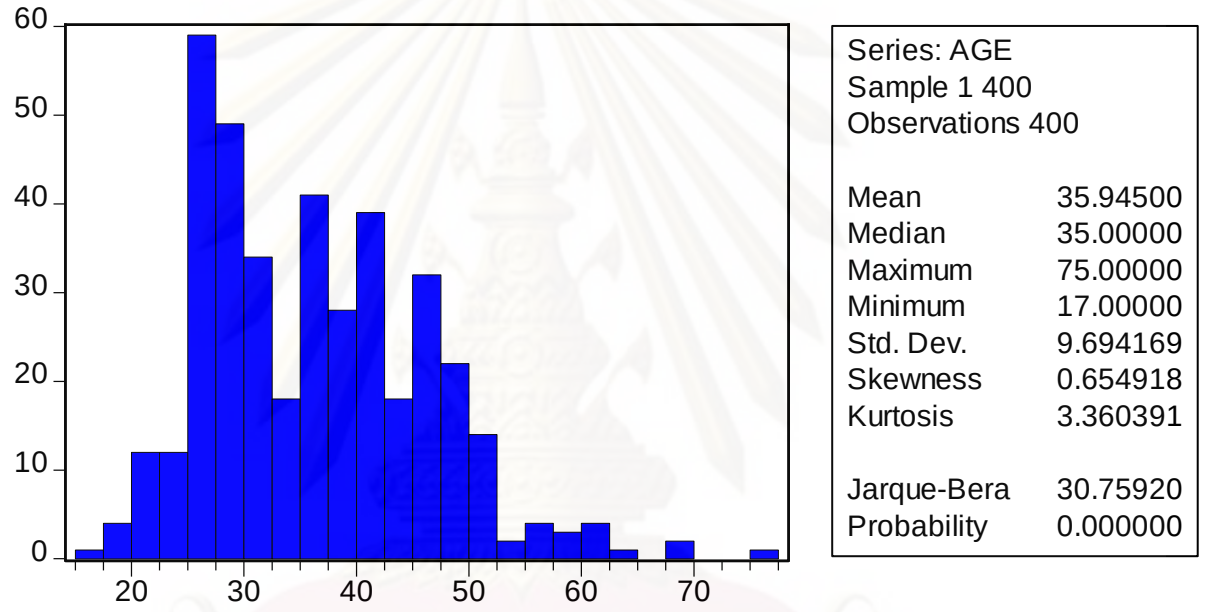
4.1 Descriptive Analysis of Data

This section of chapter four is basically concern with descriptive analysis of households factors related to malaria incidence and is the qualitative portion of the study. There were a total of four hundred (400) households sampled (observations) involved with the study, and the total observed people were two thousand and twenty (2,020) people. Forty (40%) percent of the four hundred (400) households, one hundred sixty (160) households were malaria free, while sixty (60%) percent; two hundred and forty (240) households contacted the malaria disease. A total of five hundred and five (505) people contacted malaria, while another thirty-four (34) persons died from the malaria disease. Twenty-four (24) out of the total deaths were children (71 %) and ten (10) from the total were adults (29 %).

Sixty-seven (67 %) percent of the respondents households had insecticide-treated nets (mosquito nets) and ninety-seven (97 %) percent of the respondents said they toke some actions to protect themselves from malaria. Seventeen (17 %) percent of the respondents said the nets was too expensive for them, thirteen (13 %) percent said the nets were not available to them and three (3 %) percent of them said they did not like the use of nets. Thirty-eight (38 %) percent of the respondents said they bought the nets that they had. Sixty-seven (67 %) percent of the respondents said they slept under the net, the night before the survey. Forty-eight (48 %) percent said the nets were treated before they

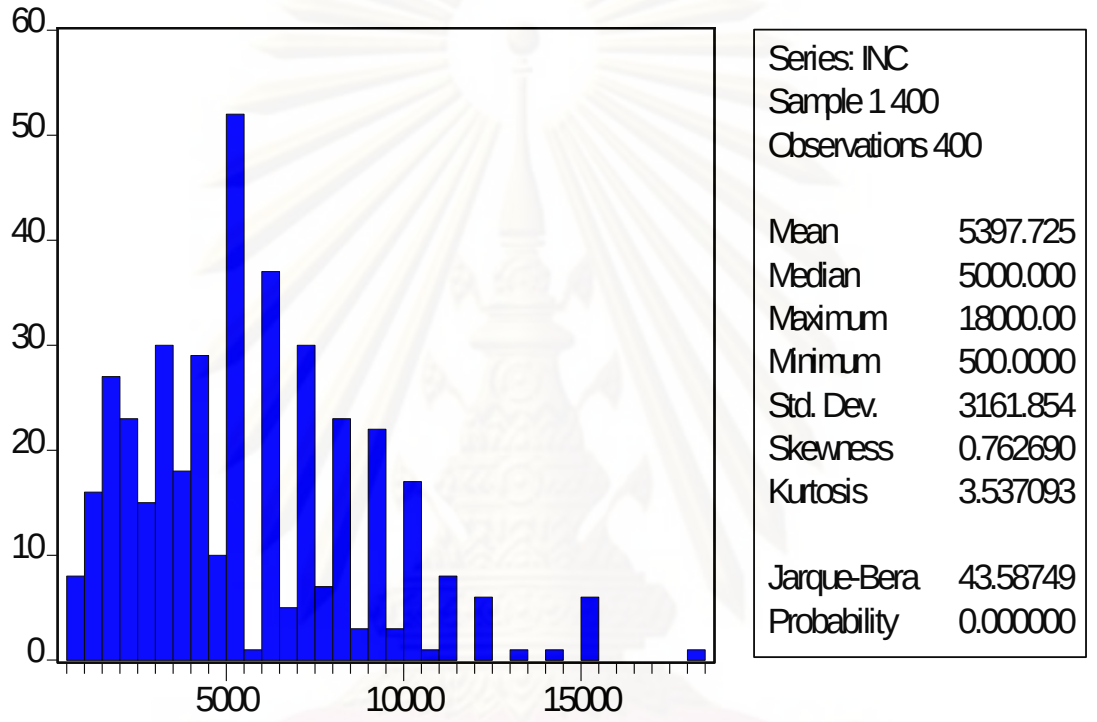
received it, Ten (10 %) percent said it was not treated and forty-two (42 %) percent said they did not know.

Figure 4.1 Ages of Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



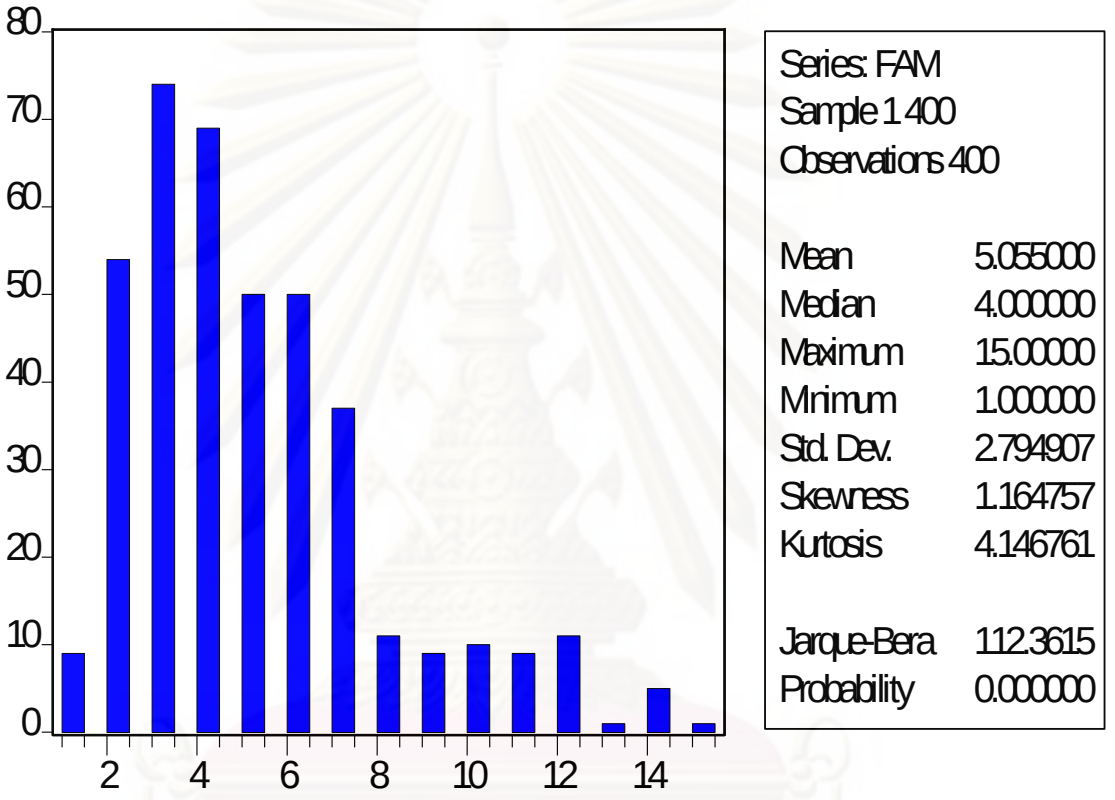
The graph above depicts the interval of ages of the respondents during the survey, with the mean age being 36 years, (SD 9.6) and range 17 to 75 (58) years of the 400 samples.The graph could also be viewed fom the prospective of dependent and independent groups the dependents includes the ages 17 to 20 years (children) and 60-75 years (eldery). The working class in the middle 25-55 years are the groups with the burden of the dependent classed,through direct family support and payment of taxes. It could be said that the dependent category are prone and vulnerable to the incidence of malaria and the working class savings and consumption drastically reduced.

Figure 4.2 Income level of Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



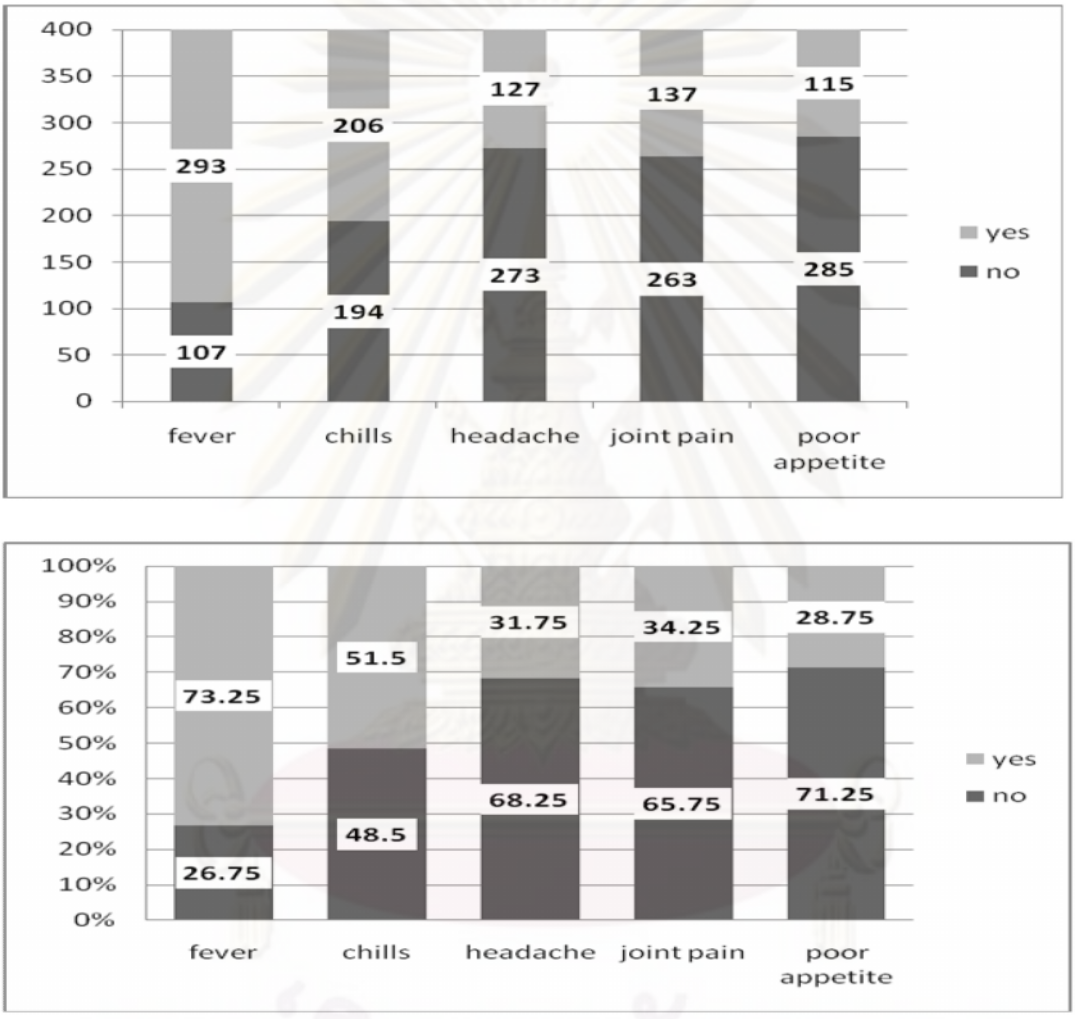
The graph shows the income level of the respondents from the household survey, with the mean income of $ 5398 dollars (SD $ 3161.9) as the monthly household income and an estimated 60,000 dollars as the annual income. The range is between $500-18,000 (17,500), it can be said from the perspective of the poverty lines of Liberia that to the right of 5000 monthly and above are the well off, while moving to the left is the poorer class. Apparently the left side of the graph from the mean is the rural setting where poverty is dominant. The point from 5000 to 15000 indicates the malaria free of group of access to health care due to their purchasing power.

Figure 4.3 Family size of Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



The mean family size according to the graph above is 5.1 persons per household, (SD 2.8 years), ranging from 1 to 15 family members per household (14). From 6 family size per household to 15 members are the over crowded households and many at time engulf by poverty and permiated by sickness and diseases. It can be argued that the same category of people are vulnerable to hunger as well and have a shorter life span.

Figure 4.4 Signs and Symptoms of Malaria of Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



The super-imposed histogram above explain the basic symptoms, with fever being 73 percent, chills 52 percent,34 percent joint pain,32 percent headache and 29 percent for poor appétit. It has a very interesting to see and perceived the imagery respondents. The same goes for both the proportions and percentages and the opposite responses, suggesting a very good knowledge of the respondents, as they are very aware of the malaria burden and its aftermath.

Figure 4.5 Sources of Malaria Information to Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia

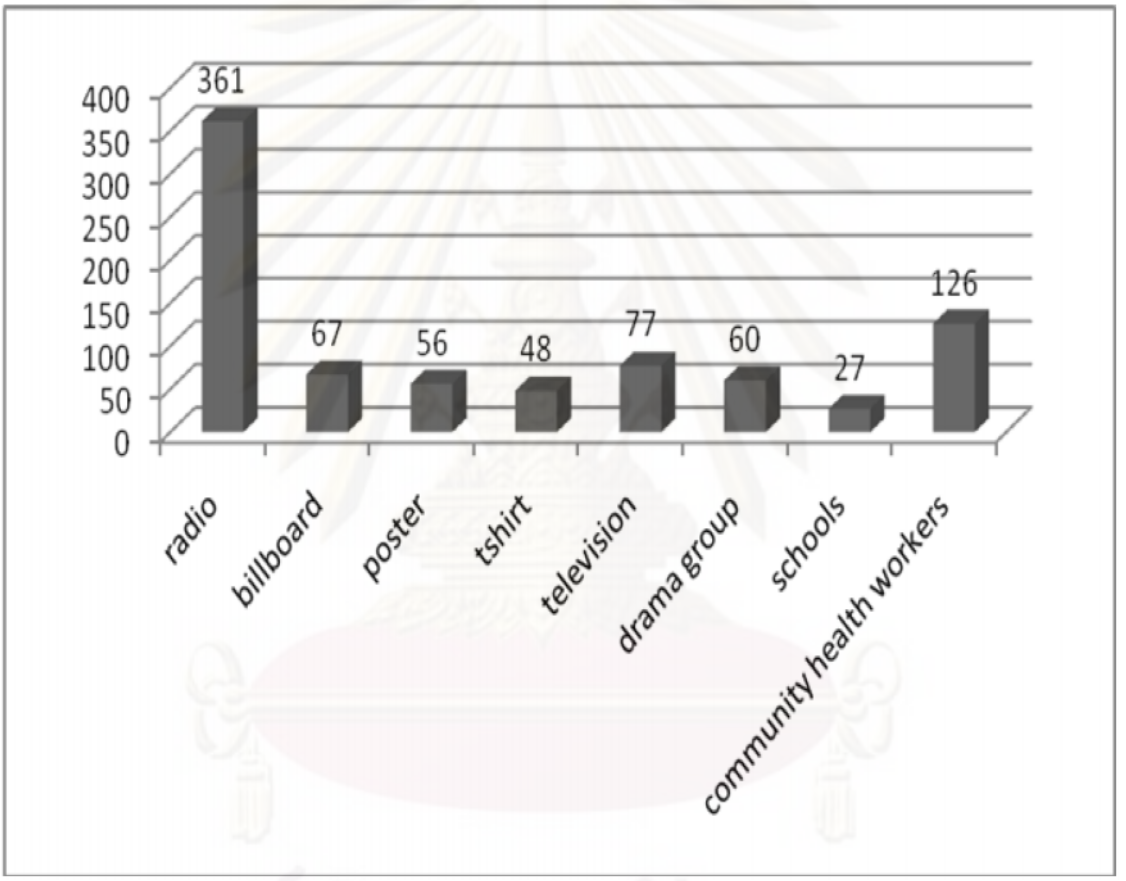
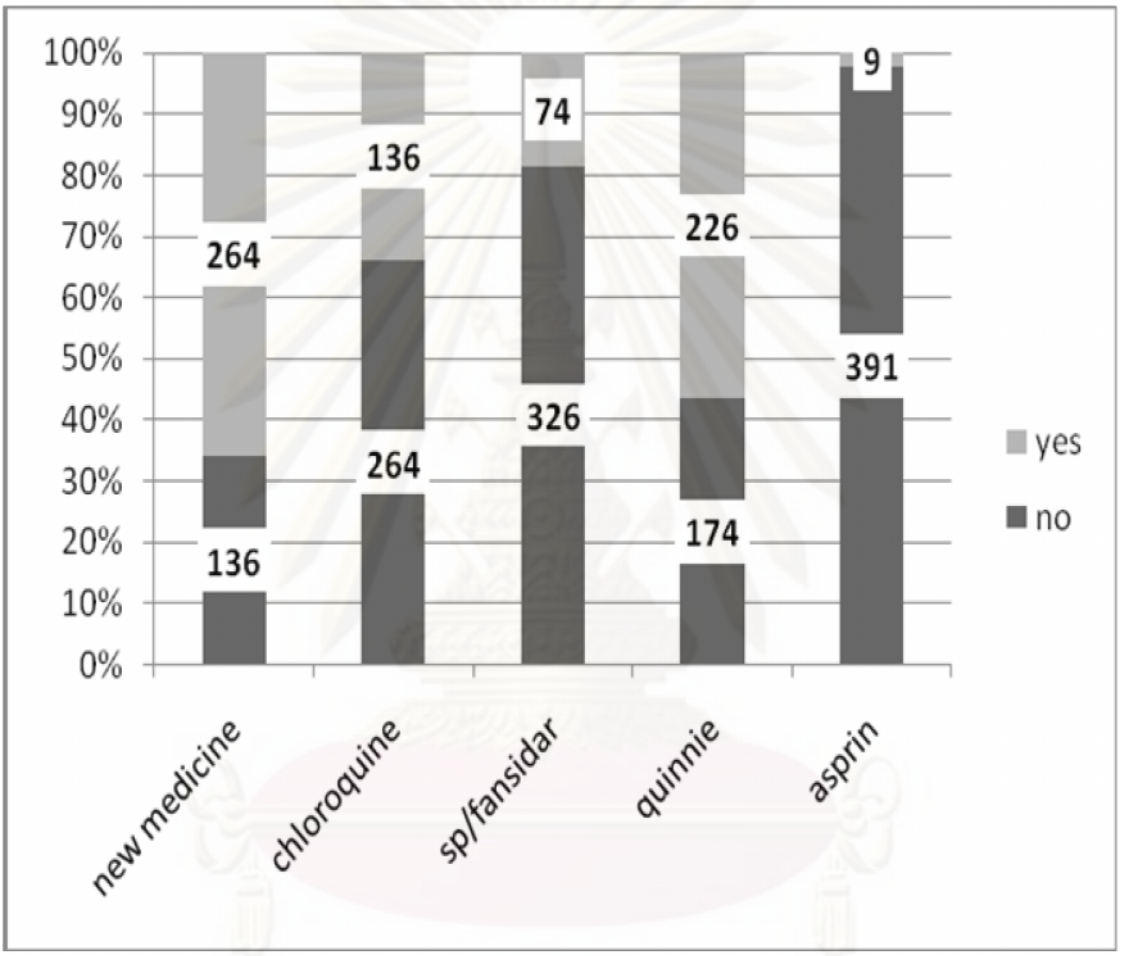


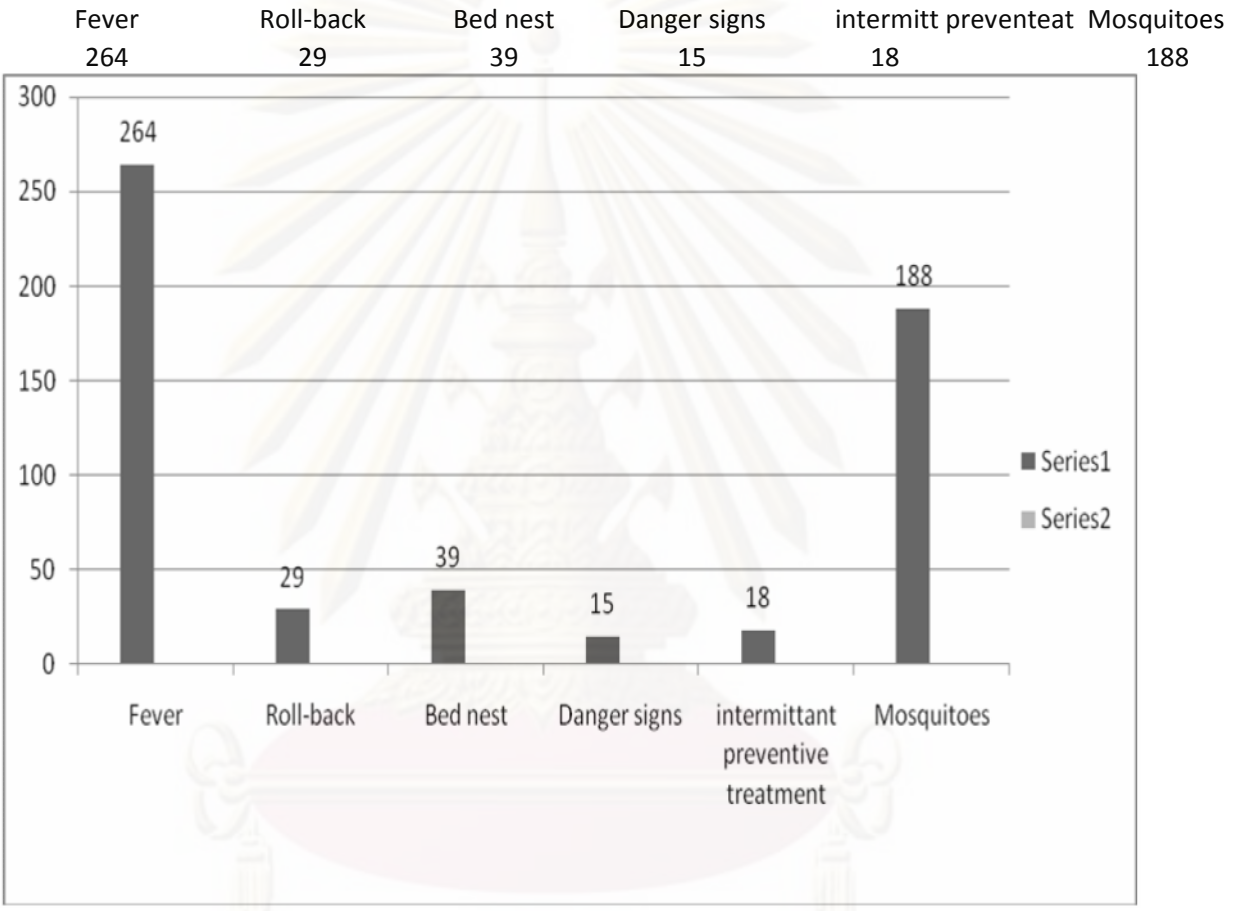
Figure 4.5 depicts that 90 percent of the information regarding malaria prevention and treatment was through the radio, 32 percent through the community health workers being the two most effective sources of outreaches. Television and billboard were the next two in the ranking order, and that health authorities may choose the two most efficient methods from the economic evaluation point of view. Information, education and communications (IEC) are one of the best ways to fight malaria and other diseases around the world.

Figure 4.6 Types of Treatment to Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



With respect to the types of treatment or medications given to the respondents, the Artemisin or the new medicine (ACT) was consumed by 66 percent of the respondents, while quinine was second to that of the ACT with a 57 % and chloroquine was the third by the order. The three most consumed seem to have been the effective and efficient drugs dispensed to the household members. This suggests that malaria was being prevented and treated at the most possible means.

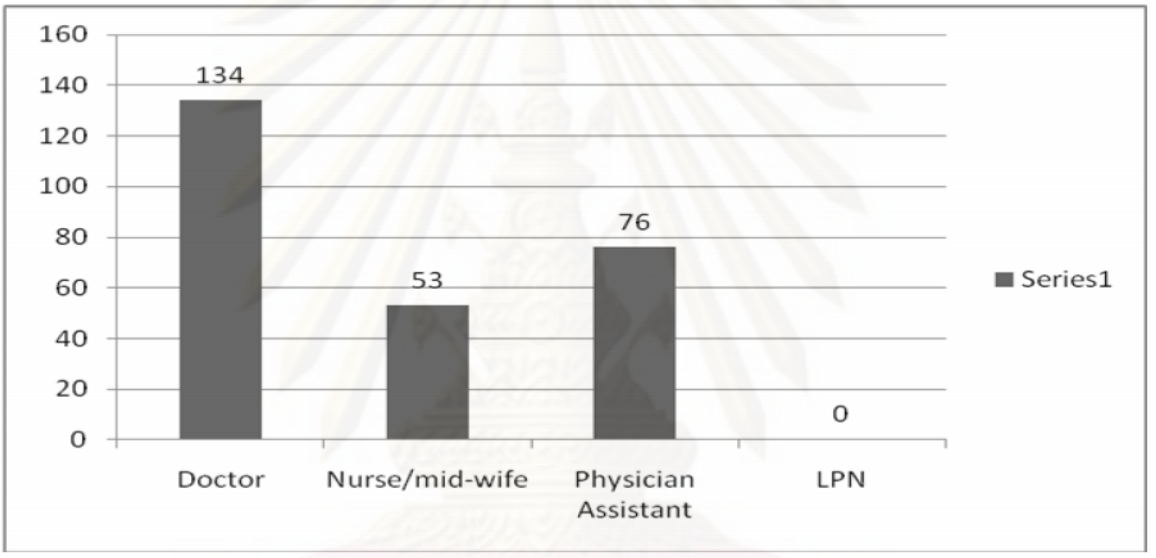
Figure 4.7 Type of Malaria Information to Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



There were six kinds of information that was disseminated to the respondents and household members, with fever being the highest at 66 % of the information, education and communication knowledge, followed by mosquitoes at 47 %. Bed nest was 10 % of the knowledge gain from the outreaches and community sensitization programs and that was follow by the World Health Organization's roll back malaria at 8 %. The first three comprising of fever, mosquitoes and bed nest can play a major role in strengthening the knowledge and practices of the community dwellers; this could reduce the risk at contacting the malaria.

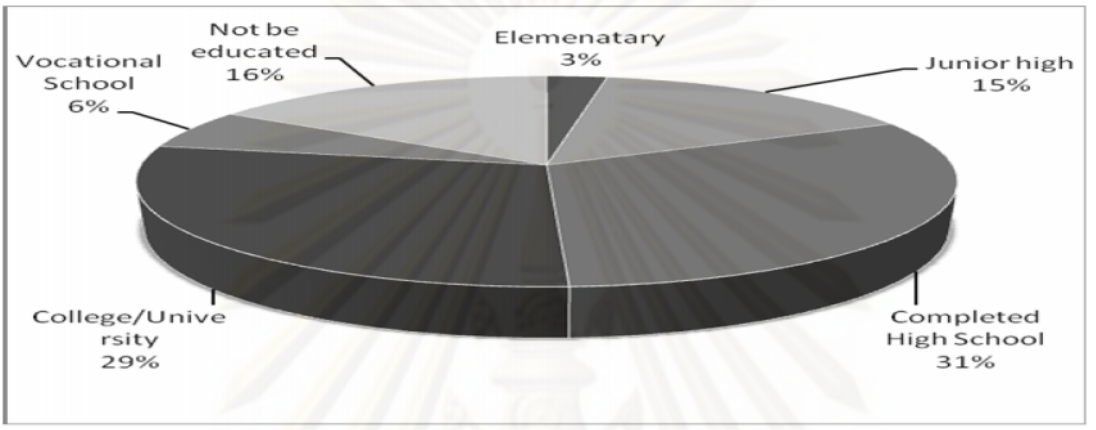
Figure 4.8 Types of Consultations by Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia

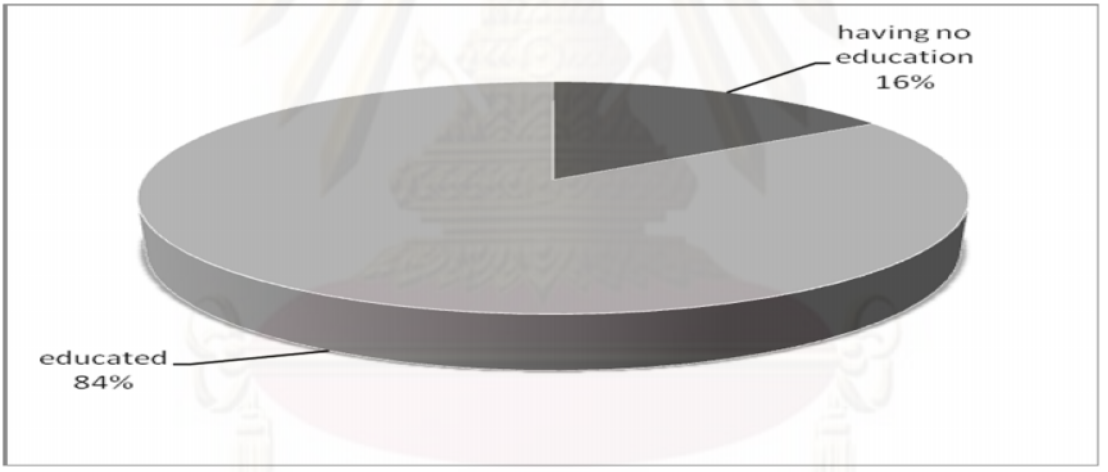
Doctor	Nurse/mid-wife	Physician Assistant	LPN
134	53	76	0



There were four categories of consultants at the health facilities where sick members of the households sought treatment and medications. Sixty-six percent of the respondents were seen by doctors during consultations. Twenty-nine percent of the respondents were assessed by a physician assistant, while twenty percent of them were attended to by a nurse or mid-wife. There was no consultation done by the license practical nurse according to the study, and that there was a good health seeking behavior on the average by the respondents. This was a concerted effort from both the patients and medical professionals to fight the malaria disease either by curative or preventive measures.

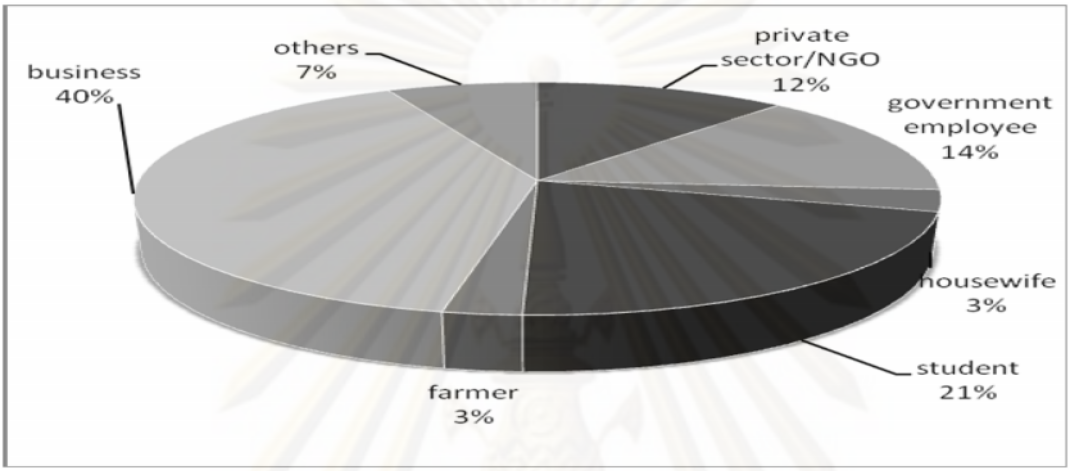
Figure 4.9 Educational Status of Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia





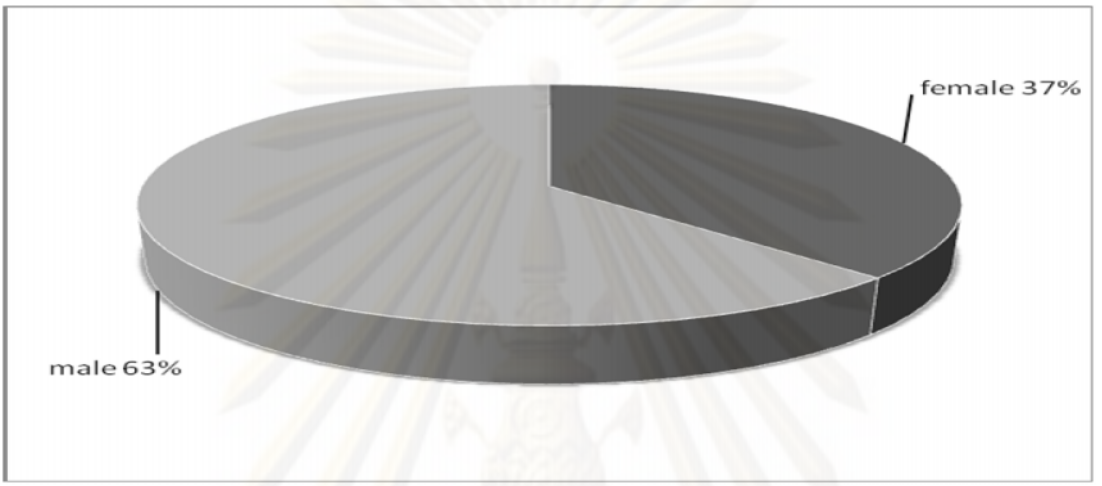
The super-imposed chart above depicts the educational status of respondents to that of the uneducated, with 31 % completing high school, 29 % being college graduates and 15 % percent of them were junior high school students. Sixteen percent of the respondents were uneducated as is shown by the chart above, while 6 % of the respondents were technical or vocational school graduates. Conclusively, 84 % of the respondents were educated and the balance 16 % was not educated, the more the education the lesser the probability of contacting malaria disease.

Figure 4.10 Types of Occupations of Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia.



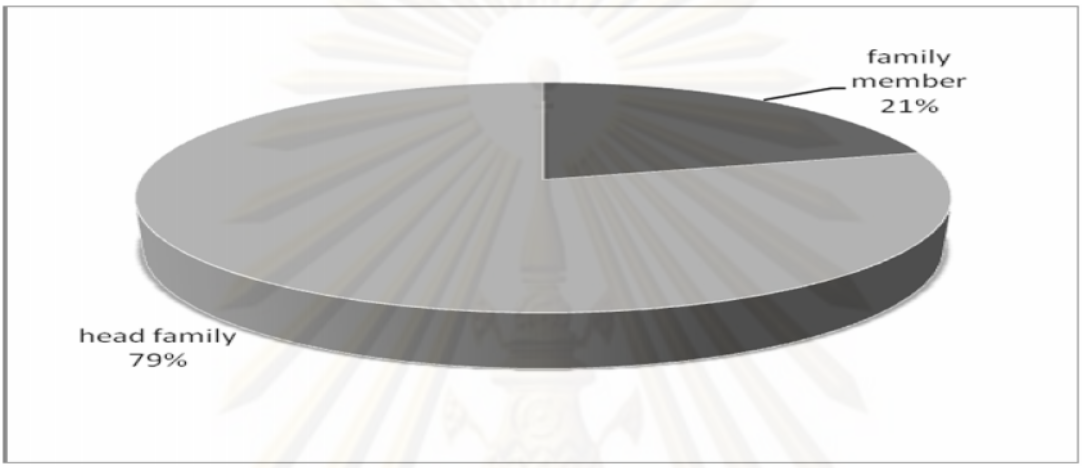
The chart above highlights the respondent's occupational status, with forty percent of them being business people, while fourteen percent of them were civil servants or government employees. Twelve percent of them worked in the private sector or non-governmental organizations. Twenty-one percent of them were students, three percent farmers and three percent house-wives. It will be fair to conclude that 76 % were employed and 24 % were unemployed.

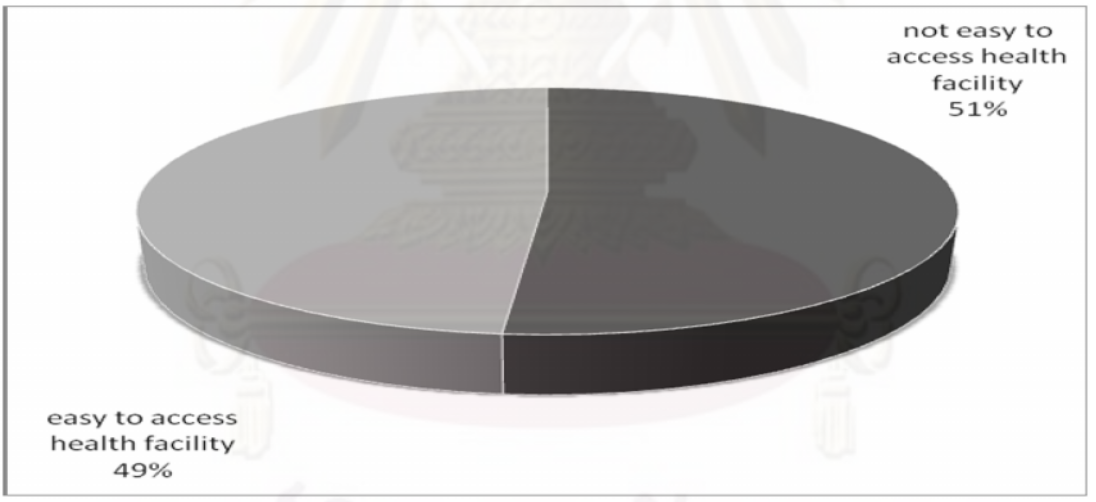
Figure 4.11 Distributions by Sex and Residence of Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



The sex of respondents and residence are contained in the super-imposed chart above, shows the men dominance with a 63 % proportion to 37 % female. Men have better resistance to the incidence of malaria than the women. The second chart below shows that 72 % of the respondents resided in the urban areas, while 28 % of them were residents of the rural area. It could logically be said that urbanization is still ongoing like many parts of the world.

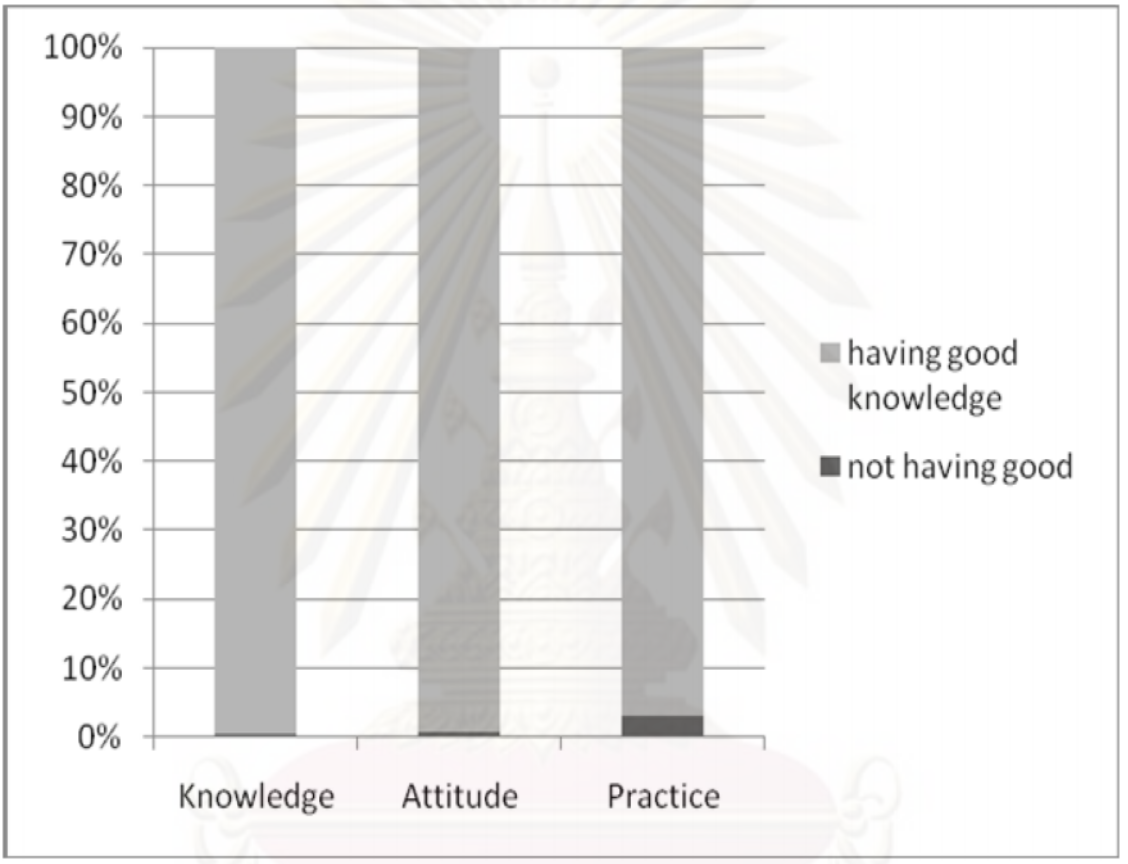
Figure 4.12 Distributions of Respondents by Rank and Access Interviewed in the Greater Monrovia District, Montserrado County-Liberia





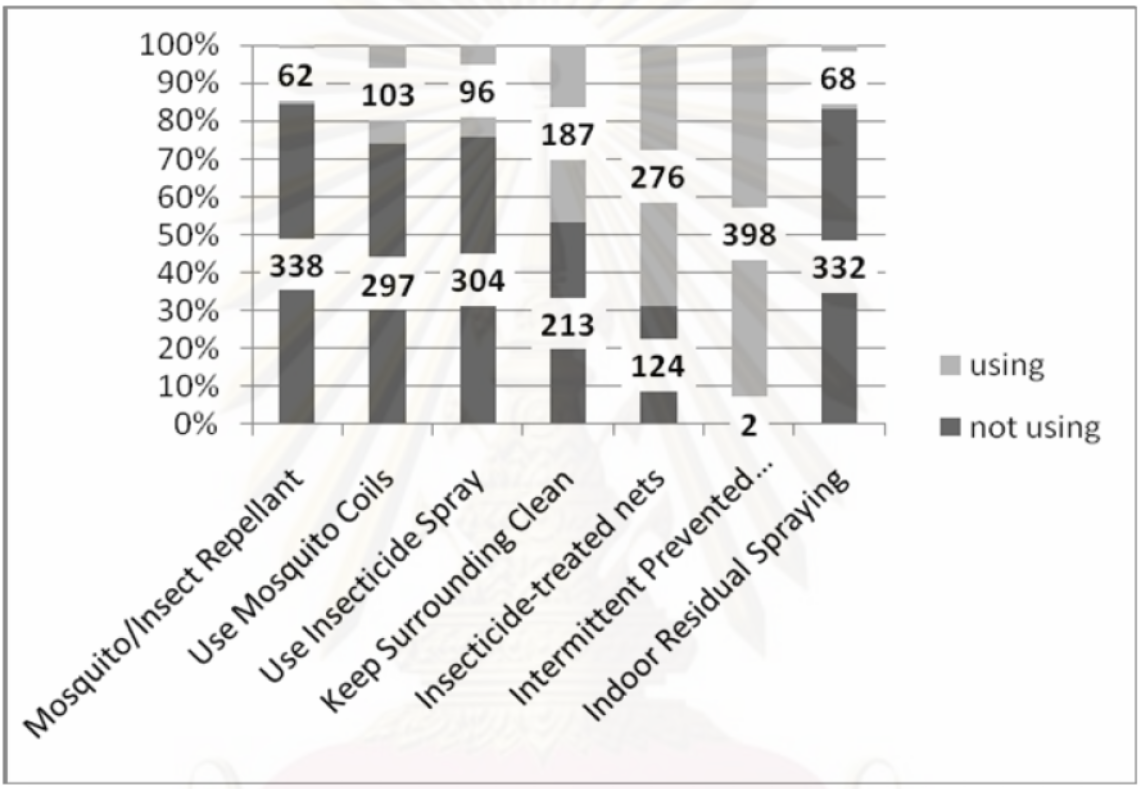
The super-imposed chart above displays the respondent's position in the household and the access to health care below, 79 % of the respondents were head of household, while 21 % were family members. Access to health care depicts 51 % of the respondents having accessed to health care, while 49 % did not have accessed.

Figure 4.13 Respondents knowledge, attitudes and practices during the survey in the Greater Monrovia District, Montserrado County-Liberia



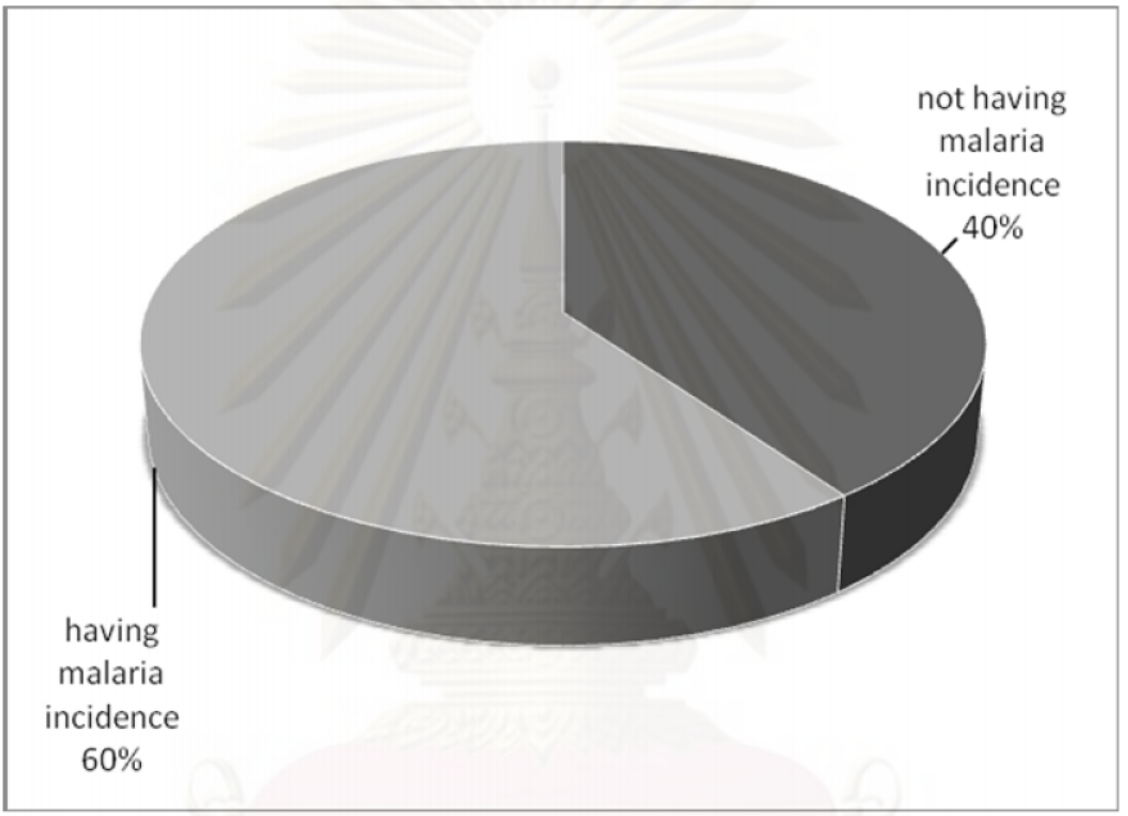
The graph above portrays the level of knowledge, attitudes and practices by the respondents at the time of the survey, with a very high percent of between ninety-five to ninety-nine percent for knowledge, attitudes and practices of the interviewees. It suggests that people in the district have good health seek behavior, good environmental management and high educational levels. The information, education and communications were also good, meaning that health authorities had full knowledge and control of situations in the communities involved.

Figure 4.14 Types of Personal Protective Measures by respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



According to the histogram above 85 % of the respondents did not use the mosquito or insect repellant, while 15 % used it. 74 % of them did not used mosquito coils, while 16 % of them did, the used of insecticide spray was used at 24 % while 76 % did not. Keeping the surrounding clean was not implemented by 53 % of the respondents, while 47 % percent of them kept their environment clean. The insecticide-treated nets were possessed by 69 % of the respondents, while the remaining 31 percent did not have the nets. The intermittent preventive treatment was applied by 99 % of the respondents. The indoor residual spraying was effected by just 17 % of the respondents, while the majority 83 % of the respondents did not carry on the spraying.

Figure 4.15 The Level Malaria Affected to the Non-Affected after Respondents Interviewed in the Greater Monrovia District, Montserrado County-Liberia



The pie chart above illustrates the affected households and non-affected during the survey, with two hundred and forty (60%) of the respondents households having at least one person or family member infected by malaria at the time of the interview. The unaffected households were one hundred and sixty (40%) of the respondents, who said that at the time of period under review they did not have malaria in their households.

Table 4.1 The Descriptive Analysis of Households' Factors Related to Malaria Incidence

Malaria incidence					
		Frequency	Percent	Valid Percent	Cumulative Percent
not having malaria incidence		160	40	40	40
having malaria incidence		240	60	60	100
	Total	400	100	100	
Burden of disease Analysis					
average number of people affected				2.10	
average number of children affected				1.48	
average number of adult affected				1.30	
Average age of malaria affected children				7.87	
Average age of malaria affected adults				35.04	
Average income of malaria affected adults				5,576.42	
Average expenditure of malaria affected adults				1,992.24	
average day lost				5.81	
Total dependency ratio				95.72	
Children dependency ratio				90.66	
Aged dependency ratio				5.06	
Total observation				400.00	Households
Total affected observation				240.00	Households
percentage of affected observation to unaffected people				60	
Total observed people				2,022.00	People
Total affected people				505.00	People
Total of dead people from malaria				34.00	People
percentage of dead people to affected people				6.73	

The survey was conducted in the Greater Monrovia District of Montserrado County, Liberia and the brief analyses of the households factors related to malaria incidence are as follows: A total of 400 households were sampled (Observations), and the total observed people were 2,020. Forty percent of the households were one hundred

sixty (160) were malaria free and sixty percent were two hundred forty (240) of them contacted the malaria disease.

The average number of people affected was two point one (2.10) percent, while the average number of children affected was one point four eight (1.48) percent, with the average number of adults affected was one point three (1.30) percent of the total affected category.

The average age of children affected by the malaria burden was seven point eight seven (7.87) years, while the average number of adults affected by the malaria burden was thirty-five (35.04) years. The average income of the adults affected by the malaria burden was five thousand five-hundred seventy six 42/100 (5,576.42) Liberian dollars and the average expenditure of the affected adults were (1,992.24) Liberian dollars.

The average days lost by the affected adults was six (5.81) days, the total dependency ratio from the survey was ninety-five (95.72) percent, while the children dependency ratio was ninety (90.66). The aged dependency ratio was five (5.06) years. The percentage of the affected observation to the unaffected people sixty to forty (60 to 40) percent, while the total affected were five hundred and five (505) people. The total fatalities (dead) from malaria were thirty-four (34) persons, with twenty-four (24) of them being children and ten (10) of them being adults. The percentage of dead people to affected people was seven (6.73) percent.

The income of adults range from one thousand ($ 1,000) to eighteen thousands ($18,000) Liberian dollars ($ 17,000).The standard deviation was two thousand two hundred sixty-two (SD $2,262) Liberian dollars, and the expenditure of the adults range from five hundred ($500) to six thousand ($6000) Liberian dollars, and seven hundred forty (SD $740.51) Liberian dollars. The days lost by adults due to malaria disease range from 1 to 14 (13) days lost and standard deviation (SD 2.5) days.

Results of Estimations

Determinants of Malaria Incidence over the Explanatory Variables: Inc, Age, Acc, FAM, Pos, Res, Edu_Stat, Job_Stat, KAP, ITN, and IRS. (OLS)

Table 4.2 Estimation Equations 1, Select Case of Position in the Family.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.234471	0.179291	1.307773	0.1917
INC	2.33E-05	8.13E-06	2.869937	0.0043***
AGE	0.010097	0.002816	3.584966	0.0004***
ACC	0.107884	0.051595	2.090989	0.0372*
FAM	0.002170	0.009267	0.234122	0.8150
POS	-0.105626	0.064079	-1.648368	0.1001
RES	-0.035237	0.057936	-0.608196	0.5434
EDU_STAT	0.037026	0.067754	0.546470	0.5851
JOB_STAT	-0.048638	0.061766	-0.787453	0.4315
KAP	-0.100155	0.127579	-0.785039	0.4329
ITN	0.027764	0.052611	0.527722	0.5980
IRS	0.030829	0.066670	0.462411	0.6440

Sum squared resid	87.55500
Log likelihood	-263.7359
Adjusted R-squared	0.062112
Probability(F- statistic)	0.0002

LOG MI = (0.2344 + 2.3300*INC + 0.0101*AGE + 0.1078*ACC + 0.0021*FAM - 0.1056*POS - 0.0352*RES + 0.0370*EDU_STAT - 0.0436*JOB_STAT - 0.1002*KAP + 0.0277*ITN + 0.0308*IRS)

N=400
* = significant level of 10%
**= significant level of 5%
***= significant level of 1%

Inc--According to the estimation, it was found that income and malaria incidence have positive relationship, the coefficient is (2.3300) and its p-value was (0.0043) less than 0.05.It is therefore statistically significant with a t-stat 2.8699, and suggest that if income increase by unit (1 unit) the malaria incidence will increased by 2.3300. The

image behind this can be said that income earning people in the sample were more than the relatively poor people; the probability to get infected by malaria is less for the relatively poor people than the relatively rich people. The relatively rich people will be at risk of the transmission of malaria at their places of work.

Age - had a coefficient of 0.0101 and a t-stat of 3.585. The p-value was 0.0004 being significant and suggests that the probability of contacting the malaria is very less for the adults than the children .In spite of that, it is significant at the p-value 0.0004.The positive sign indicates that the age group is mainly children who are prone to contacting of the malaria disease.

Access to health care—is significant and has the p-value 0.037 and a coefficient of 0.108, with the t-stat 2.091.The variable also suggests that if access to health care increased by one unit, the probability of malaria incidence occurring should decreased by 0.108, which means the public health system needs to construct more health facilities of quality services that should reduce the malaria incidence for the underprivileged.

Family size—is not significant and has the p-value 0.815 and coefficient of 0.002 apparently suggesting that due to urbanization, there were overcrowdings in most of the households made the probability of contacting the malaria very high.

POS—was found to be insignificant and a p-value of 0.1001 and coefficient -0.105, a t-stat of -1.648.The variable was statistically insignificant and suggest that position in the family did not have a positive bearing in the prevailing circumstances.

Residence—was found to be insignificant due its p-value being 0.543,and may have been either of the two scenarios, they were basically in the rural area and basic social services eluded them, with the next scenario being yes they live in the urban area and live in a slumps- environment, making them vulnerable to malaria.

Educational status—was insignificant and had a p-value 0.585,apperantly they might have been 85 % or more educated as community dwellers, but did not have the required practices or lifestyle to keep them being in the better position of malaria free

probability. There may be a need to combine good knowledge and practice to meet the desire health goals.

Occupation/Job status—even though occupation had the expected sign, it was insignificant and had the p-value 0.431 and might have been that there were good employment levels for the community dwellers, but lack of knowledge and good practice kept them in the range of the probability of contacting the malaria disease at any point in time.

Knowledge, attitude and practices (KAP) –was found to be insignificant as well, and had a p-value 0.432, suggesting that the combination of the knowledge and practices were not working, either there was a good knowledge and a bad practice or a good practice and lack of knowledge. If the lifestyles have that lacking ability at some level, there bound to be an obstacle in the way of success.

Insecticide treated nets (ITN)—was insignificant and had the p-value 0.598, this may suggest that most of the community members did not have access to both health care and the mosquito nets, or some might have had it and did not use it accordingly. It might have been too expensive for the people to buy or they were in short supply.

Indoor residual spray- was insignificant and had the p-value 0.644,there might have been more poor people in the sample who could not afford to have the IRS in their household, and for some they could not continual the interval of spraying.

The R-square is very low 0.087, Adjussted R-squared 0.62112 and Prob (F-statistic) 0.0002, probably due to the many dummy variables within the questionnaire, and the study was mostly qualitative.

Determinants of Malaria Incidence over the Explanatory Variables: Inc, Age, Acc, FAM, Sex, Res, Edu_Stat, Job_Stat, KAP, ITN, and IRS. (Logit)

Table 4.3 Estimation Equations 2, Select Case Where Correspondent are the Head of Family.

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.697135	0.904538	-1.876245	0.0606
INC	0.000114	4.35E-05	2.632702	0.0085***
AGE	0.046939	0.015172	3.093777	0.0020***
ACC	0.645276	0.264807	2.436776	0.0148*
FAM	-0.021328	0.046427	-0.459402	0.6459
SEX	-0.646946	0.286043	-2.261712	0.0237**
RES	-0.006682	0.293488	-0.022767	0.9818
EDU_STAT	0.432476	0.341536	1.266270	0.2054
JOB_STAT	-0.043509	0.342615	-0.126991	0.8989
KAP	-0.465520	0.655774	-0.709879	0.4778
ITN	0.176692	0.255242	0.692254	0.4888
IRS	0.021823	0.341242	0.063951	0.9490

Sum squared resid	68.34062
Log likelihood	-197.3336
LR statistic (11 df)	34.12845
Probability(LR stat)	0.000345

LOGIT MI = (-1.6971 + 0.0001*INC + 0.0469*AGE + 0.6452*ACC --0.0213*FAM - 0.6469*SEX - 0.0066*RES + 0.4324*EDU_STAT - 0.0435*JOB_STAT - 0.4655*KAP + 0.1766*ITN + 0.0218*IRS)

N=316
* = significant level of 10%
**= significant level of 5%
***= significant level of 1%

Inc--According to the estimation, it was found that income and malaria incidence have positive relationship, the coefficient is (0.00011) and its p-value was (0.0085) less than 0.05.It is therefore statistically significant with a z-stat 2.633, and suggest that if income increase by unit (1 unit) the probability of malaria incidence will increased by

0.00011. The image behind this can be said that income earning people in the sample were more than the relatively poor people; the probability to get infected by malaria is less for the relatively poor people than the relatively rich people. The relatively rich people will be at risk of the probability of the transmission of malaria at their places of work.

Age - had a coefficient of 0.0469 and a z-stat of 3.0937. The p-value was 0.0020 being significant and suggests that the probability of contacting the malaria is very less for the adults than the children .In spite of that, it is significant at the p-value 0.0020.The positive sign indicates that the age group is mainly children who are prone to the probability of contacting the malaria.

Access to health care—is significant and has the p-value 0.0148 and a coefficient of 0.6453, with the z-stat 2.4367.The variable also suggests that if access to health care increased by one unit, the probability of malaria incidence occurring should decreased by 0.6453, which means the public health system needs to construct more health facilities of quality services that should reduce the malaria incidence for the underprivileged.

Family size—is not significant and has the p-value 0.645 and apparently suggesting that due to urbanization, there were overcrowdings in most of the households made the probability of contacting the malaria very high.

Sex—was found to be have positive correlations with the malaria incidence and a p-value of 0.0237and coefficient -0.6469, a z-stat of -2.2617.The variable was statistically significant and suggest that if sex is to increased by one (1) unit, the probability of contacting the malaria should reduce by 0.6469.So basically if it was a man, the probability to contact malaria will be less than the opposite sex.

Residence—was found to be insignificant due its p-value being 0.982,and may have been either of the two scenarios, they were basically in the rural area and basic social services eluded them, with the next scenario being yes they live in the urban area and live in a slumps- environment, making them vulnerable to malaria.

Educational status—was insignificant and had a p-value 0.205,apperantly they might have been 85 % or more educated as community dwellers, but did not have the required practices or lifestyle to keep them being in the better position of malaria free probability. There may be a need to combine good knowledge and practice to meet the desire health goals.

Occupation/Job status—even though occupation had the expected sign, it was insignificant and had the p-value 0.899 and might have been that there were good employment levels for the community dwellers, but lack of knowledge and good practice kept them in the range of the probability of contacting the malaria disease at any point in time.

Knowledge, attitude and practices (KAP) –was found to be insignificant as well, and had a p-value 0.478, suggesting that the combination of the knowledge and practices were not working, either there was a good knowledge and a bad practice or a good practice and lack of knowledge. If the lifestyles have that lacking ability at some level, there bound to be an obstacle in the way of success.

Insecticide treated nets (ITN)—was insignificant and had the p-value 0.4888, this may suggest that most of the community members did not have access to both health care and the mosquito nets, or some might have had it and did not use it accordingly. It might have been too expensive for the people to buy or they were in short supply.

Indoor residual spray- was insignificant and had the p-value 0.949,there might have been more poor people in the sample who could not afford to have the IRS in their household, and for some they could not continual the interval of spraying.

The McFadden R-square is very low 0.079, probably due to the many dummy variables within the questionnaire, and the study was mostly qualitative.

Determinants of Income over the Explanatory Variables: MI, Age, Acc, Job_Stat, FAM, Edu_Stat, Sex, Res, POS, KAP, ITN, IPT, IRS, MIR, UMC, UIS, and KSC. (OLS)

Table 4.4 Estimation Equations 3, Select Case of Income Measure against Socio-Economic Factors and Control Measures of Households.

Variable	Coefficient	t-Statistic	Prob.
C	7.55724	26.28569	0
MI	0.240013	3.427435	0.0007***
AGE	0.006515	1.639563	0.1019
ACC	-0.073166	-0.991217	0.3222
JOB_STAT	0.156706	1.796663	0.0732*
FAM	0.016852	1.30145	0.1939
EDU_STAT	0.103367	1.067299	0.2865
SEX	0.168833	2.266932	0.024**
RES	0.283043	3.250718	0.0013***
POS	-0.021297	-0.225333	0.8218
KAP	-0.355576	-2.010196	0.0451*
ITN	0.105139	1.434581	0.1522
IPT	0.062959	0.448779	0.6538
IRS	0.316339	3.23925	0.0013**
MIR	0.077722	0.764343	0.4451
UMC	-0.031623	-0.36818	0.7129
UIS	0.095199	1.127474	0.2602
KSC	0.068658	0.947726	0.3439
R-squared	0.172763	8.386379	
Adjusted Rsquared	0.135948	0.705488	

LOG (INC) = 7.5572 + 0.2400*MI + 0.0065*AGE - 0.0731*ACC + 0.15670*JOB_STAT + 0.0168*FAM + 0.1033*EDU_STAT + 0.1688*SEX + 0.2830*RES - 0.0212*POS - 0.3555*KAP + 0.1051*ITN + 0.0629*IPT + 0.3163*IRS + 0.0777*MIR - 0.0316*UMC + 0.0951*UIS + 0.0686*KSC

* = significant level of 10% / **= significant level of 5% / ***= significant level of 1%

Malaria Incidence- was found to be significant at p-value 0.0007 and the coefficient 0.240,the meaning is that, if MI increased by 1 unit, income will increased by

0.240 dollars, the picture behind the scene is that there may have been more rich people in the sample than the poor. This may suggests that though they had money, but either were not seeking requisite treatment, or getting sub-standard treatment.

Occupation/Job status- was found to be significant with its p-value 0.073 and coefficient 0.156, had a correlation with income, suggesting that if employment increased by one unit, income will by 0.156 dollars. The more the level of employments, the less the malaria contacts by the community members.

Sex- was found to be significant and had the p-value 0.024 and coefficient 0.168, suggesting that if sex increased by one unit, income will increase by 0.168 dollars. The male sex tends to have or acquired more income than the female. This so true that even at the level of employments, there are more male employees than that of the female.

Residence- was significant and had the p-value 0.0013, and coefficient of 0.283, meaning that if residence increased by one unit, income will increase by 0.283 dollars. The picture or image being portray is that, if you lived in the urban area, you will acquire or get more income. The truth remains that the urban sector has more than 80 % of the employments opportunities.

KAP- knowledge, attitude and practice was found to be significant and had a p-value 0.045, and coefficient -0.355, meaning that if knowledge, attitude and practice increased by one unit, income should decreased by 0.355 dollars. This reduction is due to the cost of maintaining the KAP level, and if that is not done the household becomes vulnerable to all sort of negative vices.

IRS- Indoor residual spraying was found to be significant and had the p-value 0.0013 and coefficient 0.316, suggesting that at the interval of the IRS application, there will be savings or more income for the household members.

Age- was found to be insignificant due to its p-value 0.109, and perhaps they were majority adults and of had good health seeking behavior and income to maintained the good knowledge, attitude and practices.

Family size- was also found to be insignificant due the p-value 0.194; maybe there were more average family members who kept the basic needs of the family constant.

Educational Status- was insignificant and had a p-value 0.286; it might have been that there were more educated family members in the sample or the reversed.

The rest of the variables: Position in the family 0.822, Insecticide treated nets 0.152, Intermittent preventive treatment 0.654, Mosquito/insect repellant 0.445, used of mosquito coils 0.713, Use of insecticide spray 0.260, and keeping surroundings clean 0.344 were all insignificant at the p-values.

Correlation Analysis

Table 4.5 Correlation Analysis of Malaria Incidence and Mosquito/Insect Repellant

Mosquito/Insect Repellant * malaria incidence Cross tabulation				
Count				
		malaria incidence		Total
		no malaria incidence	having malaria incidence	
Mosquito/Insect Repellant	not using mir	139	199	338
	using mir	21	41	62
Total		160	240	400

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	
Pearson Chi-Square	1.148437997	1	0.28387637			
Continuity Correction	0.866100401	1	0.35203715			
Likelihood Ratio	1.16757002	1	0.279901099			
Fisher's Exact Test				0.324747873	0.17628	
Linear-by-Linear Association	1.145566902	1	0.284479079			
N of Valid Cases	400					
A	Computed only for a 2x2 table					
B	0 cells (.0%) have expected count less than 5. The minimum expected count is 24.80.					

Ho: Used of mosquito/insect repellant (MIR) and malaria incidence (MI) are not correlated.

Ha: Mosquito/insect repellant (MIR) and Malaria incidence (MI) are correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically MIR and MI are not correlated at $\alpha = 0.05$. In this light, $0.28 > 0.05$ so, accept the null hypothesis.

Table 4.6 Correlation Analysis of Malaria Incidence and Use of Mosquito Coils

Use Mosquito Coils * malaria incidence Cross tabulation				
Count				
		malaria incidence		Total
		no malaria incidence	having malaria incidence	
Use Mosquito Coils	not using umc	127	170	297
	using umc	33	70	103
Total		160	240	400

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.663386835	1	0.055620462		
Continuity Correction	3.230252907	1	0.072289524		
Likelihood Ratio	3.732093085	1	0.053376468		
Fisher's Exact Test				0.062125212	0.0353
Linear-by-Linear Association	3.654228368	1	0.055927056		
N of Valid Cases	400				
A	Computed only for a 2x2 table				
B	0 cells (.0%) have expected count less than 5. The minimum expected count is 41.20.				

Ho: Used of mosquito/insect repellant (UMC) and malaria incidence (MI) are not correlated.

Ha: Used of mosquito coils (UMC) and Malaria incidence (MI) are correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically UMIC and MI are correlated at $\alpha = 0.10$. In this light, $0.055 < 0.10$ so, reject the null hypothesis.

Table 4.7 Correlation Analysis of Malaria Incidence and Use of Insecticide Spray

Use Insecticide Spray * malaria incidence Cross tabulation				
Count				
		malaria incidence		Total
		no malaria incidence	having malaria incidence	
Use Insecticide Spray	not using umc	123	181	304
	using umc	37	59	96
Total		160	240	400

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	
Pearson Chi-Square	0.11193348	1	0.737953544			
Continuity Correction	0.046258224	1	0.82970709			
Likelihood Ratio	0.112259047	1	0.737586756			
Fisher's Exact Test				0.811334853	0.41645	
Linear-by-Linear Association	0.111653646	1	0.738269281			
N of Valid Cases	400					
A	Computed only for a 2x2 table					
B	0 cells (.0%) have expected count less than 5. The minimum expected count is 38.40.					

Ho: Used of insecticide spray (UIS) and malaria incidence (MI) are not correlated.

Ha: Used of insecticide spray (UIS) and Malaria incidence (MI) are correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically UIS and MI are not correlated at $\alpha = 0.05$. In this light, $0.73 > 0.05$ so, accept the null hypothesis.

Table 4.8 Correlation Analysis of Malaria Incidence and Keeping Surrounding Clean

Keep Surrounding Clean * malaria incidence Cross tabulation				
Count				
		malaria incidence		Total
		no malaria incidence	having malaria incidence	
Keep Surrounding Clean	not using ksc	83	130	213
	using ksc	77	110	187
Total		160	240	400

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	
Pearson Chi-Square	0.202522323	1	0.652692556			
Continuity Correction	0.120927586	1	0.728030618			
Likelihood Ratio	0.202461764	1	0.652741076			
Fisher's Exact Test				0.683060138	0.3639	
Linear-by-Linear Association	0.202016018	1	0.653098472			
N of Valid Cases	400					
A	Computed only for a 2x2 table					
B	0 cells (.0%) have expected count less than 5. The minimum expected count is 74.80.					

Ho: Keep surrounding clean (KSC) and malaria incidence (MI) are not correlated.

Ha: Keep surrounding clean (KSC) and Malaria incidence (MI) are correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically KSC and MI are not correlated at $\alpha = 0.05$. In this light, 0.65 > 0.05 so, accept the null hypothesis.

Table 4.9 Correlation Analysis of Malaria Incidence and Insecticide-treated Nets

Insecticide-treated nets * malaria incidence Cross tabulation				
Count				
		malaria incidence		Total
		no malaria incidence	having malaria incidence	
Insecticide-treated nets	not using itn	54	70	124
	using itn	106	170	276
Total		160	240	400

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig (2-sided)	Exact Sig. (1-sided)	
Pearson Chi-Square	0.942808166	1	0.331556698			
Continuity Correction	0.740708275	1	0.389434087			
Likelihood Ratio	0.938394926	1	0.332690968			
Fisher's Exact Test				0.377483099	0.19454	
Linear-by-Linear Association	0.940451145	1	0.332161846			
N of Valid Cases	400					
A	Computed only for a 2x2 table					
B	0 cells (.0%) have expected count less than 5. The minimum expected count is 49.60.					

Ho: Insecticide treated nets (ITN) and malaria incidence (MI) are not correlated.

Ha: Insecticide treated nets and (ITN) Malaria incidence (MI) are correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically ITN and MI are not correlated at $\alpha = 0.05$. In this light, $0.33 > 0.05$ so, accept the null hypothesis.

Table 4.10 Correlation Analysis of Malaria Incidence and Intermittent Preventive Treatment

Intermittent Prevented treatment * malaria incidence Cross tabulation					
Count					
		malaria incidence		Total	
		no malaria incidence	having malaria incidence		
Intermittent Prevented treatment	not using ipt		2	2	
	using ipt	160	238	398	
Total		160	240	400	

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	
Pearson Chi-Square	1.340033501	1	0.24702806			
Continuity Correction	0.188442211	1	0.664216326			
Likelihood Ratio	2.049998943	1	0.152206295			
Fisher's Exact Test				0.518796992	0.3594	
Linear-by-Linear Association	1.336683417	1	0.247619702			
N of Valid Cases	400					
A	Computed only for a 2x2 table					
B	2 cells (50.0%) have expected count less than 5. The minimum expected count is .80.					

Ho: Intermittent preventive treatment (IPT) and malaria incidence (MI) are not correlated.

Ha: Intermittent preventive treatment (IPT) and malaria incidence are (MI) correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically IPT and MI are not correlated at $\alpha = 0.05$. In this light, $0.24 > 0.05$ so accept the null hypothesis.

Table 4.11 Correlation Analysis of malaria Incidence and Indoor Residual Spray

Indoor Residual Spraying * malaria incidence Cross tabulation					
Count					
		malaria incidence		Total	
		no malaria incidence	having malaria incidence		
Indoor Residual Spraying	not using irs	138	194	332	
	using irs	22	46	68	
Total		160	240	400	

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	
Pearson Chi-Square	1.996220175	1	0.157692022			
Continuity Correction	1.630787857	1	0.201594111			
Likelihood Ratio	2.038525588	1	0.15335823			
Fisher's Exact Test				0.175610481	0.09998	
Linear-by-Linear Association	1.991229624	1	0.158212371			
N of Valid Cases	400					
A	Computed only for a 2x2 table					
B	0 cells (.0%) have expected count less than 5. The minimum expected count is 27.20.					

Ho: Indoor residual spraying (IRS) and malaria incidence (MI) are not correlated.

Ha: Indoor residual spraying (IRS) and malaria incidence (MI) are correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically IRS and MI are not correlated at $\alpha = 0.05$. In this light, $0.15 > 0.05$ so, accept the null hypothesis.

Table 4.12 Correlation Analysis of Position in the Family and Sex

Count		sex		Total
		female	male	
position in family	family	55	29	84
	head family	94	222	316
Total		149	251	400

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	36.242[a]	1	.000		
Continuity Correction[b]	34.730	1	.000		
Likelihood Ratio	35.250	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	36.152	1	.000		
N of Valid Cases	400				

Ho: Position in the family (POS) and Sex (Sex) are not correlated.

Ha: Position in the family (POS) and Sex (Sex) are correlated.

The test of hypothesis at alpha (α) level significance = 0.05. Statistically POS and Sex are correlated at $\alpha = 0.05$. In this light, $0.00 < 0.05$ so, reject the null hypothesis.

Table 4.13 Analyses/ Correlation Matrix of Variables

	AGE	INC	ACC	FAM	SEX	RES	POS	MI	JOB_STAT
AGE	1	0.153213	-0.04305	0.357816	0.140892	-0.00698	0.255086	0.185107	0.322112
INC	0.153213	1	0.091148	0.12192	0.103113	0.197397	0.06134	0.187367	0.107833
ACC	-0.04305	0.091148	1	-0.05138	0.002742	0.344476	-0.11372	0.118445	-0.03449
FAM	0.357816	0.12192	-0.05138	1	0.074459	0.066215	0.069527	0.080073	0.157422
SEX	0.140892	0.103113	0.002742	0.074459	1	0.04218	0.301008	-0.08022	0.058726
RES	-0.00698	0.197397	0.344476	0.066215	0.04218	1	-0.00425	0.041029	0.001075
POS	0.255086	0.06134	-0.11372	0.069527	0.301008	-0.00425	1	-0.05763	0.338402
MI	0.185107	0.187367	0.118445	0.080073	-0.08022	0.041029	-0.05763	1	0.002381
JOB_STAT	0.322112	0.107833	-0.03449	0.157422	0.058726	0.001075	0.338402	0.002381	1
EDU_STAT	-0.13489	0.014478	-0.05403	-0.04026	0.185621	0.064574	-0.10782	0.005568	-0.18329
KAP	-0.0718	-0.07869	-0.01909	-0.0244	0.038445	-0.00478	-0.06946	-0.05372	-0.05028

The table above is a correlation analysis of variables used in the model and will be analyzed from that perspective. The result can be summarized that family size and age have a positive relationship at 0.3578, and because of that, the more the age the better the individual will be placed to cater to, and lead his or her family. Maturity and full responsibility will give good family values. The second correlation analysis is the relationship that exists between the position in the family and age, they have a positive relationship at 0.2551 and because of that, if the age gets higher, the head of the family will be in a better position to lead and make the right and necessary decisions.

The third correlation analysis is that of access to health care and residence, and they have a positive relationship at 0.3444, and because of that, that if you live in the urban equal one, you will have good access to health care than those who are in the rural areas. The fourth correlation analysis is between position in the family and sex, and they have a positive relationship at 0.3010,and because of that, if you are a male equal one, then you will have a better status and position to lead the family. The fifth correlation analysis is between position in the family and the job status, and they have a positive

relationship at 0.3384, because of that, if you are gainfully employed, you will have a better and stronger position to head the family with effectiveness and efficiency.

Select Case if Correspondents are the Head of the Family

Table 4.14 Analyses/ Correlation Matrix of Variables

	ACC	AGE	EDU_STAT	FAM	INC	IRS	ITN	JOB_STAT	KAP	MI	RES	SEX
ACC	1.0000	-0.0149	-0.0500	-0.0346	0.0837	0.1417	0.0491	-0.0484	-0.0192	0.1509	0.3558	0.0255
AGE	-0.0149	1.0000	-0.0886	0.3301	0.1589	0.0305	0.0210	0.2949	-0.0570	0.1886	0.0264	0.0481
EDU_STAT	-0.0500	-0.0886	1.0000	-0.0151	0.0407	-0.0713	0.0405	-0.1445	0.1390	0.0229	0.0941	0.2528
FAM	-0.0346	0.3301	-0.0151	1.0000	0.0726	0.0856	-0.0926	0.2175	-0.0100	0.0304	0.0794	0.0383
INC	0.0837	0.1589	0.0407	0.0726	1.0000	0.2293	0.0489	0.1571	-0.0577	0.1862	0.2230	0.0894
IRS	0.1417	0.0305	-0.0713	0.0856	0.2293	1.0000	-0.0420	0.0238	0.0160	0.0578	0.1508	-0.0172
ITN	0.0491	0.0210	0.0405	-0.0926	0.0489	-0.0420	1.0000	0.0128	0.0055	0.0650	0.0690	-0.0353
JOB_STAT	-0.0484	0.2949	-0.1445	0.2175	0.1571	0.0238	0.0128	1.0000	-0.0143	0.0521	-0.0332	0.0043
KAP	-0.0192	-0.0570	0.1390	-0.0100	-0.0577	0.0160	0.0055	-0.0143	1.0000	-0.0563	0.0035	0.0617
MI	0.1509	0.1886	0.0229	0.0304	0.1862	0.0578	0.0650	0.0521	-0.0563	1.0000	0.0934	-0.0839
RES	0.3558	0.0264	0.0941	0.0794	0.2230	0.1508	0.0690	-0.0332	0.0035	0.0934	1.0000	0.0436
SEX	0.0255	0.0481	0.2528	0.0383	0.0894	-0.0172	-0.0353	0.0043	0.0617	-0.0839	0.0436	1.0000

The number of the sample size was reduced to 316, and the result can be summarized as follows: that family size and age have a positive relationship at 0.3301,

and because of that, the higher the age of the individual, the better the care for the faemily.Another correlation analysis is between residence and the access to health care, their relationship is also positive at0.3558, and because of that, if you live in the urban area equal (1), you will have access to health care as compared to the rural area. There is also a positive relationship between Job_status and age at 0.2949, and this implies that the higher the age is the better the job status within the households. Sex and Educational status are positively correlated at 0.2528, and suggest that if you are a male equal (1), you will have a better educational status than the female. Age and the family size have positive relationship at 0.3301, and because of that, it tell us that the older you are the better is the family you will have, full maturity and responsibility goes together. Job status and the family size have a positive relationship at 0.2175, and imply that the better your job status the better the family tend to prosper, full employment brings full satisfaction to the family.

Income and indoor residual spray (IRS) have positive relationship at 0.2293, and because of that, the longer the spraying of the household last, the more the income may be saved. Residence and income also have a negative relationship at 0.2230, and that indicate that if you reside in the urban area equal (1) then you will have better income than the rural dwellers. Income and indoor residual spray (IRS) have positive relationship at 0.2293 and suggest that the more income the urban dwelling will have, the more the chances of spraying his house at intervals. Age and job status also have a positive relationship at 0.2949 and indicate that the higher the age gets, the better the job status will be, Family size and job status have positive relationship at 0.2175 and indicate that the minimum the family size is at the urban area, the good the job status for the head of the family. Access to health care and residence are positively correlated at 0.3558 and it means that if you are residing in the urban area you may have access to quality health care. Income and residence are positively related at 0.2230 and can be said that you will have more and better income if you reside in the urban area. Educational status and sex have positive correlation at 0.2528 and can be said that if you are a male and live in the urban area, you will have a better educational status than that of the female.

CHAPTER V

DISCUSSION, CONCLUSION AND POLICY IMPLICATIONS

5.1 Discussion

There were two variables used as both dependent and independent variables to run the regressions and analyze the estimations. Malaria incidence was the primary dependent variable of the study, and was used to run two regressions, with the first, n = (400) having the following significant variables and correlated with malaria incidence: Income of the respondents, Age, and Access to health care. The second regression (n = 316) had four significant variables and was a select case: Income of the respondents, Age, Access to health care and sex of the respondents. The third regression was run with income being the dependent variable. Malaria incidence and income had positive relationship in the three equations, meaning the more income you may earn; the higher will be the malaria incidence. The sampled was conducted in a malaria endemic area, thereby putting the relative poor and the relative rich at risk of the malaria burden. The relative rich people were at risk of malaria transmission at their places of work. There is a need for health authorities to improve the existing health facilities and construct new ones that must be equipped to treat malaria and related diseases.

Income being a dependent variable in equations three (OLS), had the following variables correlated: Malaria incidence, Age of the respondents, Access to health care, Occupation, sex and residence were significant. Employment is a major variable and its significance is very important to the household members in meeting their ends means and keeps the family intact. Sex, if you are a male and reside in the urban area, you will have good income and access to health care. The population which resides in the urban is at the better end of the households to make good decisions and have a better standard of living as compare to the rural dwellers.

Mosquito or insect repellent
Use mosquito coils
Use insecticide spray
Keep surrounding clean
Insecticide treated nets
Intermittent preventive treatment
Indoor residual spraying

A correlation testing was done with seven kinds of practices to include: Mosquito/insect repellent (MIR), the use of mosquito coils (UMC), the use of insecticide spray (UIS), Keeping the surroundings clean (KSC),Insecticide treated nets (ITN), Intermittent preventive treatment (IPT) and the indoor residual spray (IRS).Six of the practices did not correlate with the malaria incidence, and only the use of mosquito coils (UMC) correlated with the malaria incidence, suggesting that from the socio-economic factors, most of the people were relatively poor and could not afford to cope with or implement the rest of those practices.

In regions where malaria is highly endemic, it is said that adults tend to generally develop partial immunity to the symptoms of the disease. The younger children, however, bear a considerable burden in terms of malaria morbidity and mortality in the endemic areas. Although this morbidity is most concentrated among pre-school children, school age children also suffer the effects, which results in to high absenteeism. The adverse effects on schooling are likely to go far beyond just number of days lost per year, as absenteeism increases failure rates, repetition of school years, and drop-out rates. There could be even more severe consequence arising from the impact of malaria on cognitive development and learning ability, which may also have long-term cognitive effects of severe cases of malaria. For example children with malaria are found to have poorer nutritional status than non-malaria children, an outcome that impairs brain development.

Please see below the following tables a summary of the descriptive statistics from the previous chapter which was basically done through charts, histograms and graphs. They include tables

Table 5.1 Socio-Economic characteristics of persons in the selected study households in the Greater Monrovia District, Montserrado County-Liberia

Characteristics	n	%
Access/Distance		
Less than 1 hour	187	47.5
1 to 1.5 hours	126	32
2 hours plus	81	20.5
Income Level		
500 – 2,800	89	22.6
3,000 – 5,500	133	34
3,000 – 9,500	129	33
9,900 –18,000	42	11
Poverty		
Extreme poverty	250	62.5
Relative poverty	150	37.5
Residence		
Urban	289	72.25
Rural	111	27.75

Table 5.2 Socio-Economic characteristics of persons in the selected study households in the Greater Monrovia District, Montserrado County-Liberia

Characteristics	n	%
Gender/Sex		
Male	251	62.75
Female	149	37.25
Age groups in years		
17 -34	189	47.25
35 -40	97	24.25
41 +	148	28.5
Family size of household		
1 – 4	206	51.5
5 – 8	148	37
9 or more	46	11.5
Highest level of education Completed		
No education	64	16
Elementary	11	2.5
Junior High	61	15.25
High School	125	31.25
Vocational School	24	6
College/ University	115	28.75
Occupation of each person		
Private sector/NGO	48	12
Government employee	58	14.5
Housewife	13	3.25
Student	85	21.25
Farmer	11	2.75
Business	159	40
Other	28	7

Table5.3 Malaria Related Knowledge, Attitude and Practices of Respondents in the Greater Monrovia District, Montserrado County-Liberia

Variables	**N**	**%**
Knowledge		
Malaria Symptoms	400	100
Fever	293	73
Chills/Shivering	206	52
Headache	127	32
Joint pain	137	34
Poor appetite	115	29
Causes of Malaria	400	100
Mosquito bites	381	95
Dirty water	110	27
Dirty surroundings		
Beer	26	7
Other	11	3
Malaria can be cure	398	99
Malaria can be prevented	388	97
How can malaria be prevented?		
Sleep under mosquito net	351	88

Use mosquito/insect repellent	62	16
Keep surroundings clean	103	26
Use of mosquito coils	96	24
Using insecticide spray	187	47
Malaria as the most serious health problem Malaria can be treated	269	67
Malaria can be treated	398	99
How can malaria be treated?		
ACT (New medicine)	264	66
CHLOROQUINE	136	34
QUINNIE	74	19
SP/FANSIDAR	226	57
ASPRIN	9	3
Households with mosquito (bed) nets	266	67
Malaria related cases		
Non- Affected	160	40
Affected	240	60
Malaria related deaths	34	0.085
Number of Children who died	24	71
Number of adults who died	10	29

Table 5.4 Respondents' Knowledge and Practices about personal protective Measures against malaria in the Greater Monrovia District, Montserrado County-Liberia

Protective measures	n	%
Sleep under mosquito net	252	63
Use mosquito/insect repellent	160	40
Keep surroundings clean	68	17
Use of mosquito coils	146	37
Using insecticide spray	101	25
Keep doors and windows closed	154	39
Other	5	1
Total	400	100
NOTE: The tabulation exceeds hundred percent due to multiple responses.		

5.2 Conclusion

The study is divided in to two parts, qualitative and quantative analysis, the qualitative is divided in to descriptive and the burden of disease analysis. The quantitive is divided in to correlations and regression analysis.

There were two variables used as both dependent and independent variables to run the regressions and analyze the estimations. Malaria incidence was the primary dependent variable of the study, and was used to run two regressions, with the first, n = (400) having the following significant variables and correlated with malaria incidence: Income of the respondents, Age, and Access to health care. The second regression (n = 316) had four significant variables and was a select case: Income of the respondents, Age, Access to health care and sex of the respondents. The third regression was run with income being the dependent variable. Malaria incidence and income had positive relationship in the three equations, meaning the more income you may earn; the higher will be the malaria incidence. The sampled was conducted in a malaria endemic area, thereby putting the relative poor and the relative rich at risk of the malaria burden. The relative rich people were at risk of malaria transmission at their places of work. There is a need for health authorities to improve the existing health facilities and construct new ones that must be equipped to treat malaria and related diseases.

Income being a dependent variable in equations three (OLS), had the following variables correlated: Malaria incidence, Age of the respondents, Access to health care, Occupation, sex and residence were significant. Employment is a major variable and its significance is very important to the household members in meeting their ends means and keeps the family intact. Sex, if you are a male and reside in the urban area, you will have good income and access to health care. The population which resides in the urban is at the better end of the households to make good decisions and have a better standard of living as compare to the rural dwellers.

Table 5.5 Hypothesis testing of the Practices and Control Methods Malaria by the Respondents

No	Practice	Level of significance 0.05/0.10	Accept or Reject Ho:	MI Comment
1	Mosquito or insect repellent	0.28>0.05	Accept	MI and UIC are not correlated at the level significant of 0.05.
2	Use mosquito coils	0.055<0.10	Reject	MI and UMC are correlated at the level significant of 0.05.
3	Use insecticide spray	0.73>0.05	Accept	MI and UIS are not correlated at the level significant of 0.05.
4	Keep surrounding clean	0.65>0.05	Accept	MI and KSC are not correlated at the level significant of 0.05.
5	Insecticide treated nets	0.33>0.05	Accept	MI and ITN are not correlated at the level significant of 0.05.
6	Intermittent preventive treatment	0.24>0.05	Accept	MI and IPT are not correlated at the level significant of 0.05.
7	Indoor residual spraying	0.15>0.05	Accept	MI and IRS are not correlated at the level significant of 0.05.

Table 5.6 Summary Table of Variables from the Model

	AGE	INC	FAM	SEX	RES	POS	MI	JOB_STAT	EDU_STAT	KAP	ACC
Mean	35.945	5397.725	5.055	0.6275	0.7225	0.79	0.6	0.7575	0.84	0.9625	0.485
Median	35	5000	4	1	1	1	1	1	1	1	0
Maximum	75	18000	15	1	1	1	1	1	1	1	1
Minimum	17	500	1	0	0	0	0	0	0	0	0
Std. Dev.	9.694169	3161.854	2.794907	0.484076	0.448326	0.407818	0.490511	0.429132	0.367065	0.190221	0.500401
Skewness	0.654918	0.76269	1.164757	-0.52744	-0.99382	-1.42398	-0.40825	-1.2016	-1.85485	-4.86884	0.060027
Kurtosis	3.360391	3.537093	4.146761	1.278189	1.987687	3.027728	1.166667	2.443843	4.440476	24.70563	1.003603
Jarque-Bera	30.7592	43.58749	112.3615	67.95649	82.92542	135.1947	67.12963	101.4114	263.9479	9432.613	66.66688

5.3 Policy Implication

The following are important information for policy implications:

5.3.1. Access to health care had an estimation result of a p-value 0.015, coefficient 0.645 and z-stat 2.437 and significantly correlated with malaria incidence at α =0.10 and present the health situation that access to health care is still difficult for most of the population 51% do not have accessed. If access to health care is to improve by 1unit, malaria incidence should reduce by 0.645 distances. Government needs to improve the existing health facilities, and construct additional facilities, and also equipped those health facilities to conduct prompt and effective diagnosis of malaria and related diseases.

5.3.2 Income had a p-value 0.0085, coefficient of 0.0001 and z-stat of 2.633, Income surprisingly had a positive correlation with malaria incidence at α = 0.01, and means if income increased by 1 dollar, malaria incidence will increase by 0.0001. This suggest that there more relatively rich people were sample than the relatively poor group, it is furthered indicative that the majority affected group of the relative rich people were probably exposed to the risk of contacting malaria while at their places of work. The places of work were environmentally unhealthy, thereby giving rise to the transmission of malaria through mosquitoes which bite and affect them. More than that, they had an average income of $5,576 Liberian dollars and an average expenditure of $1,992 Liberian dollars, about 35% of their income were expended on treatment and medications. Government needs to come in and remedies the situation so that the external expenses can reduce and allow the population to have more savings and spend portion of their income on other needs.

5.3.3 From equation 2, Sex had a p-value of 0.024, a coefficient of -0.647 and z-stat of -2.262 and negatively correlated with the malaria incidence, and statistically significant with the incidence of malaria at α = 0.05. If sex is increased by 1 unit, the probability of contacting malaria should reduce by 0.647, if it was a male and the head of the family, the probability of contacting the malaria will decreased as compare to it being

a female. The more of male category we will have the better the probability of not contacting the malaria disease. It will however be good that government intervened by training or giving the requisite knowledge to the female so as to minimized the prevalence and rate of infection from the malaria disease. The training of the female will also help in the process of making the children safe and free from the malaria disease, because they are the most vulnerable group.

5.3.4 Age had a p-value of 0.0020, a coefficient of 0.0469 and a z-stat of 3.0937, and correlated with the malaria incidence at $\alpha = 0.01$. The meaning is if age is too increased by 1 year, the probability of malaria incidence will reduce by 0.0469 years; it is a fact even from many studies that the younger once are the most affected or victims of malaria and other outbreaks. For example, 53% of the total malaria affected populations were children and 6.3% of the population died from the malaria, and 71% of the deaths from the malaria burden were also children.

5.3.5 The use of mosquito coils- there was correlation test done with seven kinds of practices to include: Mosquito/insect repellent (MIR), the use of mosquito coils (UMC), the use of insecticide spray (UIS), Keeping the surroundings clean (KSC),Insecticide treated nets (ITN), Intermittent preventive treatment (IPT) and the indoor residual spray (IRS).Six of the practices were accepted and only the use of mosquito coils (UMC) was correlated with malaria incidence at $\alpha = 0.10$, suggesting that from the socio-economic factors, most of the people were relatively poor and could not afford to cope with or implement the rest of those practices. While it is probably true that the average population live on the mosquito coils, government must ensure of the maximum safety and a good health education program to keep them in the better position of not being further affected by the continuous application of the coils.

5.3.1 Recommendations for Further Study

The following studies are to be recommended to fill the gap of knowledge and in the same vain strengthen research capacity and capability.

1. The private sector study should be conducted to assess the level of health care consumption by those who can afford to pay for the service. The result could be used to draw an objective conclusion as to what percent of the population is willing and able to pay for services and meet other needs.
2. That a study be conducted to compare the malaria incidence from a regional perspective, at which time health authorities will have a clearer view and knowledge of the most infected or malaria endemic region.
3. The health authorities need to conduct a bigger study to find out the socio-economic factors that are associated with the high malaria prevalence and the poverty level of most of the population.

5.3.2 Limitations of the Study

Because of time and resource constraints, this study has its weakness by researching only within a sub district, and from the prospective of the government intervention on one end and the people of the selected area of study. The study being a descriptive research could have been extended to compare between and amongst regions if there were time and available resources to carry on the study.

The malaria survey did not include the household's ability and willingness to pay for the treatment and prevention of malaria. The mosquito nets distribution by non-governmental organizations and the purchase of same by some members of the population show some signs or level of affordability and poverty for the population that could afford compare to the poor.

The sample size of the population used for the survey is an estimated sample due to the unavailability of population data at the community level. The 2008 National population and Housing Census of Liberia provides data only at provincial and district levels, and made it difficult to be exact or have a précised estimate at the community level.

The sampled may have had more relatively rich people than the relative poor, prompting the income variable sign to be positive instead of negative. This was unexpected and needs to be further investigated through a well supported and elaborate survey.

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APPENDICES

Appendix A

Table A.1 Measures Taken by the Household to Prevent Malaria, Liberia 2007

	Residence Area		Quintile					
	Urban	Rural	Q1	Q2	Q3	Q4	Q5	Total
None	30.4	46.8	52.4	51.1	44.0	35.0	31.6	41.7
Bed net	37.3	32.8	28.6	30.3	29.8	40.1	39.2	34.2
Insectide	21.4	3.5	2.8	3.5	9.1	10.7	16.1	9.1
*AMD	14.6	9.4	10.2	8.1	8.5	12.5	14.3	11.1
Fumigation	0.5	0.1	0.6	0.2			0.2	0.2
**ITN	4.4	3.8	2.4	2.4	7.2	4.7	3.3	4.0
***MGD	2.0	2.6	4.7	4.0	1.3	1.1	1.6	2.4
Sanitation	8.1	11.0	7.8	9.1	9.7	11.4	11.5	10.1
Herbs	0.9	4.9	2.1	2.4	4.3	6.4	2.9	3.6
Burn leaf	1.4	1.8	3.5	1.5	0.6	1.9	1.3	1.7
Window/ door net	11.6	2.8	5.3	3.7	3.4	6.7	8.0	5.6
Other	1.5	2.4	1.8	2.0	1.7	2.9	2.1	2.1

Source: Health in Liberia: Basic Diagnostic Using the 2007 CWIQ Survey- Page-10.

*Antimalaria Drug
** Insectide-treated nets
*** Maintain good drainage

Table A.2 Major Causes of Visitation to MOH Health Facilities in 2007

Eight (8) Major Causes of Visitation to MOH facilities,2007	
Disease name	Incidence per 1,000 population
Malaria	104
Acute respiratory Infections	55
Sexually Transmitted Diseases/Syndrome	24
Skin infection	18
Diarrhea(bloody &non-bloody)	15
Urinary tract infection	13
Worms	12
Trauma(accidents, injuries, wounds, burns)	8

Source: Epidemiology Unit, MOH&SW 2008.

Table A.3 Major Causes of Visitation to MOH Health Facilities in 2008

Eight (8) Major Causes of Visitation to MOH facilities,2008	
	Incidence per 1,000 population
Malaria	119
Acute respiratory Infections	41
Sexually Transmitted Diseases/Syndrome	32
Skin infection	15
Worms	13
Diarrhea(bloody &non-bloody)	10
Trauma(accidents, injuries, wounds,	9
Urinary tract infection	7

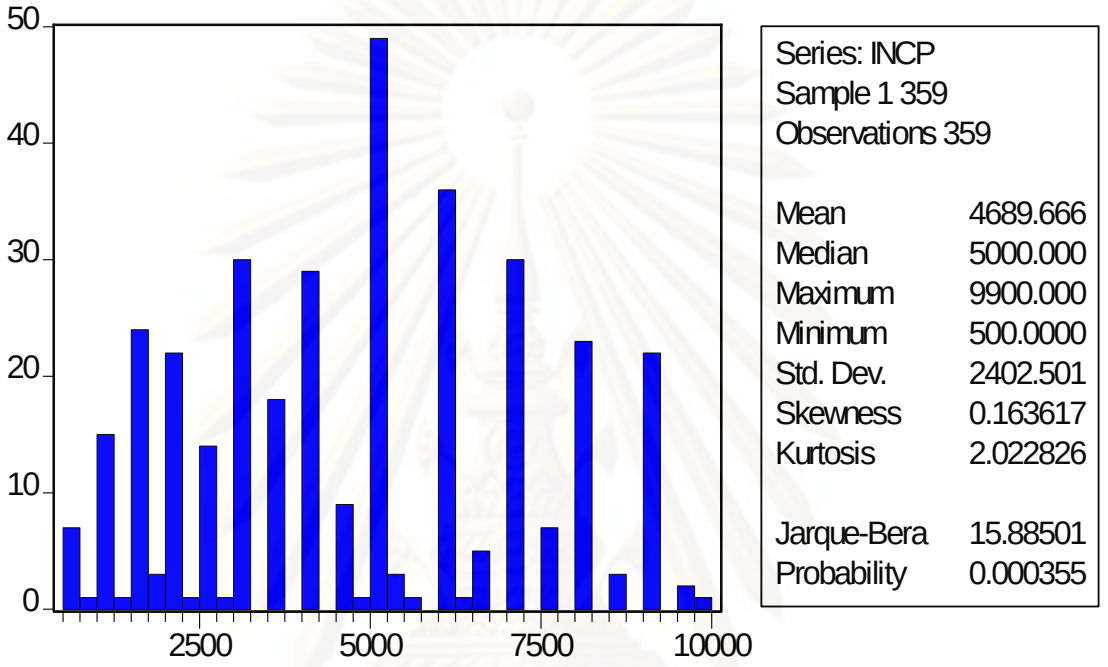
Source: Epidemiology Unit, MOH&SW 2008.

Table A .4 Ministry of Health Facilities in the 15 Counties of Liberia 2009

	County	**# of Facilities**	**# of Hospitals**	**# of Health Centers**	**# of Clinics**
1.	Montserrado	25	2	4	19
2.	Grand Bassa	30	3	1	26
3.	Rivercess	18	1	-	17
4.	Sinoe	32	1	-	31
5.	Gbarpolu	24	1	-	23
6.	Bomi	23	1	-	22
7.	Cape Mount	33	1	2	30
8.	Margibi	33	2	10	21
9.	Grand Gedeh	22	1	-	21
10.	Maryland	18	2	2	14
11.	Grand Kru	17	-	1	16
12.	River Gee	15	-	1	14
13.	Bong	33	2	3	28
14.	Lofa	48	2	2	44
15.	Nimba	40	2	2	36
	Total:	**411**	**21**	**28**	**362**

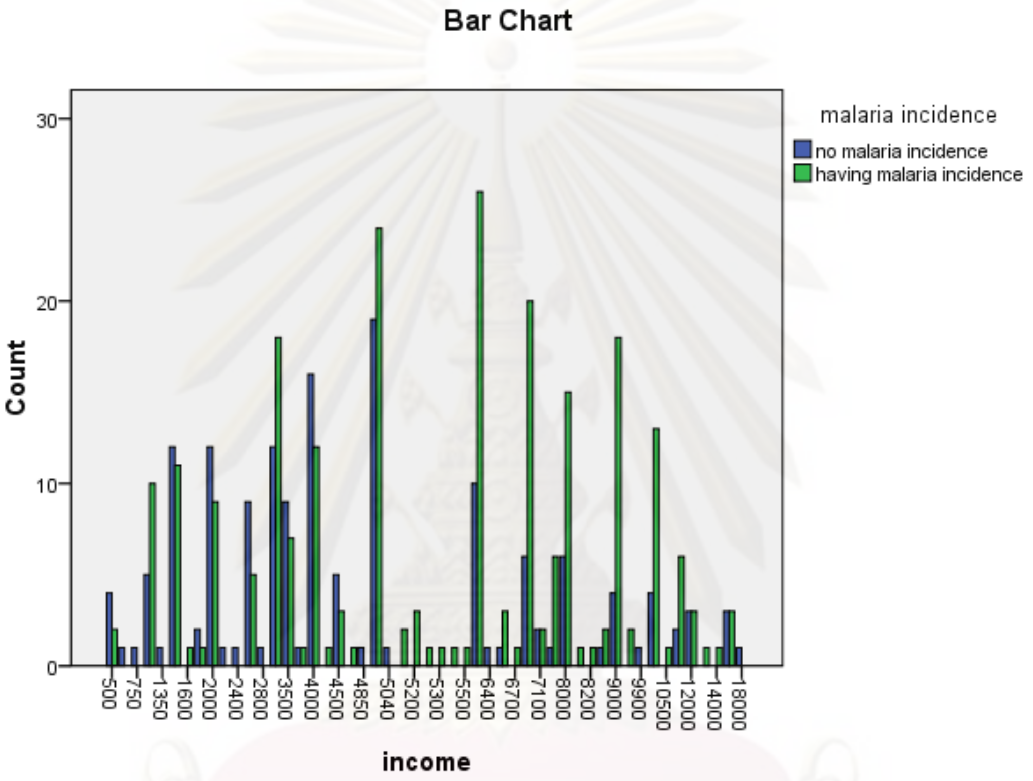
Source: Human Resource Department Ministry of Health

Figure A.5 Income Levels of Respondents and Malaria Incidence during the Survey



The histogram has been depicted as a normal distribution, after some of its observersations had been abstracted (400-41= 359). The new outlook runs from zero to ten thousand dollars, 359 samples and the 41 abstracted samples is more than ten thousand dollars. With the hypothesis which are Ho: Income is not normally distributed against the Ha: income is a normal distribution. The result of this for income is to reject Ho because the probability of Jarque-Bera is 0.000355 < 0.05 level of significance. It can be Seen that the average mean as has been decreased from 5,397.73 (N= 400) to 4689.66, (N= 359) this will make the distribution become normal.

Figure A.6 Income Levels of Respondents and Malaria Incidence during the Survey



The bar chart above illustrates the relationship between income and malaria incidence, the mean of the income as can be seen on the horizontal axis is $4689.00 dollars. The malaria incidence is above the mean and is higher from the mean to the right of the chart than income does. The left hand side is much lower from the comparative point of view, so it may be inferred that it has to changed the income in to poverty as the mean and standard deviation (Mean+SD) $4500+2402 = $6902 dollars. But if income is ≥ 6000, then poverty is zero (P=0), if income < 6000, poverty is one (P=1)

Table A.7 Correlation Analysis of Income and malaria incidence

income	no malaria incidence	having malaria incidence	Total
500-2500	49 (55.68)	39 (44.32)	88 (100)
2500-5000	64 (48.85)	67 (51.15)	131 (100)
5000-7500	22 (24.72)	67 (75.28)	89 (100)
7500-10000	16 (23.53)	52 (76.47)	68 (100)
>10000	9 (37.5)	15 (62.5)	24 (100)
Total	160	240	400

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	64.03091	50	0.087682213
Likelihood Ratio	75.73651	50	0.010876785
Linear-by-Linear Association	14.00738	1	0.000182095
N of Valid Cases	400		

Ho: Income (INC) and malaria incidence (MI) are independent.

Ha: Income and Malaria incidence are dependent.

The test of hypothesis at alpha (α) level significance = 0.10,the result of this test is rejected at Ho at this level because the probability is less (<) 0.10. Statistically INC and MI are dependent at $\alpha = 0.10$. In this light, $0.08 < 0.10$ so, reject the Ho hypothesis.

Table A.8 Correlation Analysis -9 Income/ Mosquito/insect repellent Cross tabulation

income	not using mir	using mir	Total
500-2500	75 (85.23)	13 (14.77)	88 (100)
2500-5000	112 (85.50)	19 (14.50)	131 (100)
5000-7500	78 (87.64)	11 (12.36)	89 (100)
7500-10000	55 (80.90)	13 (19.10)	68 (100)
>10000	18 (75)	6 (25)	24 (100)
Total	338	62	400
	84.5%	15.5%	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.35339	50	0.149848
Likelihood Ratio	54.64327	50	0.302607
Linear-by-Linear Association	0.584117	1	0.444703
N of Valid Cases	400		

Ho: Income (INC) and Mosquito/insect repellent (MIR) are independent.

Ha: Income (INC) and Mosquito/insect repellent (MIR) are dependent.

The test of hypothesis at alpha (α) level significance = 0.05,the result of this test is accepted at Ho at this level because the probability is more (>) 0.05. Statistically INC and MIR are independent at α = 0.05. In this light, 0.15 > 0.05 so, accept the Ho hypothesis.

Table A.9 Correlation Analysis -10 Incomes/ Use of mosquito coils Cross tabulation

income	not using umc	using umc	Total
500-2500	66 (75)	22 (25)	88 (100)
2500-5000	104 (79.39)	27 (20.61)	131 (100)
5000-7500	65 (73.04)	24 (26.96)	89 (100)
7500-10000	50 (73.53)	18 (26.47)	68 (100)
>10000	12 (50)	12 (50)	24 (100)
Total	297	103	400
	74.25%	25.75%	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51	50	0.436716
Likelihood Ratio	56	50	0.250133
Linear-by-Linear Association	4	1	0.043837
N of Valid Cases	400		

Ho: Income (INC) and Use of mosquito coils (UMC) are independent.

Ha: Income (INC) and Use of mosquito coils (UMC) are dependent.

The test of hypothesis at alpha (α) level significance = 0.05,the result of this test is accepted at Ho at this level because the probability is more (>) 0.05. Statistically INC and UMC are independent at $\alpha = 0.05$. In this light, $0.43 > 0.05$ so, accept the Ho hypothesis.

Table A.10 Correlation Analysis -11 Income /Use of insecticide spray Cross tabulation

income	not using uis	using uis	Total
500-2500	70 (79.55)	18 (20.45)	88
2500-5000	104 (79.39)	27 (20.61)	131
5000-7500	71 (79.77)	18 (20.23)	89
7500-10000	51 (75)	17 (25)	68
>10000	8 (33.33)	16 (66.67)	24
Total	304	96	400
	76%	24%	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	70	50	0.031535
Likelihood Ratio	72	50	0.023786
Linear-by-Linear Association	10	1	0.001865
N of Valid Cases	400		

Ho: Income (INC) and Use of insecticide spray (UIS) are independent.

Ha: Income (INC) and Use of insecticide spray (UIS) are dependent.

The test of hypothesis at alpha (α) level significance = 0.05, the result of this test is rejected at Ho at this level because the probability is less (<) 0.05. Statistically INC and UIS are dependent at $\alpha = 0.05$. In this light, $0.03 < 0.05$ so, reject the Ho hypothesis.

Table A.11 Correlation Analysis -12 Incomes/ Keeping surrounding clean Cross tabulation

income	not using ksc	using ksc	Total
500-2500	47 (53.41)	41 (46.59)	88
2500-5000	71 (54.20)	60 (45.80)	131
5000-7500	49 (55.06)	40 (44.94)	89
7500-10000	38 (55.88)	30 (44.12)	68
>10000	8 (33.33)	16 (66.67)	24
Total	213	187	400
	53.25%	46.75%	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	58.04962	50	0.202903
Likelihood Ratio	72.76842	50	0.01942
Linear-by-Linear Association	0.376712	1	0.539368
N of Valid Cases	400		

Ho: Income (INC) and Keeping surrounding clean (KSC) are independent.

Ha: Income (INC) and Keeping surrounding clean (KSC) are dependent.

The test of hypothesis at alpha (α) level significance = 0.05, the result of this test is accepted at Ho at this level because the probability is more (>) 0.05. Statistically INC and KSC are independent at $\alpha = 0.05$. In this light, $0.20 > 0.05$ so, accept the Ho hypothesis.

Table A.12 Correlation Analysis -13 Incomes /Insecticide treated nets Cross tabulation

income	not using itn	using itn	Total
500-2500	33 (37.50)	55 (62.50)	88
2500-5000	33 (25.20)	98 (74.80)	131
5000-7500	31 (34.83)	58 (65.17)	89
7500-10000	23 (33.82)	45 (66.18)	68
>10000	4 (16.67)	20 (83.33)	24
Total	124	276	400
	31%	69%	

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49	50	0.498725
Likelihood Ratio	61	50	0.141577
Linear-by-Linear Association	1	1	0.347639
N of Valid Cases	400		

Ho: Income (INC) and Insecticide treated nets (ITN) are independent.

Ha: Income (INC) and Insecticide treated nets (ITN) are dependent.

The test of hypothesis at alpha (α) level significance = 0.05, the result of this test is accepted at Ho at this level because the probability is more (>) 0.05. Statistically INC and ITN are independent at $\alpha = 0.05$. In this light, $0.49 > 0.05$ so, accept the Ho hypothesis.

Table A.13 Hypothesis to testing of the independence of Practice and Income by households members.

Practice	Level of significance	Accept or Reject	INC Comment
Malaria incidence	0.08 < 0.10	Reject	INC and MI are dependent at the level significant of 0.10.
Use mosquito/insect repellent	0.15 > 0.05	Accept	INC and MIR are independent at the level significant of 0.05.
Use of mosquito coils	0.43>0.05	Accept	INC and UMC are independent at the level significant of 0.05.
Use of insecticide spray	0.03<0.05	Reject	INC and UIS are dependent at the level significant of 0.05.
Insecticide treated nets	0.49>0.05	Accept	INC and ITN are independent at the level significant of 0.05.
Intermittent preventive treatment	0.40>0.05	Accept	INC and IPT are independent at the level significant of 0.05.
Indoor residual spraying	7.35E-05<0.05	Reject	INC and IRS are dependent at the level significant of 0.05.
Keeping surrounding clean	0.20>0.05	Accept	INC and KSC are independent at the level significant of 0.05.

Appendix B

QUES. NUM: __ __ __ __ __

General Information- KAP and Prevention of Malaria

IDENTIFICATION

COUNTY_____

DISTRICT_____

COMMUNITY/VILLAGE/TOWN _____

NAME OF RESPONDENT _____

INTRODUCTION AND CONSENT

Hello. My name is _____and I am a representative of the Ministry of Health & Social Welfare.

I would like to ask you few questions about malaria control and prevention. The interview usually takes 15 minutes to complete. Whatever answers you provide will be kept confidential and will not be shown to other persons.

Participation is voluntary. Even if you participate, you may decide to stop answering any or all questions at any time. However, we hope that you will participate fully in this exercise since your views are important.

At this time, do you want to ask me anything about the interview?

Do you agree to be interviewed? **YES……...…1 → CONTINUE**

NO……0 → END

I HAVE READ THE ABOVE STATEMENT AND EXPLAINED THE SAME TO THE RESPONDENT AND HE/SHE HAS AGREED TO BE INTERVIEWED NAME/SIGNATURE OF INTERVIEWER & DATE: _____

Interviewer: I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT YOU AND YOUR FAMILY WHO LIVE IN THIS HOUSE.

No.	FULL NAME OF INTERVIEWEE	Age	Sex	ADDRESS
	Please give me your full name and the names of those who live in your household	Years	M/F	Name of Community
(1)	(2)	(3)	(4)	(5)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

General Information--KAP and prevention of Malaria
February-March, 2010 Source: National Malaria Control Program/Liberia (NMCP/L)

Interviewer: I WANT TO ASK YOU SOME QUESTIONS ABOUT YOU AND YOUR FAMILY WHO LIVE IN THIS HOUSE

	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
1.	What is your age and sex?	18-28……..1 29-38……2 39-48……3 49-60……4	Male…….1 Female...2
2.	What is your place of residence? CIRCLE ALL ANSWERS MENTIONED	Urban……..1 Rural……2	
3.	What is your level of education? CIRCLE ALL ANSWERS MENTIONED	Elementary……..1 Junior High……..2 Completed High School ……..3 College/University……..4 Vocational School……..5 None of the above……..6	
4.	What is your occupation? CIRCLE ALL ANSWERS MENTIONED	Private sector/NGO……..1 Government employee……2 Farmer……3 House-wife……..4 Business……5 Student……..6 Others (please specify)……..7	
5.	What is the household monthly income?	_____$LD Specify _____$LD	

	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
6.	What is the total number of your family?	Number of persons_____ Number of adults_____ Number of children_____	
7.	What is your position in the family?	Head of the family……..1 Non-head of the family……..2	
8.	What is the closest distance between your residence and the health facilities? Please specify name_____	Miles_____ Hours_____	
9.	During the last three months did you visit the health facility	Yes_____1 No_____ 2	
10.	Whom did you see during your last visit to the health facility?	Don't know_____ 98 DOCTOR ……..1 NURSE/MIDWIF……..2 PA……3 LPN……..4	

Interviewer: I WANT TO ASK YOU SOME QUESTIONS ABOUT MALARIA

	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
2.1	Have you ever heard of a sickness called "Malaria?"	YES……..1 NO……..2	
2.2	What are the main symptoms of malaria? CIRCLE ALL ANSWERS MENTIONED	Fever……..1 Chills……2 Headache……3 Joint pain……4 Poor appetite……..5	
2.3	How many members of your household have got malaria during the past year? CIRCLE ALL ANSWERS MENTIONED	Children……1-Age_____ Children…….2-Age_____ Adults……..3-Age_____ Adults……..4-Age_____ monthly income & expenditure for treatment _____ Expenditure _____ How many days lost_____ How many days lost _____	Income
2.4	What causes malaria? CIRCLE ALL ANSWERS MENTIONED	Mosquitoes……..1 Dirty water……2 Dirty surroundings……3 Beer……..4 Certain foods……5 Others……6 (specify)_____ Don't know……..98	

	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
2.5	Are there ways to avoid getting malaria?	YES……..1 No……..2	
2.6	What are the ways to avoid getting malaria? CIRCLE ALL ANSWERS MENTIONED	Sleep under a mosquito net…1 Use mosquito coils……2 Using insectiede-spray……..3 Keep doors and window closed ……4 Mosquito/insect repellant…..5 Keep surround- clean……..6	
2.7	In the past year, have you seen or heard any messages about malaria?	YES……..1 NO……2	
2.8	What drugs are used to treat malaria? CIRCLE ALL ANSWERS MENTIONED	ACT (new medicine)..... 1 CHLOROQUINE..... 2 SP/FANSIDAR ..... 3 QUININE ..... 4 ASPIRIN ..... 5 PANADOL ..... 6 PARACETOMOL 7	

	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
2.9	During the past year did any household member die from malaria?	If yes state_____persons Children_____Age_____ Children_____Age_____ Adult_____Age_____ Adult _____Age_____ Adult _____Age_____ Monthly income _____$LD Monthly income_____ $LD Monthly Income_____ $LD	
2.10	What messages about malaria have you seen or heard? CIRCLE ALL ANSWERS MENTIONED	Fever……1 Roll Back Malaria(RBM)…….2 Bed nets……3 IPT……4 Danger Sign……5 Mosquitoes……6	
2.11	Where did you hear or see these messages about malaria? CIRCLE ALL ANSWERS MENTIONED	Radio……1 Billboard……2 Poster……3 T-Shirt……4 Leaflet/fact sheet/brochure…5 Television……6 Drama group……7 Schools……8 Community Health Workers….9 Peer Educators……10	

Interviewer: NOW I WOULD LIKE TO ASK YOU ABOUT HOW YOU PREVENT MALARIA

SECTION 3: PREVENTATIVE MEASURES

No.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
3.1	Do you do anything to protect yourself or your household members from mosquito bites?	YES……1 NO……2	
3.2	What do you currently do or use to prevent yourself or your household from being bitten by mosquitoes? CIRCLE ALL ANSWERS MENTIONED	Sleep under a mosquito net……1 Use mosquito coils……2 Using insecticide spray……3 Keep doors and windows closed……4 Mosquito/insect repellant……5 Keep surroundings clean……6	
3.3	Do you have mosquito (bed) nets in this household that can be used while sleeping?	YES……1 NO……2	
3.4	Why don't you have a mosquito net?	Too expensive……1 Not available……2 Don't Like……3 Other……4	
3.5	How many mosquito nets does your household have?	NUMBER OF NETS……	

No.	QUESTIONS AND FILTERS	NET # 1	NET #2	NET #3

3.6	ASK RESPONDENT TO SHOW YOU THE NET(S) IN THE HOUSEHOLD.	OBSERVED……1 NOT OBSERVED…. 2	OBSERVED…..1 NOT OBSERVED…..2	OBSERVED……..1 NOT OBSERVED…….2
3.7	Did you buy the net or was it given to you?	Bought……..1 Given……..2	Bought……..1 Given……..2	Bought……..1 Given……..2
3.8	**If bought**, how much did you pay for the net?	**(USD/LD)**	**(USD/LD)**	**(USD/LD)**
3.9	Where did you get the net?	Shop……..1 Clinic……..2 Market…….3 NGO……..4 Other……..5 (specify)_____	Shop……..1 Clinic……..2 Market……..3 NGO……..4 Other……..5 (specify)_____	Shop……..1 Clinic……..2 Market…….3 NGO……..4 Other……..5 (specify)_____
3.10	When you got the net, was it already treated with an insecticide to kill or repel mosquitoes?	YES……1 NO……..2 DON'T KNOW…98	YES……1 NO……..2 DON'T KNOW..98	YES……1 NO……..2 DON'T KNOW…98
3.11	Did anyone sleep under this mosquito net last night?	YES…….1 →2.13 NO……..2 →2.12 Don't Know..98 (END)	YES…1 →2.13 NO….2 →2.12 Don't Know.98 (END)	YES…1 →2.13 NO….2 →2.12 Don't Know.98 (END)
3.12	If no, Why? CIRCLE ALL ANSWERS MENTIONED AND END SESSION 2	Too hot……..1 Feel like prison….2 Itches skin/eye…..3 Suffocates/chokes. 4 Unable to hang….5 Don't feel good…..6 Other……..7 (specify)_____	Too hot……..1 Feel like prison….2 Itches skin/eye…..3 Suffocates/chokes. 4 Unable to hang..5 Don't feel good….6 Other……..7 (specify)_____	Too hot……..1 Feel like prison….2 Itches skin/eye……3 Suffocates/chokes. Unable to hang….5 Don't feel good…..6 Other……..7 (specify)_____

VITAE

NAME	:	Justine Amos Korvayan
DATE OF BIRTH	:	December 4th, 1972
PLACE OF BIRTH	:	Telewoyan Hospital, Voinjama, Lofa
NATIONALITY	:	Liberian
Email	:	justinkorvayan@ymail.com

EDUCATIONAL BACKGROUND

2008(Feb.) – 2009(May) Candidate for a Master of Business Administration
Cuttington University Graduate School
Congo Town, Monrovia- Liberia

1999 (Sept.) – 2007(April) Bachelor of Science Degree
(Major: Economics, Minor: Demography)
University of Liberia, Monrovia, Liberia

JOB EXPERIENCE

Procurement Assistant, Procurement Unit, Ministry of Health & Social Welfare, Capitol Bye Pass, Monrovia-Liberia. 2008(Aug.) – 2009 (May)

Administrative Finance Officer Extended Programme on Immunization (EPI), Ministry of Health & Social Welfare, Capitol Bye Pass, Monrovia-Liberia. May 2006 - August 2008

Administrator, Barnesville Health Center, Montserrado County Health Services, May 2004 – April 2006

Office Assistant in the Office of the Deputy Minister of Planning, Human Resource & Development, Ministry of Health & Social Welfare. December 2003 – September 2004